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		October, 2016
<b>IACPE</b> No 19, Jalan Bilal Mahmood 80100 Johor Bahru Malaysia	<b>MANAGING PROJECT QUALITY, TIME AND COST</b>  <b>CERTIFIED PRACTICING PROJECT MANAGER TRAINING MODULE</b>	

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## INTRODUCTION

### Scope

Project management is the application of knowledge, skills, tools, and techniques for project activities to meet or exceed stakeholder needs and expectations in a project. A project is a temporary endeavor undertaken to create a unique product or Service that is different in some distinguishing way from all similar products or services <sup>[1]</sup>.

One of the biggest problems of project managers is to harmonize project quality, time and cost. These factors are the three points of the iron triangle, if one factor neglected will have a corresponding detrimental effect upon the other two. Projects of success is where these three factors have been balanced and there is a need to embrace quality, time and cost management as a human activity system.

Every project has an anticipated level of quality for the project deliverables. The details and specifications set out by the customer determine what the expected level of quality. A project is a one-time task constrained by time, cost, and quality, and its success depends on how well these constraints are balanced. Very often project managers try to maximize project quality within a given deadline and budget.



**Figure 1** : The iron triangle.

This training module useful in directing a project manager for measuring project success. Cost, time and quality are closely related, and change of one, effects the others. In today's world, which is very competitive, the quality is perhaps the most important element of business competition.

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## General Considerations

A portfolio refers to a collection of projects or programs and other work that are grouped together to facilitate effective management of that work to meet strategic business objectives. Portfolio management refers to the centralized management of one or more portfolios, which includes identifying, prioritizing, authorizing, managing, and controlling projects, programs, and other related work, to achieve specific strategic business objectives. Portfolio management focuses on ensuring that projects and programs are reviewed to prioritize resource allocation, and that the management of the portfolio is consistent with and aligned to organizational strategies.

**Table 1** : Comparative overview of project, program, and portfolio management.

	<b>Projects</b>	<b>Programs</b>	<b>Portfolios</b>
Scope	Project have defined objectives. Scope is progressively elaborated throughout the project life cycle	Program have a larger scope and provide more significant benefits.	Portfolios have a business scope that changes with the strategic goals of the organization.
Change	Project managers expect change and implement processes to keep change managed and controlled.	The program manager must expect change from both inside and outside the program and be prepared to manage it.	Portfolio managers continually monitor changes in the broad environment.
Planning	Project managers progressively elaborate high-level information into detailed plans throughout the project life cycle.	Program managers develop the overall program plan and create high-level plans to guide detailed planning at the component level.	Portfolio managers create and maintain necessary processes and communication relative to the aggregate portfolio.
Management	Project managers manage the project team to meet the project objectives.	Program managers manage the program staff and the project managers; they provide vision and overall leadership.	Portfolio managers may manage or coordinate portfolio management staff.
Success	Success is measured by product and project quality, timeliness, budget compliance, and degree of customer satisfaction.	Success is measured by the degree to which the program satisfies the needs and benefits for which it was undertaken.	Success is measured in terms of aggregate performance of portfolio components.

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Monitoring	Project managers monitor and control the work of producing the products, services or results that the project was undertaken to produce.	Program managers monitor the progress of program components to ensure the overall goals, schedules, budget, and benefits of the program will be met.	Portfolio managers monitor aggregate performance and value indicators.
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Perhaps the most well-known measure of success criteria in projects is the iron triangle that places quality, time and cost at the center of project success. However, projects that are delivered on time, within budget and meet scope specifications may not necessarily be perceived to be successful by key stakeholders.

The iron triangle was originally conceived as a framework to enable project managers to evaluate and balance the competing demands of cost, time and quality within their projects. Central to the concept of the iron triangle is the mutual dependency between the three constraints: increasing quality will increase the amount of time needed, which also will lead to an increase in cost. A tight time schedule could lead to a decrease in quality and subsequent increase in cost.

#### **A. Project Quality Management <sup>[2]</sup>**

Project quality management includes processes and activities of the performing organization that determine quality policies, objectives and responsibilities so that the project will satisfy for needs for which it was undertaken.

Before a project manager can plan for quality, he must know what the quality expectations are. As part of the quality management, the project manager and the project team must identify the requirements of planning, determine how the requirements may be met, and identify the costs and time demands to meet the identified requirements. If the outcome of a project meets or exceeds the project contractor's expectations, the project is deemed successful.

The project contractor gives priority to the availability of the outcome in the longer-term perspective, because the project must be profitable. If individual activities are excessively crashed, rework, modifications, or even project failure may occur. Quality checks must be performed immediately after the completion of each individual activity, and corrective actions such as rework or modification can be taken if the quality is not acceptable. The rework can improve quality cost and time will be increased.



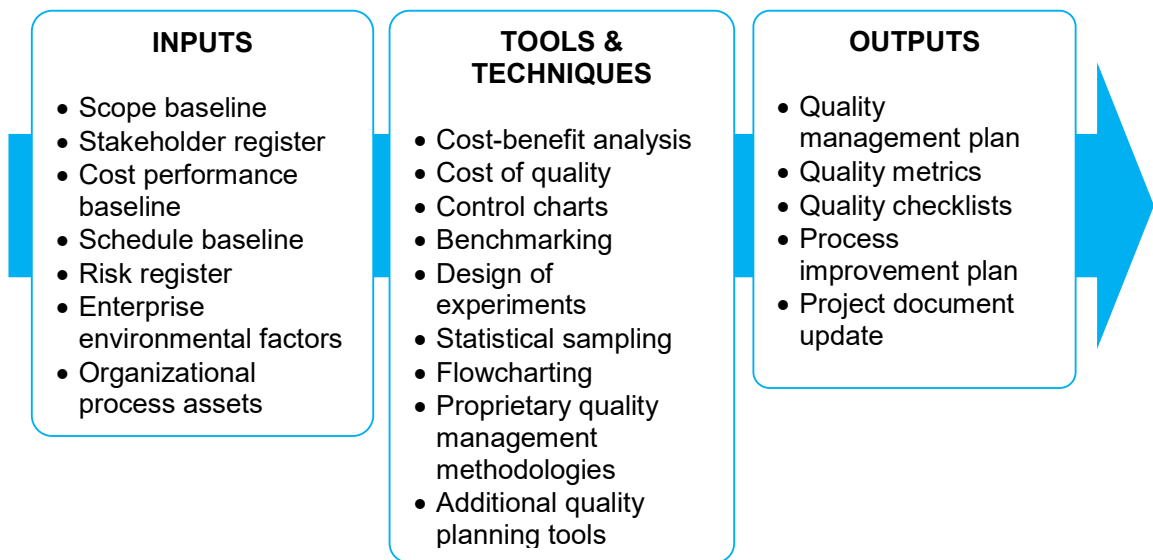
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Modern quality management complements project management. Both disciplines recognize the importance of :

- *Customer satisfaction.* Understanding, evaluating, defining, and managing expectations so that customer requirements are met.
- *Prevention over inspection.* One of the fundamental tenets of modern quality management states that quality is planned, designed, and built.
- *Continuous improvement.* The plan-do-check-act cycle is the basis for quality improvement.
- *Management Responsibility.* Success requires the participation of all members of the project team, but remains the responsibility of management to provide the resources needed to succeed.

Project quality management processes which include the following:

- Plan Quality is the process of identifying quality requirements and/or standards for the project and product, and documenting how the project will demonstrate compliance. Quality planning should be performed in parallel with the other project planning processes.



**Figure 2 : Plan quality.**

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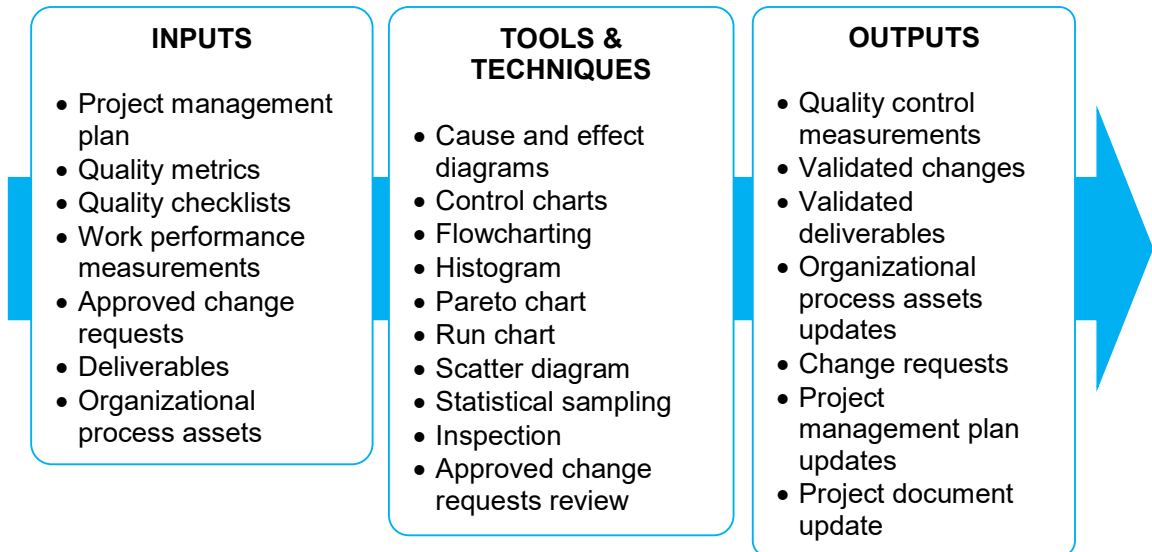
- Perform Quality Assurance is the process of auditing the quality requirements and the results from quality control measurements to ensure appropriate quality standards and operational definitions are used.



**Figure 3** : Perform quality assurance.

- Perform Quality Control is the process of monitoring and recording results of executing the quality activities to assess performance and recommend necessary changes. Quality control is performed throughout the project. Quality standards include project processes and product goals. Project results include deliverables and project management results, such as cost and schedule performance. Quality control is often performed by a quality control department or similarly titled organizational unit. Quality control activities identify causes of poor process or product quality and recommend and/or take action to eliminate them.

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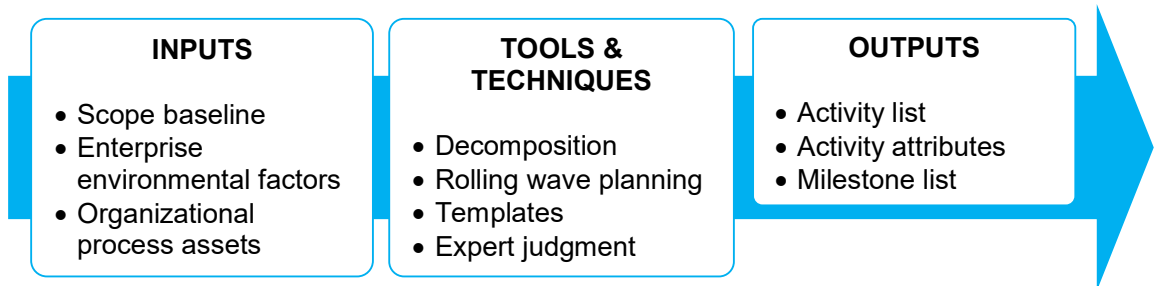
**Figure 4 :** Perform quality control.

## **B. Project Time Management<sup>[2]</sup>**

Project Time Management includes the processes required to manage timely completion of the project. These processes interact with each other and with processes in the other Knowledge Areas. Each process can involve effort from one group or person, based on the needs of the project. Each process occurs at least once in every project and occurs in one or more of the project phases, if the project is divided into phases.

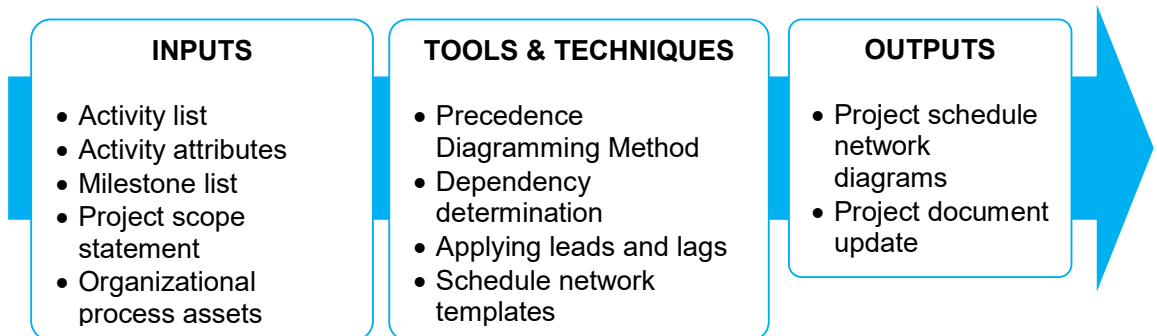
Project quality management processes which include the following:

- Define Activities is the process of identifying the specific actions to be performed to produce the project deliverables. Project work packages are typically decomposed into smaller components called activities that represent the work necessary to complete the work package. Activities provide a basis for estimating, scheduling, executing, and monitoring and controlling the project work. objectives will be met.



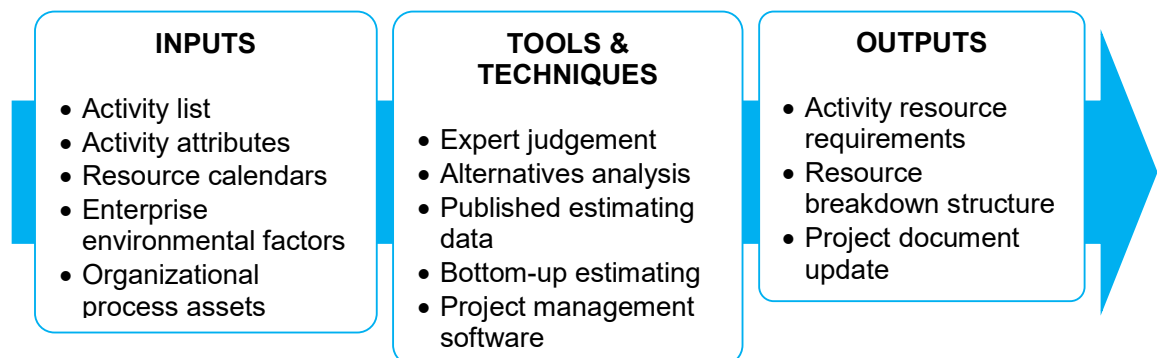
**Figure 5 :** Define activities.

- Sequence Activities is the process of identifying and documenting relationships among the project activities. Activities are sequenced using logical relationships.



**Figure 6 :** Sequence activities.

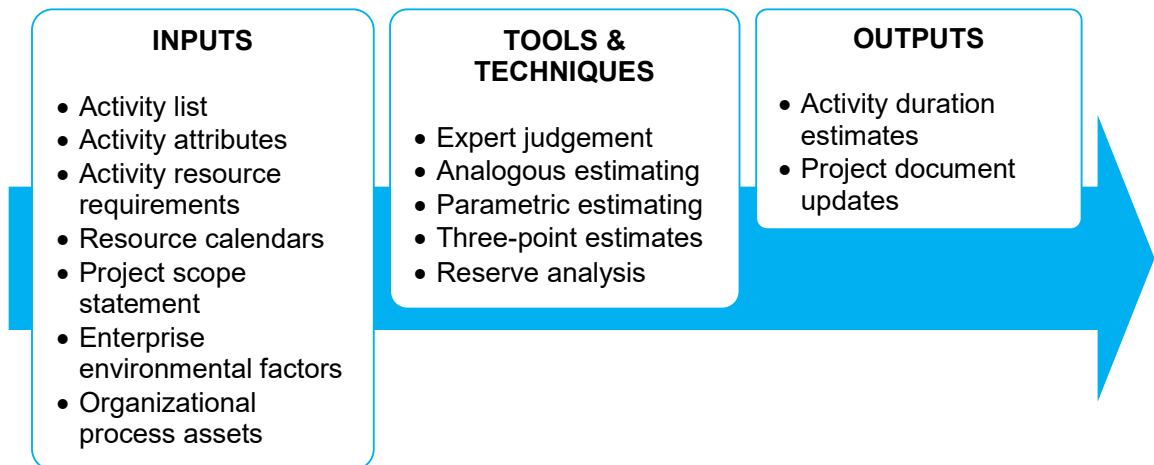
- Estimate Activity Resources is the process of estimating the type and quantities of material, people, equipment, or supplies required to perform each activity.



**Figure 7 :** Estimate activity resources.

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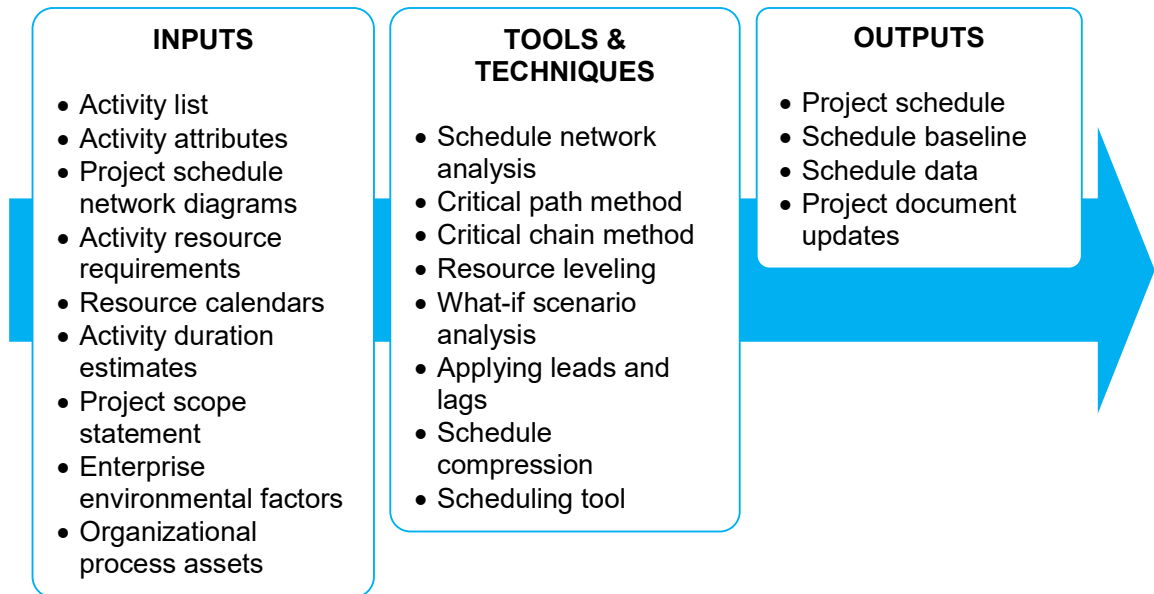
- Estimate Activity Durations is the process of approximating the number of work periods needed to complete individual activities with estimated resources. Estimating activity durations uses information on activity scope of work, required resource types, estimated resource quantities, and resource calendars.



**Figure 8** : Estimate activity durations.

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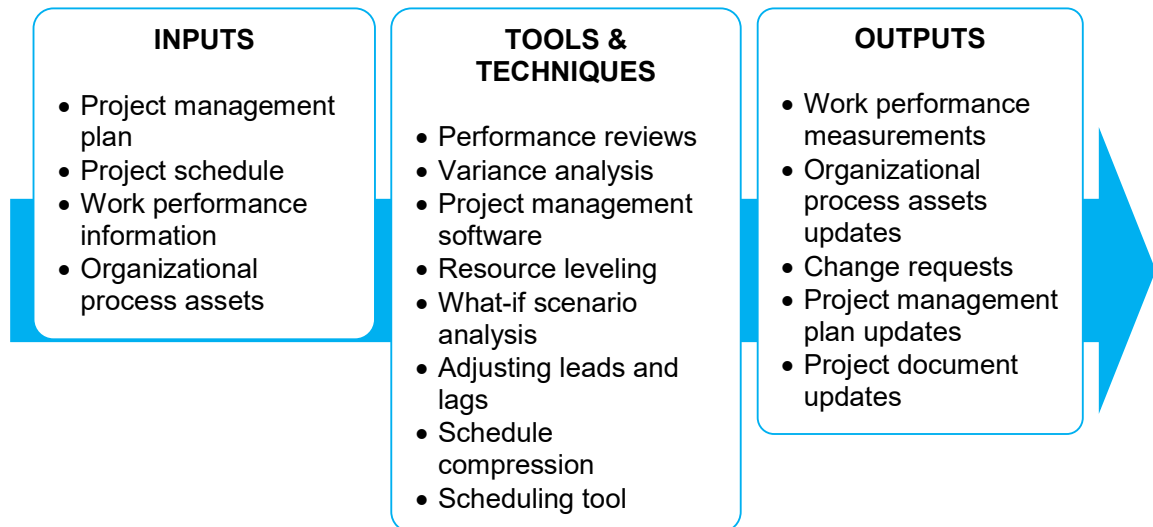
- Developing a Schedule is the process of analysing activity sequences, durations, resource requirements, and schedule constraints to create the project schedule. Entering the activities, durations, and resources into the scheduling tool generates a schedule with planned dates for completing project activities.



**Figure 9** : Develop schedule.

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- Control Schedule is the process of monitoring the status of the project to update project progress and manage changes to the schedule baseline.



**Figure 10** : Control schedule overview.

Schedule control is concerned with:

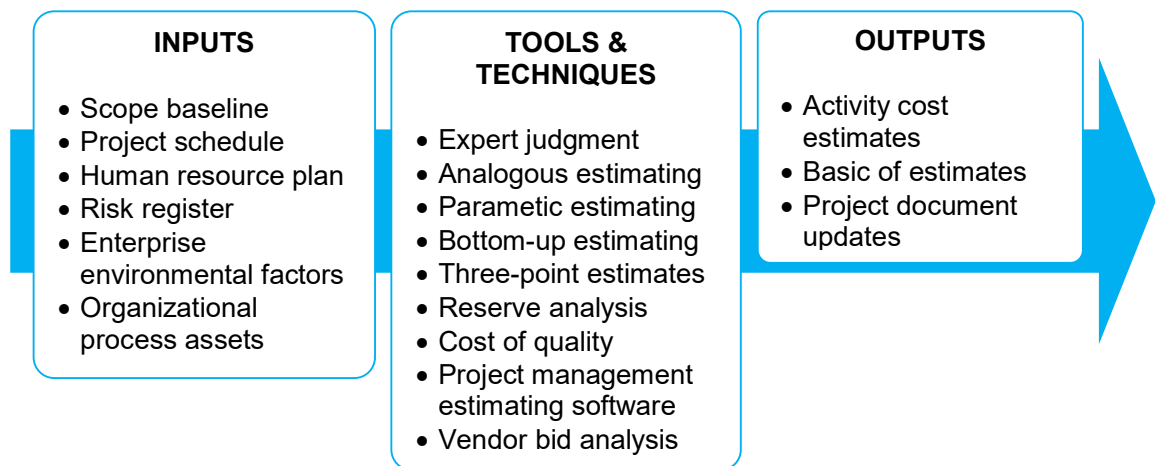
- Determining the current status of the project schedule
- Influencing the factors that create schedule changes
- Determining that the project schedule has changed
- Managing the actual changes as they occur

### **C. Project Cost Management**

Project cost management includes the processes involved in estimating, budgeting, and controlling costs so that the project can be completed within the approved budget. Project cost management processes which include the following:

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- Estimate Costs is the process of developing an approximation of the monetary resources needed to complete project activities. Cost estimates are a prediction that is based on the information known at a given point in time. It includes the identification and consideration of costing alternatives to initiate and complete the project. Cost trade-offs and risks must be considered, such as make versus buy, buy versus lease, and the sharing of resources in order to achieve optimal costs for the project.

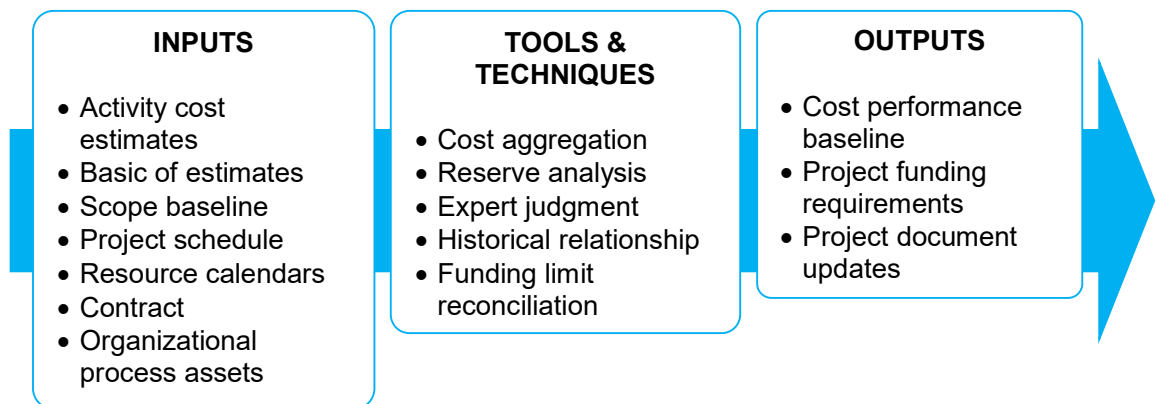


**Figure 11** : Estimate cost.



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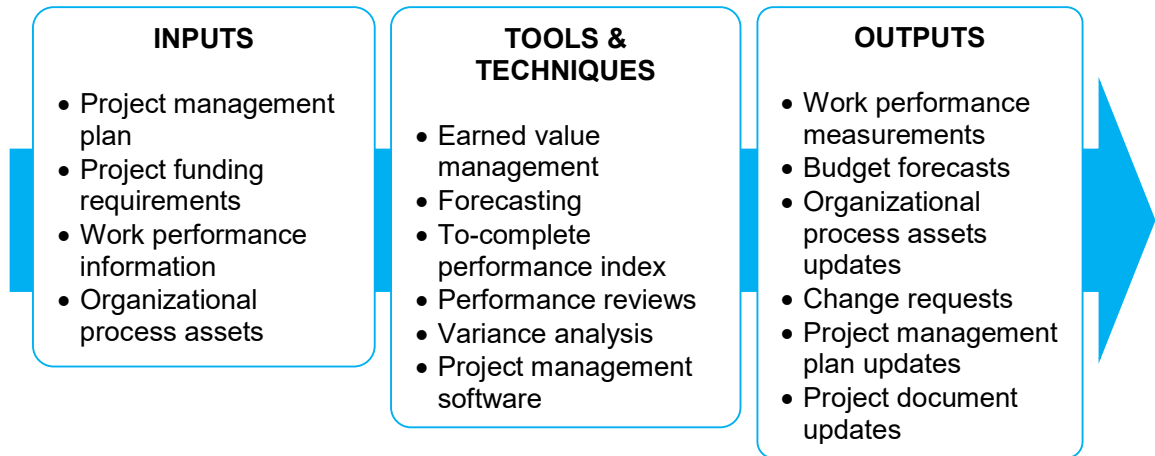
- Determine Budget is the process of aggregating the estimated costs of individual activities or work packages to establish an authorized cost baseline. This baseline includes all authorized budgets, but excludes management reserves. Project budgets constitute the funds authorized to execute the project. Project cost performance will be measured against the authorized budget



**Figure 12** : Determine budget.

- Control Costs is the process of monitoring the status of the project to update the project budget and managing changes to the cost baseline. Updating the budget involves recording actual costs spent to date. Project cost control includes:
  - a. Influencing the factors that create changes to the authorized cost baseline
  - b. Ensuring that all change requests are acted on in a timely manner
  - c. Managing the actual changes when and as they occur
  - d. Ensuring that cost expenditures do not exceed the authorized funding, by period and in total for the project.
  - e. Monitoring cost performance to isolate and understand variances from the approved cost baseline
  - f. Monitoring work performance against funds expended
  - g. Preventing unapproved changes from being included in the reported cost or resource usage
  - h. Acting to bring expected cost overruns within acceptable limits
  - i. Informing appropriate stakeholders of all approved changes and associated cost

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**Figure 13** : Control costs.

Each process can involve effort from one group or person, based upon the needs of the project. Each process occurs at least once in every project and occurs in one or more project phases, if the project is divided into phases. On some projects, especially ones of smaller scope, cost estimating and cost budgeting are so tightly linked that they are viewed as a single process that can be performed by a single person over a relatively short period of time. These processes are presented here as distinct processes because the tools and techniques for each are different.

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## DEFINITION

**Activity attributes**, extend the description of the activity by identifying the multiple components associated with each activity.

**Activity list**, is a comprehensive list including all schedule activities required on the project.

**Adjusting leads and lags**, is used to find ways to bring project activities that are behind into alignment with plan.

**Analogous estimating**, uses parameters such as duration, budget, size, weight, and complexity, from a previous, similar project, as the basis for estimating the same parameter or measure for a future project.

**Cause and effect diagrams**, also called Ishikawa diagrams or fishbone diagrams, illustrate how various factors might be linked to potential problems or effects.

**Control charts**, to determine whether or not a process is stable or has predictable performance.

**Cost of quality**, includes all costs incurred over the life of the product by investment in preventing nonconformance to requirements, appraising the product or service for conformance to requirements and failing to meet requirements (rework).

**Cost performance baseline**, is an authorized time-phased budget at completion (BAC) used to measure, monitor, and control overall cost performance on the project.

**Critical chain**, is a schedule network analysis technique that modifies the project schedule to account for limited resources. Initially, the project schedule network diagram is built using duration estimates with required dependencies and defined constraints as inputs.

**Deliverable**, is any unique and verifiable product, result, or capability to perform a service that must be produced to complete a process, phase, or project.

**Design of experiments (DOE)**, a statistical method for identifying which factors may influence specific variables of a product or process under development or in production.

**Duration estimates**, may include contingency reserves, (sometimes referred to as time reserves or buffers) into the overall project schedule to account for schedule uncertainty.

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**Earned value management (EVM)**, in its various forms is a commonly used method of performance measurement. It integrates project scope, cost, and schedule measures to help the project management team assess and measure project performance and progress.

**Expert judgment**, is often required to assess the resource-related inputs to this process. Any group or person with specialized knowledge in resource planning and estimating can provide such expertise.

**Flowchart**, is a graphical representation of a process showing the relationships among process steps.

**Histogram**, is a vertical bar chart showing how often a particular variable state occurred.

**Human resource plan**, a part of the project management plan, provides guidance on how project human resources should be defined, staffed, managed, controlled, and eventually released.

**Inspection**, is the examination of a work product to determine whether it conforms to documented standards.

**Milestone list**, identifies all milestones and indicates whether the milestone is mandatory, such as those required by contract, or optional, such as those based upon historical information. A milestone is a significant point or event in the project.

**Pareto chart**, also referred to as a Pareto diagram, is a specific type of histogram, ordered by frequency of occurrence.

**Precedence Diagramming method (PDM)**, is a method used in Critical Path Methodology (CPM) for constructing a project schedule network diagram that uses boxes or rectangles, referred to as nodes, to represent activities, and connects them with arrows that show the logical relationships that exist between them.

**Project schedule network diagrams**, are schematic displays of the project's schedule activities and the logical relationships among them, also referred to as dependencies.

**Process analysis**, the follows of the steps outlined in the process improvement plan to identify needed improvements.

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**Process improvement plan.** The process improvement plan details the steps for analyzing processes to identify activities which enhance their value.

**Quality audit,** is a structured, independent review to determine whether project activities comply with organizational and project policies, processes, and procedures.

**Quality checklist,** is a structured tool, usually component-specific, used to verify that a set of required steps has been performed.

**Quality control measurements,** are the documented results of quality control activities in the format specified during quality planning.

**Quality management plan.** The quality management plan describes how quality assurance will be performed within the project.

**Quality metric,** is an operational definition that describes, in very specific terms, a project or product attribute and how the quality control process will measure it.

**Resource breakdown structure,** is a hierarchical structure of the identified resources by resource category and resource type.

**Resource leveling,** is a schedule network analysis technique applied to a schedule that has already been analyzed by the critical path method.

**Risk register,** ultimately 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 over time.

**Rolling wave planning,** is a form of progressive elaboration planning where the work to be accomplished in the near term is planned in detail and future work is planned at a higher level of the WBS.

**Run chart,** is a line graph that shows data points plotted in the order in which they occur.

**Schedule baseline,** is a specific version of the project schedule developed from the schedule network analysis.

**Schedule network analysis,** is a technique that generates the project schedule. It employs various analytical techniques, such as critical path method, critical chain method, what-if analysis, and resource leveling to calculate the early and late start and finish dates for the uncompleted portions of project activities.

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**Scope baseline**, is a component of the project management plan.

**Stakeholder register**. The stakeholder register identifies stakeholders with a particular interest in, or impact on, quality.

**The cost performance baseline**, is an authorized time-phased Budget at Completion (BAC) used to measure, monitor, and control overall cost performance on the project.

**What-if scenario analysis**, is used to review various scenarios to bring the schedule into alignment with the plan.

**Work Performance information**, Information about project progress, such as which activities have started, their progress, and which activities have finished.

**Work performance measurements**, are used to produce project activity metrics to evaluate actual progress as compared to planned progress.