<table>
<thead>
<tr>
<th>Knowledge area</th>
<th>Process Group: Initiating</th>
<th>Process Definition</th>
<th>Inputs</th>
<th>Tools &amp; Techniques</th>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integration Management</td>
<td>Includes the processes &amp; activities to identify, define, combine, unify, &amp; coordinate the various processes &amp; project management activities within the project management process groups</td>
<td>It is the process of developing a document that formally authorizes the existence of a project and provides the project manager with the authority to apply organizational resources to project activities</td>
<td>(1) Project Statement of Work: Narrative description of products, services or results to be delivered by a project. For internal projects, the project initiator or sponsor provides the SOW based on business needs, products or service requirements. For external projects, the SOW can be received from the customer as part of the bid document (RFP, RFI, RFB) or as part of contract. (1.1) Business Need: &amp; The Cost Benefit Analysis are contained in the Business Case. (1.2) Product Scope Description: Documents the characteristics of the product, service or results that the project will be undertaken to create. The description should also document the relationship between the products, services, or the results being created and the business need that project will address (1.3) Strategic Plan</td>
<td>(1) Expert Judgment (1.1) Other units within the organization (1.2) Consultants (1.3) Stakeholders, including customers or sponsors (1.4) Professional or Technical Associations (1.5) Industry Groups (1.6) Subject Matter Experts (SME) (1.7) Project Management Office (PMO)</td>
<td>(1) Project Charter (1.1) Project Purpose or Justification (1.2) Measurable project objectives and related success criteria. (1.3) High-level requirements (1.4) Assumptions &amp; Constraints (1.5) High level project descriptions and boundaries (1.6) High-level risks (1.7) Summary milestone schedule (1.8) Summary budget</td>
</tr>
</tbody>
</table>

Integration includes making choices about resource allocation, making tradeoffs, among competing objectives and alternatives, and managing the interdependencies among the project management knowledge area. The project deliveries may also need integrating with ongoing operations of the performing org, the requesting org, and long term strategic planning that takes future problems and opportunities into considerations.

Also includes the activities needed to manage project documents to ensure consistency with the project management plan and product, service or capability deliverables

Some activities performed by project management team are

(1) Develop, review, analyze and understand the scope. This includes the project and product requirements, criteria, assumptions, constraints, & other influences related to a project & how each

**Process Group: Initiating**

**Benefits:** A well-defined project start and project boundaries, creation of a formal record of the project, and a direct way for senior management to formally accept and commit to the project.

**Project charter establishes a partnership between the performing & the requesting organization.** In case of external projects, a formal contract is typically the preferred way to establish an agreement. A charter is still used to establish internal agreements within an organization to assure proper delivery under the contract.

(1) The approved charter formally initiates the project

(2) The project charter should be authored by the sponsoring entity

(3) The project charter provides the project manager with the authority to plan and execute the project

(4) It is recommended that project manager participate in the development of the project charter, to obtain a functional understanding of the project requirements. The understanding will better allow for efficient resource allocation to project activities

(5) Projects are initiated by an entity external to the project such as a sponsor, program or project management office (PMO) staff person, or a portfolio governing body chairperson or authorized representative

(6) The project initiator or sponsor should be at a level that is appropriate to procure funding or commit resources to the project

(7) Chartering a project validates alignment of the project to the strategy and ongoing work of the organization

(8) A project charter is not considered to be a contract, because there is no consideration of money promised or exchanged in its creation.

(2.1) Business Need

(A) Market Demand
(B) Organizational Need
(C) Customer Request
(D) Technological Advance
(E) Legal requirement
(F) Ecological Impacts
(G) Social Need

(2.2) Project Selection Methods

(A) Benefit Measurement Methods

- Murder Board
- Peer Review
- Scoring Models
- Economic Models
  - Present Value
  - Net Present Value (NPV)
  - Internal Rate of Return (IRR)
  - Payback Period
  - Cost-Benefit Analysis (CBA)

(B) Constrained Optimization Methods

- Linear Programming
- Integer Programming
- Dynamic Programming
- Multi-Objective Programming

(3) Agreements

(3.1) MOU, SLA, LOA, LOI, Verbal, email or other written agreements

**Project Management Processes**

**Inputs**

<table>
<thead>
<tr>
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<table>
<thead>
<tr>
<th>Process Group: Planning</th>
<th>(3.2) Contracts are used for external customer satisfaction and organization's needs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.2 Develop Project Management Plan</td>
<td>(4) Enterprise Environmental Factors (5) Organizational Process Assets</td>
</tr>
<tr>
<td>Benefits: It is a central document that defines the basis of all project work.</td>
<td>(1) Project Charter (2) Outputs from Other processes (3) Enterprise environmental factors (4) Organizational process assets</td>
</tr>
<tr>
<td>It is the process of defining, preparing, and coordinating all subsidiary plans and integrating them into a comprehensive project management plan.</td>
<td>(1) Expert Judgment (2) Facilitation Techniques (2.1) Brainstorming (2.2) Conflict Resolution (2.3) Problem Solving (2.4) Meeting Management</td>
</tr>
</tbody>
</table>
| (1) Project Management Plan defines how the project is executed, monitored, and closed. | (1) Project Management Plan (1.1) Scope Baseline (1.2) Schedule Baseline (1.3) Cost Baseline (1.4) Scope Management Plan (1.5) Requirements Management Plan (1.6) Schedule Management Plan (1.7) Cost Management Plan (1.8) Quality Management Plan (1.9) Process Improvement Plan (1.10) Human Resource Management Plan (1.11) Communications Management Plan (1.12) Risk Management Plan (1.13) Procurement Management Plan (1.14) Stakeholder Management Plan (1.15) Change Management Plan (1.16) Configuration Management Plan (1.17) Life cycle selected for the project & processes for each phase (1.18) Details of tailoring decisions specified by the project management team |}

**Process Group: Execution**

<table>
<thead>
<tr>
<th>4.3 Direct and Manage Project Work</th>
<th>(1) Deliverables: A deliverable is any unique and verifiable product, result or capability to perform a service that is required to be produced to complete a process, phase or project. Deliverables are typically tangible components completed to meet the project objectives and can include components of the project management plan.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benefits: It provides overall management of the project work.</td>
<td>(2) Work performance data: Are the raw observations and measurements identified during activities being performed to carry out the project work. Data are often viewed as lowest level of detail from which information is derived by other processes. Data is gathered through work execution and passed to the controlling process for further analysis.</td>
</tr>
<tr>
<td>Direct and Manage project work include</td>
<td>(3) Change Requests: A formal proposal to modify any document, deliverable, or baseline. An approved change request will replace the associated document, deliverable or baseline and may result in update to other parts of the project management plan. Request for change can be</td>
</tr>
<tr>
<td>(1) Perform activities to accomplish project activities</td>
<td>(2.1) Corrective Action: An intentional activity to carry out the project work. Data are often viewed as lowest level of detail from which information is derived by other processes. Data is gathered through work execution and passed to the controlling process for further analysis.</td>
</tr>
<tr>
<td>(2) Create project deliverables to meet the planned project work</td>
<td>(2.2) Preventive Action: An intentional activity that ensures the future performance of the project work is aligned with the project management plan</td>
</tr>
<tr>
<td>3) Provide, train and manage the team members assigned to the project</td>
<td>(2.3) Defect Repair: An intentional activity to carry out the project work. Data are often viewed as lowest level of detail from which information is derived by other processes. Data is gathered through work execution and passed to the controlling process for further analysis.</td>
</tr>
</tbody>
</table>
modify a non-conforming product or product component.
(3) Enterprise Environmental Factors
(4) Organization Process Assets

Process Group: Monitoring & Controlling

4.4 Monitor and Control Project Work

It is the process of tracking, reviewing, and reporting the progress to meet the performance objectives defined in the project management plan.

Benefits: It allows stakeholders to understand the current state of the project, the steps taken, and budget, schedule and scope forecasts.

Monitoring includes collecting, measuring, and distributing performance information, and assessing measurements and trends to effect process improvements. Continuous monitoring gives the project management team insight into the health of the project and identifies any area that may require special attention.

Control includes determining corrective or preventive actions or re-planning and following upon actions plans to determine whether the actions taken resolved the performance issue.

The monitoring and control project work process is concerned with:

(1) Comparing actual project performance against the project management plan.
(2) Assessing performance to determine whether any corrective or preventive actions are indicated, and then recommending those actions as necessary.
(3) Identifying new risks and analyzing, tracking, and monitoring existing project risks to make sure the risks are identified, their status is reported, and that the appropriate risk response plans are being executed.

(1) Project Management Plan
(1.1) Scope Management Plan
(1.2) Schedule Management Plan
(1.3) Cost Management Plan
(1.4) Quality Management Plan
(1.5) Human Resource Management Plan
(1.6) Communication Management Plan
(1.7) Risk Management Plan
(1.8) Procurement Management Plan
(1.9) Stakeholder Management Plan
(1.10) Requirements Management Plan
(1.11) Process Improvement Plan
(1.12) Scope Baseline
(1.13) Cost Baseline
(1.14) Schedule Baseline
(2) Schedule Forecasts
(2.1) Time Estimate to Complete (ETC)
(2.2) Schedule Variance (SV)
(2.3) Schedule Performance Index (SPI)
(3) Cost Forecasts
(3.1) Estimates to Complete (ETC)
(3.2) Cost Variance (CV)
(3.3) Cost Performance Index (CPI)
(4) Validated Changes
(5) Work Performance Information: is the performance data collected from various controlling processes, analyzed in context, and integrated based on relationships across areas. Thus work performance data has been transformed into work performance information.
(5.1) Project Management Plan Updates
(5.2) Project Documents Update
(5.3) Requirements Documentation
(5.4) Projects Logs (issues, assumptions, risk register, stakeholder register)

(1) Expert Judgment
(2) Analytical Techniques
(2.1) Regression Analysis
(2.2) Grouping Methods
(2.3) Casual Analysis
(2.4) Root Cause Analysis
(2.5) Forecasting Methods
(A) Judgment Methods (Qualitative)
- Salesforce estimates
- Executive Opinion
- Market Research
- Delphi Method
(B) Quantitative Methods
- Linear Regression (Casual)
- Time-Series Analysis
- Naive Forecast
- Simple Moving Average
- Weighted Moving Average
- Exponential Smoothing
- Trend-Adjusted Exponential Smoothing method
- Multiplicative Seasonal Method
- Additive Seasonal Method
(2.6) Failure Mode & Effect Analysis
(FMEA): An analytical procedure in which each potential failure mode in every component of a product is analyzed to determine its effect on the reliability of that component and, by itself or in combination with other possible failure modes, on the reliability of the product or system and on the required function of the component; or the examination of a product (at the system and/or lower levels) for all ways that a failure may occur. For each potential failure,
<table>
<thead>
<tr>
<th>(1) Project Management Plan</th>
<th>(7) Organizational Process Assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1.1) Scope Management Plan</td>
<td>- an estimate is made of its effect on the total system and of its impact. In addition, a review is undertaken of the action planned to minimize the probability of failure and to minimize its effects.</td>
</tr>
<tr>
<td>(1.2) Scope Baseline</td>
<td>(2.7) Fault Tree Analysis (FTA)</td>
</tr>
<tr>
<td>(1.3) Change Management Plan</td>
<td>(2.8) Reserve Analysis</td>
</tr>
<tr>
<td></td>
<td>(2.9) Trend Analysis</td>
</tr>
<tr>
<td></td>
<td>(2.10) Earned Value Management</td>
</tr>
<tr>
<td></td>
<td>(2.11) Variance Analysis</td>
</tr>
<tr>
<td></td>
<td>(3) Expert Judgment</td>
</tr>
<tr>
<td>(2) Work Performance Reports</td>
<td>(4) Project Management Information Systems (PMIS)</td>
</tr>
<tr>
<td>(2.1) Resource Availability</td>
<td></td>
</tr>
<tr>
<td>(2.2) Schedule &amp; Cost Data</td>
<td></td>
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<tr>
<td>(2.3) EVM Reports</td>
<td></td>
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<tr>
<td>(2.4) Burn up &amp; Burn down Charts</td>
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<tr>
<td></td>
<td></td>
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<td>(3) Change Requests</td>
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<td>(5) Organization Process Assets</td>
<td></td>
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</table>

**Process Group: Monitoring & Controlling**

### 4.5 Perform Integrated Change Control

- It is the process of reviewing all change requests; approving changes and managing changes to deliverables, organizational process assets, project documents, and the project management plan; and communicating the disposition. It reviews all requests for changes or modifications to project documents, deliverables, baselines, or the project management plan and approves or rejects the changes.

**Benefits:**
- It allows for documented changes within the project to be considered in an integrated fashion while reducing project risk, which often arises from changes made without considerations to the overall project objectives or plan.

**PICC process is conducted from project inception through completion and is the ultimate responsibility of the project manager.**

Changes may be requested by any stakeholder involved with the project. Although changes may be initiated verbally, they should be recorded in written form and entered into the change management or configuration management system.

**Configuration Management System:** A subsystem of overall project management system. It is a collection of formal documented procedures used to apply technical and administrative direction and surveillance to:

1. Identify and document the functional and physical characteristics of a product, result, service, or component
2. Control any changes to such characteristics;
3. Record and report each change and its implementation status;
4. 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.

Every documented change request needs to be either approved or rejected by a responsible individual, usually the project sponsor or project manager. The responsible individual will be identified in the project management plan or by organizational procedures. When required, the PICC process includes a Change Control Board (CCB), which is formally chartered group responsible for reviewing, evaluating, approving, delaying, or rejecting changes to the project, and for recording and communicating such decisions. The applied level of change control is dependent upon the application area, complexity of the specific project, contract requirements, and the context and environment in which the project is performed.

**Project:** A project is a temporary endeavor undertaken to create a unique product, service, or result. Temporary nature indicates a finite beginning and end. A project ends when the project objectives have been achieved, when the project is terminated because its objectives will not or cannot be achieved, or when the need for the project no longer exists. The outcome of the project may be tangible or intangible. Most projects are undertaken to create a lasting outcome. Although repetitive elements may be present in some project deliverables and activities, this repetition does not change the fundamental, unique characteristics of the project work. Because of the unique nature of projects, there may be uncertainties or differences in products, services, or results that the project creates. In addition, projects are undertaken at all organizational levels. A project can involve a single individual or multiple individuals, a single organization unit, or multiple organizational units from multiple organizations.

**What Project creates?** A product that can be either component of other item, an enhancement of an item, or an end item in itself. A service or a capability to perform a service. An improvement in existing products or service lines (Six Sigma). A result such as an outcome of a document (eg research project).

**Relationships among Portfolio, Programs, and Projects**

**Portfolio:** Refers to a collection of projects, programs, sub-portfolios, and operations managed as a group to achieve strategic objectives.

**Programs:** Are grouped within a portfolio and are comprised of subprograms, projects, or other work that are managed in coordinated fashion in support of the portfolio. Although the projects or programs within the portfolio may not necessarily be interdependent or directly related, they are linked to the organization’s strategic plan by means of the organization’s portfolio.
Configuration control is focused on the specification of both the deliverables and the processes; while change control is focused on identifying, documenting, and approving or rejecting changes to the project documents, deliverables, or baselines. Some configuration management activities included in PICC are as follows:

1. Configuration Identification: Identification and selection of a configuration item to provide a basis for which the product configuration is defined and verified, documents and products are labeled, changes are managed, and accounting is maintained.

2. Configuration Status Accounting: Information is recorded and reported as to when appropriate data about the configuration item should be provided. This information includes a listing of approved configuration identification, status of proposed changes to the configuration, and the implementation status of the approved changes.

3. Configuration Verification & Audit: ensures the composition of a project's configuration items is correct and that corresponding changes are registered, assessed, approved, tracked, and correctly implemented. This ensures the functional requirements defined in the configuration documentation have been met.

**Process Group: Closing**

4. **Close Project or Phase**

   It is the process of finalizing all activities across all of the Project Management Processes to formally complete the project or phase.

   **Benefits:** It provides lessons learned, the formal ending of project work, and the release of organization resources to pursue new endeavors.

   When closing the project, the project manager reviews all prior information from the previous phase closure to ensure that all project work is completed and that the project has met its objectives.

   Since project scope is measured against the project management plan, the project manager reviews the scope baseline to ensure completion before considering the project closed.

   Step by step methodologies that address:

   - (1) Actions and activities necessary to satisfy completion or exit criteria for the phase or project
   - (2) Actions & activities necessary to transfer the project's products services or results to the next phase or to production and/or operations.
   - (3) Activities needed to collect project or phase records, audit project success or failure, gather lessons learned and achieve project information for future use by the organization.

---

**Project Management:** Application of knowledge, skills, tools and techniques to project activities to meet the project requirements. Project management is accomplished through the appropriate application and integration of the 47 logically grouped project management processes, which are categorized into 5 process groups. These five groups are:

1. Initiating
2. Planning
3. Executing
4. Monitoring & Controlling
5. Closing

Project management develops and implements plans to achieve a specific scope that is driven by the objectives of program or portfolio it is subjected to and, ultimately to organizational strategies.

---

**Scope Management**

Includes processes required to ensure that the project includes all the work required, and only the work.

**Process Group: Planning**

5. **Plan Scope Management**

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

   **Benefits:** It provides guidance and direction on how scope will be planned.

   - (1) Project Management Plan
   - (2) Project Charter
   - (3) Enterprise Environmental Factors
   - (4) Organizational Process Assets

---

**Process Group: Executing**

5. **Plan Scope Management**

   - (1) Project Management Plan
   - (2) Meetings

---

**Process Group: Monitoring & Controlling**

5. **Plan Scope Management**

   - (1) Expert Judgment
   - (2) Meetings

---

**Process Group: Closing**

5. **Close Project or Phase**

   - (1) Project Management Plan
   - (2) Accepted Deliverables
   - (3) Organizational Process Assets

---

**Process Group: Monitoring & Controlling**

5. **Close Project or Phase**

   - (1) Expert Judgment
   - (2) Meetings

---

**Process Group: Executing**

5. **Plan Scope Management**

   - (1) Project Management Plan
   - (2) Project Charter
   - (3) Enterprise Environmental Factors
   - (4) Organizational Process Assets
(1) Product Scope: Features and functions that categorize a product, service, or result.

(2) Project Scope: Work performed to deliver a product, service, or result with the specified features and functions. The term project scope is sometimes viewed as including product scope.

The scope baseline for the project is the approved version of the project scope statement, WBS, and its associated WBS dictionary. A baseline can be changed only through formal change control procedures and is used as a basis for comparison when validating scope and control processes as well as other controlling processes.

Completion of the project scope is managed throughout the project.

The development of the scope management plan and the detailing of the project scope begin with the analysis of the information contained in the project charter, the latest approved subsidiary plans of the project management plan, historical information contained in the organizational process assets, and any other relevant enterprise environmental factors. This plan helps reduce the project scope creep.

Scope Creep: Is the uncontrolled expansion to product or project scope without adjustments to time, cost, and resources.

**Progressive Elaboration:** Involves continuously improving and detailing a plan as more detailed and specific information and more accurate estimates become available. Progressive elaboration allows a project management team to define work and manage it to a greater level of detail as the project evolves.

### Project Constraints:

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<tbody>
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<td><strong>5.2 Collect Requirements</strong></td>
<td>(2) Requirements Management Plan</td>
</tr>
<tr>
<td>It is the process of determining, documenting, and managing stakeholder needs and requirements to meet project objectives.</td>
<td>(3) Stakeholder Management Plan</td>
</tr>
<tr>
<td><strong>Benefits:</strong> It provides the basis for defining and managing the project scope and including the product scope.</td>
<td>(4) Project Charter</td>
</tr>
<tr>
<td>Requirements become the foundation of WBS, cost, schedule, quality planning, and sometimes procurements are based upon these requirements. The development of requirements begins with analysis of information contained in the project charter, the stakeholder register, and the stakeholder management plan.</td>
<td>(5) Stakeholder Register</td>
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**Project Boundary:** is defined as the point in time at which the start or completion of the project or project phase is authorized.

<table>
<thead>
<tr>
<th>(1.4) Project requirements</th>
<th>(1) Requirements Traceability</th>
<th>(2) Requirements Traceability Matrix: is a grid that links</th>
</tr>
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<tbody>
<tr>
<td><strong>(1.3) Solution requirements</strong></td>
<td>(1.1) Business Requirements</td>
<td></td>
</tr>
<tr>
<td>(A) Functional and nonfunctional requirements</td>
<td>(A) Business &amp; Project objectives for traceability</td>
<td></td>
</tr>
<tr>
<td>(B) Technology and standard compliance requirements</td>
<td>(B) Business rules for the performing organization</td>
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<tr>
<td>(C) Quality Requirements</td>
<td>(C) Guiding principles of the organization</td>
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<td></td>
<td>(1.2) Stakeholder requirements</td>
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<tr>
<td>(A) Impacts to other organizational areas</td>
<td>(A) Impacts to other organizational areas</td>
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<tr>
<td>(B) Impacts to other entities inside and outside the performing organization</td>
<td>(B) Impacts to other entities inside and outside the performing organization</td>
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<td>(C) Stakeholder communication and reporting requirements</td>
<td>(C) Stakeholder communication and reporting requirements</td>
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<tr>
<td><strong>(1.5) Transition requirements</strong></td>
<td>(1.3) Solution requirements</td>
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<tr>
<td>(1.6) Requirements assumptions, dependencies, and constraints</td>
<td>(A) Levels of service, performance, safety, compliance etc</td>
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<tr>
<td>(B) Acceptance criteria</td>
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The phase-to-phase relationship strongly influences how the requirements are managed. The project manager chooses the most effective relationship for the project and documents this approach in the requirements management plan.

(2.1) How requirements activities will be planned tracked and reported

(2.2) Configuration management activities such as: how changes to the project will be initiated, how impacts will be analyzed, how they will be tracked, and reported as well as authorization levels required to approve these changes.

(2.3) Requirement prioritization process

(2.4) Product metrics that will be used and the rationale for using them

(2.5) Traceability structure to reflect which requirement attributes will be captured on the traceability matrix

**Traceability Matrix:**

- **A** Acceptance criteria
- **B** Business rules for the performing organization
- **C** Guiding principles of the organization
- **D** Business & Project objectives for traceability
- **E** Business & Project objectives for traceability
| **Project Management Office:** A management structure that standardizes the project related governance processes and facilitates the sharing of resources, methodologies, tools and techniques. Responsibility of PMO can vary from providing project management support functions to actually being responsible for the direct management of one or more projects.

**Types of PMO:**

1. **Supportive:** Provide a constructive role to projects by supplying templates, best practices, training, access to information and lessons learned from other projects. This type of PMO serves as a project repository. The degree of control provided by the PMO is low.

2. **Controlling:** Provide support and require compliance through various means. Compliance may involve adopting project management frameworks or methodologies, using specific templates, forms and tools, or conformance to governance. The degree of control provided by the PMO is moderate.

3. **Directive:** This type of PMO takes control of the projects by directly managing the projects. The degree of control provided by the PMO is high.

Integrates data and information from corporate strategic projects and evaluates how higher level strategic objectives are being fulfilled.

Natural liaison between the organization’s portfolios, programs, projects and the corporate measurement system.

Projects supported or administered by the PMO may not be related, other than by being managed together.

May have the authority to act as integral stakeholder and a key decision maker throughout the life of each project, to make recommendations, or to terminate projects or take other actions, as required, to remain aligned with the business objectives. The PMO may be involved in the selection, management and deployment of shared or dedicated project resources.

**Functions of PMO:**

1. Managing shared resources across all projects administered by the PMO

2. Identifying and developing project management methodology, best practices, and standards

3. Coaching, mentoring, training and oversight

4. Monitoring compliance with project management standards, policies, procedures, and templates, by means of project audit.

5. Developing and managing project policies, procedures, templates, and other shared documentation (OPA)

6. Coordinating Communication across projects

---

**Project Management Vs PMO**

| (1) Focuses on specified project objectives | (1) Manages major program, scope changes which may be seen as potential opportunities to better achieve business objectives |
| (2) Controls the assigned project resources to best meet Project objective | (2) Optimizes use of shared resources across all projects |
| (3) Manages the constraints (scope, schedule, cost, quality, Etc) of the individual projects | (3) Manages the methodologies, standards, overall risks / opportunities matrices and interdependencies among projects at enterprise level. |

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**PMO Objective:** Collecting customer needs also known as the voice of the customer (VOC). These needs are then objectively and goals are set for achieving them. (3.3) User stories: Which are short, textual descriptions of required functionality, are often developed during a requirements workshop. User stories describe the stakeholders who benefits from the feature (role), what the stakeholder needs to accomplish (goal), and the benefit to the stakeholder (motivation). User stories are widely used with agile methods.

**Group Creativity Techniques**

1. Brainstorming: A technique used to generate and collect multiple ideas related to project and product requirements. Although brainstorming by itself does not include voting or prioritization, it is often used with other group creativity techniques that do.

2. Nominal Group Technique: A technique that enhances brainstorming with a voting process used to rank the most useful ideas for further brainstorming or for prioritization.

3. Idea/Mind Mapping: A technique in which ideas created through individual brainstorming sessions are consolidated into a single map to reflect commonality and differences in understanding, and generate new ideas.

4. Affinity Diagram: A technique that allows large numbers of ideas to be classified into groups for review and analysis.

5. Multi criteria decision analysis: A technique that utilizes a decision matrix to provide a systematic analytical approach for establishing criteria, such as risk levels, uncertainty, and valuation, to evaluate and rank many ideas.

**Group Decision Making Techniques**

1. Unanimity: A decision that is reached whereby everyone agrees on a single course of action. One way to reach unanimity is the Delphi Technique, in which a selected group of experts answers questionnaires and provides feedback regarding the responses from each round of requirement gathering. The responses are only available to the facilitator to maintain anonymity.

2. Majority: A decision that is reached with support obtained from more than 50% of the members of the group. Having a group size with an uneven no. of participants can ensure that a decision will be reached, rather than resulting in a tie.

3. Plurality: A decision that is reached whereby the largest block in a group decides, even if a majority is not achieved. This method is generally used when the product requirements from their origin to the deliverables that satisfy them. The implementation of a requirements traceability matrix helps ensure that each requirement adds business value linking it to the business and project objectives. It provides a means to track requirements throughout the project lifecycle, helping to ensure that the requirements approved in the requirements documentation are delivered at the end of the project. Finally it provides a structure for managing changes to the product scope.

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**Attributes:** Attributes associated with each requirement can be recorded in the requirements traceability matrix. These attributes helps to define key requirements help to define key information about the requirement. Typical attributes used in the requirements traceability matrix include:

- **Identifiers** (A) Business needs, opportunities, goals and objectives
- **Description** (B) Project Objectives
- **Scope** (C) Project Scope/WBS deliverables
- **Development** (D) Product Design
- **Test** (F) Test Strategy & Test scenarios
- **Implementation** (G) High-level requirements to more detailed requirements

---
number of options nominated is more than two.

(5.4) Dictatorship: In this method, one individual makes the decision for the group.

(6) Questionnaires & Surveys

(7) Observations: provide a direct way of viewing individuals in their environment and how they perform their jobs or tasks and carry out processes. It is particularly helpful for detailed processes when the people that use the product have difficulty or are reluctant to articulate their requirements.

(7.1) Job Shadowing: It is usually done externally by an observer viewing a business expert performing a job.

(7.2) Participant Observer: Who actually performs a process or procedure to experience how it is done to uncover hidden requirements.

(8) Prototypes: Supports the concept of progressive elaboration in iterative cycles of mock-up creation, user experimentation, feedback generation, and prototype revision. When enough feedback cycles have been performed, the requirements obtained from the prototype are sufficiently complete to move to a design or build phase.

(8.1) Storyboarding: is a prototyping technique showing sequence or navigation through a series of images or illustrations. Storyboards are used on a variety of projects in a variety of industries, such as film, advertising, industrial design, and on agile and other software development projects. In software development, storyboards use mock-ups to show navigation paths through webpages, screens, or other user interfaces.

(9) Benchmarking: involves comparing actual or planned practices, such as processes and operations, to those of comparable organizations to identify best practices, generate ideas for improvement, and provide a basis for measuring performance.

(10) Context Diagrams: is an e.g. of scope model. Context diagrams visually depict the product scope by showing a business system (process, equipment, computer system, etc) and how people and other systems (actors) interact with it. Context diagrams show inputs to the business system, the actor(s) providing the input, the outputs from the business system, and the actors receiving the output.

(11) Document Analysis: is used to elicit requirements by analyzing existing documentation and identifying information...
Process Group: Planning

5.3 Define Scope

It is the process of developing a detailed description of the project and product.

Benefits: It describes the product, service, or result boundaries by defining which of the requirements collected will be included in and excluded from the scope.

Define scope process selects the final project requirements from the requirements documentation delivered during the Collect Requirements Process. It then develops the detailed description of the project and product, service, or result.

The define scope process can be highly iterative. In iterative life cycle projects, a high-level vision will be developed for the overall project but the detailed scope is developed one iteration at a time and the detailed planning for the next iteration is carried out as work progresses for the current project scope and deliverables.

Process Group: Planning

5.4 Create WBS

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

Benefits: It provides a structured vision of what has to be delivered.

The WBS is a hierarchical decomposition of the total scope of work to be carried out by the project team to accomplish the project objectives and create the required deliverables. The work organizes and defines the total scope of the project, and represents the work specified in the current approved project scope statement.

The planned work is contained in the lowest level of WBS components, which are called Work Packages.

Work Packages: A work package is used to group the activities where work is scheduled and estimated, monitored, and controlled. The work package is the work defined at the lowest level of WBS for which cost & duration can be estimated. In the context of the WBS, work refers to work products or deliverables that are the result of activity and not to the activity itself. The level and details of work package will vary with the size and complexity of the project.
Organizational Project Management (OPM): OPM is a strategy execution framework utilizing project, program, and portfolio management as well as organizational enabling practices to consistently and predictably deliver organizational strategy producing better performance, better results, and a sustainable competitive advantage. OPM advances organizational capability by linking project, program and portfolio management principles and practices with organizational enablers (eg structural, cultural, technological and HR practices) to support strategic goals.

breakdown the overall scope of the project. This level of expertise of provided by any group or individual with relevant training, knowledge, or experience with similar projects or business areas. Expert judgment can also come in the form of predefined templates that provide guidance on how to effectively breakdown common deliverables.

The project manager, in collaboration with the project team, then determines the final decomposition of the project scope into the discrete work packages that will be used to effectively manage the work of the project.

(2.1) Top-Down Approach, use of Organization specific guidelines & WBS Templates

(2.3) Bottom-Up Approach: During integration of sub components

(2.4) Decomposition: of the upper level WBS components requires subdividing the work for each of the deliverables or subcomponents into its most fundamental elements, where the WBS components represent verifiable products, services, or results. The WBS may be structured as an outline, an organization chart, or other method that identifies a hierarchical breakdown. Verifying the correctness of the decomposition requires determining that the lower-level WBS components are those that are necessary and sufficient for completion of the corresponding higher-level deliverables. Different deliverables have different levels of decomposition. To arrive at the work package, the work for some deliverables needs to be decomposed only to the next level, while others need additional level of decomposition. As the work is decomposed to greater level of detail, the ability to plan, manage, and control the work is enhanced. However, excessive decomposition can lead to nonproductive management effort, inefficient use of resources, decreased efficiency in performing the work, and difficulty aggregating data over different levels of the WBS.

(2.5) Rolling Wave Planning: Decomposition may not be possible for a deliverable or subcomponent that will be accomplished far into the future. The project management team usually waits, until the deliverable or sub component is agreed on, so the details of the WBS can be developed.

(2.6) 100% Rule: The WBS represents all project and product work, including the project management work. The total of the work at the lowest levels should roll up to the higher levels so that nothing is left out and no extra work is performed.

(2.7) The WBS Structure

(A) Code of account identifier

(B) Description of work

(C) Assumptions and constraints

(D) Responsible organization

(E) Schedule Milestone

(F) Associated schedule activities

(G) Resources required

(H) Cost estimates

(I) Quality requirements

(J) Acceptance criteria

(K) Technical reference

(L) Agreement Information

(2) Project Documents Updates

(2.1) Requirements documentation

detailed deliverable, activity, and scheduling information about each component in the WBS.

(A) Code of account identifier

(B) Description of work

(C) Assumptions and constraints

(D) Responsible organization

(E) Schedule Milestone

(F) Associated schedule activities

(G) Resources required

(H) Cost estimates

(I) Quality requirements

(J) Acceptance criteria

(K) Technical reference

(L) Agreement Information
<table>
<thead>
<tr>
<th>Process Group: Monitoring &amp; Controlling</th>
<th>(1) Project Management Plan</th>
<th>(1) Inspection</th>
<th>(1) Accepted Deliverables</th>
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<tbody>
<tr>
<td>5.5 Validate Scope</td>
<td>(2) Requirements Documentation</td>
<td>(2) Group-Decision Making Techniques</td>
<td>(2) Change Requests</td>
</tr>
<tr>
<td>It is the process of formalizing acceptance of the completed variables.</td>
<td>(3) Requirements Traceability Matrix</td>
<td>(3) Project Documents Updates</td>
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<tr>
<td>Benefits: It brings objectivity to the acceptance process and increases the chance of final product, service or result acceptance by validating each deliverable</td>
<td>(4) Verified Deliverables</td>
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<tr>
<td>The verified deliverables obtained from the control quality process are reviewed with the customer or sponsor to ensure that they are competed satisfactorily and have received formal acceptance of the deliverables by the customer or sponsor.</td>
<td>(5) Work Performance Data</td>
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<td>In this process, the outputs obtained as a result of the planning processes in the project scope management area, such as the requirements documentation or the scope baseline as well as the work performance data obtained from the execution processes in other knowledge areas, are the basis for performing the validation and for final acceptance.</td>
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<td>The validate scope process differs from the quality control process in that the former is primarily concerned with acceptance of deliverables, while quality control is primarily concerned with correctness of deliverables and meeting the quality requirements specified for the deliverables.</td>
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<tr>
<th>Process Group: Monitoring &amp; Controlling</th>
<th>(1) Project Management Plan</th>
<th>(1) Variance Analysis: is a technique for determining the cause and degree of difference between the baseline and actual performance. Project performance measurements are used to assess the magnitude of variation from the original scope baseline. Important aspects of project scope control include determining the cause and degree of variance relative to the scope baseline and deciding whether corrective or preventive action is required.</th>
<th>(1) Work Performance Information</th>
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<tr>
<td>5.6 Control Scope</td>
<td>(1.1) Scope Baseline</td>
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<td>(2) Change Requests</td>
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<tr>
<td>It is the process of monitoring the status of the project and product scope and managing changes to the scope baseline.</td>
<td>(1.2) Scope Management Plan</td>
<td>(3) Project Management Plan Updates</td>
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<td>Benefits: It allows the scope baseline to be maintained throughout the project.</td>
<td>(1.3) Change Management Plan</td>
<td>(3.1) Scope Baseline Updates</td>
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<td>(1.4) Configuration Management Plan</td>
<td>(A) Project Scope Statement</td>
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<td>(1.5) Requirements Management Plan</td>
<td>(B) WBS</td>
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<td>(2) Requirements Documentation</td>
<td>(C) WBS Dictionary</td>
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<td>(3) Requirements Traceability Matrix</td>
<td>(3.2) Other Baseline Updates (if required)</td>
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<td>(4) Work Performance Data</td>
<td>(3.2.1) Cost Baseline</td>
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<td>(5) Organizational Process Assets</td>
<td>(3.2.2) Schedule Baseline</td>
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<td>(4) Project Document Updates</td>
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<td>(4.1) Requirements documentation</td>
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<td>(4.2) Requirements Traceability Matrix</td>
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<td>(5) Organizational Process Updates</td>
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<td>(5.1) Causes of Variances</td>
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<td>(5.2) Corrective action chosen and the reasons</td>
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<td>(5.3) Lessons learned from project scope control</td>
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<td></td>
<td>(1.1) Scope Baseline</td>
<td>(1.1) Project Schedule Model Development: The</td>
<td>(1.1) Project Schedule Model Development: The</td>
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The third level
(B) Using major deliverables as the second level of decomposition
(C) Incorporating subcomponents which may be developed by organizations outside the project team, such as contracted work. The seller then develops the supporting contract WBS as part of the contracted work.
Processes required to manage timely completion of the project.

**Schedule Model:** is a representation of the plan for executing the project’s activities including durations, dependencies, and other planning information, used to produce project schedules along with other scheduling artifacts.

### 6.1 Plan Schedule Management

It is the process of establishing the policies, procedures, and documentation for planning, developing, managing, executing, and controlling the project schedule.

**Benefits:** It provides guidance and direction on how the project schedule will be managed throughout the project.

Is a component of project management plan, may be formal or informal, highly detailed or broadly framed, based upon the needs of the project and includes appropriate control thresholds. It defines how the schedule contingencies will be reported and addressed. The schedule management plan may be updated to reflect a change in the way the schedule is managed. The schedule management plan is a major input to the Develop Project Management Plan process.

### 6.2 Define Activities

**Process Group:** Planning

**6.2 Define Activities**

It is the process of identifying and documenting the specific actions to be performed to produce the project deliverables.

**Benefits:** Is to breakdown work packages into activities that provide a basis for estimating, scheduling, executing, monitoring, and controlling the project work.

Implicit in the process are defining and planning the schedule activities such that the project activities will be met.

The create WBS process identifies the deliverables at the lowest level in the WBS – the work package. Work packages are typically decomposed into smaller components called activities that represent the work effort required to complete the work packages.

### 1.2 Cost, Risk and Communications

**Activity List:** Is a comprehensive list that includes all schedule activities required on the project. The activity list also includes the activity identifier and a scope of work description for each activity in sufficient detail to ensure that the project team members understand what work is required to be completed. Each activity should have its unique title that describes its place in the schedule, even if the activity title is displayed outside the context of the project schedule.

### 1.3 Units of measure

**Activity Type:** Level of effort (LOE): An activity that does not produce definitive end products and is measured by the passage of time

**Discreet Effort:** An activity that can be planned depending on where it is in the project life cycle. During early strategic planning, when information is less defined, work packages may be decomposed into the known level of detail. As more is known about the upcoming events in the near term, work packages can be decomposed into activities.

### 1.4 Organizational procedure links

**Logical Relationships:**

- Predecessor Activities
- Successor Activities
- Imposed Dates

**Activity Description:**

- Activity Type
- Person responsible
- Geographic Area
- Project Calendar

**Earned Value Management (EVM) rules**

- Control thresholds
- Rules of performance measurements

**Project schedule model maintenance**

- Schedule variance (SV)
- Schedule performance index (SPI)

**Meeting**

- Schedule variance (SV)
- Schedule performance index (SPI)
- Project schedule model maintenance

**Scheduling methodology and the scheduling tool to be used in the development of the project schedule model are specified.**

- Level of accuracy
- Units of measure
- Schedule management process are documented.

**Cost, Risk and Communications**

- Earned Value Management techniques to be employed

**Control accounts at which management of**

- Control thresholds
- Rules of performance measurements
- Earned Value Management (EVM) rules or other physical measurement techniques to be assessed

**Activity**

- Activity Type
- Person responsible
- Geographic Area
- Project Calendar

**Organizational Process Assets**

- Activity Types
- Person responsible
- Geographic Area
- Project Calendar

**Process descriptions:**

- Description of each of the schedule management process are documented.

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    - Description of each of the schedule management processes are documented.

  - Process descriptions:

    - Description of each of the schedule management processes are documented.
Process Group: Planning

6.3 Sequence Activities
It is the process of identifying and documenting relationships among the project activities.

Benefits: It defines the logical sequence of work to obtain the greatest efficiency given all project constraints.

Every activity and milestone except the first and last should be connected to at least one predecessor with a finish-to-start or start-to-start logical relationship and at least one successor with a finish-to-finish or start-to-finish logical relationship. Logical relationship should be designed to create a realistic project schedule. It may be necessary to use lead or lag time between activities to support a realistic and achievable project schedule.

Tangible Elements: Monetary assets, fixtures, stock holder equity, and utility
Intangible Elements: Good will, brand recognition, public benefit, and trademarks

Operations: Ongoing endeavours that produce repetitive output, with resources assigned to do basically the same set of tasks according to the standards institutionalized in a product life cycle.

Operational Management: Area of management concerned with on going production of goods and / or services. It is concerned with managing processes that transforms inputs (eg materials, components, energy and labour) into outputs (eg products, goods, and / or services). It involves ensuring that business operations continue efficiently by using the optimum resources needed and meeting customer demands

Operational Stakeholders: (1) Plant Operators (2) Manufacturing line supervisors (3) Help desk staff (4) Production system support analyst (5) Customer service representative (6) Sales persons (7) Maintenance workers (8) Call centre personnel (9) Retail workers (10) Line Managers (11) Training Officers (12) Telephone sales personnel

Business Value: Entire value of the business; the total sum of all tangible and intangible elements
Tangible Elements: Monetary assets, fixtures, stock holder equity, and utility
Intangible Elements: Good will, brand recognition, public benefit, and trademarks

(1) Precedence Diagraming Method: Is a technique used for constructing a schedule model in which activities are represented by nodes and are graphically linked by one or more logical relationships to show the sequence in which activities are to be performed. Activity-On-Node (AON) is one method of representing a precedence diagram. This is the method used by most project management software packages.

PDM included four types of dependencies or logical relationships. A predecessor activity is an activity that logically comes before a dependent activity in a schedule. A successor activity is a dependent activity that logically comes after another activity in a schedule.

(1.1) Finish-to-start: A successor activity cannot start until a predecessor activity has finished.
(1.2) Start-to-start
(1.3) Finish-to-Finish
(1.4) Start-to-Finish

(2) Dependency Determination
(2.1) Mandatory dependencies: Are those that are legally or contractually required or inherent in the nature of the work. Mandatory dependencies often involve physical limitations, such as on a construction project, where it is impossible to erect the super structure until after the foundation has been built. Also sometimes referred to as hard logic or hard dependencies. Technical dependencies may not be mandatory. The project team determines which dependencies are mandatory during the process of sequencing the activities. Mandatory dependencies should not be confused with assigning schedule constraints in the scheduling tool.

(2.2) Discretionary dependencies: Are sometimes referred to as preferred logic, preferential logic, or soft logic. Discretionary dependencies are established based on knowledge of best practices within a particular application area or some unusual aspect of the project where a specific sequence is desired even though there may
be other acceptable sequences. Discretionary dependencies should be fully documented since they can create arbitrary total float values and can limit later scheduling options. When fast tracking techniques are employed, these discretionary dependencies should be reviewed and considered for modification or removal. The project team determines which dependencies are discretionary during the process of sequencing the activities.

(2.3) External dependencies: Involve a relationship between project activities and non-project activities. These dependencies are usually outside the project team’s control.

(2.4) Internal dependencies: Involve a precedence relationship between project activities and are generally inside the project team’s control.

(2) Leads and Lags: A lead is the amount of time whereby a successor activity can be advanced with respect to a predecessor activity. Lead is often represented as a negative value for lag in scheduling software. \((\text{Lead} = -\text{Lag})\)

A lag is the amount of time whereby a successor activity will be delayed with respect to a predecessor activity. The use of lead or lag should not replace schedule logic. Activities and their related assumptions should be documented.

### Responsibilities and Competencies of the Project Manager:

(1) Responsible to satisfy needs: task needs, team needs, and individual needs. Project Manager becomes the link between the strategy and the team

(2) Competencies required:

(a) Knowledge: Project Management Knowledge

(b) Performance: What Project Manager is able to do or accomplish while applying project management knowledge

(c) Personal: How the project manager behaves when performing the project or related activity. Personal effectiveness encompasses attitudes, core personality characteristics, and leadership which provides the ability to guide the project team while achieving project activities and balancing project constraints.

### Process Group: Planning

#### Planning

### 6.4 Estimate Activity Resources

Is the process of estimating type and quantities of material, human resources, equipment, or supplies required to perform each activity.

**Benefits:** It identifies the type, quantity, and characteristics of resources required to complete the activity which allows more accurate cost and duration estimates.

The estimate activity resources process is closely coordinated with estimate cost process.

(1) Schedule Management Plan

(2) Activity List

(3) Activity Attributes

(4) Resource Calendars: Is a calendar that identifies the working days and shifts on which each specific resource (human resource, equipment, and material) is available. It specifies when and how long identified project resources will be available during the project. The information may be at the activity or project level. This knowledge includes consideration of attributes such as resource experience and/or skill level, as well as various geographical locations from which the resources originate and when they may be available.

(5) Risk Register

(6) Activity Cost Estimates

(7) Enterprise Environmental Factors

(8) Organizational Process Assets

### Process Group: Planning

(1) Expert Judgment

(2) Alternative Analysis

(3) Published Estimating Data

(4) Bottom-Up Estimating: Is a method of estimating project duration or cost by aggregating the estimates of the lower level components of the WBS. Activities may or may not have dependencies between them that can affect the application and use of resources. If there are dependencies, this pattern of resource usage is reflected and documented in the estimated requirements of the activity.

(5) Project Management Software

(6) Activity Resource Requirements: Identify the types and quantities of resources required for each activity in a work package. These requirements then can be aggregated to determine the estimated resources for each work package and each work period.

(2) Resource Breakdown Structure: Is a hierarchical representation of resources by category and type. The resource breakdown structure is useful for organizing and reporting project schedule data with resource utilization information.

(2.1) Category: Labor, Material, Equipment, & Supplies

(2.1) Type: Skill level, Grade Level, Other information

(3) Project Documents Updates

(3.1) Activity List

(3.2) Activity Attributes

(3.3) Resource Calendars

(1) Activity Duration Estimates: are quantitative
6.5 Estimate Activity Durations

Is the process of estimating the number of work periods needed to complete individual activities with estimated resources.

**Benefits:** It provides the amount of time each activity will take to complete, which is a major input to schedule development process

Estimate activity duration uses information on activity scope of work, required resource types, estimated resource quantities, and resource calendars. The inputs to the estimates of activity duration originate from the person or group on the project team who is most familiar with the nature of work in the specific activity. The duration estimate is progressively elaborated, and the process considers the quality and availability of input data. Thus, the duration estimate can be assumed to be progressively more accurate and of better quality.

The estimate activity durations process requires an estimation of amount of work effort required to complete the activity and the amount of available resources estimated to complete the activity. These estimates are used to approximate the number of work periods (activity duration) needed to complete the activity using the appropriate project and resource calendars. All data and assumptions that support duration estimating are documented for each estimate of activity duration.

**Program Management:** harmonizes its projects and program components and controls interdependencies in order to realize specified benefits. A program is defined as group of related projects, subprograms, and program activities, managed in a coordinated way to obtain benefits not available from managing them individually. A project may or may not be part of a program but a program will always have projects.

Program management is the application of knowledge, skills, tools and techniques to a program in order to meet the program requirements and to obtain benefits and control not available by managing projects individually.

Projects within a program are related through the common outcome or collective capability. If the relationship between projects is only that of a shared client, seller, technology or resource, the effort should be managed as a portfolio of projects rather than a program.

Program management focuses on the interdependencies & helps to determine optimal approach for managing them. Actions related to these interdependencies may include:

1. Resolving resource constraints and / or conflicts that affect multiple projects within the program.
2. Aligning organizational / strategic direction that affects projects and program goals and objectives
3. Resolving issues and change management within a shared governance structure.

(2) Activity List
(3) Activity Attributes
(4) Activity Resource Requirements
(5) Resource Calendars
(6) Project Scope Statement
(7) Risk Register
(8) Resource Breakdown Register
(9) Enterprise Environmental Framework
(10) Organizational Process Assets

(2) Analogous Estimating: Is a technique for estimating the duration or cost of an activity or a project using historical data from a similar activity or project. When estimating durations, this technique relies on the actual duration of previous, similar projects as the basis for estimating the duration of the current project. It is a gross value estimating approach sometimes adjusted for known differences in project complexity. It is frequently used when there is limited amount of detailed information about the project. It is less costly, less time consuming than other techniques, but is also less accurate. Can be applied to a total project or to segment of a project and may be used in conjunction with other estimating methods. Analogous estimating is most reliable when the previous activities are similar in fact and not just in appearance, and the project team members preparing the estimates have the needed expertise.

(3) Parametric Estimating: Is an estimating technique in which an algorithm is used to calculate cost or duration based on historical data and project parameters. Parametric estimating uses a statistical relationship between historical data and other variables (eg sq ft in construction) to calculate an estimate for activity parameters, such as cost, budget, and duration. Activity durations can be quantitatively determined by multiplying the quantity of work to be performed by labor hours per unit of work. The technique can produce higher levels of accuracy depending upon the sophistication and underlying data built into the model. Parametric time estimates can be applied to a total project or to segments of a project in conjunction with other estimating methods.

(4) Three-Point Estimating: The accuracy of single point activity duration estimates may be improved by considering estimation uncertainty and risk. This concept originated from Program Evaluation and review Technique (PERT). PERT uses three estimates to define an approximate range for an activity's duration.

Most likely (TM): This estimate is based on the duration of the activity, given the resources likely to be assigned, their productivity, realistic expectations of availability for the activity, dependencies on other participants, and interruptions

Optimistic(TO): The activity duration based on the best-case scenario for the activity.
Pessimistic(t\text{P}): The activity duration based on analysis of the worst-case scenario for the activity

Duration estimates based on three points with an assumed distribution provide an expected duration and clarify the range of uncertainty around the expected duration Following formulae can be used
(4.1) Triangular Distribution : \( (t_\text{O}+t_\text{M}+t_\text{P})/3 \)
(4.2) Beta Distribution : \( (t_\text{O}+4t_\text{M}+t_\text{P})/6 \)
(4.3) Beta Dist. S.D : \( (P-O)/6 \)
(4.4) Beta Dist. Variance : \( (P-O)/6)^2 \)

(5) Group Decision Making Techniques: Is an assessment process having multiple alternatives with an expected out-come in the form of future actions. These techniques are useful for engaging team members to improve estimate accuracy and commitment to the emerging estimates.

(6) Reserve Analysis
(6.1) Contingency Reserve: Duration estimates may include contingency reserves also referred as time reserves or buffers, into the project schedule to account for schedule uncertainty. Contingency reserves are the estimated duration within the schedule baseline which is allocated for identified risks that are accepted and for which contingent or mitigation responses are developed. Contingency reserves are associated with the “know-unknowns”, which may be estimated to account for unknown amount of rework. The contingency reserve may be a percentage of the estimated activity duration, a fixed no of work periods, or may be developed by using quantitative analysis methods such as Monte Carlo Simulation. Contingency reserve may be separated from individual activities and aggregated into buffer. As more precise information about the project becomes available, the contingency reserve may be used, reduced, or eliminated. Contingency should be clearly identified in schedule documentation.

(6.2) Management Reserve: Estimates may also be produced for the amount of management reserve of time for the project. Management reserves are a specified amount of the project duration withheld for management control purpose and are reserved for unforeseen work that is within scope of the project. Management reserves are intended to address the “unknown-unknowns” that can affect a project. Management reserve is not included in the schedule baseline, but it is part of the overall project duration requirements. Depending on contract terms, use of management reserve may require an

<table>
<thead>
<tr>
<th>Advantages:</th>
<th>Disadvantages:</th>
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<tbody>
<tr>
<td>(1) Efficient project organization</td>
<td>(1) No &quot;Home&quot; or team members when project is completed</td>
</tr>
<tr>
<td>(2) Team loyalty to project</td>
<td>(2) Lack of specialization in disciplines</td>
</tr>
<tr>
<td>(3) More effective communication than functional organization</td>
<td>(3) Duplication of facilities and job functions</td>
</tr>
<tr>
<td>(4) May result in less efficient use of resources</td>
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</table>

Matrix Organization:

(1) Blend of functional and projectized organization
(2) Can be classified as weak, balanced or strong
(3) Weak matrix organizations maintain many of the characteristics of a functional organization, and the role of the project manager is more of a coordinator or expeditor

Project Coordinator: Power to make some decisions, have some authority , and report to higher level manager

Project Expediter: Cannot personally make or enforce decisions, works as staff assistant, and communications coordinator

(4) Strong matrix organizations have many of the characteristics of the projectized organizations, and have full time project managers with considerable authority and full time project administrative staff

(5) Balanced matrix organizations recognizes the need for a project manager, it doesnot provide the project manager with the full authority over the project and the project funding

<table>
<thead>
<tr>
<th>Advantages:</th>
<th>Disadvantages:</th>
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<tbody>
<tr>
<td>(1) Highly visible project objectives</td>
<td>(1) Extra administration is required</td>
</tr>
<tr>
<td>(2) Improved project manager control over resources</td>
<td>(2) Project team members have more than one boss</td>
</tr>
<tr>
<td>(3) More support from functional area</td>
<td>(3) More complex to monitor and control</td>
</tr>
<tr>
<td>(4) Maximum utilization of scarce resources</td>
<td>(4) Resource allocation is more complex</td>
</tr>
<tr>
<td>(5) Better coordination</td>
<td>(5) Extensive policies and procedures are needed</td>
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<tr>
<td>(6) Better horizontal and vertical dissemination of information</td>
<td>(6) Functional managers may have different priorities than project managers</td>
</tr>
<tr>
<td>(7) Team members maintain a home</td>
<td>(7) Higher potential for conflict</td>
</tr>
</tbody>
</table>

Projectized Organization: Team members are often collocated. Most of the organizations resources are involved in project work, and project managers have a great deal of independence and authority. They often have organizational units called departments, but they can either report directly to the project manager or provide support services to the various projects

Advantages of Projectized Organization:

(1) Efficient project organization
(2) Team loyalty to project
(3) More effective communication than functional organization
(4) May result in less efficient use of resources

Disadvantages of Projectized Organization:

(1) No "Home" or team members when project is completed
(2) Lack of specialization in disciplines
(3) Duplication of facilities and job functions
(4) More complex to monitor and control
(5) Resource allocation is more complex
(6) Extensive policies and procedures are needed

Advantages of Matrix Organization:

(1) Efficient project organization
(2) Team loyalty to project
(3) More effective communication than functional organization
(4) May result in less efficient use of resources

Disadvantages of Matrix Organization:

(1) Extra administration is required
(2) Project team members have more than one boss
(3) More complex to monitor and control
(4) Resource allocation is more complex
(5) Extensive policies and procedures are needed
(6) Functional managers may have different priorities than project managers
(7) Higher potential for conflict
6.6 Develop Schedule

Process Group: Planning

It is the process of analyzing activity sequences, durations, resource requirements, and schedule constraints to create the project schedule model.

Benefits: By entering schedule activities, durations, resources, resource availabilities, and logical relationships into the scheduling tool, it generates a schedule model with planned dates for completing project activities.

Developing an acceptable schedule is often an iterative process. The schedule model is used to determine the planned start and finish dates for project activities and milestones based on the accuracy of the inputs. Schedule development can require the revision and review of duration estimates and resource estimates to create the project schedule model to establish an approved project schedule the can serve as a baseline to track progress

Once the activity start and finish dates have been determined, it is common to have project staff assigned to the activities review their assigned breakdown structure and confirm that the start and finish dates present no conflict with resource calendars or assigned activities in other projects or task and thus are still valid. As work progresses, revising and maintaining the project schedule model to sustain a realistic schedule continues throughout the duration of the project

Functional Organization: Is a hierarchy where each employee has one clear supervisor. Staff members are grouped by specialty such as production, marketing, engineering and accounting at the top level. Specialties may be further subdivided into focused functional units. Such as mechanical and electrical engineering. Each department in a functional organization will do its project work independently of the other.

<table>
<thead>
<tr>
<th>Advantages:</th>
<th>Disadvantages:</th>
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</thead>
<tbody>
<tr>
<td>(1) Easier management of specialties</td>
<td>(1) People place more emphasis on their functional specialty to the detriment of the project</td>
</tr>
<tr>
<td>(2) Team member reports to only one supervisor</td>
<td>(2) No career path in project management</td>
</tr>
<tr>
<td>(3) Similar resources are centralized as the company is grouped by specialty</td>
<td>(3) Project Manager has little or no authority</td>
</tr>
<tr>
<td>(4) Clear defined career paths in the area of work specialization</td>
<td>(4) Little to none resource availability</td>
</tr>
<tr>
<td>(5) Functional Manager manages project budget</td>
<td>(5) Functional Manager manages project budget</td>
</tr>
<tr>
<td>(6) Part time availability of project manager and project management administrative staff</td>
<td></td>
</tr>
</tbody>
</table>

Composite Organization: A projectized organization within a functional organization. Includes full time staff from different functional departments, may develop its own operating procedures, may even operate outside of the standard, formalized reporting structure during the project. An organization may manage most of its project in a strong matrix, but allow small projects to be managed by functional departments.

<table>
<thead>
<tr>
<th>Change to the schedule baseline.</th>
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<tbody>
<tr>
<td>(1) Schedule Network Analysis: Is a technique that generates the project schedule model, and is used as a basis for calculating various analytical techniques, such as critical path method, critical chain method, what-if analysis, and resource optimization techniques to calculate the early and late start and finish dates for the uncompleted portion of project activities. Some network paths may have points of path convergence or path divergence that can be identified and used in schedule compression analysis or other analysis.</td>
</tr>
<tr>
<td>(2) Critical Path Method: Is a method used to estimate the minimum project duration and determine the amount of scheduling flexibility on the logical network paths within the schedule model. This schedule network analysis technique calculates the early start, early finish, late start, late finish dates for all activities without regard for any resource limitations by performing a forward and backward pass analysis through the schedule network. The critical path is the sequence of activities that represent the longest path through a project, which determines the shortest possible project duration. The resulting early and late start and finish dates are not necessarily the project schedule, rather they indicate the time periods within which the activity could be executed.</td>
</tr>
<tr>
<td>Using the parameters entered in the schedule model for activity durations, logical relationships, leads, lags, and other known constraints. The critical path method is used to calculate the amount of scheduling flexibility on the logical network path within the schedule model. On any network path, the schedule flexibility is measured by the amount of time that a schedule activity can be delayed or extended from its early start date without delaying the project finish date or violating a schedule constraint, and is termed “total float”. A CPM critical path is normally characterized by zero total float on the critical path. As implemented with PDM sequencing, critical path may have positive, zero, or negative total float depending on constraints applied. Any activity on the critical path is called a critical path activity. Schedule networks may have multiple near-critical paths. Once the total float for a network has been calculated, then the “free-float” – the amount of time that a schedule activity can be delayed or extended from its early start date without delaying the project finish date or violating a schedule constraint, and is termed “total float”. A CPM critical path is normally characterized by zero total float on the critical path. As implemented with PDM sequencing, critical path may have positive, zero, or negative total float depending on constraints applied. Activity on the critical path is called a critical path activity. Schedule networks may have multiple near-critical paths. Once the total float for a network has been calculated, then the “free-float” – the amount of time that a schedule activity can be delayed or extended from its early start date without delaying the project finish date or violating a schedule constraint, and is termed “total float”.</td>
</tr>
<tr>
<td>(2) Project Schedule: The project schedule is an output of a schedule model that presents linked activities with planned dates, durations, milestones, and resources. At a minimum project schedule includes a planned start date and planned finish date for each activity. If resource planning is done at an early stage, then the project schedule remains preliminary until resource assignments have been confirmed and scheduled start and finish dates are established. This process occurs no later than the completion of the project management plan. A target project schedule model may also be developed with a defined target start and target finish for each activity. The project schedule presentation may be presented in summary form, sometimes referred to as master schedule or milestone schedule or presented in detail. Schedule presentation formats include Bar Charts Milestone Charts Project Schedule Network Diagrams (A) Pure-logic diagrams: activities and relationships without a timescale (B) Logic-bar chart: activity date information and project network logic and the projects critical path (C) Time-scaled logic: Time scale and bars that represent duration activities with the logical activities.</td>
</tr>
<tr>
<td>(3) Schedule Data (3.1) Schedule Milestones (3.2) Schedule Activities (3.3) Activity Attributes (3.4) Assumptions &amp; Constraints (3.5) Supporting Details (A) Resource requirements by time period (Resource Histogram) (B) Alternative Schedules, best case or worst case, not-resource levelled, resource levelled, with or without imposed dates (C) Scheduling of contingency reserves (D) Cash-flow projections (E) Order &amp; Delivery Schedules (4) Project Calendars (5) Project Management Plan Updates (5.1) Schedule Baseline (5.2) Schedule Management Plan (6) Project Documents Updates (6.1) Activity Resource Requirements (6.2) Activity Attributes (6.3) Calendars (6.4) Risk Registers</td>
</tr>
</tbody>
</table>
Project Stakeholders: A stakeholder is an individual group or organization who may affect, be affected by, or perceive itself to be affected by a decision, activity or outcome of a project. Stakeholders may be actively involved in the project or have interest that may be positively or negatively affected by the performance or completion of the project. Different stakeholders may have competing expectations that might create conflicts within the project. Stakeholders may also exert influence over the project, its deliverables, and the project team in order to achieve a set of outcomes that satisfy strategic business objectives or other needs.

Stakeholders include all members of the project team as well as all interested entities that are internal or external to the organization. The project team identifies internal and external, positive and negative, and performing and advising stakeholders in order to determine the project requirements and the expectations of all parties involved. The project manager should manage the influence of these various stakeholders in relation to the project requirements to ensure a successful outcome.

Stakeholders have varying levels of responsibility and authority when participating on a project. This level can change over the course of the project life cycle. Their involvement may range from occasional contributions in surveys, and focus groups to full project sponsorship which includes providing financial, political or other support. Some stakeholders may also detract from success of the project, either passively or actively. These stakeholders require the project manager’s attention throughout the project’s life cycle, as well as planning to address any issues they may raise.

Stakeholder identification is a continuous process throughout the entire project lifecycle. Identifying the stakeholders, understanding their relative degree of influence on a project, and balancing their demands, needs, and expectations are critical to the success of the project. Failure to do so can lead to delays, cost increases, unexpected issues and other negative consequences including project cancellation. Just as stakeholders can positively or adversely impact a project’s objectives, a project can be perceived by the stakeholders as having positive or negative results. Overlooking negative stakeholders interests can result in an increased likelihood of failures, delays, or other negative consequences to the project. Eg of stakeholders are

1. Sponsors
2. Customers and users (customers – acquires projects product; users – utilize project’s product)
3. Sellers (also called vendors, suppliers, contractors)
4. Business partners
5. Organizational groups
6. Functional Managers
7. Other stakeholders

be delayed without delaying the early start date of any successor or violating a schedule constraint can also be determined

(3) Critical Chain Method: It is developed from the critical path method approach and considers the effects of resource allocation, resource optimization, resource levelling, and activity duration uncertainty on the critical path determined using the critical path method. To do so, the critical path method uses the concept of buffers and buffer management. The critical chain method uses activities with durations that do not include safety margins, logical relationships, and resource availability with statistically determined buffers composed of aggregated safety margins of activities at specified points on the project schedule path to account for limited resources and project uncertainties. The resource constrained critical path is known as “critical chain.” The critical chain method adds duration buffers that are non-work schedule activities to manage uncertainty. One buffer, placed at the end of the critical chain is known as “project buffer” and protects the target finish date from slippage along the critical chain. Additional buffers, known as “feeding buffers” are placed at each point where a chain of dependent activities that are not on the critical chain feeds into the critical chain. Feeding buffers thus protect the critical chain from slippage along the feeding chains. The size of each buffer should account for uncertainty in the duration of the chain of dependent activities leading up to that buffer. Once the buffer schedule activities are determined, the planned activities are scheduled to their latest possible planned start and finish dates. Consequently, instead of managing the total float of network paths, the critical chain method focuses on managing the remaining buffer durations against the remaining durations of chain of activities.

(4) Resource Optimization Techniques
(4.1) Resource Levelling: A technique in which start and finish dates are adjusted based on resource constraints with the goal of balancing demand for resources with the available supply. Resource levelling can be used when shared or critically required resources are only available at certain times, or in limited quantities, or over-allocated, such as when a resource has been assigned to two or more activities during the same time period or to keep resource usage at constant level. Resource levelling can often cause the original critical path to change, usually increase.

(4.2) Resource Smoothing: A technique that adjusts the activities of a schedule model
such that the requirements for resources on the project do not exceed certain predefined resources limits. In resource smoothing, as opposed to resource levelling, the project’s critical path is not changed and the completion date may not be delayed. In others words, activities may only be delayed within their free and total float. Thus resource smoothing may not be able to optimize all resources.

(5) Modeling Techniques
(5.1) What-if Scenario Analysis: This is an analysis of the question “what if the situation represented by scenario ‘X’ happens?” The outcome of what-if scenario analysis can be used to assess the feasibility of the project schedule under adverse conditions, and in preparing contingency and response plans to overcome or mitigate the impact of unexpected situations.

(5.2) Simulation: Simulation involves calculating multiple project durations with different sets of activity assumptions, usually using probability distributions constructed from three-point estimates to account for uncertainty. The most common simulation technique is Monte Carlo analysis, in which a distribution of possible activity durations is defined for each activity and used to calculate a distribution of possible outcomes for the total project.

(6) Leads and Lags

(7) Schedule Compression: techniques used to shorten the schedule duration without reducing the project scope, in order to meet schedule constraints, imposed dates, or other schedule objectives

(7.1) Crashing: A technique used to shorten the schedule duration for the least incremental cost by adding resources. Eg of crashing include approving overtime, bringing in additional resources, or paying to expedite delivery to activities on the critical path. Crashing works only for activities on the critical path where additional resources will shorten the activity’s duration. Crashing does not always produce a viable alternative and may result in increased risk and /or cost.

(7.2) Fast Tracking: A technique in which activities or phases normally done in sequence are performed in parallel for at least a portion of their duration. Fast tracking may result in rework and increased risk. Fast tracking only works if activities can be overlapped to shorten the project duration.

(8) Scheduling Tool

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<tbody>
<tr>
<td></td>
<td>(1.1) Schedule Management Plan</td>
<td>(1.1) Trend Analysis</td>
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</table>
6.7 Control Schedule

It is the process of monitoring the status of project activities to update project progress and manage changes to the schedule baseline to achieve the plan.

**Benefits:** It provides the means to recognize deviation from the plan and take corrective and preventive actions and thus minimize risk.

Control schedule as a component of PICC process is concerned with:
1. Determining the current status of the project schedule
2. Influencing the factors that create schedule changes
3. Determining if the project schedule has changed
4. Managing the actual changes as they occur
5. If an agile approach is utilized control schedule is concerned with:
   1. Determining the current status of the project schedule by comparing the total amount of work delivered and accepted against the estimates of work completed for the elapsed time
   2. Conducting retrospective reviews (Scheduled reviews to record lessons learned) for correcting processes and improving, if required)
   3. Reprioritizing the remaining work plan (balck log)
   4. Determining the rate at which the deliverables are produced, validated, and accepted (velocity) in given time per iteration (agreed work cycle duration, typically two weeks or one month)
   5. Determining that the project schedule has changed
   6. Managing the actual changes as they occur

### Cost Management

**Process Group: Planning**

**7.1 Plan Cost Management**

The process establishes the policies, procedures, and documentation for planning, managing, expending, and controlling project costs.

**Benefits:** It provides guidance and direction on how the project costs will be managed throughout the project.

Project cost management should consider the stakeholder requirements for managing costs. Different stakeholders will measure project costs in different ways and at different times.

<table>
<thead>
<tr>
<th>1.2 Schedule Baseline</th>
<th>1.2 Critical Path Method</th>
<th>1.2 Cost Management Plan</th>
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</thead>
</table>
| 1.2 Project Schedule  | 1.1 Critical Chain Method | Is a component of the project management plan and describes how the project costs will be planned, structured, and controlled. The cost management processes and their associated tools and techniques are documented in the cost management plan. Cost management plan can establish the following:
| 1.2 Schedule Baseline | 1.4 Earned Value Management | (1.1) Units of measure |
| 1.2 Work Performance Data | (A) Schedule Variance (SV) | (1.2) Level of precision |
| 1.2 Project Calendars | (B) Schedule Performance Index | (1.3) Level of accuracy |
| 1.2 Schedule Data | (C) Total Float | (1.4) Organizational Procedure links: The work breakdown structure (WBS) provides the framework for the cost management plan, allowing for consistency with the estimates, budgets, and control of costs. The WBS component used for the project cost accounting is called the control account. Each control account is assigned a unique code or account numbers that links directly to the performing organization accounting system.
| 1.2 Organizational Process Assets | (D) Early Finish Variances | (1.5) Control thresholds: Variance thresholds for monitoring cost performance may be specified to indicate and agreed upon amount of variation to be allowed before some action needs to be taken. Thresholds are typically expressed as percentage deviations from the baseline plan.
| 1.3 Other information | (1.6) Rules of performance measurements: Earned Value Management (EVM) rules for performance measurements are set.
| (A) Cost related scheduling | (A) Define the Points in WBS at which measurement of Control Accounts will be performed |
| (B) Risk | | |
| (C) Communications decisions | | |
For eg, the cost of an acquired item may be measured when the acquisition decision is made or committed, the order is placed, the item is delivered, or the actual cost is incurred or recorded for project accounting purposes.

Project cost management is primarily concerned with the cost of resources needed to complete project activities. Project cost management should, also consider the effect of project decisions on the subsequent recurring cost of using, maintaining, and supporting the project, services, or result of the project.

In many organizations, predicting and analyzing the prospective financial performance of the project's product is performed outside of the project. In others such as a capital facilities project, project cost management can include this work. When such predictions and analysis are included, project cost management may address additional processes and numerous general financial management techniques such as return on investment, discounted cash flow, and investment payback analysis. The cost management planning efforts occur early in project planning and sets the framework for each of the cost management processes so that performance of the project.

<table>
<thead>
<tr>
<th>Process Group: Planning</th>
<th>(1) Expert Judgment</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.2 Estimate Costs</td>
<td>(2) Analogous Estimating</td>
</tr>
<tr>
<td>The process of developing an approximation of the monetary resources needed to complete project activities Benefits: It determines the amount of cost required to complete project work</td>
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</tr>
<tr>
<td>Cost estimates are a prediction that is based on the information known at a given point in time. Cost estimates include the identification and consideration of costing alternatives to initiate and complete the project. Cost trade-offs and risks should be considered, such as make versus buy, buy versus lease, and the sharing of resources in order to achieve optimal costs for the project.</td>
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<tr>
<td>Cost estimates are generally expressed in units of some currency (ie dollars, euros etc), although in some instances other units of measure, such as staff hours, or staff days, are used to facilitate comparisons by eliminating the effects of currency fluctuations</td>
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<tr>
<td>Cost estimates should be revised and refined during the course of the project to reflect additional detail as it becomes available and assumptions are tested. The accuracy of a project estimate will increase as the project progresses through the project life cycle. For eg a project in the initiation phase may have a &quot;rough order of magnitude (ROM)&quot; estimates in the range of -25% to +75%. Later in the project, as more information is known, definitive estimates could narrow the range of accuracy to -5% to +10%. In some organizations there are guidelines for when such refinements can be made and the degree of confidence or accuracy that is expected.</td>
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<tr>
<td>Costs are estimated for all resources that will be charged to the project. This includes but is not limited to labor, material, equipment, services, and facilities, as well as special categories such as an inflation allowance, cost of financing, or contingency cost. A cost estimate is a quantitative assessment of the likely costs of or resources required to complete the activity. Can be presented at the activity level or in summary form.</td>
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</tr>
<tr>
<td>(3) Scope Baseline: The project Scope Statement It also states whether the estimates will be limited to direct project costs only or whether the estimates will also include indirect costs. &quot;Indirect Costs&quot;: are those costs that cannot be directly traced to a specific project and therefore will be accumulated and allocated equitably over multiple projects by some approved and documented accounting procedure. One of the most common constraints for many projects is a limited project budget. Examples of other constraints are required delivery dates, available skilled resources, and organizational policies. (3.2) Work breakdown Structure: (3.3) WBSS dictionary (3.4) Additional information that may be found in the scope baseline includes contractual and legal implications such as health, safety, performance, environmental, insurance, intellectual property rights, licenses, and permits.</td>
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<tr>
<td>(4) Project Schedule: Type, Quantity and amount of time these resources are applied to complete the work of the project are major factors in determining the project cost. Estimate activity resources involves determining the availability of staff, the no of staff hours required, and quantities of material and equipment needed to perform schedule activities. It is closely coordinated with cost estimating. Activity duration estimates will affect cost estimates on any project where the project budget includes an allowance for the cost of financing (including interest charges) and where resources are applied per unit of time for the duration of the activity. Activity duration estimates can also affect the cost estimates that have time sensitive costs included in them, such as a capital facilities project.</td>
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</tr>
<tr>
<td>(5) Three-Point Estimating: (5.1) Triangular Distribution cE = (cO+cM+cP)/3 (5.2) Beta Distribution cE = (cO+4cM+cP)/6 (5.3) Beta Dist. S.D : (P-O)/6 (5.4) Beta Dist. Variance :[(P-O)/6]^2</td>
<td></td>
</tr>
<tr>
<td>(6) Reserve Analysis: Cost estimates may include contingency reserves (contingency allowances) to allow for cost uncertainty. Contingency reserves are the budget within the cost baseline that is allocated for identified risks, which are accepted and for which contingent or mitigating responses are developed. Contingency reserves are often viewed as the part of the budget intended to address the &quot;known-unknowns&quot; that can affect a project. For e.g. rework for some project deliverables could be anticipated, while the amount of this rework is unknown. Contingency reserves may be estimated to account for this unknown amount of rework. Contingency reserves can be provided for a specific activity, for the whole project, or both. The contingency reserve may be a % of the estimated cost, a fixed number, or may be developed by using quantitative analysis methods. As more precise information about the project becomes available, the contingency reserve may be used, reduced, or eliminated. Contingency should be clearly identified in cost documentation. Contingency reserves are part of the cost baseline and the overall funding requirements for the project. Estimates may be produced for the amount</td>
<td></td>
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<tr>
<td>(7) Cost Management Plan</td>
<td></td>
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<tr>
<td>(8) Human Resource Management Plan: provides project staffing attributes, personnel rates, and related rewards/recognition, which are necessary components for developing the project cost estimates.</td>
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<tr>
<td>(9) Parametric Estimating</td>
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<tr>
<td>(10) Bottom-up Estimating</td>
<td></td>
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<tr>
<td>(11) Cost of Financing + Interest Charges</td>
<td></td>
</tr>
<tr>
<td>(12) Inflation Allowance</td>
<td></td>
</tr>
<tr>
<td>(13) Exchange Rates</td>
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<tr>
<td>(14) Contingency Reserve</td>
<td></td>
</tr>
<tr>
<td>(15) Indirect costs if included at the activity level or at higher level.</td>
<td></td>
</tr>
<tr>
<td>(16) Basis of Estimates: clear and complete understanding of how the cost estimate was derived. (2.1) Documentation of Basis of Estimates (2.2) Documentation of All Assumptions made (2.3) Documentation of any Known constraints (2.4) Indication of the Range of possible estimates (2.5) Indication of the Confidence level of the final estimates (3.1) Risk Register</td>
<td></td>
</tr>
<tr>
<td>(17) Activity Cost Estimations: are the quantitative assessments of the probable costs required to complete project work. Cost estimates can be presented in summary form or in detail. (1.1) Direct Labor (1.2) Materials (1.3) Equipment (1.4) Services (1.5) Facilities (1.6) Information Technology (1.7) Cost of Financing + Interest Charges (1.8) Inflation Allowance (1.9) Exchange Rates (1.10) Contingency Reserve (1.11) Indirect costs if included at the activity level or at higher level.</td>
<td></td>
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<tr>
<td>(18) Process descriptions</td>
<td></td>
</tr>
<tr>
<td>(19) Additional details</td>
<td></td>
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<tr>
<td>(20) Description of strategic funding choices</td>
<td></td>
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<tr>
<td>(21) Procedure to account for fluctuations in currency exchange rates</td>
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<tr>
<td>(22) Project cost recording</td>
<td></td>
</tr>
<tr>
<td>(23) Project Documents Updates</td>
<td></td>
</tr>
<tr>
<td>(24) Risk Register</td>
<td></td>
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</tbody>
</table>

For eg, the cost of an acquired item may be measured when the acquisition decision is made or committed, the order is placed, the item is delivered, or the actual cost is incurred or recorded for project accounting purposes.
as union labor with regularly expiring collective bargaining agreements or materials with seasonal cost variations.

(5) Risk Register: The risk register should be reviewed to consider the risk response cost. As a general rule, when the project experiences a negative risk event the near term cost of the project will usually increase, and there will sometimes be a delay in the project schedule. In a similar way, the project team should be sensitive to potential opportunities that can benefit the business either by directly reducing activity cost or by accelerating the schedule.

(6) Enterprise Environmental Factors
(6.1) Market Conditions: These conditions describe what products, services, and results are available in the market from whom, and under what terms and conditions. Regional and/or global supply and demand conditions greatly influence costs.
(6.2) Published commercial Information: Resource cost rate information is often available from commercial databases that track skills and human resources costs and provide standard costs for material and equipment. Published seller price lists are another source of information.
(7) Organizational Process Assets
(7.1) Cost estimating policies
(7.2) Cost estimating templates
(7.3) Historical information
(7.4) Lessons learned

of management reserve to be funded for the project. Management reserves are the amount of management reserves to be funded for the project. Management reserves are an amount of the project budget withheld for management control purposes and are reserved for unforeseen work that is within the scope of the project. Management reserves are intended to address the "unknown-unknowns" that can affect a project. The management reserve is not included in the cost baseline but is part of the overall project budget and funding requirements. When an amount of management reserve is used to fund unforeseen work, the amount of management reserve used is added to the cost baseline, thus requiring an approved change to the cost baseline.
(6.1) Contingency Reserve (included in Cost baseline)
(6.2) Management Reserve (excluded from Cost baseline but part of project budget)

(7) Cost of Quality (COQ)
(7.1) Cost of Non-Conformance
(A) Internal Failure Costs
(B) External Failure Costs
(7.2) Cost of Conformance
(A) Appraisal Costs
(B) Prevention Costs

(8) Project Management Software

(9) Vendor Bid Analysis: analysis of what the project should cost, based on the responsive bids form qualified vendors. When projects are awarded under competitive processes, additional cost estimating work may be required of the project team to examine the price of individual deliverables and to derive a cost that supports the final project cost.

(10) Group-Decision Making Techniques

<table>
<thead>
<tr>
<th>Process Group: Planning</th>
<th>7.3 Determine Budget</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Benefits:</strong> It determines the cost baseline against which project performance can be monitored and controlled.</td>
<td><strong>Benefits:</strong> It is the process of aggregating the estimated costs of individual activities or work packages to establish an authorized cost baseline.</td>
</tr>
</tbody>
</table>

A project budget includes all the funds authorized to execute the project. The cost baseline is the approved version of the time-phased project budget, but excludes management reserves.

<table>
<thead>
<tr>
<th>(1) Cost Management Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>(2) Scope Baseline</td>
</tr>
<tr>
<td>(2.1) Project Scope Statement: Formal limitations by period for the expenditure of project funds can be mandated by the organization, by agreement, or by other entities such as government agencies. These funding constraints are reflected in project scope statement.</td>
</tr>
<tr>
<td>(2.2) Work Breakdown Structure</td>
</tr>
<tr>
<td>(2.3) WBS Dictionary</td>
</tr>
<tr>
<td>(3) Activity Cost Estimates</td>
</tr>
<tr>
<td>(4) Basis of Estimates</td>
</tr>
<tr>
<td>(5) Project Schedule: This information can be used to aggregate costs to the calendar periods</td>
</tr>
</tbody>
</table>

| (1) Cost Aggregation: Cost estimates are aggregated by work packages in accordance with the WBS. The work package cost estimates are then aggregated for the higher component levels of the WBS (such as control accounts) and ultimately for the entire project. |
| (2) Reserve Analysis |
| (3) Expert Judgment |
| (4) Historical Relationships: Both the cost and accuracy of analogous and parametric models can vary widely. They are most likely to be reliable when |
| (4.1) Historical information used to develop the model is accurate |

| (1) Cost Baseline: is the approved version of the time-phased project budget, excluding any management reserves, which can only be changed through formal change control procedures and is used as a basis for comparison to actual results. It is developed as a summation of the approved budgets for the different schedule activities. |
| (1.1) Activity cost estimates for the various project activities along with any contingency reserves for these activities are aggregated into their associated work packages costs. Activity cost estimates + Activity Contingency reserve = Work Package Cost Estimate |
| (1.2) The work package cost estimates along with any contingency reserves estimated for the work packages are aggregated into control accounts. Work Package Cost Estimate + Contingency Reserve = Control Accounts |
| (1.3) The summation of control accounts make up the |
in which the costs are planned to be incurred.

(6) Resource Calendars: This information can be used to indicate resource costs over the duration of the project.

(7) Risk Register: The risk register should be reviewed to consider how to aggregate the risk response cost.

(8) Agreements: Applicable agreement information and costs relating to products, services or results that have been or will be purchased are included when determining the budget.

(9) Organizational Process Assets

9.1 Existing formal and informal cost budgeting related policies and guidelines

9.2 Cost budgeting tools

9.3 Reporting methods

(4.2) Parameters used in the model are readily quantifiable

(4.3) Models are scalable, such that they work for large projects, small projects, and phases of a project.

(5) Funding Limit Reconciliation: The expenditure of funds should be reconciled with any funding limits on the commitment of funds for the project. A variance between the funding limits and planned expenditure will sometimes necessitate the rescheduling of work to level out the rate of expenditure. This is accomplished by placing imposed date constraints for work into the project schedule.

(1.4) Management reserves are added to the cost baseline to produce the project budget. As changes warranting the use of management reserve arise, the change control process is used to obtain approval move the applicable management reserves funds into the cost baseline.

Cost Baseline + Management Reserve = Project Budget

(2) Project Funding Requirements: Total funding requirements and periodic funding requirements (eg quarterly, annually) are derived from the cost baseline. The cos baseline will include projected expenditures plus anticipated liabilities. Funding often occurs in incremental amounts that are not continuous, and may not be evenly distributed and may appear as steps in the s curve. The total funds required are those included in the cost baseline, plus management reserves, if any. Funding requirements may include the source(s) of funding.

(3) Project Documents Updates

(3.1) Risk Register

(3.2) Activity Cost Estimates

(3.3) Project Schedule

**Process Group: Monitoring & Controlling**

**7.4 Control Costs**

Is the process of monitoring the status of the project to update the project costs and managing changes to the cost baseline.

**Benefits:** It provides the means to recognize variance from the plan in order to take corrective action and minimize risk.

Updating the budget requires knowledge of the actual costs spent to date. Any increase to the authorized budget can only be approved through the PICC process. Monitoring the expenditure of the funds without regard to the value of work being accomplished for such expenditures has little value to the project, other than to allow the project team to stay within the authorized funding. Much of the effort of cost control involves analyzing the relationship between the consumption of project funds to the physical work being accomplished for such expenditures. The key to the effective cost control is management of the approved cost baseline and the changes to that baseline. Project cost control includes:

1. Influencing the factors that create changes to the authorized cost baseline.

2. Ensuring that all changes are acted on in a timely manner.

3. Managing the actual changes when and as they occur.

4. Ensuring that cost expenditure do not exceed the authorized funding by period, by WBS component, by activity, and in total for the project.

5. Monitoring cost performance to isolate and understand variances from the approved cost baseline.

6. Monitoring work performance against funds expended.

(1) Project Management Plan

(1.1) Cost Baseline

(1.2) Cost Management Plan

(2) Project Funding Requirements

(3) Work Performance Data

(4) Organizational Process Assets

(1) Earned Value Management (EVM): EVM is a methodology that combines scope, schedule, and resource measurements to assess project performance and progress. It integrates the scope baseline with the cost baseline, along with the schedule baseline, to form the performance measurement baseline, which helps the project management team assess and measure project performance and progress. It is a project measurement technique that requires the formation of an integrated baseline against which performance can be measured for the duration of the project.

The principles of EVM can be applied to all projects in any industry. EVM develops and monitors three key dimensions for each work package and control account.

(1.1) Planned Value (PV): Is the authorized budget assigned to scheduled work. It is the authorized budget planned for the work to be accomplished for an activity or WBS component, not including management reserve. The budget is allocated by phase over the life of the project, but at a given moment, planned value defines the physical work that should have been accomplished. The total of the PV is sometimes referred as the performance measurement baseline (PMB). The total planned value for the project is also known Budget at Completion (BAC).

(1.2) Earned Value: is the measure of work performed expressed in terms of the budget authorized for that work. It is the budget associated with the authorized work that has been completed. The EV being

(1) Work Performance Information

(2) Cost Forecasts

(3) Change Requests

(4) Project Management Plan Updates

(4.1) Cost Baseline

(4.2) Cost Management Plan

(5) Project Documents Updates

(5.1) Activity Cost Estimates

(5.2) Basis of Estimates

(6) Organizational Process Assets Updates

(6.1) Causes of Variances

(6.2) Corrective Action Chosen and the reasons

(6.3) Financial Databases

(6.4) Other Types of lessons learned from project cost control
(8) Preventing unapproved changes from being included in the reported cost or resource usage

(9) Informing appropriate stakeholders of all approved changes and associated cost.

(10) Bringing acceptable cost overruns within acceptable limits.

**Project Team:** Includes the project manager and the group of individuals who act together in performing the work of the project to achieve its objectives. The structure and characteristics of a project team can vary widely, but one constant is the project manager’s role as the leader of the team, regardless of what authority the project manager may have over the members. Project teams include roles such as

**Project Management Staff:** The members of the team who perform project management activities such as scheduling, budgeting, reporting and control, communications, risk management and administrative support. The role may be performed or supported by a project management office (PMO).

**Project Staff:** The members of the team who carry out the work creating the project deliverables

**Supporting experts:** develop or execute the project management plan. This can include roles such as contracting, financial management, logistics, legal, safety, engineering, test or quality control.

**User or Customer Representatives:** members of the organization who will accept the deliverables or products of the project may be assigned to act as representatives of liaisons to ensure proper coordination, advise on requirements, or validate the acceptability of the project results

**Sellers, Business Partners, Business Partner members**

**Composition of the project team:** (1) Dedicated (2) Part time

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measured needs to be related to the PMB, and the EV measured cannot be greater than the authorized PV budget for a component. The EV is often used to calculate the percent complete of a project. Progress measurement criteria should be established for each WBS component to measure work in progress. Project Managers monitor EV, both incrementally to determine current status and cumulatively to determine the long-term performance trend.

(1.3) **Actual Cost:** is the realized cost incurred for work performed during a specific time period. It is the total cost incurred in accomplishing the work that the EV measured. The AC needs to correspond in definition to what was budgeted in PV and measured in the EV (e.g., direct hours only, direct costs only, or all costs including indirect costs). The AC will have no upper limit; Whatever is spent to achieve the EV will be measured.

(1.4) **SV = EV-PV**

(A) \( SV > 0 \) => Ahead of Schedule

(B) \( SV < 0 \) => Behind Schedule

(C) \( SV = 0 \) => Baseline Schedule

(D) The EVM schedule variance will ultimately equal zero when the project is completed because of all the planned value will have been earned.

(1.5) **SPI = EV/PV**

(A) \( SPI > 1 \) => Ahead of Schedule

(B) \( SPI < 1 \) => Behind Schedule

(C) \( SPI = 0 \) => Baseline Schedule

(1.6) **CV = EV-AC**

(A) \( CV > 0 \) => Under Budget

(B) \( CV < 0 \) => Over Budget

(C) \( CV = 0 \) => Baseline

(D) The Cost variance at the end of the project will be difference between budget at completion (BAC) and the actual amount spent.

(1.7) **CPI = EV/AC**

(A) \( CPI > 1 \) => Under Budget

(B) \( CPI < 1 \) => Over Budget

(C) \( CPI = 1 \) => Baseline

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(2) **Forecasting**

(2.1) **EAC forecast for ETC work performed when initial plan is no longer valid**

- EAC = AC + Bottom Up ETC

(2.3) **EAC forecast for ETC work performed at budgeted rate**

- EAC = AC + (BAC – EV)

(2.4) **EAC forecast for ETC work performed at the present CPI**

- EAC = BAC/CPI

(2.5) **EAC forcast for ETC work considering both CPI & SPI**

- EAC = AC + [(BAC – EV)/(CPIxSPI)]

(2.6) **ETC = EAC – AC => Assuming work is proceeding on plan**
(2.7) ETC = Re-estimate => Re-estimate the remaining work from the bottom up

(3) To Complete Performance Index (TCPI):
   is a measure of the cost performance that is required to be achieved with remaining resources in order to meet a specified management goal (BAC or EAC), expressed as a ratio of cost to finish the outstanding work to the remaining budget
   TCPI = Work Remaining / Funds Remaining

(3.1) Based on BAC
   \[ \frac{(BAC - EV)}{(BAC - AC)} \]
   • TCPI > 1 => Harder to Complete
   • TCPI < 1 => Easier to Complete
   • TCPI = 1 => Same to Complete

(3.2) Based on EAC
   \[ \frac{(BAC – EV)}{(EAC – AC)} \]
   • TCPI > 1 => Harder to Complete
   • TCPI < 1 => Easier to Complete
   • TCPI = 1 => Same to Complete

(4) Performance Reviews

(4.1) Variance Analysis: as used in the EVM is the explanation (cause, impact, and corrective actions) for cost (CV = EV-AC), schedule (SV = EV-PV) and variance at completion (VAC = BAC – EAC) variances.
   An important aspect of project cost control includes determining the cause and degree of variance relative to the cost baseline and deciding whether corrective or preventive action is required. The percentage range of acceptable variances will tend to decrease as more work is accomplished.

(4.2) Trend Analysis

(4.3) Earned Value Performance

(5) Project Management Software

(6) Reserve Analysis

Quality Management

Project quality management uses policies and procedures to implement, with in the project's context, the organization's quality management system and, as appropriate, it supports continuous process improvement activities as undertaken on behalf of the performing organization. Project quality management works to ensure that the project requirements, including product

Process Group: Planning

8.1 Plan Quality Management

It is the process of identifying quality requirements and/or standards for the project and its deliverables, and documenting how the project will demonstrate compliance with relevant quality requirements and/or standards.

Benefits: It provides guidance and direction on how quality will be managed and validated throughout the project

(1) Project Management Plan
   (1.1) Scope baseline
   (A) Project scope statement
   (B) WBS
   (C) WBS dictionary
   (1.2) Schedule baseline
   (1.3) Cost baseline
   (1.4) Other Management Plans

(2) Stakeholder Register

(3) Risk Register

(4) Requirements Documentation

(5) Enterprise Environmental Factors

(6) Organizational Process Assets

(1) Cost-Benefit Analysis

(2) Cost of Quality
   (2.1) Cost of Non-Conformance: Money spent during and after the project because of failures
   (A) Internal Failure Costs (Failures found by the project)
   (B) External Failure Costs (failures found by the customer)
   (C) Failure costs are also called cost of poor quality
   (2.2) Cost of Conformance: Money spent during the project to avoid failures
   (A) Prevention Costs (Build a quality product)
   (B) Appraisal Costs (Assess the quality)

(1) Quality Management Plan: is a component of the project management plan that describes how the organization's quality policies will be implemented. It describes how the project management team plans to meet the quality requirements set for the project.

The quality management plan may be formal or informal, detailed or broadly framed. The style and detail of the quality management plan are determined by the requirements of the project. The quality management plan should be reviewed early in the project to ensure that decisions are based on accurate information. The benefits of this review can include a sharper focus on the project's value proposition and reductions in costs and the frequency of schedule overruns that are caused by rework.

(2) Process improvement Plan: a subsidiary or a component of project management plan. The process improvement plan details the steps for analyzing project management and product development processes to identify activities that enhance their value. Areas to consider include
Project Quality Management addresses the management of the project and the deliverables of the project. It applies to all projects, regardless of the nature of the deliverables. Quality measures and techniques are specific to the type of deliverables being produced by the project. Failure to meet the quality requirements can have serious, negative consequences for any or all the project stakeholders. For e.g.,

Meeting customer requirements by overworking the project team may result in decreased profits and increased project risks, employee attrition, errors and rework.

Meeting project schedule objectives by rushing planned quality inspections may result in undetected errors, decreased profits, and increased post-implementation risks.

Project quality management uses policies and procedures to implement, within the project's context, the organization's quality management system and, as appropriate, it supports continuous process improvement activities as undertaken on behalf of the performing organization.

Quality: as a delivered performance or result is the degree to which

Project Governance: The alignment of the project with stakeholders' needs or objectives. Is critical to successful management of stakeholder engagement and the achievement of organizational objectives. Project governance enables organizations to consistently manage projects and maximize the value of project outcomes and align the projects with business strategy. It provides a framework in which the project manager and sponsors can make decisions that satisfy both the stakeholders needs and expectations and organizational strategic objectives or address circumstances that where these may not be in alignment. It is an oversight function that is aligned with the organization's governance model and that encompasses the project life cycle. Project governance framework provides the project manager and the team with structure, processes decision-making models and tools for managing the project, while supporting and controlling the project successful delivery. It provides a comprehensive, consistent method of controlling the project and ensuring its success by defining and documenting and communicating reliable, repeatable project practices. It includes a framework for making project decisions, defining roles, responsibilities and accountabilities for the success of the project, and determines the effectiveness of the project manager. A project governance is defined by and fits within the larger context of the portfolio, program, or organization sponsoring it but is separate from organization governance. Eg of elements of project governance framework include:

1. Project success and deliverable acceptance criteria
2. Process to identify, escalate, and resolve issues that arise during the project
3. Relationship among the project team, organizational groups, and external stakeholders
4. Project identification chart that identifies project roles
5. Processes and procedures for the communication of information.
6. Project decision making process
7. Guidelines for aligning project governance and organizational strategy
8. Project lifecycle approach
9. Process for stage gate or phase reviews
10. Process for review and approval for changes to budget, scope, quality, and schedule which are beyond the authority of the project manager.
11. Process to align internal stakeholders with project process requirements

Requirements, are met and validated

Inspections

1. Project success and deliverable acceptance criteria
2. Process to identify, escalate, and resolve issues that arise during the project
3. Relationship among the project team, organizational groups, and external stakeholders
4. Project identification chart that identifies project roles
5. Processes and procedures for the communication of information.
6. Project decision making process
7. Guidelines for aligning project governance and organizational strategy
8. Project lifecycle approach
9. Process for stage gate or phase reviews
10. Process for review and approval for changes to budget, scope, quality, and schedule which are beyond the authority of the project manager.
11. Process to align internal stakeholders with project process requirements

(3.1) Cause-and-Effect Diagram (Fish Bone / Ishikawa Diagrams): The problem statement placed at the head of the fishbone is used as a starting point to trace the problem's source back to its actionable root cause. The problem statement typically describes the problem as a gap to be closed or as an objective to be achieved. The causes are found by looking at the problem statement and asking "Why" until the actionable root cause has been identified or until the reasonable possibilities have been exhausted. Fishbone diagrams often prove useful in linking the undesirable effects seen as special variation to the assignable cause upon which project teams should implement corrective actions to eliminate the special variation detected in a control chart

(3.2) Flowcharts (Process Maps): they display the sequence of steps and the branching possibilities that exist for a process that transforms one or more inputs into one or more outputs. Flow charts show the activities, decision points, branching loops, parallel paths, and the overall order of processing by mapping the operational details of procedures that exists within a horizontal value chain of a Supplier Input, Customer (SPIOC) model. Flow charts may prove useful in understanding and estimating the cost of quality in a process. This is obtained by using the workflow branching logic and associated relative frequencies to estimate expected monetary value for the conformance and non-conformance work required to deliver the expected conforming output

(3.3) Check Sheets (Tally Sheets): may be used as a checklist when gathering data. Check sheets are used to organize facts in a manner that fill facilitate the effective collection of useful data about a potential quality problem. They are especially useful for gathering attributes data while performing inspections to identify defects. Foe eg data about the frequencies or consequences of defects collected in check sheets are often displayed using pareto diagrams

(3.4) Pareto diagrams: exists as a special forms of vertical bar chart and are used to identify the vital few sources that are responsible for causing most of a problem’s effects. The categories shown on the horizontal axis exist as a valid probability distribution that accounts for 100% of the possible observations. The relative frequencies of each specified cause listed on the horizontal axis decrease in magnitude until the default source named "other" accounts for any non-specified causes. Typically, the Pareto diagram will be

(2.1) Process Boundaries: Describe the purpose of the process, the start and end of the process, its inputs and outputs, the process owner, and the stakeholder of the process

(2.2) Process Configuration: Provides a graphic depiction of processes, with interfaces identified, used to facilitate analysis

(2.3) Process metrics: Along with control limits, allows analysis of process efficiency.

(2.4) Targets for improved performance

(3) Quality Metrics: A quality metric specifically describes a project or product attribute and how the control quality process will measure it. A measurement is an actual value. The tolerance defines the allowable variations to the metric. Quality metrics are used in the perform quality assurance and control quality processes. Some examples of quality metrics include on-time performance, Cost control, defect frequency, failure rate, availability, reliability, and test coverage

(4) Quality Checklists: A checklist is a structured tool, usually component – specific, used to verify that a set of required steps has been performed. Based on the project's requirements and practices, checklists may be simple or complex. Many organizations have standardized checklist available to ensure consistency in frequently performed tasks. In some application areas, checklists are also available from professional associations or commercial service providers. Quality checklists should incorporate the acceptance criteria included in the scope baseline

(5) Project Documents Updates

(5.1) Stakeholder Register

(5.2) Responsibility Assignment Matrix

(5.3) WBS

(5.4) WBS Dictionary
a set of inherent characteristics fulfill requirements.”

Grade: as a design intent is a category assigned to deliverables having the same functional use but different technical characteristics.

The project manager and the project management team are responsible for managing the tradeoffs associated with delivering the required levels of both quality and grade.

Quality level that fails to meet quality is always a problem; a low grade to quality may not be a problem.

Precision: is a measure of exactness
Accuracy: is an assessment of correctness

Precise measurements are not necessarily accurate measurements, and accurate measurements are not necessarily precise measurements.

Every project should have a quality management plan. Project teams should follow the quality management plan and should have data to demonstrate compliance with the plan.

Modern quality management approaches seek to minimize variation and to deliver results that meet defined requirements. These approaches recognize the importance of

**Project Life Cycle:** Project life cycle is the series of phases that a project passes through from its initiation to its closure. A life cycle can be documented within a methodology. The life cycle provides the basic framework for managing the project, regardless of the specific work involved.

**Characteristics of Project Life Cycle:** Generic life cycle structure
(1) Starting the project
(2) Organizing and preparing
(3) Carrying out the project work
(4) Closing the project

Life cycle should not be confused with project management process groups, because the processes in a process group consists of activities that may be performed and recur within each phase of a project as well as the project as a whole.

organized into categories that measure either frequencies or consequences.

(3.5) Histograms: are a special form of bar chart and are used to describe the central tendency, dispersion, and shape of a statistical distribution. Unlike the control chart, the histogram does not consider the influence of time on the variation that exists within a distribution.

(3.6) Control Charts: are used to determine whether or not a process is stable or has predictable performance. Upper and lower specification limits are based on requirements of the agreement. They reflect the maximum and minimum values allowed. There may be penalties associated with exceeding the specification limits. Upper and lower control limits are different from specification limits. The control limits are determined using standard statistical calculations and principles to ultimately establish the natural capability for a stable process. The project manager and appropriate stakeholders may use the statistically calculated control limits to identify the points at which corrective action will be taken to prevent unnatural performance. The corrective action typically seeks to maintain the natural stability of a stable and capable process. For repetitive process, the control limits are generally set at +/- 3s around a process mean that has been set at 0s. A process is considered out of control when (1) a data point exceeds a control limit; (2) seven consecutive plot points are above the mean; (3) seven consecutive plot points are below the mean.

Control charts can be used to monitor various types of output variables. Although used most frequently to track repetitive activities required for producing manufactured lots, control charts may also be used to monitor cost and schedule variances, volume, and frequency of scope changes, or other management results to help determine if the project management processes are in control.

(3.7) Scatter Diagrams (Correlation Charts): they seek to explain a change in the dependent variable, Y, in relation to a change observed in the corresponding independent variable, X. The direction of correlation may be proportional (Positive Correlation), inverse (negative correlation), or a pattern of correlation may not exist (zero correlation). If correlation can be established, a regression line can be calculated and used to estimate how a change to the independent variable will influence value of dependent variable.

(4) Benchmarking: Comparing actual or planned project practices to those of comparable projects to identify best practices, generate ideas for improvement,
Customer Satisfaction: Understanding, evaluating, defining, and managing requirements so that customer expectations are met. This requires a combination of conformance to requirements (to ensure the project produces what it was created to produce) and fitness for use (the product or service needs to satisfy the real needs).

Prevention over inspection: Quality should be planned, designed, and built into – not inspected into the project's management or the project deliverables. The cost of preventing mistakes is generally much less than the cost of correcting mistakes when they are inspected or usage.

Continuous Improvement: The PDCA (plan-do-check-act) cycle is the basis for quality improvement as defined by Schewhart and modified by Deming. In addition, quality improvement initiatives such as Total Quality Management (TQM), Six Sigma, Lean Sigma could improve the quality of the project's product. Commonly used process improvement models include Malcolm Baldrige, Organizational Project Management Maturity Model (OPM3), and Capability Maturity Model Integration (CMMI).

Design of Experiments (DOE): is a statistical method for identifying which factors may influence specific variables of a product or process under development or in production. DOE may be used during the plan quality management process to determine the number and type of test and their impact on cost of quality. DOE also plays a role in optimizing products or processes. DOE is used to reduce the sensitivity of product performance to sources of variations caused by environmental or manufacturing differences. One important aspect of the technique is that it provides a statistical framework for systematically changing all of the important factors, rather than changing the factors one at a time. Analysis of the experimental data should provide the optimal conditions for the product or process highlight the factors that influence the results, and reveal the presence of interactions and synergy among the factors. For eg automotive designers use this technique to determine which combination of suspension and tires will produce the most desirable ride characteristics at a reasonable cost.

Statistical Sampling: Involves choosing part of a population of interest for inspection. Sample frequency and sizes should be determined during the plan quality management process so that the cost of quality will include the number of tests, expected scrap, etc.

Additional Quality Planning Tools

(7.1) Brainstorming
(7.2) Force Field Analysis: Diagram of forces for and against the change
(7.3) Nominal Group Techniques: is used to allow ideas to be brainstormed in small groups and then reviewed by a larger group
(7.4) Quality Management and Control Tools

Meetings

Process Group: Execution

8.2 Perform Quality Assurance

It is the process of auditing the quality requirements and the results from quality control measurements to ensure that appropriate quality standards and operational definitions are used.

(1) Quality Management Plan
(2) Process Improvement Plan
(3) Quality Metrics
(4) Quality Control Measurements: are the results of control quality activities. They are and provide a basis for measuring performance. Benchmarked projects may exist within the performing organization or outside of it, or can be within the same application area. Benchmarking allows for analogies from projects in a different application area to be made.

(5) Design of Experiments (DOE): is a statistical method for identifying which factors may influence specific variables of a product or process under development or in production. DOE may be used during the plan quality management process to determine the number and type of test and their impact on cost of quality. DOE also plays a role in optimizing products or processes. DOE is used to reduce the sensitivity of product performance to sources of variations caused by environmental or manufacturing differences. One important aspect of the technique is that it provides a statistical framework for systematically changing all of the important factors, rather than changing the factors one at a time. Analysis of the experimental data should provide the optimal conditions for the product or process highlight the factors that influence the results, and reveal the presence of interactions and synergy among the factors. For eg automotive designers use this technique to determine which combination of suspension and tires will produce the most desirable ride characteristics at a reasonable cost.

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(8) Meetings

(1) Quality Measurement and Control Tools: The perform quality assurance processes the tools and techniques of the plan quality management and control quality processes. In addition, other tools that available include

(1.1) Affinity Diagrams: The affinity diagram is similar to mind-mapping techniques in

(2) Change Requests
(2.1) Quality Management Plan
(2.2) Scope Management Plan
(2.3) Schedule Management Plan
(2.4) Cost Management Plan
Project Phases: A project may be divided into a no of phases. A project phase is a collection of logically related project activities that culminates in the completion of one or more deliverables. Project phases are used when the nature of the work to be performed is unique to a portion of the project, and are typically linked to the development of a specific major deliverable. The high level nature of project phases makes them an element of the project life cycle. The phase structure allows the project to be segmented into logical subsets for ease of management, planning, and control. The number of phases, the need for phases, and the degree of control applied depend on the size, complexity and potential impact of the project.

Characteristics of Project Phases:

(1) The work has a distinct focus that differs from any other phase. This often involves different organizations, locations and skill sets.

(2) Achieving the primary deliverable or objective of the phase requires controls or processes unique to the phase or its activities.

(3) The closure of a phase ends with some form of transfer or hand-off of the work product produced as the phase deliverable. This phase end represents a natural point to reassess the activities underway and to change or terminate the project if necessary. This point may be referred to as stage gate, milestone, phase review, phase gate or kill point. In many cases, the closure of a phase is required to be approved in some form before it can be considered closed.

Benefits: It facilitates the improvement of quality process
The quality assurance process implements a set of planned and systematic acts and processes defined within the project’s quality management plan. Quality assurance seeks to build confidence that a future output or an unfinished output, also known as work in progress, will be completed in a manner that meets the specified requirements and expectations. Quality assurance contributes to the state of being certain about quality by preventing defects through the planning processes or by inspecting out defects during the work-in-progress stage of implementation. Perform quality assurance is an execution process that uses data created during plan quality management and control quality processes.

In project management, the prevention and inspection aspects of quality assurance should have a demonstrable influence on the project. A quality assurance work will fall under the conformance work category in the cost of quality framework.

Perform quality assurance also provides an umbrella for continuous process improvement, which is an iterative means for improving the quality of all processes. Continuous process improvement reduces waste and eliminates activities that do not add value. This allows processes to operate at an increased level of efficiency and effectiveness.

(5) Project Documents
used to analyze and evaluate the quality of the processes of the project against the standards of the performing organization or the requirements specified. Quality control measurements can also compare the processes used to create the measurements, and validate actual measurements to determine their level of correctness.

(5) Project Documents
that they are used to generate ideas that can be linked to form organized patterns of thought about a problem. In project management, the creation of the WBS may be enhanced by using the affinity diagram to give structure to the decomposition of scope.

(1.2) Process Decision Program Charts (PDPC): Used to understand a goal in relation to the steps for getting to the goal. The PDPC is useful as a method for contingency planning because it aids teams in anticipating intermediate steps that could derail achievement of the goal.

(1.3) Interrelationship Digraphs: An adaptation of relationship diagrams. The interrelationship digraphs provide a process for creative problem solving in moderately complex scenarios that possess intertwined logical relationships for up to 50 relevant items. The interrelationship digraph may be developed from data generated in other tools such as the affinity diagram, the tree diagram, or the fish bone diagram.

(1.4) Tree Diagrams: Also known as systematic diagrams and may be used to represent decomposition hierarchies such as the WBS, RBS (Risk Breakdown Structure), and OBS (Organizational Breakdown Structure). In project management, tree diagrams are useful in visualizing the parent-to-child relationships in any decomposition hierarchy that uses a systematic set of rules that define a nesting relationship. Tree diagrams can be depicted horizontally (such as risk breakdown structure) or vertically (such as team hierarchy or OBS). Because tree diagrams permit the creation of nested branches that terminate into a single decision point, they are useful as decision trees for establishing an expected value for a limited no. of dependent relationships that have been diagramed systematically.

(1.5) Prioritization Matrices: Identify the key issues and the suitable alternatives to be prioritized as a set of decisions for implementation. Criteria are prioritized and weighted before being applied to all available alternatives to obtain a mathematical score that ranks the options.

(1.6) Activity Network Diagrams: Previously known as arrow diagrams. They include both the AOA (Activity on Arrow) and, most commonly used, AON (Activity on Node) formats of a network diagram. Activity network diagrams are used with project scheduling methodologies such as program evaluation and review technique (PERT), critical path method (CPM), and precedence diagramming method (PDM).

(1.7) Matrix Diagrams: A quality management and control tool used to perform data analysis within the organizational structure created in the
(2) Quality Audits: A quality audit is a structured, independent process to determine if project activities comply with organizational and project policies, processes, and procedures. The objectives of quality audit many include:

(2.1) Identify all good and best practices being implemented
(2.2) Identify all nonconformity, gaps, and short comings
(2.3) Share good practices introduced or implemented in similar projects in the organization and / or industry
(2.4) Proactively offer assistance in a positive manner to improve implementation of processes to help the team raise productivity.
(2.5) Highlight contribution of each audit in the lessons learned repository of the organization.

The subsequent effort to correct any deficiencies should result in a reduced cost of quality and in increase in sponsor or customer acceptance of the project’s product. Quality audits may be scheduled or random, and may be conducted by internal or external auditors.

Quality audits can confirm the implementation of approved change requests including updates, corrective actions, defect repairs, and preventive actions.

(3) Process Analysis: follows the steps identified in the process improvement plan to identify needed improvements. This analysis also examines problems experienced, constraints experienced, and non-value-added activities identified during process operation. Process analysis includes root cause analysis - a specific technique used to identify a problem, discover the underlying causes that lead to it, and develop preventive action.

**Process Group: Monitoring & Controlling**

**8.3 Control Quality**

Is the process of monitoring and recording results of executing the quality activities to assess performance and recommend necessary changes

**Benefits:**
(1) identifying the causes of poor process or product quality and recommending and/or taking action to eliminate them
(2) Validating that project deliverables and work meet the requirements specified by key stakeholders necessary for final acceptance

<table>
<thead>
<tr>
<th>(1) Project Management Plan</th>
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<tbody>
<tr>
<td>(2) Quality Metrics: A quality metric describes a project or product attribute and how it will be measured. E.g.</td>
</tr>
<tr>
<td>(2.1) Function Points</td>
</tr>
<tr>
<td>(2.2) Mean Time Between Failure (MTBF)</td>
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<td>(2.3) Mean Time to Repair (MTTR)</td>
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<tr>
<td>(3) Quality Checklists</td>
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<td>(4) Work Performance Data</td>
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<table>
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<tr>
<th>(1) Seven Basic Quality Tools</th>
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<tr>
<td>(2) Statistical Sampling</td>
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(3) Inspection: An inspection is the examination of work product to determine if it conforms to documented standards. The result of an inspection generally include measurements and may be conducted at any level. For e.g. the result of a single activity can be inspected, or the final product of the project can be inspected. Inspection may be called reviews, peer

(1) Quality Control Measurements: are the documented results of the control quality activities. They should be captured in the format that was specified through the Plan Quality Management process.

(2) Validated Changes

(3) Verified Deliverables: A goal of the control quality process is to determine the correctness of deliverables. The results of performing the control quality process are verified deliverables. Verified deliverables are an input to Validate scope for formalized acceptance.
The control quality process uses a set of operational techniques and tasks to verify that the delivered output will meet the requirements.

Quality Assurance should be used during the project’s planning and executing phases to provide confidence that the stakeholder’s requirements will be met.

Quality Control should be used during the project executing and closing phases to formally demonstrate, with reliable data, that the sponsor and/or customer’s acceptance criteria have been met.

Prevention: keeping errors out of the process

Inspection: Keeping errors out of the hands of the customer

Variable Sampling: the result either conforms or does not confirm

Tolerances: specified range of acceptable results

Control limits: that identifies the boundaries of common variation in a statistically stable process or process performance.

(5) Approved Change Requests
(6) Deliverables
(7) Project Documents
(7.1) Agreements
(7.2) Quality Audit Reports & Change Logs supported with CA plans
(7.3) Training plans & Assessment of effectiveness
(7.4) Process documentation using either the 7 basic QC tools or Quality Management or Control tools
(8) Organizational Process Assets

(4) Approved Change Requests Review

(4) Work Performance Information: is the performance data collected from various controlling processes, analyzed in context and integrated based on relationships across areas. E.g. include information about the project requirements fulfillment such as causes for rejections, rework required, or the need for process adjustments.

(5) Change Requests
(6) Project Management Plan Updates
(6.1) Quality Management Plan
(6.2) Process Improvement Plan
(7) Project Documents Updates
(7.1) Quality Standards
(7.2) Agreements
(7.3) Quality Audit reports & Change logs supported with corrective action plans
(7.4) Training plans & assessments of effectiveness
(7.5) Process docs such as information obtained using 7 basic Quality tools or the quality management and control tools
(8) Organizational Process Assets Updates
(8.1) Completed Checklists
(8.2) Lessons learned documentation

Human Resource Management

Includes the processes that organize, manage, and lead the project team. The project team is comprised of the people with assigned roles and responsibilities for completing the project.

Project team members may have varied skill sets, may be assigned full or part-time, and may be added or removed from the team as project progresses. Project team members may also be referred to as the project’s staff. Although specific roles & responsibilities for the project team members are assigned, the involvement of all team members in project planning and decision making is beneficial. Participation of team members during planning adds their expertise to the process and strengthens their commitment to their roles and responsibilities.

Process Group: Planning

9.1 Plan Human Resource Management

Is the process of Identifying and documenting project roles, responsibilities required skills, reporting relationships, and creating a staff management plan.

Benefits: It establishes project roles and responsibilities, project organization charts, and the staffing management plan including the timetable for staff acquisition and release.

Human resource planning is used to determine and identify human resources with necessary skills required for project success. The human resource management plan describes how the roles and responsibilities, reporting relationships, and staffing management plan will be addressed and structured within a project. It also contains the staffing management plan including time tables for staff acquisition and release, identification of training needs, team building strategies, plan for recognition and reward programs, compliance considerations, safety issues and the impact of the staffing management plan on the organization.

Team Building; Team building is the process of helping a group of individuals, bound by a common purpose, to work with each other, the leader, external stakeholders, and the organization. The result of good leadership and good team building is team work.

Team building activities consists of tasks (establish goals, define and negotiate roles, responsibilities and procedures) and processes (interpersonal behavior with emphasis on communication, conflict management, motivation, and leadership). Developing a team environment involves handling project team problems and discussing these as team issues without placing blame on individuals. Team building can be further enhanced by obtaining top management support; encouraging team member commitment; introducing appropriate rewards, recognition, and ethics; creating a team identity; managing conflicts effectively; promoting trust and open communication.

(1) Project Management Plan
(1.1) The project life cycle and the processes that will be applied to each phase
(1.2) How work will be executed to accomplish the project objectives
(1.3) A change management plan that documents how changes will be monitored and controlled
(1.4) A configuration management plan that documents how configuration management will be performed.
(1.5) How integrity of project baseline will be maintained
(1.6) Needs and methods of communication among stakeholders
(1.7) Activity Resource Requirements
(3) Enterprise Environmental Factors
(3.1) Existing Human Resources
(3.2) Project Resources
(3.3) Contractual Requirements
(4) Organizational Process Assets
(4.1) Organizational standard processes, policies, and role descriptions
(4.2) Templates for organizational charts and positions descriptions
(4.3) Lessons learned on organizational structures that have worked in previous projects
(4.4) Escalation procedures for handling issues within the team and within the performing organization.

(1.1) Hierarchical-type charts
(A) Organizational Breakdown Structure (OBS): The traditional organizational chart structure can be used to show positions and relationships in a graphical top-down format. The OBS is arranged according to existing dept., project activities or work packages listed under each dept., units or teams
(B) Resource Breakdown Structure (RBS): Is a hierarchical list of resources related to categories and resource type that facilitates planning and controlling of project work, helpful in tracking project costs and can be aligned with org’s accounting system can contain resources other than human resources.

(1.2) Matrix-based charts
(A) Responsibility Assignment Matrix (RAM): Is a Grid that shows project resources assigned to each work package, It illustrates the connection b/w work packages or activities and project team members. The matrix format shows all activities associated with one person and all people associated with one activity. Eg RACI Chart

(1) Organization Charts and Position Description: Regardless of the method utilized, the objective is to ensure that each work package has an unambiguous owner and that all team members have a clear understanding of the roles and responsibilities.

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(1) Human Resource Management Plan
(1.1) Roles and Responsibilities
(A) Role: The function assumed by or assigned to a person in the project. E.g. testing coordinator, civil engineer, business analyst
(B) Authority: The right to apply project resources, make decisions, sign approvals, accept deliverables, and influence others to carry out the work of the project. E.g. decisions that need a clear authority include selection of a method for completing an activity, quality acceptance, and how to respond to project variances. Team members operate best when their individual levels of authority match their individual responsibilities
(C) Responsibility: The assigned duties and work that a project team member is expected to perform in order to complete a project's activities
(D) Competency: The skill and capacity required to complete assigned activities within the project constraints. If project team members do not possess required competencies, performance can be jeopardized. When such mismatches are identified, proactive responses such as training, hiring, schedule changes, or scope changes are identified.

(1.2) Project Organization Charts
(1.3) Staffing Management Plan: describes when and how project team members will be acquired and how long they will be needed.

(A) Staff acquisition:
- Whether the human resources come from within the organization or from external contracted sources
- Whether the team members need to work in central locations or may work from distant locations
- Costs associated with each level of expertise needed for the project
- Level of assistance that the organization’s human resource department and functional managers are needed to contribute.
communication among team members; and providing leadership.

While team building is essential during the front end of the project, it can become a challenge when project goals are becoming more specific. Changes in a project environment are inevitable. To manage these changes effectively, a continued and renewed team-building effort is required. Outcomes of team building include mutual trust, high-quality information exchange, better decision making, and effective decision making.

Influencing: is a strategy of sharing power and relying on interpersonal skills to get others to cooperate towards common goals. Using the following guidelines can influence team members:
1. Lead by example, and follow through with commitments
2. Clarify how a decision will be made
3. Use a flexible interpersonal style and adjust the style to the audience
4. Apply your power skillfully and cautiously. Think of long-term collaboration.

Trust Building: The ability to build trust across the project team and other key stakeholders is a critical component in effective team leadership. Trust is associated with cooperation, information sharing, and effective problem resolution. Without trust it is difficult to establish the positive relationships necessary between the various stakeholders engaged in the project. When trust is compromised, relationships deteriorate, people disengage, and collaboration becomes more difficult, if not impossible. Some actions project managers can take to help build trust:
1. Engage in open and direct communication to resolve problems
2. Keep all stakeholders informed, especially when fulfilling commitments is at risk
3. Spend time directly engaged with the team asking non-assumptive questions to gain a better understanding of the situations affecting the team
4. Be direct and explicit about what you need or expect
5. Do not withhold information out of a fear of being wrong but be willing to share information even if you may be wrong
6. Be receptive to innovation and address any issue or concerns in a forthright manner
7. Look beyond your own interest
8. Demonstrate a true concern for others and avoid engaging in pursuits that could be viewed as being detrimental to the interest of others

Leadership: Leadership involves focusing the efforts of a group of people toward a common goal and enabling them to work as a team. In general terms, leadership is the ability to get things done through others. Respect and trust, rather than fear and submission, are the key elements of effective leadership. Although important throughout all project phases, effective leadership is critical during the beginning phases of a project when the emphasis is on communicating the vision and motivating and inspiring project participants to achieve high performance.

The project management team is a subset of the project team and is responsible for the project management and leadership activities such as initiating, planning, executing, monitoring, controlling, and closing. For smaller projects the project management responsibilities may be shared, by the entire team or administered solely by the project manager. The project sponsor works with the project management team, typically assisting with matters such as project funding, clarifying scope, monitoring progress, and influencing stakeholders in both the requesting and performing organization for the project benefit.

Managing and leading the project team includes:
1. Influencing the project team: The project manager needs to be aware of and influence, when possible, human resource factors that may impact the project. These factors include team environment, geographical locations of team members, communications among stakeholders, internal and external politics, cultural issues, organizational uniqueness, and other factors that may alter project uniqueness.
2. Professional & Ethical behavior: The project management team should be aware of the project uniqueness.
of, subscribe to, and ensure that all team members follow professional and ethical behavior

| Existence need, R = Relatedness, G = Growth
| (3.7) Porter And Lawler Model Of Motivation: Valve of rewards > Efforts > Perceived Efforts – Reward Probability > Performance > Satisfaction
| (4) Expert Judgment: is used to
| (4.1) List the preliminary requirements for the required skills
| (4.2) Assess the roles required for the project based on standardized role descriptions within the organization
| (4.3) Determine the preliminary effort level and number of resources needed to meet project objectives.
| (4.4) Determine reporting relationships needed based on the organizational culture
| (4.5) Provide guidelines on lead time required for staffing, based on lessons learned and market conditions
| (4.6) Identify risks associated with staff acquisition, retention and release plan.
| (4.7) Identify and recommend programs for complying with government and union contracts.

(5) Meetings

### Process Group: Executing

#### 9.2 Acquire Project Team

It is the process of confirming human resource availability and obtaining the team necessary to complete project activities.

**Benefits:** Consists of outlining and guiding the team selection and responsibility assignment to obtain a successful team.

The project management team may or may not have direct control over team member selection because of collective bargain agreements, use of subcontractor personnel, matrix project environment, internal or external reporting relationships, or other various reasons. It is important that following factors are considered during the process of acquiring the project team:

1. The project manager or project management team should effectively negotiate and influence others who are in a position to provide the required human resources for the project.
2. Failure to acquire the necessary human resources for the project may affect project schedules, budgets, customer satisfaction, quality and risks. Insufficient human resources or capabilities decrease the probability of success and, in a worst case scenario, could result in project cancellation.
3. If the human resources are not available due to constraints, such as economic factors or previous assignments to other projects, the project manager or project team may be required to assign alternative resources, perhaps with lower competencies, provided there is no violation of legal, regulatory, mandatory, or other specific criteria.

**Human Resource Management Plan**

(1) Human Resource Management Plan
(2) Enterprise Environmental Factors
(3) Organizational Process Assets

#### Pre-Assignment: When project team members are selected in advance, they are considered pre-assigned. This situation can occur if the project is the result of specific people being identified as part of a competitive proposal, if the project is dependent upon the expertise of particular persons, or if some staff assignments are defined within the project charter.

1. (2) Negotiation: The project management team may need to negotiate with
   - (2.1) Functional Managers to ensure that the project receives appropriately competent staff in the required time frame and that the project team members will be able, willing, and authorized to work on the project until their responsibilities are completed.
   - (2.2) Other project management teams within the performing organization, to appropriately assign scarce or specialized human resources.
   - (2.3) External organizations, vendor, suppliers, etc, for appropriate, scarce, specialized, qualified, certified, or other such specified human resources. Special consideration must be given to external negotiation policies, practices, processes, guidelines, legal and other such criteria.

2. (3) Acquisition: When the performing organization is unable to provide the staff needed to complete a project, the required services may be acquired from outside source. This can involve hiring individual
(4) Virtual Teams: Can be defined as groups of people with a shared goal who fulfill their roles with little or no time spent meeting face to face. The virtual teams model make it possible to

(4.1) Form teams of people from the same organization who live in widespread geographic areas.
(4.2) Add special expertise to the project team even though the expert is not in the same geographic area.
(4.3) Incorporate employees who work from home offices
(4.4) Form teams of people who different shifts, hours or days.
(4.5) Include people with mobility limitations or disabilities
(4.6) Move forward with the projects that would have been ignored due to travel expenses.

There are some disadvantages related to virtual teams, such as possibility for misunderstanding, feeling of isolation, difficulties in sharing knowledge and experience between team members, and cost of appropriate technology. Communication planning becomes increasingly important in a virtual team environment. Additional time may be needed to set clear expectations, facilitate communications, develop protocols for resolving conflict, include people in decision making, understand cultural differences, and share credit in success.

(5) Multi-Criteria Decision Analysis: By use of multi-criteria decision analysis tool, criteria are developed and used to rate or score potential team members. They are weighted according to the relative importance of the needs within the team. Some of the selection criteria are

(5.1) Availability,
(5.2) Cost
(5.3) Experience
(5.4) Ability
(5.5) Knowledge
(5.6) Skills
(5.7) Attitude
(5.8) International Factors

### Process Group: Executing

#### 9.3 Develop Project Team

It is the process of improving competencies, team member interaction, and overall team environment to enhance project performance.

**Benefits:** It results in improved team work, enhanced people skills and competencies, motivated employees, reduced staff turnover rates, and improved overall project performance.

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<td>(B) Listening Techniques</td>
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</table>

(1) Interpersonal Skills (Soft Skills)

(1.1) Leadership
(1.2) Team Building
(1.3) Motivation
(1.4) Communication

(1) Team Performance Assessment: The performance of a successful team is measured in terms of technical success according to agreed- upon project objectives (including quality levels), performance on project schedule (finished on time), and performance on budget (finished within financial constraints). High-performance teams are characterized by these task- oriented and result-oriented outcomes. As a result of conducting an evaluation of the team's overall performance, the project management team can identify specific training, coaching, mentoring, assistance, or changes required to improve the team's
Overlapping phases may require additional resources to allow work to be done in parallel, may increase risk, and can result in rework if uncertainty, but may eliminate options for reducing the overall schedule.

**Phase-to-Phase Relationship:**

1. **Sequential Relationship:** A phase starts only when the previous relationship is complete. Step by step nature of the approach reduces uncertainty, but may eliminate options for reducing the overall schedule.

2. **Overlapping Relationship:** A phase starts prior to completion of previous one. E.g. of schedule compression technique called fast tracking. Overlapping phases may require additional resources to allow work to be done in parallel, may increase risk, and can result in rework if a subsequent phase progresses before accurate information is available from the previous phase.

Project managers should acquire skills to identify, build, maintain, motivate, lead, and inspire project teams to achieve high team performance and to meet the project objectives. Team work is a critical factor for project success, and developing effective project teams is one of the primary responsibility of project manager. Project manager should create an environment that facilitates team work. Project manager should continually motivate their team by providing challenges and opportunities, by providing timely feedback and support as needed and by recognizing and rewarding good performance. High team performance can be achieved by using open and effective communication, creating team building opportunities, developing trust among team members, managing conflicts in constructive manner, and encouraging collaborative problem solving and decision making. The project manager should request management support and / or influence the appropriate stakeholders to acquire the resources needed to develop effective project teams.

Project managers operate in global environment and work on projects characterized by cultural diversity. Team members often have diverse industry experience, known multiple languages and sometimes operate in the “team language” that may be a different language or norm than the native one. The project team should capitalize on cultural differences, focus on developing and sustaining the project team throughout the life cycle, and promote working together inter dependent to in a climate of mutual trust. Developing the project team improves the people skills, technical competencies, and overall team environment and project performance. It requires clear, timely, effective and efficient communication between team members throughout the life of the project. Objectives of developing a project team include:

1. Improving knowledge and skills of team members to increase their ability to complete project deliverables, while lowering costs, reducing schedules, and improving quality
2. Improving feelings of trust and agreement among team members to raise morale, lower conflict, and increase team work
3. Creating a dynamic, cohesive and collaborative team culture to improve individual and team productivity, team spirit, and cooperation and (2) allow cross training and mentoring between team members to share knowledge and expertise.

- **Active**
- **Passive**

1.5 Influencing

1.6 Decision Making

(A) Decision Making Styles

- Command
- Consultation
- Consensus
- Coin flip (random)

(B) Factors that affect the decision style

- Time constraints
- Trust
- Quality
- Acceptance

(C) Decision Making Model

- Problem Definition
- Problem Solution Generation
- Ideas to Action
- Solution Action Planning
- Solution Evaluation Planning
- Evaluation of the outcome & processes

1.7 Political & Cultural Awareness

1.8 Negotiation

1.9 Trust Building

1.10 Conflict Management

(A) Main Sources
- Incongruent requirements
- Competition for resources
- Breakdown in communications

(B) Handling Styles
- Collaborative
- Assertiveness
- Accommodation
- Avoidance or Compromise

1.11 Coaching

1.12 Emotional Intelligence

1.12 Emotional Intelligence

(2) Training: It includes all activities designed to enhance the competencies of the project team members. Training can be formal or informal. E.g. of training methods include classroom, online, computer-based, on-the-job training from another project team member, mentoring and coaching. If project team members lack the necessary management or technical skills, such skills can be developed as part of the project work. Schedule training takes place as stated in the human resource management plan. Unplanned training takes place as a result of observation, conversation, and project performance appraisals conducted during the controlling processes of managing the project team. Training cost could be included in the project budget, or supported by the performing organization if the added skills may be useful for future projects. It could be performed by in-house or external trainers.

(3) Team-building activities: The Tuckman ladder (Tuckman 1965; Tuckman & Jensen, 1977), which includes five stages of development that teams, may go through.
Predictive lifecycles: Also known as fully plan-driven are ones in which the project scope, and the time and cost required to deliver that scope are determined as early in the project life cycle as practically possible. These projects proceed through a series of sequential or overlapping phases, with each phase generally focusing on a subset of project activities and project management processes. The work performed in each phase is usually different in nature to that in the preceding and subsequent phases, therefore, the makeup and skills required of the project team may vary from phase to phase. Preferred when the product to be delivered is well understood, there is substantial base of industry practice or when the product is required to be delivered in full to have value to stakeholder groups.

(3.1) Forming: This phase is when the team meets and learns about the project and their formal roles and responsibilities. Team members tend to be independent and not as open in this phase.

(3.2) Storming: During this phase, the team begins to address the project work, technical discussions, and the project management approach. If team members are not collaborative and open to differing ideas and perspective, the environment can become counterproductive.

(3.3) Norming: In this phase, team members begin to work together and adjust their work habits and behaviors to support the team. The team learns to trust each other.

(3.4) Performing: Teams that reach the performing stage function as a well-organized unit. They are interdependent and work through issues smoothly and effectively.

(3.5) Adjourning: In this phase, the team completes the work and moves on from the project. This typically occurs when staff is released from the project as deliverables are completed or as part of carrying out the close Project or Phase process.

(4) Ground Rules: establishes clear expectations regarding acceptable behavior by project team members. Early commitment to clear guidelines decreases misunderstandings and increases productivity. Discussing ground rules in areas such as code of conduct, communication, working together, or meeting etiquette allows team members to discover values that are important to one another. All project team members share responsibility for enforcing the rules once they are established.

(5) Colocation: Also referred to as “tight matrix”, involves placing many or all of the most active project team members in the same physical location to enhance their ability to perform as a team. Colocation can be temporary, such as at strategically important times during the project, or for the entire project. Colocation strategies can include a team meeting room (sometimes called “war room”), places to post schedules, and other conveniences that enhance communication and a sense of community.

(6) Recognition and Rewards: Part of the team development process involves recognizing and rewarding desirable behavior. The original plans concerning ways in which to reward people are developed during the plan human resource management process. Award decisions are made, formally or informally, during the
Adaptive Lifecycles: Also known as change-drive or agile methods are intended to respond to high levels of change and ongoing stakeholder involvement. Adaptive methods are also iterative and incremental, but differ in that iterations are very rapid (usually with duration of 2 to 4 weeks) and are fixed in time and cost. Adaptive projects generally perform several processes in each iteration, although early iterations may concentrate more on planning activities.

The overall scope of the project will be decomposed into a set of requirements and work to be performed, sometimes referred to as a product backlog. At the beginning of the iteration, the team will work to determine how many of the highest priority items on the backlog list can be delivered within the next iteration. At the end of each iteration, the product should be ready for review by the customer. This does not mean that the customer is required to accept the delivery, just that the product should not include unfinished, incomplete, or unusable features. The sponsor and customer representatives should be continuously engaged with the project to provide feedback on deliverables as they are created and to ensure that the product backlog reflects their current needs.

Generally preferred when dealing with a rapidly changing environment, when requirements and scope are difficult to define in advance, and when it is possible to define small incremental improvements that will deliver value to stakeholders.

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<th>Process Group: Executing</th>
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<th>9.4 Manage Project Team</th>
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Benefits: It influences team behavior, manages conflict, resolves issues, and appraises team member performance.

Managing the project team requires a variety of management skills for fostering team work and integrating the efforts of team members to create high performance teams. Team management involves a combination of skills with special emphasis on communication, conflict management, negotiation, and leadership. Project Managers should provide challenging assignments to team members and provide recognition for high performance.

Cultural differences should be considered while determining recognition and rewards. Most project team members are motivated by an opportunity to grow, accomplish, and apply their professional skills to meet new challenges. A good strategy for project managers is to give the team recognition throughout the lifecycle of the project rather than waiting until the project is completed.

(7) Personnel Assessment Tools: Give Project Managers & the project team insight into areas of strength & weaknesses. These tools help project managers assess the team preferences, aspirations, how they process and organize information, how they tend to make decisions, and how they prefer to interact with people. These tools can provide improved understanding, trust, commitment, and communications among team members and facilitate more productive teams throughout the project. Various tools are available such as:

- (7.1) Attitudinal surveys
- (7.2) Specific assessments
- (7.3) Structured interviews
- (7.4) Ability tests
- (7.5) Focus groups

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Successful conflict management results in greater productivity and positive working relationships. When managed properly, difference in opinion can lead to increased productivity and better decision making. If the differences become negative factor,
project team members are initially responsible for their resolution. If conflicts escalate, the project manager should help facilitate a satisfactory resolution. Conflict should be addressed early and usually in private, using a direct collaborative approach. If disruptive conflict continues, formal procedures may be used, including disciplinary actions.

The success of project managers in managing their project teams often depends a great deal on their ability to resolve conflict. Different project managers may utilize different conflict resolution methods. Factors that influence conflict resolution methods include

- Relative importance and intensity of conflict
- Time pressure for resolving the conflict
- Positions taken by persons involved
- Motivation to resolve conflict on a long-term or a short-term basis

There are five general techniques for resolving conflicts:

- Withdraw/Avoid: Retreating from an actual or potential conflict situation; postponing the issue to be better prepared or to be resolved by others
- Smooth/Accommodate: Emphasizing areas of agreement rather than areas of difference; conceding one's position to the needs of others to maintain harmony and relationships
- Comprise/Reconcile: Searching for solutions that bring some degree of satisfaction to all parties in order to temporarily or partially resolve the conflict
- Force/Direct: Pushing one's viewpoint at the expense of the others; offering only win-lose solutions, usually enforced through a power position to resolve an emergency
- Collaborate/Problem Solve: Incorporating multiple viewpoints and insights from differing perspectives; requires a cooperative attitude and open dialogue that typically leads to consensus and commitment.

Interpersonal Skills:

- Leadership,
- Influencing: Key influencing skills include
  - Ability to be persuasive and clearly articulate points and positions
  - High levels of active and effective listening skills
  - Awareness of, and consideration for, the various perspectives in any situation
  - Gathering relevant and critical information to address important issues and reach agreements while maintaining mutual trust

Iterative & Incremental Lifecycles: Iterative and incremental life cycle are ones in which project phases (also called iterations) intentionally repeat one or more project activities as the project team's understanding of the product increases. Iterations develop the product through a series of repeated cycles, while increments successively add to the functionality of the product. These life cycles develop products both iteratively and incrementally. Iterative and incremental projects may proceed in phases, and the iterations themselves will be performed in a sequential or overlapping. During an iteration activities from all project management process groups will be performed. At the end of each iteration, a deliverable or set of deliverables will be completed. Future iterations may enhance those deliverables or create new ones. Each iteration incrementally builds the deliverables until the exit criteria for the phase are met, allowing the project team to incorporate feedback.

In most iterative lifecycles, a high-level vision will be developed for the overall undertaking, but the detailed scope is elaborated one iteration at a time. Often the planning for the next iteration is carried out as work progresses on the current iteration's scope and deliverables. The work required for a given set of deliverables may vary in duration and effort, and the project team may change between or during iterations.

Those deliverables that are not addressed within the scope of the current iteration are typically scoped at a high level only and may be tentatively assigned to a specific future iteration. Changes to the scope are carefully managed once work begins. Generally preferred when an organization needs to manage changing objectives and scope, to reduce the complexity of a project, or when the partial delivery of a product is beneficial and provides value for one or more stakeholder groups without impact to the final deliverable or set of deliverables. Large and complex projects are frequently executed in an iterative fashion to reduce risk by allowing the team to incorporate feedback.
Communications Management

Includes the processes that are required to ensure timely and appropriate planning, collection, creation, distribution, storage, retrieval, management, control, monitoring and the ultimate disposition of project information. Project Managers spent most of their time communicating with team members and other project stakeholders, whether they are internal (at all organization levels) or external to the organization. Effective communication creates a bridge between diverse stakeholders who may have different cultural and organizational backgrounds, different levels of expertise, and different perspectives and interests, which impact or have an influence upon the project execution or outcome. The communication activities involved in these processes may have often many potential dimensions that need to be considered, including but not limited to:

1.1 Organizational Charts
1.2 Project Organization & Stakeholder responsibility relationships
1.3 Logistics of how many persons will be involved in the project & at which locations
1.4 Internal Information Needs
1.5 External Information Needs
1.6 Stakeholder information & communication requirements from within the stakeholder register

(1) Communicate to the stakeholders and misunderstanding or misinterpretation of the message communicated.

On most projects, communication planning is performed very early, such as during project management plan development. This allows appropriate resources, such as time and budget, to be allocated to activities.

Effective communication means that the information is provided in the right format, at the right time, to the right audience, and with the right impact.

Efficient communication means providing only the information that is needed.

Important consideration that need to be taken into account include:

1. Project Management Plan
2. Stakeholder Register
3. Enterprise Environmental Factors
4. Organizational Process Assets

(1) Project Management Plan
(2) Stakeholder Register
(3) Enterprise Environmental Factors
(4) Organizational Process Assets

(1.1) Stakeholder communications requirements
(1.2) Information to be communicated, including language, format, content, and level of detail
(1.3) Reason for the distribution of the information
(1.4) Time frame & the frequency for the distribution of required information & receipt of acknowledgement or response if applicable
(1.5) Person responsible for communicating the information
(1.6) Person responsible for authorizing release of confidential information
(1.7) Person or groups who will receive the information
(1.8) Methods or technologies used to convey the information, such as memos, email, and /or press releases.
(1.9) Resources allocated for communication activities including time and budget
(1.10) Escalation process identifying time frames & management chain (names) for escalation of issues that cannot be resolved at a lower staff level.
(1.11) Method of updating & refining the communications management plan as the project progresses & develops
(1.12) Glossary of common terminology
(1.13) Flow charts of the information flow in the project, workflows with possible sequence of authorization, list of reports, & meeting plans
(1.14) Communication constraints usually derived from a specific legislation or regulation, technology & organization policies.

(2.1) Project Documents Updates
(2.2) Project Schedule
(2.3) Stakeholder Register

(2) Communication Technology: Methods used to transfer information among project stakeholders may vary significantly. Factors that affect choice of communication technology include:

2.1 Urgency of the need for information:
2.2 Availability of technology
2.3 Ease of Use
2.4 Project Environment
2.5 Sensitivity and Confidentiality of the information

(3) Communication Models: Basic communication model consist of sender and receiver. Medium is technology medium and includes the mode of communication while

(4) Communication Requirements Analysis: The analysis of the communication requirements determines the information needs of the project stakeholders. These requirements are defined by combining the type and format of information needed with an analysis of the value of that information. Project resources should be expended only on communicating information that contributes to the success of the project or where a lack of communication can lead to failure.

The project manager should also consider the number of potential communication channels or paths as an indicator of the complexity of a project's communications. The total number of potential communication channel is \( n^{(n-1)}/2 \), where \( n \) represents the number of stakeholders. As a result, a key component of planning the project's actual communications is to determine and limit who will communicate with whom and who will receive what information.

(1.1) Organizational Charts
(1.2) Project Organization & Stakeholder responsibility relationships
(1.3) Disciplines, Departments & Specialties involved in the project
(1.4) Internal Information Needs
(1.5) External Information Needs
(1.6) Stakeholder information & communication requirements from within the stakeholder register

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(2) Formal (reports, minutes, briefings) and informal (emails, memos, ad-hoc discussions)

(3) Vertical (up & down the organization) and horizontal (with peers)

(4) Official (news letters, annual reports) and unofficial (off the record communications)

(5) Written and Oral, and verbal (voice inflections) and no verbal body language

Most communications skills are common for both general management and project management

(1) Listening actively and effectively

(2) Questioning and probing ideas and situations to ensure better understanding

(3) Educating to increase team’s knowledge so that they can be more effective

(4) Fact finding to identify and confirm information

(5) Setting and managing expectations

(6) Persuading a person, a team, or an organization to perform and action

(7) Motivating to provide encouragement or reassurance

(8) Coaching to improve performance and achieve desired results

(9) Negotiating to

**Process Group: Executing**

**10.2 Manage Communications**

It is the process of creating, collecting, distributing, storing, retrieving, and the ultimate disposition of project information in accordance to the communications management plan

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<thead>
<tr>
<th>(1) Communications Management Plan</th>
<th>(1) Communications Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>(2) Work Performance Reports</td>
<td>(2) Communications Model</td>
</tr>
<tr>
<td>(3) Enterprise Environmental Factors</td>
<td>(3) Communications Methods</td>
</tr>
<tr>
<td>(4) Organizational Process Assets</td>
<td>(4) Information Management Systems</td>
</tr>
<tr>
<td></td>
<td>(4.1) Hard Copy Document Management</td>
</tr>
</tbody>
</table>

(1) Project Communications: involves the activities that are required for information to be created, distributed, received, acknowledged, and understand. Project communications may include

(1.1) Performance reports

(1.2) Deliverables status

(1.3) Schedule Progress

(1.4) Cost incurred

noise includes any interference or barriers that might compromise the delivery of the message for e.g., distance, unfamiliar technology, inadequate infrastructure, cultural difference, and lack of back ground information. The sequence of steps in a basic communication model is

(3.1) Encode

(3.2) Transmit Message

(3.3) Decode

(3.4) Acknowledge

(3.5) Feedback/Response

The sender is responsible for the transmission of the message, ensuring that the information being communicated is clear and complete, and conforming the communication is clearly understood. The receiver is responsible for ensuring that the information is received in its entirety, understood correctly, and acknowledged or responded to appropriately.

(4) Communication Methods

(4.1) Interactive Communication: Between two or more parties performing a multidirectional exchange of information. It is the most efficient way to ensure a common understanding by all participants on specified topics, and includes meetings, phone calls, instant messaging, and video conferencing.

(4.2) Push Communication: Sent to specific recipients who intend to receive the information. This ensures that the information is distributed but does not ensure that it actually reached or was understood by the intended audience. E.g. letters, memos, reports, emails, faxes, voice mails, blogs, press releases

(4.3) Pull Communication: Used for very large volumes of information, or for very large audiences, and requires the recipients to access the communication content at their own discretion. E.g. intranet sites, e-learning, lessons learned databases, knowledge repository.

The choice of communication methods that are used for a project may need to be discussed and agreed upon by the project stakeholders based on communication requirements; cost and time constraints; and familiarity and availability of the required tools and resources that may be applicable to the communication process

(5) Meetings
|成就相互接受的协议 | Benefits: It enables an efficient and effective communications flow between project stakeholders. This process goes beyond the distribution of relevant information and seeks to ensure that the information being communicated to project stakeholders has been appropriately generated, as well as received and understood. It also provides opportunities for stakeholders to make requests for further information, clarification, and discussion. Techniques and considerations for effective communication management include:
(1) Sender-receiver models: Incorporating feedback loops to provide opportunities for interaction / participation and remove barriers to communication
(2) Choice of media: Situation specifies as to when to communicate in writing versus orally, when to prepare an informal memo vs a formal report, and when to communicate face to face vs by email.
(3) Writing Style: Appropriate use of active vs passive voice, sentence structure, and word choice
(4) Meeting Management Techniques: Preparing an agenda and dealing with conflicts.
(5) Presentation Techniques: Awareness of the impact of body language and design of visual aids
(6) Facilitation Techniques: Building consensus and overcoming obstacles
(7) Listening Techniques: Listening actively (acknowledging, clarifying, and confirming understanding) and removal of barriers that adversely affect comprehension.

| Project Group: Controlling | Benefits: It ensures and optimal information flow among all communication participants, at any moment in time. The control communications process can trigger an interaction of the plan communications management and / or manage communications processes. This iteration illustrates the continuous nature of the project communications management processes. Specific communication elements, such as issues or key performance indicators (eg actual vs planned schedule, cost, and quality) may trigger an immediate revision, while others may not. The impact and repercussions of project communications should be carefully evaluated and controlled to ensure that the right message is delivered to the right audience at the right time. |

| 10.3 Control Communications | Project Management Plan
(1.1) Stakeholder communication requirement
(1.2) Reason for the distribution of the information
(1.3) Time frame & Frequency for the distribution of required information
(1.4) Individual or group responsible for communication of the information
(1.5) Individual or group receiving the information
(2) Project Communications
(2.1) Deliverables status
(2.2) Schedule Progress
(2.3) Cost Incurred
(3) Issue log: An issue log is used to document and monitor the resolution of issues. It may be used to facilitate communication and ensure a common understanding of issues. A written log documents and helps to monitor who is responsible for resolving specific issues by a target date. Issue resolution addresses obstacles that can block the team from achieving its goals. This information is important to the control communications process as it provides both a repository for what has already happened in the project and a platform for subsequent communications to be delivered. |

| 1.1) Project Management Plan | Information Management Systems
(1) Work Performance Information
(2) Change Requests
(2.1) New or revised cost estimates, activity sequences, schedule dates, resource requirements, and analysis of risk response alternatives
(2.2) Adjustments to the project management plan and documents
(2.3) Recommendations of corrective actions that may bring the expected future performance of the project back in line with the project management plan
(2.4) Recommendations of preventive actions that may reduce the probability of incurring future negative project performance

| 1.4) Electronic Project Management Tools | (1.5) Urgency and impact analysis
(1.6) method of delivery
(1.7) level of confidentiality

| 4.2) Electronic Communications Management | Performance Reporting: Act of collecting and distributing performance information, including status reports, progress measurements, and forecasts. Performance reporting involves the periodic collection and analysis of baseline vs actual data to understand and communicate the project progress and performance as well as to forecast the project results. Performance reporting may include:
(5.1) Analysis of past performance
(5.2) Analysis of project forecasts (including time and cost)
(5.3) Current status of risk and issues
(5.4) Work completed during the period
(5.5) Work to be completed in the next period
(5.6) Summary of changes approved in the period
(5.7) Other relevant information, which is reviewed and discussed. |

| 4.3) Electronic Project Management Tools | Organizational Process Assets
(4.1) Stakeholder Notifications
(4.2) Project Reports
(4.3) Project Presentations
(4.4) Project Records
(4.5) Feedback from stakeholders
(4.6) Lessons Learned Documentation

| 4.4) Project Records | Organizational Process Assets

| 4.5) Feedback from stakeholders | Organizational Process Assets

| 4.6) Lessons Learned Documentation | Organizational Process Assets

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## Risk Management

**Process Group: Planning**

### 11.1 Plan Risk Management

It is the process of defining how to conduct risk management activities for a project.

**Benefits:** It ensures that the degree, type, and visibility of risk management are commensurate with both the risks and the importance of project to the organization.

The risk management plan is vital to communicate with and obtain agreement and support from all stakeholders to ensure the risk management process is supported and performed effectively over the project life cycle.

Careful and explicit planning enhances the probability of success for other risk management processes. Planning is also important to provide sufficient resources and time for risk management activities and to establish an agreed-upon basis for evaluating risks. The risk management plan should begin when a project is conceived and should be completed early during project planning.

<table>
<thead>
<tr>
<th>Process Group: Planning</th>
<th>(1) Project Management Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>11.2 Identify Risks</strong></td>
<td>(1) List of Identified Risk: The identified risks are the initial entry into the risk register. The risk register is a document in which the results of risk analysis and risk response planning are recorded. It contains the outcomes of the other risk management processes as they are conducted, resulting in an increase in the level and type of information contained in the risk register overtime. The preparation of the risk register begins in the identifying risks process with the following information, and then becomes available to other project management and risk management processes.</td>
</tr>
</tbody>
</table>

**Process Group: Planning**

### 11.2 Identify Risks

It is the process of identifying which risk may affect the project and documenting their characteristics

**Benefits:** The documentation of existing risks and the knowledge and ability it provides to the project team to anticipate events.

Identify risks is an iterative process, because new risks may evolve or become known as the project progresses through its life cycle.

<table>
<thead>
<tr>
<th>Process Group: Planning</th>
<th>(1) Risk Management Plan</th>
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<tr>
<td><strong>11.2 Identify Risks</strong></td>
<td>(1.1) List of Identified Risk: The identified risks are</td>
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</table>
### Risk Identification

The frequency of iteration and participation in each cycle will vary by situation. The format of the risk statements should be consistent to ensure that each risk is understood clearly and unambiguously in order to support effective analysis and response development. The risk statement should support the ability to compare the relative effect of one risk against others on the project. The process should involve the project team so they can develop and maintain a sense of ownership and responsibility for the risk response actions. Stakeholders outside the project may also provide additional objective information.

| (6) Scope Baseline: Project assumptions are found in the project scope statement. Uncertainty in project assumptions should be evaluated as potential causes of project risk. The WBS is a critical input to identifying risks as it facilitates an understanding of the potential risks at both the micro and macro levels. Risks can be identified and subsequently tracked at summary, control account, and work package level. |
| (7) Activity Cost Estimates |
| (8) Activity Duration Estimates |
| (9) Stakeholder Register |
| (10) Project Documents |
| (10.1) Project Charter |
| (10.2) Project Schedule |
| (10.3) Project Schedule Diagrams |
| (10.4) Issue Log |
| (10.5) Quality Checklists |
| (10.6) Other information proven to be valuable in identifying risks |
| (11) Procurement Documents |
| (12) Enterprise Environmental Factors |
| (13) Organizational Process Assets |

Individual project risks are different from overall project risk. Overall project risk represents the effect of uncertainty on the project as a whole. It is more than the sum of the individual risks within a project, since it includes all sources of project uncertainty. It represents the exposure of stakeholders to implications of variations in project outcome, both positive and negative.

Organizations perceive risk as the effect of uncertainty on projects and organizational objectives. Organizations and stakeholders are willing to accept varying degree of risks depending on their risk attitude. The risk attitudes of both the organization and the stakeholders may be influenced by a number of factors, which are broadly classified into three themes:

(1) Risk Appetite: Which is the degree of uncertainty an entity is willing to take on in anticipation of a reward.

(2) Risk Tolerance: Are the risks worth taking, given the desired outcome and the available resources?

(3) Risk Threshold: The level of risk beyond which the entity will not proceed or will seek to reduce or avoid the risk.

(4) Risk Analysis: Every project and its plan is conceived and developed based on a set of hypotheses, scenarios, or assumptions. Assumption analysis explores the validity of assumptions as they apply to the project. It identifies risks to the project from inaccuracy, instability, inconsistency, or incompleteness of assumptions.

(5) Diagraming Techniques: Cause and Effect Diagrams: Also known as Ishikawa or fishbone diagrams and are useful for identifying causes of uncertainty an entity is willing to take on in anticipation of a reward.

(6.1) Ishikawa or Fishbone Diagrams: A useful tool for identifying the causes of a problem, especially in quality control.

(6.2) Delphi Technique: A way to reach consensus of experts. Project risk experts participate in this technique anonymously. A facilitator uses a questionnaire to solicit ideas about the important project risk. The responses are summarized and are then recirculated to the experts for further comments. Consensus may be reached in a few rounds of this process. The Delphi technique helps to improve the data and keeps any one person having undue influence on the outcome.

(6.3) Interviewing: Experienced project participants, stakeholders, and subject matter experts help to identify risks.

(6.4) Root Cause Analysis: A specific technique used to identify a problem, discover the underlying causes that lead to it, and develop preventive action

(3) Checklist Analysis: Risk identification checklist are developed based on historical information and knowledge that has been accumulated from previous similar projects and from other sources of information. The lowest level of RBS can also be used as risk checklist. While a checklist may be quick and simple, it is impossible to build an exhaustive one, and care should be taken to ensure the checklist is not used to avoid the effort of proper risk identification. The team should also explore items that do not appear on check list. Additionally, checklist should be pruned from time to time to remove or archive related items. The checklist should be reviewed during project closure to incorporate new lessons learned and improve it for use on future projects.

(4) Assumptions Analysis: Every project and its plan is conceived and developed based on a set of hypotheses, scenarios, or assumptions. Assumption analysis explores the validity of assumptions as they apply to the project. It identifies risks to the project from inaccuracy, instability, inconsistency, or incompleteness of assumptions.

(5) Diagraming Techniques: Cause and Effect Diagrams: Also known as Ishikawa or fishbone diagrams and are useful for identifying causes of uncertainty an entity is willing to take on in anticipation of a reward.
Project Management Process: These processes ensure the effective flow of the project throughout its life cycle. These processes encompass the tools and techniques involved in applying the skills and capabilities described in the knowledge area.

Process Group: Planning

11.3 Perform Qualitative Risk Analysis

It is the process of prioritizing risks for further analysis or action by assessing and combining their probability of occurrence and impact. Benefits: It enables project managers to reduce the level of uncertainty and focus on high-priority risks. Perform Qualitative Risk Analysis assesses the priority of identified risks using their relative probability or likelihood of occurrence, the corresponding impact on project objectives if the risks occur, as well as other factors such as the time frame for response and the organization’s risk tolerance associated with the project constraints of cost, schedule, scope, and quality. Such assessments reflect the risk attitude of the project team and other stakeholders. Effective assessments therefore require explicit identification and management of the risk approaches of key participants in the perform qualitative risk analysis process. Where these risk approaches introduce bias into assessment of identified risks, attention should be paid to identifying bias and correcting it.

Establishing definitions of the levels of probability and impact can reduce the influence of bias. The time criticality of risk-related actions may magnify the importance of risk. An evaluation of the quality of the available information on project risks also helps to clarify the assessment of risk’s importance to the project. Perform Qualitative risk analysis is usually a rapid and cost-effective means of establishing priorities for Plan Risk Responses and lays the foundation for perform quantitative risk analysis, if required. The perform qualitative risk analysis process is performed regularly throughout the project life cycle as defined in the projects risk management plan. This process can lead into Perform Quantitative Risk Analysis.

1) Risk Management Plan: Key elements used are:
(1.1) Roles and responsibilities for conducting risk management
(1.2) Budget, schedule activities for risk management
(1.3) risk categories
(1.4) definitions of probability and impact
(1.5) revised stakeholder risk tolerances

The inputs are usually tailored to the project during the plan risk management processes. If they are not available, they may be developed during the perform qualitative risk analysis process.

2) Scope Baseline
3) Risk Register
4) Enterprise Environmental Factors
(4.1) Industry studies of similar projects by risk specialists
(4.2) Risk databases that may be available from industry or proprietary sources.

5) Organizational Process Assets

1) Risk Probability and Impact Assessment: Risk probability assessment investigates the likelihood that each specific risk will occur. Risk impact assessment investigates the potential effect of a project objective such as schedule, cost, quality, or performance, including both negative effects for threats and positive effects for opportunities. Probability and impact are assessed for each identified risk. Risks can be assessed in interviews or meetings with participants selected for their familiarity with the risk categories on the agenda. Project team members and knowledgeable persons external to the project are included. The level of probability for each risk and its impact on each objective is evaluated during the interview or meeting. Explanatory detail, including assumptions justifying the levels assigned, are also recorded. Risk probabilities and impacts are related according to the definitions given in the risk management plan. Risks with low ratings of probability and impact will be included in the risk register as part of the watch list for future monitoring.

2) Probability and Impact Matrix: Risk can be prioritized for further quantitative analysis and planning risk responses based on their risk rating. Ratings are assigned to risks based on their assessed probability and impact. Evaluation of each risk’s
and risk avoidance. To be successful, an organization should be committed to address risk management proactively and consistently throughout the project. A conscious choice should be made at all levels of the organization to actively identify and pursue effective risk management during the life of the project. Project risk could exist at the moment a project is initiated. Moving forward on a project without a proactive focus on risk management is likely to lead to more problems arising from unmanaged threats.

**Risk Analysis** or directly into **Plan Risk Responses Plan**.

Importance and priority for attention is typically conducted using a lookup table or a probability and impact matrix. Such a matrix specifies combinations of probability and impact that lead to rating the risks as low, moderate, or high priority. Descriptive terms or numeric values can be used depending on organizational preference.

Each risk is rated on its probability of occurrence and impact on an objective if it does occur. The organization should determine which combinations of probability and impact result in a classification of high risk, moderate, and low risk. Usually, these risk-rating rules are specified by the organization in advance of the project and included in organizational process assets. Risk rating rules can be tailored in the plan risk management process to the specific project.

An organization can rate a risk separately for each objective (e.g., cost, time, and scope). In addition, it may develop ways to determine one overall rating for each risk. Finally, opportunities and threats are handled in the same matrix using definitions of the different levels of impact that are appropriate for each.

The risk score helps to guide risk responses. For example, risks that have a negative impact on objectives, otherwise known as threats if they occur, and that are in the high-risk zone of the matrix, may require priority action and aggressive response strategies. Threats found in the low-risk zone may not require proactive management action beyond being placed in the risk register as part of the watch list or adding a contingency reserve. Similarly for opportunities, those in the high-risk zone, which may be obtained most easily and offer the greatest benefit, should be targeted first. Opportunities in the low risk zone should be monitored. The numbers of steps in the scale are usually established when defining the risk attitude of the organization.

(3) **Risk Data Quality Assessment**: is a technique to evaluate the degree to which the data about risks is useful for risk management. It involves examining the degree to which the risk is understood and the accuracy, quality, reliability, and integrity of the data about the risk.

The use of low quality risk data may lead to a qualitative risk analysis of little use to the project. If data quality is unacceptable, it may be necessary to gather data. Often, the collection of information about risks is difficult, and consumes more time and

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**Product-Oriented Process**: These processes specify and create the project's product. Product-oriented processes are typically defined by the project life cycle and vary by application area as well as the phase of the product life cycle. The scope of the project cannot be defined without some basic understanding of how to create the specified product.

**Tailoring**: Project Managers and their team should carefully address each process and its inputs and outputs and determine which are applicable to the project they are working on. The PMBOK Guide may be used as a resource in managing a project while considering the overall approach and methodology to be followed for the project. This effort is known as tailoring.
11.4 Perform Quantitative Risk Analysis

It is the process of numerically analyzing the effect of identified risks on overall project objectives. It produces quantitative risk information to support decision making in order to reduce project uncertainty. Perform quantitative risk analysis generally follows the perform qualitative risk analysis process as potentially and substantially impacting the project’s competing demands. The perform qualitative risk analysis process analyses the effect of those risks on project objectives. It is used mostly to evaluate the aggregate effect of all risks affecting the project. When the risks drive the quantitative analysis, the process may be used to assign a numerical priority rating to those risks individually. Perform quantitative risk analysis is performed on risks that have been prioritized by the perform qualitative risk analysis process as potentially and substantially impacting the project’s competing demands. The perform quantitative risk analysis process analyses the effect of those risks on project objectives. It is used mostly to evaluate the aggregate effect of all risks affecting the project. When the risks drive the quantitative analysis, the process may be used to assign a numerical priority rating to those risks individually.

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Process Group: Planning

(1) Risk Management Plan
(2) Cost Management Plan
(3) Schedule Management Plan
(4) Risk Register
(5) Enterprise Environmental Factors
(6) Organizational Process Assets

(1) Data Gathering and Representation Techniques
(1.1) Interviewing: techniques draw on experience and historical data to quantify the probability and impact of risks on project objectives. The information needed depends upon the type of probability distributions that will be used. For instance, information would be gathered on optimistic (low), pessimistic (high), and most likely scenarios for some commonly used distributions.
(1.2) Probability Distribution: Continuous probability distributions, which are used extensively in modeling and simulation, represent the uncertainty in values such as durations of schedule activities and costs of project components. Discrete distributions can be used to represent uncertain events, such as the outcome of a test or a possible scenario in a decision tree. Beta distribution and triangular distribution are widely used continuous distribution. These distributions depict shapes that are compatible with the data typically developed during the quantitative risk analysis. Uniform distributions can be used if there is no obvious value that is more likely than another between specified high and low bands, such as in the early concept stage of design. Other commonly used distributions include uniform, normal, lognormal. In these charts the horizontal (X) axes represents possible values of time and cost and the vertical (Y) axes represent relative likelihood

(1.1.1) Probabilistic Analysis of the project: Estimates are made of potential project schedule and cost outcomes listing the possible completion dates and costs with their associated confidence levels. This output, often expressed as a cumulative frequency distribution, is used with stakeholder risk tolerances to permit qualification of the cost and time contingency reserves. Such contingency reserves are needed to bring the risk of occurring stated project objectives to a level acceptable to the organization.
(1.1.2) Probability of achieving cost and time objectives: With the risks facing the project, the probability of achieving project objectives under the current plan can be estimated using quantitative risk analysis results.
(1.1.3) Prioritized list of quantified risks: The list includes those risks that pose the greatest threat or present the greatest opportunity to the project. These include the risk that may have the greatest effect on cost contingency and those that are most likely to influence the critical path. These risks may be evaluated, in some cases, through a tornado diagram generated as a result of the simulation analysis.
(1.1.4) Trends in Quantitative Risk Analysis results: As the analysis is repeated, a trend may become apparent that leads to conclusions affecting risk responses. Organizational historical information on project schedule, cost, quality, and performance should reflect new insights gained through the Perform Quantitative Risk Analysis processes. Such history may take the form of a quantitative risk analysis report. This report may be separate from, or linked to, the risk register.

(1.4) Trends in Quantitative Risk Analysis results: As the analysis is repeated, a trend may become apparent that leads to conclusions affecting risk responses. Organizational historical information on project schedule, cost, quality, and performance should reflect new insights gained through the Perform Quantitative Risk Analysis processes. Such history may take the form of a quantitative risk analysis report. This report may be separate from, or linked to, the risk register.
(2) Quantitative Risk Analysis and Modeling Techniques: Commonly used techniques use both even-oriented and project oriented analysis approaches, including

(2.1) Sensitivity Analysis (Tornado Diagram): helps to determine which risks have the most potential impact on the project. It helps to understand how variations in project’s objectives correlate with variations in different uncertainties. Conversely, it examines the extent to which the uncertainty of each project elements affects the objectives being studied when all other uncertain elements are held at their baseline values. One typical display of sensitivity analysis is the tornado diagram which is useful for comparing relative importance and impact of variables that have a high degree of uncertainty to those that are more stable. The tornado diagram is also helpful in analyzing risk-taking scenarios enabled on specific risks whose quantitative analysis highlights possible benefits greater than corresponding identified negative impacts. A tornado diagram is a special type of bar chart used in sensitivity analysis for comparing the relative importance of the variables. In a tornado diagram, the Y-axis contains each type of uncertainty at base values, and the X-axis contains the spread or correlation of the uncertainty to the studied impact.

(2.2) Expected Monetary Value (EMV) Analysis (Decision Tree Analysis): is a statistical concept that calculates the average outcome when the future includes scenarios that may or may not happen (i.e. analysis under uncertainty). The EMV of opportunities are generally expressed as positive values, while those of threats are expressed as negative values. EMV requires a risk-neutral assumption – neither risk averse nor risk seeking. EMV for a project is calculated by multiplying the value of each possible outcome by its probability of occurrence and adding the products together. A common use of this type of analysis is a decision tree analysis.

(2.3) Modeling and Simulation (Monte Carlo Technique): A project simulation uses a model that translates the specified detailed uncertainties of the project into their potential impact on project objectives. Simulations are typically performed using the Monte Carlo techniques. In a simulation, the project model is computed many times (iterated), with the input values (e.g. cost estimates, or activity durations) chosen at random for each iteration from the probability distributions of these variables. A histogram (e.g. total cost, or completion date) is calculated from the iterations. For a cost risk-analysis, a simulation uses cost estimates. For a schedule risk analysis, the
11.5 Plan Risk Responses

It is the process of developing options and actions to enhance opportunities and to reduce threats to project objectives.

Benefits: It addresses the risks by their priority, inserting resources and activities into the budget, schedule, and project management plan as needed.

The plan risk responses process follows the perform quantitative risk analysis process (if used). Each risk response requires an understanding of the mechanism by which it will address the risk. This is the mechanism used to analyze if the risk response plan is having the desired effect. It includes identification and assignment of one person (an owner for risk response) to take responsibility for each agreed-to and funded risk response. Risk responses should be appropriate for significance of the risk, cost-effective in meeting the objectives of the project, and responses are chosen and agreed upon, they are included in the risk register.

The plan risk responses process presents commonly used approaches to planning responses to the risks. Risks include threats and opportunities that can affect project success, and responses are discussed for each.

<table>
<thead>
<tr>
<th>Process Group: Planning</th>
<th>Schedule Network Diagram and Duration Estimates are Used.</th>
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</thead>
<tbody>
<tr>
<td>(1) Risk Management Plan</td>
<td>(3) Expert Judgment</td>
</tr>
<tr>
<td>(1.1) Roles and Responsibilities</td>
<td>(1.1) Project Management Plan Updates</td>
</tr>
<tr>
<td>(1.2) Risk Analysis Definitions</td>
<td>(1.2) Cost Management Plan</td>
</tr>
<tr>
<td>(1.3) Timing for reviews (and for eliminating risks from reviews)</td>
<td>(1.3) Quality Management Plan</td>
</tr>
<tr>
<td>(1.4) Risk Thresholds for low, moderate and high risks. Risk thresholds help identify those risks for which specific responses are needed</td>
<td>(1.4) Procurement Management Plan</td>
</tr>
<tr>
<td>(2) Risk Register</td>
<td>(1.5) Human Resource Management Plan</td>
</tr>
<tr>
<td>(2.1) Identified risks</td>
<td>(1.6) Scope Baseline</td>
</tr>
<tr>
<td>(2.2) Root causes of risks</td>
<td>(1.7) Schedule Baseline</td>
</tr>
<tr>
<td>(2.3) List of potential responses</td>
<td>(1.8) Cost Baseline</td>
</tr>
<tr>
<td>(2.4) Risk owners</td>
<td>(2.4) Project Documents Updates</td>
</tr>
<tr>
<td>(2.5) Symptoms and Warning signs</td>
<td>(G)</td>
</tr>
<tr>
<td>(2.7) The relative rating or priority list of project risks</td>
<td>(F)</td>
</tr>
<tr>
<td>(2.8) Risk requiring responses in the near term</td>
<td>(E)</td>
</tr>
<tr>
<td>(2.9) Risk for additional analysis and response</td>
<td>(D)</td>
</tr>
<tr>
<td>(2.10) Trends in quantitative analysis results</td>
<td>(C)</td>
</tr>
<tr>
<td>(2.11) Watch List, which is a list of low priority risks within the risk register</td>
<td>(B)</td>
</tr>
<tr>
<td>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. Specific actions are developed to implement that strategy, including primary and backup strategies, as necessary. A fall back plan can be developed for implementation if the selected strategy turn out not to be fully effective or if an accepted risk occurs.</td>
<td>(A)</td>
</tr>
<tr>
<td>Secondary risks are risks that arise as a direct result of implementation of a risk response. A contingency reserve is often allocated for time or cost. If developed, it may include identification of conditions that trigger its use.</td>
<td>Risk avoidance is a risk response strategy whereby the project team acts to eliminate the threat or protect the project from its impact. It usually involves changing the project management plan to eliminate the threat entirely. The project manager may also isolate the project objectives from the risk’s impact or change the objective that is in jeopardy. Examples of this include extending the schedule, changing the strategy, or reducing scope. The most radical avoidance strategy is to shut down the project entirely. Some risks that arise early in the project can be avoided by clarifying requirements, obtaining information, improving communication, or acquiring expertise.</td>
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</tbody>
</table>
Project Information

Data: Throughout the lifecycle of the project, a significant amount of data and information is collected, analysed, transformed and distributed in various formats to project team members and other stakeholders. Project data are collected as a result of various executing processes and are shared with the project team.

Information: The collected data are analysed in context, and aggregated and transformed to become project information during various controlling processes.

Reports: The information may then be communicated verbally or stored and distributed as reports in various formats.

Work Performance Data: The raw observations and measurements identified during activities performed to carry out the project work. Eg include reported % of work physically completed, quality and technical performance measures, start and finish dates of schedule activities, no of change requests, no of defects, actual costs, actual durations, etc.

Work Performance Information: The performance data collected from various controlling processes analysed in context and integrated based on relationships across areas. Eg: status of deliverables, implementation status for change requests and forecasted estimates to complete.

Work Performance Reports: The physical or electronic representation of work performance information compiled in project documents, intended to generate decisions or raise issues, actions or awareness. Eg status reports, memos, justifications, information notes, electronic dash boards, recommendations, and updates.

Enterprise Environmental Factors: Refers to conditions not under the control of the project team, that influence, constraints, or direct the project.

1. Organizational culture, structure and governance
2. Geographical distribution of facilities and resources
3. Government and industry standards (e.g. regulatory agency regulations, codes of conduct, product standard, quality standards and workmanship standards)
4. Infrastructure (existing facilities and capital equipment)
5. Existing human resources (e.g. skills, disciplines, and knowledge, such as design development, legal, contracting, purchasing)
6. Personnel administration (e.g. staffing and retention guidelines, employee performance reviews and training records, rewards and overtime policy, and time tracking)
7. Company work authorization system
8. Market place conditions
9. Stakeholder risk tolerances
10. Political climate
11. Organizational established communication channels
12. Commercial databases (e.g. standard costing estimates data, industry risk study information, risk databases)
13. Project Management Information Systems (scheduling software tool, configuration management system, info collection and distribution complex processes, conducting more tests, or choosing a more stable supplier are examples of mitigation actions. Mitigation may require prototype development to reduce the risk of scaling up from a bench-scale model of a product or process. Where it is not possible to reduce probability, a mitigation responses might address the risk impact by targeting linkages that determine the severity. For e.g. designing redundancy into a system may reduce the impact from a failure of the original equipment.

1.3 Transfer: Risk transference is a risk response strategy where by the project team shifts the impact of a threat to a third party, together with ownership of the response. Transferring the risk simply gives another party responsibility for its management – it does not eliminate it. Transferring does not mean disowning the risk by transferring it to a later project or other person without his or her knowledge or agreement. Risk transference nearly always involves a risk premium to the party taking on the risk. Transferring liability for risk is most effective in dealing with financial exposure. Transference tool can be quite diverse and include the use of insurance, performance bonds, warranties, guaranties etc. Contracts or agreements may be used to transfer liability for specified risks to other party. For e.g when a buyer has capabilities that the seller does not possess, it may be prudent to transfer some work and its concurrent risk contractually back to the buyer. In many cases, use of cost-plus contract may transfer the cost risk to the buyer, while a fixed-price contract may transfer risk to the seller.

1.4 Accept: Risk acceptance is a risk response strategy whereby the project team decides to acknowledge the risk and not take any action unless the risk occurs. This strategy is adopted where it is not possible or cost-effective to address a specific risk in any other way. This strategy indicates that the project team has decided not to change the project management plan to deal with a risk, or is unable to identify any other suitable response strategy. This strategy can be either passive or active. Passive acceptance requires no action except to document the strategy, leaving the project team to deal with the risks as they occur, and to periodically review the threat to ensure that it does not change significantly. The most common active acceptance strategy is to establish a contingency reserve, including amounts of time, money, or resources to handle the risks.

2) Strategies for Positive Risks or Opportunities: 3 of the 4 responses suggested to deal with risks potentially...
Organizational Process Assets: Plans, processes, policies, procedures, and knowledge bases specific to and used by the performing organization. OPA may be grouped as under

1. Processes & Procedures
   1.1. Initiating and Planning:
      1.1.1. Guidelines and criteria for tailoring the organizational set of standard processes and procedures to satisfy the specific needs to the project
      1.1.2. Specific organizational standards such as policies (e.g. human resource policy, health and safety policies, and project management policies and procedures), product and project life cycles, and quality policies and procedures (e.g. process audits, improvement targets, and standardized process definitions for use in the organization
      1.1.3. Templates (e.g. risk register, work breakdown structure, project schedule network diagram and control templates)
   1.2. Executing, Monitoring & Controlling
      1.2.1. Change control procedures, including the steps by which performing organizations standards, policies, plans, and procedures or any project document will be modified, and how any change will be approved and validated.
      1.2.2. Financial controls procedures (e.g. time reporting, required expenditure and disbursement reviews, accounting codes, and standard contact provisions)
      1.2.3. Issues and defect management procedures defining issue and defect controls, issue and defect identification and resolution, and action item tracking
      1.2.4. Organizational communication requirements (e.g. specific communication technology available, authorized communication media, record retention policies, and security requirements)
      1.2.5. Procedures for prioritizing, approving, and issuing work authorizations
      1.2.6. Risk control procedures, including risk categories, risk statement templates, probability and impact definitions, and probability and impact matrix
      1.2.7. Standardized guidelines, work instructions, proposal evaluation criteria, and performance measurement criteria.
   1.3. Closing
      1.3.1. Project closure guidelines or requirements (e.g. lessons learned, final project audits, project evaluations, product validations and acceptance criteria
   2. Corporate Knowledge base
      2.1. Configuration management knowledge bases containing the versions and baselines of all performing organization standards, policies and procedures and project documents
      2.2. Financial databases containing information such as labour hrs, incurred costs, budgets, and any project cost overruns.
      2.3. Historical information and lessons learned knowledge bases. (e.g. project records and documents, all project closure information, and documentation, information regarding both the results of previous project selection decisions and previous project performance information, and information form risk management activities
      2.4. Issues and defect management databases containing issue and defect status, control information, issue and defect resolution, and action item results.
      2.5. Process measurement databases used to collect and make available measurement data on process and products
      2.6. Project files from previous projects (e.g. scope, cost, schedule, and performance measurement baselines, project calendars, project schedule, network diagram, risk registers, planned response actions, and defined risk impact.

Positive impact on project objectives are exploit, enhance and share. The 4th strategy, accept; can be used for negative risks or threats as well as positive risks or opportunities.

(2.1) Exploit: The exploit strategy may be selected for risks with positive impacts where the organizations wishes to ensure that the opportunity is realized. This strategy seeks to eliminate the uncertainty associated with a particular upside risk by ensuring the opportunity definitely happens. E.g. of directly exploiting responses include assigning an organization’s most talented resources to the project to reduce the time to completion or using new technologies or technology upgrades to reduce cost and duration required to realize project activities.

(2.2) Enhance: The enhance strategy is used to increase the probability and / or the positive impacts of an opportunity. Identifying and maximizing key drivers of these positive – impact risks may increase the probability of their occurrence. E.g. Of enhancing opportunities include adding more resources to an activity to finish early.

(2.3) Share: Sharing a positive risk involves allocating some or all of the ownership of the opportunity to a third party who is best able to capture the opportunity for the benefit of the project. E.g. of sharing actions include forming risk-sharing partnerships, team, special purpose companies, or joint ventures. Which can be established with the express purpose of taking advantage of the opportunity so that all parties gain from their actions

(2.4) Accept: Accepting an opportunity is being willing to take advantage of the opportunity if it arises, but not actively pursuing it.

(3) Contingent Response Strategies: Some responses are designed for use only if certain events occur. For some risks, it is appropriate for the project team to make a response plan that will only be executed under certain predefined conditions, if it is believed that there will be sufficient warning to implement the plan. Events that trigger the contingency response, such as missing intermediate milestones or gaining higher priority with a supplier should be defined and tracked. Risk responses identified using this technique are often called contingency plan or fall back plans and include identified triggering events that set the plans in effect

(4) Expert Judgment

Process Group: Controlling

Process Group:

11.6 Control Risks

<table>
<thead>
<tr>
<th>Process Group</th>
<th>(1) Project Management Plan</th>
<th>(1) Risk Reassessment: Control risks often results in identification of new risks, reassessment of current risks, and closing of the risks that are outdated. Project risk reassessment should be regularly</th>
<th>(1) Work Performance Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1.1) Risk Management Plan</td>
<td>(2) Risk Register</td>
<td></td>
<td>(2) Change Requests: Implementing contingency plans or workarounds sometimes result in a change requests. Change requests are prepared and submitted to the PICC</td>
</tr>
</tbody>
</table>
It is the process of implementing the risk response plans, tracking identified risks, monitoring residual risks, identifying new risks, and evaluating risk process effectiveness throughout the project.

**Benefits:** It improves efficiency of the risk approach throughout the project life cycle to continuously optimize risk responses.

Planned risk responses that are included in the risk register are executed during the life cycle of the project, but the project work should be continuously monitored for new, changing and outdated risks.

The control risks process applies techniques, such as variance and trend analysis, which require the use of performance information generated during project execution. Other purposes of the control risks process are to determine if:

1. Project assumptions are still valid
2. Analysis shows an assessed risk has changed or can be retired
3. Risk Management policies and procedures are being followed
4. Contingency reserves for cost or schedule should be modified for alignment with the current risk assessment.

Control risks can involve choosing alternative strategies, executing a contingency or fall back plan, taking corrective action, and modifying the project management plan. The risk response owner reports periodically to the project manager on the effectiveness of the plan, any unanticipated effects, any correction needed to handle the risk appropriately. Control risks also includes updating the organization process assets, including project lessons learned databases and risk management templates, for the benefit of future projects.

### Progress Management

<table>
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<th>Process Group: Planning</th>
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</thead>
<tbody>
<tr>
<td><strong>12.1 Plan Procurement Management</strong></td>
</tr>
</tbody>
</table>

(1) Project Management Plan
   (1.1) Project scope statement
   (1.2) WBS
   (1.3) WBS dictionary

(2) Requirements Documentation

(3) Work Performance Data
   (3.1) Deliverable Status
   (3.2) Schedule Progress
   (3.3) Costs incurred

(4) Work Performance Reports

(5) Reserve Analysis: Throughout execution of the project, some risks may occur with positive or negative impacts on budget or schedule contingency reserve. Reserve analysis compares the amount of the contingency reserves remaining to the amount of risk remaining at any time in the project in order to determine if the remaining reserve is adequate.

(6) Meetings

(1) Procurement Management Plan
   (1.1) Types of contract to be used
   (1.2) Risk Management Issues
   (1.3) Whether independent estimates will be used & whether they are needed as evaluation criteria
   (1.4) Those actions the project team can take unilaterally.

(2) Risk Audits: risk audits examine and document the effectiveness of risk responses in dealing with identified risks and their root causes, as well as effectiveness of the risk management process. The project manager is responsible for ensuring that the risk audits are performed at an appropriate frequency, as defined in the project’s risk management plan. Risk audits may be included during routine project review meetings, or the team may choose to hold separate risk audit meetings. The format of the audit and its objectives should be clearly defined before the audit is conducted.

(3) Variance & Trend Analysis: For the purpose of controlling risks, trends in the project’s execution should be reviewed using performance information. Earned value analysis and other methods of project variance and trend analysis may be used for monitoring overall project performance. Outcomes from these analyses may forecast potential deviation of the project at completion from cost and schedule targets. Deviation such as demonstrating more or less functionality than planned at a milestone, can help to forecast the degree of success in achieving the project’s scope.

(4) Technical Performance Measurement: Compares technical accomplishments during project execution to the schedule of technical achievement. It requires the definition of objective, quantifiable, measures of technical performance, which can be used to compare actual results against targets. Deviation such as demonstrating more or less functionality than planned at a milestone, can help to forecast the degree of success in achieving the project’s scope.

(5) Reserve Analysis: Throughout execution of the project, some risks may occur with positive or negative impacts on budget or schedule contingency reserve. Reserve analysis compares the amount of the contingency reserves remaining to the amount of risk remaining at any time in the project in order to determine if the remaining reserve is adequate.

(6) Meetings
It is the process of documenting project procurement decisions, specifying the approach, and identifying the potential sellers.

Benefits: It determines whether to acquire outside support, and if so, how to acquire it, how much is needed, and when to acquire it.

Plan procurement management identifies those project needs that can best be met or should be met by acquiring products, services, or results outside of the project versus those project needs which can be accomplished by the project team. When the project obtains products, services, and results required for project performance from outside of the performing organization, the processes form plan procurement management through close procurements are performed for each item to be acquired.

The plan procurement processes also includes evaluating potential sellers, particularly if the buyer wishes to exercise some degree of influence or control over acquisition decisions. Thought should also be given to who is responsible for obtaining or holding any relevant permits and professional licenses that may be required by legislation, regulation, or organizational policy in executing the project.

The requirements of the project schedule can significantly influence the strategy during the plan procurement management processes. Decisions made in developing the procurement management plan can also influence the project schedule and are integrated with develop schedule, estimate activity resources, and make-or-buy analysis.

The plan procurement management process include evaluating the risks involved with each make-or-buy analysis. It is also includes the type of contract planned to be sued with respect to avoiding or mitigating risks, sometimes transferring risks to the seller.

(3) Risk Register
(4) Activity Resource Requirements
(5) Project Schedule
(6) Activity Cost Estimates
(7) Stakeholder Register
(8) Enterprise Environmental Factors
(8.1) Market place conditions
(8.2) Products, services, and results that are available in the market place
(8.3) Suppliers, including past performance or reputation
(8.4) Typical terms and conditions for products, services, and results or for the specific industry
(8.5) Unique local requirements
(9) Organizational Process Assets
(9.1) Formal procurement policies, procedures, and guidelines
(9.2) Management systems that are considered in developing the procurement management plan and select contractual relationships to be used
(9.3) An established multi-tier supplier system of prequalified sellers based on prior experience

A legal contractual relationships generally fall into one of two broad categories: either fixed-price or cost reimbursable. Also, there is a third type commonly used in use called the time and material contract. In practice it is not unusual to combine one or more types into a single procurement.

(9.1) Fixed Price Contracts: This category of contract is used in establishing fixed price contracts for a defined product, service or result to be provided. Fixed price contracts may also incorporate financial incentives for achieving or exceeding project objectives, such as schedule delivery dates, cost and technical performance or anything that can be quantified and subsequently measured. Sellers under fixed-price contracts are legally obligated to complete such contracts, with possible financial damages if they do not. Under the fixed price arrangement, buyers need to precisely specify the product or services being produced.

Changes in scope may be accommodated, but generally with an increase in contract price.

(1) Firm Fixed Price Contracts (FFP): The price for goods is set at the outset and not subject to change unless the scope of work changes. Any cost increase due to adverse performance is the responsibility of the seller, who is obligated to complete the effort. Under the FFP contract buyer should precisely specify the products / services to be procured, and any changes to the procurement specification can increase project organization, but may be committed to working on other projects, in which case, the project may be needed to sources such effort from outside the organization in order to meet its schedule commitments.

Budget constraints may influence make-or-buy decisions. If a buy decision is made, then a further decision of whether to purchase or lease is made also. A make-or-buy analysis should consider all related costs – both direct costs as well as indirect support costs. For e.g. the buy side of the analysis includes both the actual out-of-pocket costs to purchase the product, as well as indirect costs of supporting the purchasing process and purchased item.

Available contract types are also considered during the bid analysis. The risk sharing between the buyer and the seller determines the suitable contract types, while the specific contract terms and conditions formalize the degree of risk being assumed by the buyer and the seller. Some jurisdictions have other types of contracts defined, for e.g. contract types based on the obligations of the seller not the customer – and the contract parties have the obligations to identify the appropriate type of contract as soon as the applicable law has been agreed upon.

(2) Expert Judgment: is often used to assess the inputs to and outcomes from this process. Expert judgment may also be used to develop or modify the criteria that will be used to evaluate seller proposals. Expert legal judgment may involve the services of legal staff to assist with unique procurement issues, terms and conditions. Such judgment, including business and technical expertise, can be applied to the technical details of the acquired products, services, or results and to various aspects of the procurement management processes.

(3) Market Research: includes examination of industry and specific vendor capabilities. Procurement teams may leverage information gained at conferences, online reviews and variety of sources to identify market capabilities. The team may also use the particular procurement objectives to leverage maturing technologies while balancing risks associated with the breadth of vendors who can provide the materials or services desired.[4]

(4) Meetings

If the performing organization has a prescribed procurement, contracting, or purchasing department.

(1.3) Standardized procurement documents, if needed
(1.6) Managing multiple suppliers
(1.7) Coordinating procurement with other project aspects such as scheduling & performance reporting
(1.8) Any constraints & assumptions that could affect project.

(1.9) Handling the long lead items to purchase certain items from sellers & coordinating the extra time needed to procure these items with the development of the project schedule.

(1.10) Handling the make-or-buy decisions & linking then into the estimate activity resources & develop schedule processes.

(1.11) Setting the schedule dates in each contract for the deliverables & coordinating with the schedule development and control processes.

(1.12) Identifying requirements for performance bonds or insurance contracts if necessary, and establishing the amount of project risk

(1.13) Establishing the direction to be provided to the sellers on developing & maintaining a WBS.

(1.14) Establishing the form & format to be used for the procurement / contract statement of work

(1.15) Identifying pre-qualified sellers, if any to be used

(1.16) Procurement metrics to be used to manage contracts and evaluate sellers

(2) Procurement Statement of Work (SOW): for each procurement is developed form the project scope baseline and defines only that portion of the project scope that is to be included within the related contract. The procurement SOW describes the procurement item in sufficient detail to allow prospective sellers to determine if they are capable of providing the products, services or results required. Budget constraints may influence make-or-buy decisions. If a buy decision is made, the budget constraint of what can be spent is also made. Under the fixed price contract, buyers need to precisely specify the product or services being produced. Under the fixed price contract, the buyer is obligated to complete the effort. Under the FFP contract buyer should precisely specify the products / services to be procured, and any changes to the procurement specification can increase project organization, but may be committed to working on other projects, in which case, the project may be needed to sources such effort from outside the organization in order to meet its schedule commitments.
Depending upon the procurement policies, an organization adhering to the project while the specific needs of procurements meet certain that all responsibility to make management team's is the project perform or provide. It what the seller is to be mandated by an technical disciplines. contracting, specialists in early phases from may seek support in management team identified project need. that will satisfy the services, or results, describes the products, contract language ensure that the process. In all cases, the primary focus of the review and approval process is to ensure that the contract language describes the products, services, or results, that will satisfy the identified project need.

The project management team may seek support in early phases from specialists in contracting, purchasing, law, and technical disciplines. Such involvement can be mandated by an organization's policies.

The various activities the cost to the buyer. (B) Fixed Price Incentive Fee Contracts (PFIF): Gives the buyer and seller some flexibility in that it allows for deviation from performance, with financial incentives tied to achieving agreed upon metrics. Typically such financial incentives are related to cost, schedule, or technical performance to the seller. Performance targets are established at the outset and final contract price is determined after completion of all work based on seller's performance. A price ceiling is set and all cost above the price ceiling is the seller's responsibility, who is obligated to complete the work.

(C) Fixed Price with Economic Price Adjustments Contracts (FP-EPA): Used whenever seller's performance period spans a considerable period of years. It is a fixed-price contract, but with special proviso for pre-defined final adjustments to the contract price due to changed conditions, such as inflation changes, cost increase (or decrease) for specific commodities. EPA clause relates to some reliable financial index which is used to precisely adjust the final price. The FP-EPA is intended to protect both buyer and seller from external conditions beyond their control.

(9.2) Cost Reimbursable Contracts: This category of contract involves payments (cost reimbursements) to the seller for all legitimate actual costs incurred for completed work, plus a fee representing seller profit. Cost reimbursable contracts may also include financial incentive clause whenever the seller exceeds or falls below defined objectives such as costs, schedule or technical performance target. A cost-reimbursable contract provides flexibility to redirect a seller whenever the scope of work cannot be precisely defined at the start & needs to be altered, or when high risk may exist in the effort.

(A) Cost Plus Fixed Fee Contracts (CPF): The seller is reimbursed for all allowable costs for performing the contract work and receives a fixed fee calculated as a % of initial project cost. A fee is paid for completed work & does not change due seller performance. Fee amounts do not change unless scope changes.

(B) Cost Plus Incentive Fee Contracts (CPIF): The seller is reimbursed for all allowable costs for performing the contract work, and receives a pre-determined incentive fee based upon achieving certain performance objectives as set forth in the contract. In CPIF contracts, if the final costs are less or greater than the original estimated costs, then both the buyer and the seller share costs from the contract work and any required contractual provisions. With government contracting, some or all of the content and structure of procurement documents may be defined by regulation.

The complexity & level of detail of procurement docs should be consistent with the value of & risks associated with planned procurements. Procurement documents are required to be sufficient to ensure consistent, appropriate responses, but flexible enough to allow consideration of any seller suggestions for better ways to satisfy the same requirement.

Issuing a procurement request to potential sellers to submit a proposal or bid is normally done in accordance with the policies of the buyer organization, which can include publication of the request in public newspaper, in trade journals, in public registers, or on the internet.

(4) Source selection criteria: are often included as a part of procurement documents. Such criteria are developed and used to rate or score seller proposals, and can be objective or subjective.

Selection criteria may be limited to only the purchase price if the procurement item is readily available from a number of sellers. Purchase price in this context includes both the cost of the item and all ancillary expenses such as delivery.

Other selection criteria can be identified and documented to support an assessment for more complex products, services, or results. Some possible source selection criteria are:

(4.1) Understanding of need
(4.2) Overall or life-cycle cost
(4.3) Technical Capability
(4.4) Risk
(4.5) Management approach
(4.6) Technical Approach
(4.7) Warranty
(4.8) Financial Capacity
(4.9) Production capacity and interest
(4.10) Business size & type
(4.11) Past performance of sellers
(4.12) References
(4.13) Intellectual property rights
(4.14) Proprietary rights
(5) Make-or-Buy Decisions

Common terms are in use for different types of procurement documents and may include,

(3.3) Request for Information (RFI)
(3.4) Invitation for Bid (IFB)
(3.5) Request for Proposal (RFP)
(3.6) Request for Quotation (RFQ)
(3.7) Tender Notice
(3.8) Invitation for Negotiation
(3.9) Invitation for sellers initial response
involved in the project procurement processes from the life cycle of an agreement. By actively managing the agreement life cycle and carefully wording the terms and conditions of a procurement, some identifiable risks may be transferred to the seller. Entering into an agreement for products or services is one method of allocating the responsibility for managing or sharing potential risks.

A complex project may involve managing multiple contracts or subcontracts simultaneously or in sequence. In such cases, each contract life cycle may end during any phase of the project life cycle. Project Procurement Management is discussed within the perspective of the buyer-seller relationship. The buyer-seller relationship may exist at many levels on any one project, and between organizations internal to and external to the acquiring organizations.

Depending on the application area, the seller may be identified as a contractor, subcontractor, vendor, service provider, or supplier. Depending on the buyer's position in the project acquisition cycle, the buyer may be called a client, customer, prime contractor, contractor, acquiring organization, service requestor, or purchaser. The seller can be viewed during the conduct procurement processes, the team will receive bids for proposals and will apply previously defined selection criteria to select one or more seller who are qualified to perform the work and acceptable as a seller.

On major procurement items, the overall process of requesting responses from sellers and evaluating those responses can be repeated. A short list of qualified sellers can be established based on a preliminary proposal. A more detailed evaluation can then be conducted based on a more specific and comprehensive requirements document requested from the seller on the short list. In addition, tools and techniques described here may be used alone or in conjunction with other techniques to perform the work and accept the seller.

Process Group: Executing

12.2 Conduct Procurements

It is the process of obtaining seller responses, selecting a seller, and awarding a contract.

Benefits: It provides alignment of internal and external stakeholder expectations through established agreements

During the conduct procurement processes, the team will receive bids for proposals and will apply previously defined selection criteria to select one or more seller who are qualified to perform the work and acceptable as a seller.

On major procurement items, the overall process of requesting responses from sellers and evaluating those responses can be repeated. A short list of qualified sellers can be established based on a preliminary proposal. A more detailed evaluation can then be conducted based on a more specific and comprehensive requirements document requested from the seller on the short list. In addition, tools and techniques described here may be used alone or in conjunction with other techniques to perform the work and accept the seller.

Departures based on a pre-negotiated formula, for eg. 80/20 split over/under target costs based on actual performance of the seller.

(C) Cost Plus Award Fee Contracts (CPAF): The seller is reimbursed all legitimate costs, but the majority of the fee is earned only on the satisfaction of certain broad subjective performance criteria defined and incorporated into the contract. The determination of the fee is based solely on the subjective determination of seller performance by the buyer and is not subjected to appeals.

(9.3) Time and Material Contracts: These contracts are hybrid type of contractual arrangement that contain aspects of both cost-reimbursable & fixed-price contracts. They are often used for staff augmentation, acquisition of experts, and any outside support when a precise statement of work cannot be quickly prescribed. These types of contracts resemble cost-reimbursable contracts in that they can be left open ended and may be subject to a cost increase for the buyer. The full value of the agreement and the exact quantities of items need not be defined by the buyer at the time of contract award. Thus T&M contracts can increase in contract value as if they were cost-reimbursable contracts. Many organizations require not-to-exceed values and time limits placed to prevent unlimited cost growth. Conversely, T&M contracts can also resemble fixed unit price arrangements when certain parameters are specified in the contract. Unit labor, or material rates can be preset by the buyer and seller, including seller profit, when both parties agree on the values for specific resources categories such as senior engineer at specified rate per hour or categories of material at specified rates per unit.

(6) Change Requests

(7) Project Documents Updates

(7.1) Requirements Documentation

(7.2) Requirements Traceability Matrix

(7.3) Risk Register.

12.2.2 Proposal Evaluation Techniques

(1) Bidder Conferences: Sometimes called contractor conferences, vendor conferences, and pre-bid conferences, are meetings between the buyer and all prospective sellers prior to submittal of a bid or proposal. They are used to ensure that all prospective sellers have a clear and common understanding of the procurement requirements, and that no bidder receives preferential treatment. To be fair, buyers should take great care to ensure that all prospective sellers hear every question form the buyer. Typical fairness is addressed by techniques such as collecting questions from bidders or arranging field visits in advance of the bidder conference.

Responses to question can be incorporated into the procurement documents as amendments.

(2) Proposal Evaluation Techniques

(2.1) Weighting Systems

(1) Selected Sellers: The selected sellers are those who have been judged to be in a competitive range based upon the outcome of the proposal or bid evaluation, and who negotiated a draft contract that will become the actual contract when an award is made. Final approval of all complex, high-value, high-risk, procurements will generally require organizational senior management approval prior to award.

(2) Agreements: A procurement agreements includes terms and conditions, and may incorporate other items that the buyer specifies regarding what the seller is to perform or provide. It is the project management team's responsibility to make certain that all agreements meet the specific needs of the project while adhering to organizational procurement policies. Depending upon the application area, an agreement can also be called an understanding, a contract, a subcontract, or a purchase order. Regardless of the document's complexity a contract is a mutually binding legal agreement that obligates the seller to provide the specified products, services, or results, and obligates the buyer to compensate the seller.
the contract life cycle first as bidder, then as the selected source, and then as the contracted supplier or vendor.

The seller will typically manage the work as a project if the acquisition is not for hired human, goods, or common products. In such case

(1) The buyer becomes the customer, and is thus a key project stakeholder for the seller

(2) The seller’s project management team is concerned with all the processes of project management, not only with those of this knowledge area

(3) Terms and conditions of the contract become key inputs to many of the seller’s management processes. The contract can actually contain the inputs (e.g. major deliverables, key milestones, cost objectives) or it can limit the project’s team’s options (e.g. buyers approval of staffing decisions is often required on design projects)

In this section, it is assumed that the buyer of an item for the project is assigned to the project team and that the seller is organizationally external to the project team. It is also assumed that a formal contractual relationship will be developed and exists between the buyer and the seller. However, most of the discussions in this

| (2) | Screening Systems |
| (2.3) | Past Performance History |
| (2.4) | Presentations |
| (3) | Independent Estimates: For many procurement items, the procuring organization may elect to either prepare its own independent estimate, or have an estimate of costs prepared by an outside professional estimator, to serve as a benchmark on proposed responses. Significant differences in cost estimates can be an indication that the procurement statement of work was deficient, ambiguous, and/or that the prospective sellers either misunderstood or failed to respond fully to the procurement statement of work |
| (4) | Expert Judgment |
| (5) | Advertising |
| (6) | Analytical Techniques: |
| (7) | Procurement Negotiations: Clarify the structure, requirements, and other terms of the purchase so that mutual agreement can be reached prior to signing the contract. Final contract language reflects all agreements reached. Subjects covered should include responsibilities, authority to make changes, applicable terms and governing law, technical and business management approaches, proprietary rights, contract financing, technical solutions, overall schedule, payment and price. Negotiations conclude with a contract document that can be executed by both buyer and seller. For complex procurement items, contract negotiation can be an independent process with inputs (e.g. issues or an open items listing) and outputs (e.g. documented decisions) of its own. For simple procurement items, the terms and conditions of the contract can be previously set and non-negotiable, and only need to be accepted by the seller |
| (8) | Organizational Process Assets |

A contract is a legal relationship subject to remedy on courts. The major components in an agreement document will vary, but may include the following.

(2.1) SOW or Deliverables |
(2.2) Schedule Baseline |
(2.3) Performance reporting |
(2.4) Roles & Responsibilities |
(2.5) Seller’s Place of Performance |
(2.6) Pricing |
(2.7) Payment Terms |
(2.8) Place of Delivery |
(2.9) Inspection & Acceptance Criteria |
(2.10) Warranty |
(2.11) Product Support |
(2.12) Limitation of Liability |
(2.13) Fees & Retainer |
(2.14) Penalties |
(2.15) Incentives |
(2.16) Insurance & Performance Bonds |
(2.17) Subordinate Contract Approvals |
(2.18) Change Requests Handling |
(2.19) Termination Clause & Alternative Dispute Resolution (ADR) mechanisms |
(2.20) Performance reporting |
(2.21) Termination Clause & Alternative Dispute Resolution (ADR) mechanisms |
(2.22) SOW or Deliverables |
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(2.115) Change Requests Handling |
(2.116) Termination Clause & Alternative Dispute Resolution (ADR) mechanisms |
Process Group: Controlling

12.3 Control Procurements

It is the process of managing procurement relationships, monitoring contract performance, and making changes and corrections to contracts as appropriate.

Benefits: It ensures that both the seller’s and buyer’s performance meets procurement requirements according to the terms of the legal agreement.

Both the buyer and the seller will administer the procurement for contract. Each is required to ensure that both parties meet their contractual obligations and that their own legal rights are protected. The legal nature of the contractual relationship makes it imperative that the project management team is aware of the legal implications of actions taken. When controlling any procurement on larger projects with multiple providers, a key aspect of contract administration is managing interfaces among the various providers.

Due to varying organizational structures, many organizations treat contract administration as an administrative function separate from the project organization. While a procurement administrator may be on the project team, this individual typically reports to a supervisor from a different department. This is usually true of the performing organization is also the seller of the project to an external customer.

Control procurements include application of the appropriate project management processes to the contractual relationship(s) and integration of the outputs from these processes into the overall management of the project. This integration will often occur at multiple levels when there are multiple sellers and multiple products, services, or results involved. The project management processes that are applied may include,

1. Direct & Manage Project Work: To authorize the seller’s work at the appropriate time
2. Control Quality: To inspect and verify adequacy of the seller’s product
3. Perform Integrated Change Control
4. Control Risks

Control procurements also have a financial management component that involves monitoring payments to the seller. This ensures that payment terms defined within the contract are met and the seller’s compensation is linked to the seller’s progress, as defined in the contract. One of the principal concerns when making payments to suppliers is that there is a close relationship of payments made to the work accomplished.

The control procurement process reviews and documents how well a seller is performing or has performed based on the contract and establishes corrective actions when needed. These performance reviews may be used as a measure of the seller’s competency for performing similar work on future projects. Similar evaluations are

(1) Project Management Plan
(2) Procurement Management Plan
(3) Agreements
(4) Approved Change Requests

(1) Project Management Plan
(2) Procurement Management Plan
(3) Agreements
(4) Approved Change Requests

(1) Contract Change Control System: Defines the process by which the procurement can be modified. It includes the paper work, tracking systems, dispute resolution procedures, and approval level necessary for authorizing changes. The contract change control system is integrated with the integrated change control system.

(2) Procurement Performance Reviews: A structured review of the seller’s progress to deliver project scope and quality, within any agreement as defined by the contract. It can include a review of seller prepared documentation and buyer inspection, as well as quality audits conducted during seller’s execution of the work. The objective of a performance review is to identify performance success or failures, progress with respect to the procurement statement of work, and contract non-compliance, which allow the buyer to quantify the seller’s demonstrated ability or inability to perform work. Such reviews may take place as a part of project status reviews, which would include key suppliers.

(3) Inspections & Audits: Inspections and audits required by the buyer and supported by the seller, as specified in the procurements contract, can be conducted during execution of the project to verify compliance in the seller’s work processes or deliverables. If authorized by contract, some inspection and audit teams can include buyer procurement personnel.

(4) Performance Reporting: Work performance data and reports supplied by sellers are evaluated against the agreement requirements. Work performance information from this evaluation is then reported as appropriate. Performance reporting provides management with information about how effectively the seller is achieving the contractual objectives.

(5) Payments Systems: Payments to the seller are typically processed by the accounts payable system of the buyer after the receipt of buyer invoices that have been paid and approved payments.

(6) Claims Administration: Contested changes and potential constructive changes

(1) Work Performance Reports
(5.1) Technical Documentation: Seller-developed technical documentation and other deliverable information are provided IAW terms of the contract.
(5.2) Work Performance Information: The seller’s performance reports indicate which deliverables have been completed and which have not.
(6.1) The extent to which quality standards are being satisfied
(6.2) The cost that have been incurred and committed
(6.3) Identification of seller invoices that have been paid

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(6) Claims Administration: Contested changes and potential constructive changes

(7.9) Delay
(7.10) Extreme Demands
(7.11) Withdrawal
(7.12) Fait accompli

(1) Work Performance Information: Provides a basis of current or potential problems to support later claims or new procurements. By reporting on the performance of a vendor, the organization increases knowledge of performance of the procurement, which supports improved forecasting, risk management, and decision making. Performance reports also assist in the events there is a dispute with the vendor.

Work performance information includes reporting compliance of contract, which provides procuring organizations a mechanism to track specific deliverables expected and received from vendors. Contract compliance reports report detailed communications with vendors so that potential issues are addressed promptly to the satisfaction of all parties.

(2) Change Requests: Change requests to the following are processed through the PECC process
(2.1) Project Management Plan
(2.2) Its subsidiary plan
(2.3) Procurement Management Plan
(2.4) Cost Baseline
(2.5) Schedule Baseline

Requested by unresolved changes can include direction provided by the buyer or actions taken by the seller, which the other party considers a constructive change to the contract. Since any of these constructive changes may be disputed by one and can lead to a claim against the other party, such changes are tracked and documented by project correspondence.

(3) Project Management Plan Updates
(3.1) Procurement Management Plan
(3.2) Schedule Baseline
(3.3) Cost Baseline

(4) Project Documents Updates
(4.1) Procurement Documentation

(5) Organizational Process Updates
(5.1) Correspondence: Contract terms and conditions often require written documentation certain aspects of buyer / seller communications, such as the need for warnings of unsatisfactory performance and requests for contract changes or clarifications. This can include the reported results of buyer audits and inspections that indicate weakness the seller needs to correct. In addition to specific contract requirements for documentation, a complete and accurate written record of all written and oral contract communications as well as actions taken and decisions made are maintained by both parties.

(5.2) Payment Schedules and requests
(5.3) Seller performance evaluation documentation: Seller performance evaluation documentation is prepared by the buyer. Such performance evaluations documents the seller’s ability to continue to perform work on the current contract, indicate if the seller can be allowed to perform work on future projects, or rate how well the seller’s
also carried out when it is necessary to confirm that a seller is not meeting the seller's contractual obligations and when the buyer contemplates corrective actions. Control procurements include capturing the necessary details for managing any early terminations of the contracted work (for cause, convenience and default) in accordance with the termination clause of the agreement. These details are used in the close procurement process to terminate the agreement.

Agreements can be amended at any time prior to contract closure by mutual consent, IAW the change control terms of the agreement. Such amendments are typically captured in writing. Amendments are typically captured in writing.

Process Group: Closing

12.4 Close Procurements

It is the process of completing each procurement

Benefits: It documents agreements and related documentation for future reference

The close procurements process also involves administrative activities such as finalizing open claims, updating records to reflect final results, and archiving such information for future use. Close procurements addresses each contract applicable to the project or a project phase. In multiphase projects, the term of a contract may only be applicable to a given phase of the project. In these cases, the close procurements process closes the procurement(s) applicable to that phase of the project. Unresolved claims may be subject to litigation after closure. The contract terms and conditions can prescribe specific procedures for agreement closure. The close procurement process the close project or phase process by ensuring contractual agreements are completed or terminated.

Early termination of a contract is a special case of procurement closure that can result from a mutual agreement by both parties, from the default of one party, or for convenience of the buyer of provided for in the contract. The rights and responsibilities of the parties in the event of an early termination are contained in the terminations clause of the contract. Based upon those procurement terms and conditions, the buyer may have the right to terminate the whole contract or a portion of the contract, at any time, for cause or convenience. However, upon those contract terms and conditions, the buyer have to compensate the seller's preparations and for any completed and accepted work related to terminated part of the contract.

(1) Project Management Plan
   (1.1) Procurement Management Plan
   (2) Procurement Documents

(1) Procurement Audits: A procurement audit is a structured review of the procurement process originating from the plan procurement management process through control procurements. The objective of a procurement audit is to identify success and failures that warrant recognition in the preparation or administration of other procurement contracts on the project, or on other projects within the performing organization.

(2) Procurement Negotiations: In all procurement negotiations, the final equitable settlement of all outstanding issues, claims, and disputes by negotiation is a primary goal. Whenever settlement cannot be achieved through direct negotiation, some form of alternative dispute resolution (ADR) including mediation or arbitration may be explored. When all these fails, litigation in courts is the least desirable option

(3) Record Management System

(1) Closed Procurements: The buyer, usually through its authorized procurement administrator, provides the seller with formal written notice that the contract has been completed. Requirements for formal procurement closure are usually defined in the terms and conditions of the contract and are included in the procurement management plan.

(2) Organizational Process Assets Updates
   (2.1) Procurement File: A complete set of indexed contract documentation, including the closed contract, is prepared for inclusion, with the final project files
   (2.2) Deliverable Acceptance: Documentation of formal acceptance of seller-provided deliverables may be required to be retained by the organization. The close procurement process ensures this documentation requirement is satisfied. Requirements for formal deliverable acceptance and how to address non-conforming deliverables are usually defined in the agreement.

(2.3) Lessons learned Documentation: Lessons learned, what has been experienced, and process improvement recommendations should be developed for the project file to improve future procurements.

Stakeholder Management

13.1 Identify Stakeholder

Includes the processes

(1) Project Charter: The project charter can provide information about internal and external parties related with the project and affected by the result or the execution of the project, such as finalizing open claims, updating records to reflect final results, and archiving such information for future use.

(1) Stakeholder Analysis: is a technique of systematically gathering and analyzing quantitative and qualitative information to determine whose interests should be taken into consideration.

(1) Stakeholder Register
   (1.1) Identification information
      (A) Name
      (B) Organizational Position

(1) Close Procurements: The buyer, usually through its authorized procurement administrator, provides the seller with formal written notice that the contract has been completed. Requirements for formal procurement closure are usually defined in the terms and conditions of the contract and are included in the procurement management plan.

(2) Organizational Process Assets Updates
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(2.3) Lessons learned Documentation: Lessons learned, what has been experienced, and process improvement recommendations should be developed for the project file to improve future procurements.
required to identify the people, groups or organizations that could impact or be impacted by the project to analyze stakeholder expectations and their impact on the project, and to develop appropriate management strategies for effectively engaging stakeholders in project decisions and execution. Stakeholder management also focuses on continuous communication with stakeholders to understand their needs and expectations, addressing issues as they occur, managing conflicting interests and fostering appropriate stakeholder engagement in project decisions and activities. Stakeholder satisfaction should be managed as a key project objective.

Every project will have stakeholders who are impacted by or can impact the project in a positive or negative way. While some stakeholders may have a limited ability to influence the project, others may have a significant influence on the project and its expected outcomes. The ability of the project manager to correctly identify and manage these stakeholders in an appropriate manner can mean the difference between success and failure.

It is the process of identifying the people, groups, or organizations that could impact or be impacted by a decision, activity, or outcome of the project analyzing and documenting relevant information regarding their interests, involvement, interdependencies, influence, and potential impact on project success.

**Benefits:** It allows the project manager to identify the appropriate focus for each stakeholder or group of stakeholders.

Project stakeholders are individuals, groups, or organizations who may affect, be affected by, or perceive themselves to be affected by a decision, activity, or outcome of a project. They are comprised of persons and organizations such as customers, sponsors, the performing organization and the public who are actively involved in the project, or whose interests may be positively or negatively affected by the execution or completion of the project. They may also exert influence over the project and its deliverables. Stakeholders may be at different levels within the organization and may possess different authority levels, or may be external to the performing organization for the project.

It is critical for project success to identify the stakeholders early in the project or phase and to analyze their levels of interest, their individual expectations, as well as their importance and influence. This initial assessment should be reviewed and updated regularly. Most projects will have a diverse number of stakeholders, depending on their size, type and complexity. While the project manager’s time is limited and should be used as efficiently as possible, these stakeholders should be classified according to their interest, influence, and involvement in the project, taking into consideration the fact that the affect or influence of a stakeholder may not occur or become evident until later stages in the project or phase. This establishes the project manager to focus on relationships necessary to ensure the success of the project.

It is the ability of the project manager to ensure the success of the project. It allows the project manager to identify the appropriate focus for each stakeholder or group of stakeholders. Stakeholder classification models include:

1. **Power/Interest Grid:** Grouping the stakeholders based on their level of authority (“power”) and their level of concern (“interest”) regarding the project outcomes.
2. **Power/Influence Grid:** Grouping the stakeholders based on their level of authority (“power”) and their active involvement (“influence”) in the project.
3. **Influence/Impact Grid:** Grouping the stakeholders based on their active involvement (“influence”) in the project and their ability to effect changes to the project’s planning or execution (“impact”).
4. **Salience Model:** Describing classes of stakeholders based on their power (ability to impose their will), urgency (need for immediate attention), and legitimacy (their right to engage in the decision-making process).

**Assessment Information**

(A) **Major requirements**
(B) **Main expectations**
(C) **Potential Influence in the project**
(D) **Phase on the life cycle with the most interest**
(E) **Role in the project**
(F) **Contact information**

The stakeholder register should be consulted and updated on a regular basis, as stakeholder’s may change – new ones identified throughout the lifecycle of the project.
Managing stakeholder expectations through negotiations and agreements is crucial in ensuring project success. Manage Stakeholder Engagement involves activities such as communicating with stakeholders to understand their needs, interests, and potential impact on project success. Benefits of effective stakeholder management include a clearer understanding of project objectives, minimizing resistance from stakeholders, and increasing the likelihood of success.

Stakeholder management is more than improving communications; it involves creating and maintaining relationships throughout the project life cycle. As the project progresses, stakeholders might change priorities, leading to a need for active engagement and communication. Stakeholder management requires an iterative process that is reviewed regularly by the project manager to confirm their continued commitment to the project's success.

Key strategies for stakeholders include:

1. **Facilitating Consensus**: Bringing stakeholders together to reach a common understanding.
2. **Influence People to Support**: Encouraging stakeholders to align with project goals.
3. **Leading**: Taking charge when necessary to guide stakeholders.
4. **Overcoming Resistance**: Addressing obstacles to success.

Effective stakeholder management is achieved through the use of tools and techniques such as the Stakeholder Engagement Matrix, which helps in understanding the current level of engagement and the required level at different stages. This matrix is documented using the Stakeholder Register.

### Process Group: Executing

**13.3 Manage Stakeholder Engagement**

It is the process of communicating and working with stakeholders to meet their needs/expectations, address issues as they occur, and foster appropriate engagement in project activities. Stakeholder management is crucial throughout the project life cycle.

Benefits of effective stakeholder management include:

- Increased stakeholder satisfaction
- Improved project success rate
- Reduced risks and conflicts
- Enhanced project visibility

Manage Stakeholder Engagement involves activities such as:

1. Engaging stakeholders at appropriate project stages to ensure they continue to support the project.
2. Managing stakeholder expectations through negotiations and communication, ensuring project goals are achieved.

### Process Group: Planning

**13.2 Plan Stakeholder Management**

It is the process of developing appropriate management strategies to effectively engage stakeholders throughout the project life cycle, based on the analysis of their needs, interests, and potential impact on project success.

**Benefits:**

- It provides a clear, actionable plan to interact with project stakeholders to support the project's interests.
- It allows for the identification and management of various ways to effectively engage stakeholders.

Plan stakeholder management by identifying how the project will affect stakeholders, which then allows the project manager to develop strategies to manage their expectations and achieve the project objectives.

Stakeholder management is more than improving communications; it involves creating and maintaining relationships throughout the project life cycle. As the project progresses, the membership of the stakeholder community and the level of engagement may change, requiring iterative management planning that is reviewed on a regular basis by the project manager.

### Tools and Techniques

- **Stakeholder Engagement Matrix**
- **Stakeholder Register**
- **Analytical Techniques**
- **Meetings**
- **Project Management Plan Updates**
- **Organizational Process Assets**
- **Organizational Process Updates**
- **Lessons learned documentation**

### Stakeholder Management Plan

- **Stakeholder Management Plan**: is a component of the Project Management Plan and identifies the management strategies required to effectively engage stakeholders.
- **Desired & Current engagement levels of key stakeholders**
- **Scope & impact of change to stakeholders**
- **Interrelated relationships & potential overlap between stakeholders**
- **Stakeholder communications requirement for the current project phase**
- **Information to be distributed to the stakeholders, including language, format, & level of detail**
- **Reason for the distribution of such information & the expected impact to stakeholder engagement**
- **Information to be communicated, including language, format, content & level of detail**
- **Time frame and frequency for the distribution of required information to stakeholders**
- **Method of updating & refining the stakeholder management plan**
- **Project progresses and develops strategies**

Project Managers should be aware of the sensitive nature of the stakeholder management plan and take appropriate precautions. For e.g., information on stakeholders who are resistant to the project can be potentially damaging, and due consideration should be given regarding the distribution of such information. Updating the stakeholder management plan, the validity of underlying assumptions should be reviewed to ensure continued accuracy and relevance.

### References

- **Communication Methods**
- **Interpersonal Skills**
- **Building Trust**
- **Resolving Conflict**
- **Active Listening**
- **Over Resistance to Change**
- **Management Skills**
- **Facilitate Consensus toward project objectives**
- **Influence people to support the project**
- **Negotiate agreements to satisfy the project needs**
- **Modify organizational behavior to accept the project outcomes**
- **Project Management Plan Updates**
- **Project Management Plan**
- **Stakeholder Management Plan**
- **Change Requests**
- **Stakeholder Register**
- **Lessons learned documentation**

### Other Tools

- **Issue Log**
- **Project Documents Updates**
- **Project Schedule**
- **Stakeholder notifications**
- **Project Reports**
- **Project Presentations**
- **Project Records**
- **Feedback from stakeholders**
- **Stakeholder Register**
(3) Addressing potential concerns that have not yet become issues and anticipating future problems that may be raised by stakeholders. Such concerns need to be identified and discussed as soon as possible to assess associated project risk.

Managing stakeholder engagement helps to increase the probability of project success by ensuring that stakeholders clearly understand the project goals, objectives, benefits and risks. This enables them to be active supporters of the project and to help guide activities and project decisions. By anticipating people's reactions to project, proactive actions can be taken to win support or minimize negative impacts.

The ability of stakeholders to influence the project is typically highest during the initial stages and gets progressively lower as the project progresses. The project manager is responsible for encouraging and managing the various stakeholders in a project and may call upon the project sponsor to assist as needed. Active management of stakeholder involvement decreases the risk of the project failing to meet its goals and objectives.

**Process Group: Monitoring & Controlling**

**13.4 Control Stakeholder Engagement**

It is the process of monitoring project stakeholder relationships and adjusting strategies and plans for engaging stakeholders.

**Benefits:** It will maintain or increase the efficiency or effectiveness of stakeholder engagement activities as the project evolves or the environment changes.

Stakeholder engagement activities are included in the stakeholder management plan and are executed during the life cycle of the project. Stakeholder engagement should be continuously controlled.

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| (14) Project Management Plan           | (2) Change Requests: Analysis of project performance and interaction with stakeholder often generates change requests. These change requests are processes through the PICC as follows:
| (15) Project Management Plan           | (2.1) Recommend corrective action include changes that bring the expected future performance of the project in line with the project management plan
| (16) Project Management Plan           | (2.2) Recommended preventive actions can reduce the probability of incurring future negative project performance
| (17) Project Management Plan           | (3) Project Management Plan Updates
| (18) Project Management Plan           | (3.1) Scope Management Plan        |
| (19) Project Management Plan           | (3.2) Schedule Management Plan     |
| (20) Project Management Plan           | (3.3) Cost Management Plan         |
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| (24) Project Management Plan           | (3.7) Risk Management Plan         |
| (25) Project Management Plan           | (3.8) Procurement Management Plan  |
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| (39) Project Management Plan           | (5.5) Feedback from stakeholders   |
| (40) Project Management Plan           | (5.6) Lessons learned documentation|
1.2 Persons to Whom the Code Applies
The Code of Ethics and Professional Conduct applies to:
1.2.1 All PMI members
1.2.2 Individuals who are not members of PMI but meet one or more of the following criteria:
   1. Non-members who hold a PMI certification
   2. Non-members who apply to commence a PMI certification process
   3. Non-members who serve PMI in a volunteer capacity

1.4 Values that Support this Code
Practitioners from the global project management community were asked to identify the values that formed the basis of their decision making and guided their actions. The values that the global project management community defined as most important were: responsibility, respect, fairness, and honesty. This Code affirms these four values as its foundation.

1.5 Aspirational and Mandatory Conduct
Each section of the Code of Ethics and Professional Conduct includes both aspirational standards and mandatory standards. The aspirational standards describe the conduct that we strive to uphold as practitioners. Although adherence to the aspirational standards is not easily measured, conducting ourselves in accordance with these is an expectation that we have of ourselves as professionals—it is not optional. The mandatory standards establish firm requirements, and in some cases, limit or prohibit practitioner behaviour. Practitioners who do not conduct themselves in accordance with these standards will be subject to disciplinary procedures before PMI’s Ethics Review Committee.

CHAPTER 2. RESPONSIBILITY
2.1 Description of Responsibility
Responsibility is our duty to take ownership for the decisions we make or fail to make, the actions we take or fail to take, and the consequences that result.

2.2 Responsibility: Aspirational Standards
As practitioners in the global project management community:
   2.2.1 We make decisions and take actions based on the best interests of society, public safety, and the environment.
   2.2.2 We accept only those assignments that are consistent with our background, experience, skills, and qualifications.
   2.2.3 We fulfill the commitments that we undertake — we do what we say we will do.
   2.2.4 When we make errors or omissions, we take ownership and make corrections promptly. When we discover errors or omissions caused by others, we communicate them to the appropriate body as soon they are discovered. We accept accountability for any issues resulting from our errors or omissions and any resulting consequences.
   2.2.5 We protect proprietary or confidential information that has been entrusted to us.
   2.2.6 We uphold this Code and hold each other accountable to it.

2.3 Responsibility: Mandatory Standards
As practitioners in the global project management community, we require the following of ourselves and our fellow practitioners:
   2.3.1 We inform ourselves and uphold the policies, rules, regulations and laws that govern our work, professional, and volunteer activities.
   2.3.2 We report unethical or illegal conduct to appropriate management and, if necessary, to those affected by the conduct.

   Ethics Complaints
   2.3.3 We bring violations of this Code to the attention of the appropriate body for resolution.
   2.3.4 We only file ethics complaints when they are substantiated by facts.

CHAPTER 3. RESPECT
3.1 Description of Respect
Respect is our duty to show a high regard for ourselves, others, and the resources entrusted to us. Resources entrusted to us may include people, money, reputation, the safety of others, and natural or environmental resources. An environment of respect engenders trust, confidence, and performance excellence by fostering mutual cooperation — an environment where diverse perspectives and views are encouraged and valued.

3.2 Respect: Aspirational Standards
As practitioners in the global project management community:
   3.2.1 We inform ourselves about the norms and customs of others and avoid engaging in behaviours they might consider disrespectful.
   3.2.2 We listen to others’ points of view, seeking to understand them.
   3.2.3 We approach directly those persons with whom we have a conflict or disagreement.
   3.2.4 We conduct ourselves in a professional manner, even when it is not reciprocated.

3.3 Respect: Mandatory Standards
As practitioners in the global project management community, we require the following of ourselves and our fellow practitioners:
   3.3.1 We negotiate in good faith.
   3.3.2 We do not exercise the power of our expertise or position to influence the decisions or actions of others in order to benefit personally at their expense.
   3.3.3 We do not act in an abusive manner toward others.
   3.3.4 We respect the property rights of others.

CHAPTER 4. FAIRNESS
4.1 Description of Fairness
Fairness is our duty to make decisions and act impartially and objectively. Our conduct must be free from competing self interest, prejudice, and favoritism.

4.2 Fairness: Aspirational Standards
As practitioners in the global project management community:
   4.2.1 We demonstrate transparency in our decision-making process.
   4.2.2 We constantly reexamine our impartiality and objectivity, taking corrective action as appropriate.
   4.2.3 We provide equal access to information to those who are authorized to have that information.
   4.2.4 We make opportunities equally available to qualified candidates.

4.3 Fairness: Mandatory Standards
As practitioners in the global project management community, we require the following of ourselves and our fellow practitioners:

   Conflict of Interest Situations
   4.3.1 We proactively and fully disclose any real or potential conflicts of interest to the appropriate stakeholders.
   4.3.2 When we realize that we have a real or potential conflict of interest, we refrain from engaging in the decision-making process or otherwise attempting to influence outcomes, unless or until: we have made full disclosure to the affected stakeholders; we have an approved mitigation plan; and we have obtained the consent of the stakeholders to proceed.

   Favouritism and Discrimination
   4.3.3 We do not hire or fire, reward or punish, or award or deny contracts based on personal considerations, including but not limited to, favouritism, nepotism, or bribery.
   4.3.4 We do not discriminate against others based on, but not limited to, gender, race, age, religion, disability, nationality, or sexual orientation.
   4.3.5 We apply the rules of the organization (employer, Project Management Institute, or other group) without favouritism or prejudice.

CHAPTER 5. HONESTY
5.1 Description of Honesty
Honesty is our duty to understand the truth and act in a truthful manner both in our communications and in our conduct.

5.2 Honesty: Aspirational Standards
As practitioners in the global project management community:
   5.2.1 We earnestly seek to understand the truth.
   5.2.2 We are truthful in our communications and in our conduct.
   5.2.3 We provide accurate information in a timely manner.

5.3 Honesty: Mandatory Standards
As practitioners in the global project management community, we require the following of ourselves and our fellow practitioners:
   5.3.1 We do not engage in or condone behavior that is designed to deceive others, including but not limited to, making misleading or false statements, stating half-truths, providing information out of context or withholding information that, if known, would render our statements as misleading or incomplete.
   5.3.2 We do not engage in dishonest behavior with the intention of personal gain or at the expense of another.