

Target: PMP® Certification



Project Cost Management

20	PLAN COST MANAGEMENT		
21	ESTIMATE COSTS		
22	DETERMINE BUDGET		
23	CONTROL COSTS		

Project Cost Management

*** Project Cost Management.** Project Cost Management includes the processes involved in planning, estimating, budgeting, financing, funding, managing, and controlling costs so that the project can be completed within the approved budget.

Project Cost Management

Rough Order of Magnitude (ROM) estimate	Budget estimate	Definitive estimate
-25% to +75% from actual	-10% to +25% from actual	-5% to +10% or -10% to +10% from actual
Usually done during initiating phase	Usually done during planning phase	Usually done during final planning

Project Cost Management

Type of costs	• Variable: changes with the amount of work (materials) • Fixed: doesn't change as work changes (set up) • Direct: directly attributable to project (team travel) • Indirect: incurred for the benefit of more than one project (administrative costs)
Sunk Costs	Expended costs (should not be considered when deciding whether to continue with a troubled project)
Depreciation	Lost value over time • Straight line depreciation - same amount of depreciation is taken each year • Accelerated depreciation (faster than straight line)
Law of diminishing returns	The more you put in something, the less you get out of it!
Working capital	Current assets minus current liabilities

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PLAN COST MANAGEMENT

*** Plan Cost Management.** The process of defining how the project costs will be estimated, budgeted, managed, monitored, and controlled.

20**PLAN COST MANAGEMENT****INPUTS**

- » Project charter
- » Project management plan
 - Schedule management plan
 - Risk management plan
- » Enterprise Environment Factors
- » Organizational Process Assets

TOOLS & TECHNIQUES

- ✓ Expert judgment
- ✓ Data analysis
- ✓ Meetings

OUTPUTS

Cost management plan»

20**PLAN COST MANAGEMENT****INPUTS****» Enterprise Environment
Factors**

EEF examples:

- Market conditions describe what products, services, and results are available in the regional and global market
- Currency exchange rates for project costs sourced from more than one country
- Published commercial information such as resource cost rate information and seller price list

20**PLAN COST MANAGEMENT****INPUTS****» Organizational Process Assets**

OPA examples:

- Financial controls procedures
- Historical information and lessons learned knowledge bases
- Financial databases
- Existing formal and informal cost estimating and budgeting-related policies, procedures, and guidelines

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PLAN COST MANAGEMENT



TOOLS & TECHNIQUES

✓ Analytical techniques

Present value

The current worth of a future sum of money or stream of cash flows given a specified rate of return. Future cash flows are discounted at the discount rate, and the higher the discount rate, the lower the present value of the future cash flows.

Net Present Value (NPV)

Present Value of all benefits minus Present Value of all costs.

Each project is an investment with a specific NPV. The one with the highest NPV should be chosen.

Example: Project A has an NPV of \$15,000 and Project B has an NPV of \$20,000. Which one to choose?

Answer: Project B (it has a higher NPV)

Internal Rate of Return (IRR)

Also known as discounted rate. The rate at which project inflows (revenues) and project outflows (costs) are equal.

Each project is an investment with a specific IRR. The one with the highest IRR should be chosen.

Example: Project A has an IRR of 10% and Project B has an IRR of 12%. Which one to choose? Answer: Project B (it has a higher IRR)

Discounted Cashflow (DCF)

It is a valuation method used to estimate the attractiveness of an investment opportunity. DCF analysis uses future free cash flow projections and discounts them to arrive at a present value estimate, which is used to evaluate the potential for investment. If the value arrived at through DCF analysis is higher than the current cost of the investment, the opportunity may be a good one.

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PLAN COST MANAGEMENT



TOOLS & TECHNIQUES

✓ Analytical techniques

Payback Period	The number of time periods it takes to recover the investment made in the project before starting to make profit Projects with shorter payback periods should be chosen
Benefit Cost Ratio (BCR)	$BCR > 1$ means the benefits are greater than costs $BCR < 1$ means the costs are greater than benefits Projects with higher BCR should be chosen
Opportunity Cost	The cost of selecting one project over another Example: Project A has an NPV of US \$100,000 and project B has an NPV of US \$115,000. What is the opportunity cost of selecting Project B? Answer: \$100,000
Return of Investment (ROI)	It is a performance measure used to evaluate the efficiency of an investment or to compare the efficiency of a number of different investments. ROI measures the amount of return on an investment relative to the investment's cost. To calculate ROI, the benefit (or return) of an investment is divided by the cost of the investment, and the result is expressed as a percentage or a ratio. $(\text{Benefits} - \text{Costs}) / \text{Costs}$
Life Cycle Costing	It involves looking at costs over the entire life of the product, not just the cost of the project to create the product

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PLAN COST MANAGEMENT



OUTPUTS

Cost management plan»

* **Cost Management Plan.** A component of a project or program management plan that describes how costs will be planned, structured, and controlled.

It includes:

- Units of measure
- Level of precision
- Level of accuracy
- Organizational procedures 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 number(s) that links directly to the performing organization's accounting system.
- Control thresholds
- Rules of performance measurement
- Reporting formats
- Process descriptions
- Additional details. Such as description of strategic funding choices: self-funding, funding with equity, or funding with debt

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ESTIMATE COSTS



* **Estimate Costs.** The process of developing an approximation of the monetary resources needed to complete project activities.

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ESTIMATE COSTS



INPUTS

- » Project management plan
 - Cost management plan
 - Quality management plan
 - Scope baseline
- » Project documents
 - Lessons learned register
 - Project schedule
 - Resources requirements
 - Risk register
- » Enterprise Environment Factors
- » Organizational Process Assets

TOOLS & TECHNIQUES

- ✓ Expert judgment
- ✓ Analogous estimating
- ✓ Parametric estimating
- ✓ Bottom-up estimating
- ✓ Three-point estimating
- ✓ Data analysis
 - Alternatives analysis
 - Reserve analysis
 - Cost of quality
- ✓ Project management information system
- ✓ Decision making
 - Voting

OUTPUTS

- Cost estimates »
- Basis of estimates »
- Project documents updates »
 - Assumption log
 - Lessons learned register
 - Risk register

21**ESTIMATE COSTS****INPUTS**

» Human resource
management plan

It includes:

- Personnel rates
- Rewards/recognition

21**ESTIMATE COSTS****INPUTS****» Enterprise Environment
Factors**

EEF examples:

- Market conditions describe what products, services, and results are available in the regional and global market
- Currency exchange rates for project costs sourced from more than one country
- Published commercial information such as resource cost rate information and seller price list

21**ESTIMATE COSTS****INPUTS****» Organizational Process
Assets**

OPA examples:

- Cost estimating policies
- Cost estimating templates
- Historical information
- Lessons learned

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ESTIMATE COSTS



TOOLS & TECHNIQUES

✓ Analogous estimating

* **Analogous Estimating.** A technique for estimating the duration or cost of an activity or a project using historical data from a similar activity or project.

Analogous cost estimating is generally less costly and less time consuming than other techniques, but it is also generally less accurate.

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ESTIMATE COSTS



TOOLS & TECHNIQUES

✓ Parametric estimating

* **Parametric Estimating.** An estimating technique in which an algorithm is used to calculate cost or duration based on historical data and project parameters.

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ESTIMATE COSTS



TOOLS & TECHNIQUES

✓ Bottom-up estimating

* **Bottom-Up Estimating.** A method of estimating project duration or cost by aggregating the estimates of the lower-level components of the work breakdown structure (WBS).

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ESTIMATE COSTS



TOOLS & TECHNIQUES

✓ Three-point estimating

- **Most likely (cM).** The cost of the activity, based on realistic effort assessment for the required work and any predicted expenses.
- **Optimistic (cO).** The activity cost based on analysis of the best-case scenario for the activity.
- **Pessimistic (cP).** The activity cost based on analysis of the worst-case scenario for the activity.

Depending on the assumed distribution of values within the range of the three estimates the expected cost, **cE**, can be calculated using a formula. Two commonly used formulas are triangular and beta distributions. The formulas are:

- **Triangular Distribution.** $cE = (cO + cM + cP) / 3$
- **Beta Distribution** (from a traditional PERT analysis). $cE = (cO + 4cM + cP) / 6$

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ESTIMATE COSTS



TOOLS & TECHNIQUES

✓ Reserve analysis

There are two types of reserve:

- **Contingency Reserve:** also known as contingency allowance.
 - It is used for known unknowns
 - Part of the cost baseline
 - It is calculated as percentage of the estimated cost, a fixed number, or may be developed by using quantitative analysis methods
 - Contingency reserves can provide for a specific activity, for the whole project, or both.
- **Management Reserve**
 - It is used for unknown unknowns (budget for unforeseen work)
 - It is not included in the cost baseline but is part of the overall project budget and funding requirements
 - When an amount of management reserves 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

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ESTIMATE COSTS



TOOLS & TECHNIQUES

✓ Cost of quality

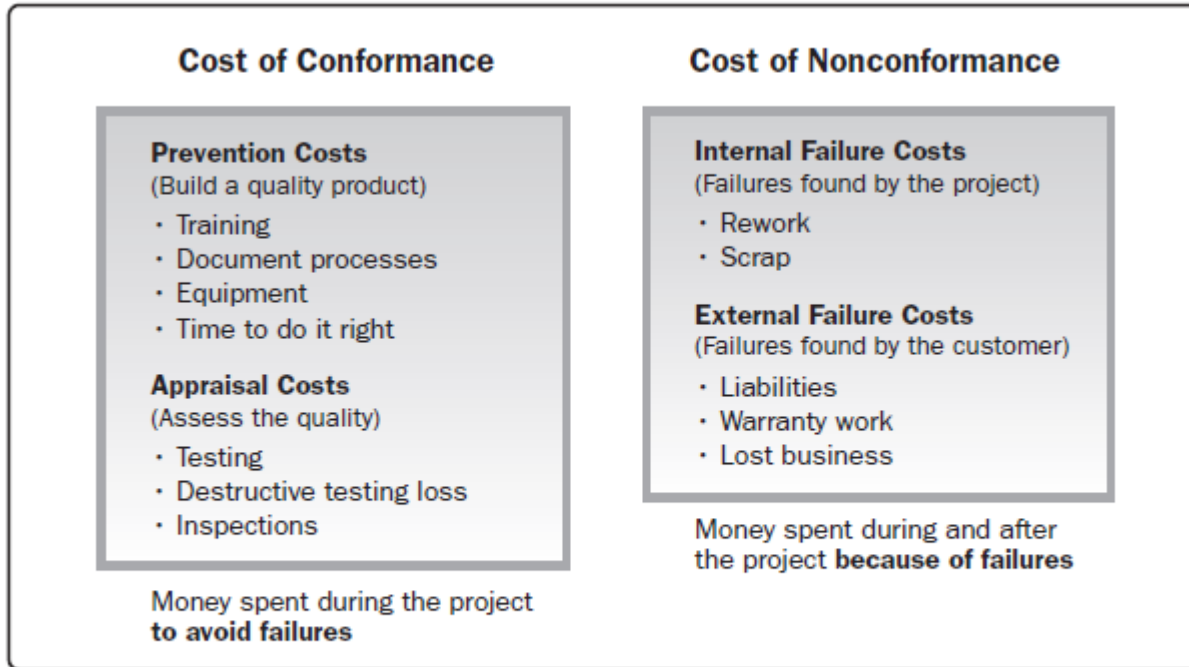


Figure 8-5. Cost of Quality

21**ESTIMATE COSTS****TOOLS & TECHNIQUES**✓ **Vendor bid analysis**

The potential sellers may be asked to submit bids that may be used in the cost estimating process

21**ESTIMATE COSTS****TOOLS & TECHNIQUES**✓ **Group decision-making techniques**

More accurate estimates and greater commitment may be obtained by working as a team on estimates.
Example of techniques include:

- Delphi technique
- Nominal group technique
- Brainstorming

21**ESTIMATE COSTS****OUTPUTS****Activity cost estimates »**

They include:

- Direct labor
- Materials
- Equipment
- Services
- Facilities
- Information technology
- Cost of financing
- An inflation allowance
- Exchange rates
- Cost contingency reserve
- Indirect costs

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ESTIMATE COSTS



OUTPUTS

Basis of estimates »

* **Basis of Estimates.** Supporting documentation outlining the details used in establishing project estimates such as assumptions, constraints, level of detail, ranges, and confidence levels.

They include:

- Documentation of the basis of the estimate (i.e., how it was developed)
- Documentation of all assumptions made
- Documentation of any known constraints
- Indication of the range of possible estimates
- Indication of the confidence level of the final estimate

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DETERMINE BUDGET

*** Determine Budget.** The process of aggregating the estimated costs of individual activities or work packages to establish an authorized cost baseline.

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DETERMINE BUDGET



INPUTS

- » Project management plan
 - Cost management plan
 - Resource management plan
 - Scope baseline
- » Project documents
 - Basis of estimates
 - Cost estimates
 - Project schedule
 - Risk register
- » Business documents
 - Business case
 - Benefits management plan
- » Agreements
- » Enterprise Environment Factors
- » Organizational Process Assets

TOOLS & TECHNIQUES

- ✓ Expert judgment
- ✓ Cost aggregation
- ✓ Data analysis
 - Reserve analysis
- ✓ Historical information review
- ✓ Funding limit reconciliation
- ✓ Financing

OUTPUTS

- Cost baseline »
- Project funding requirements »
- Project documents updates »
 - Cost estimates
 - Project schedule
 - Risk register

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DETERMINE BUDGET



TOOLS & TECHNIQUES

✓ Cost aggregation

*** Cost Aggregation.** Summing the lower-level cost estimates associated with the various work packages for a given level within the project's WBS or for a given cost control account.

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DETERMINE BUDGET



TOOLS & TECHNIQUES

✓ Historical relationships

- Any historical relationships that result in parametric estimates or analogous estimates involve the use of project characteristics (parameters) to develop mathematical models to predict total project costs. Such models may be simple (e.g., residential home construction is based on a certain cost per square foot of space) or complex (e.g., one model of software development costing uses multiple separate adjustment factors, each of which has numerous points within it)
- For example: Agile Adjusted Planning Velocity = Planning Velocity x DP x DF x DT x DD

Proximity (DP)	Time Together (DF)	Knowledge of Technology (DT)	Knowledge of Domain (DD)
Multiple Time Zones: DP = 0.8	<3 months: DF = 0.6	Low: DT = 0.6	Low: DD = 0.6
Same Office Building: DP = 1.0	3 to 12 months: DF = 0.8	Medium: DT = 0.8	Medium: DD = 0.8
Radical Colocation: DP = 1.6	>12 months: DF = 1.0	High: DT = 1.0	High: DD = 1.0

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DETERMINE BUDGET



TOOLS & TECHNIQUES

✓ Funding limit reconciliation

*** Funding Limit Reconciliation.** The process of comparing the planned expenditure of project funds against any limits on the commitment of funds for the project to identify any variances between the funding limits and the planned expenditures.

A variance between the funding limits and the planned expenditures will sometimes necessitate the rescheduling of work to level out the rate of expenditures. This is accomplished by placing imposed date constraints for work into the project schedule

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DETERMINE BUDGET



OUTPUTS

Cost baseline »

* **Cost Baseline.** The approved version of the time-phased project budget, excluding any management reserves, which can be changed only through formal change control procedures and is used as a basis for comparison to actual results.

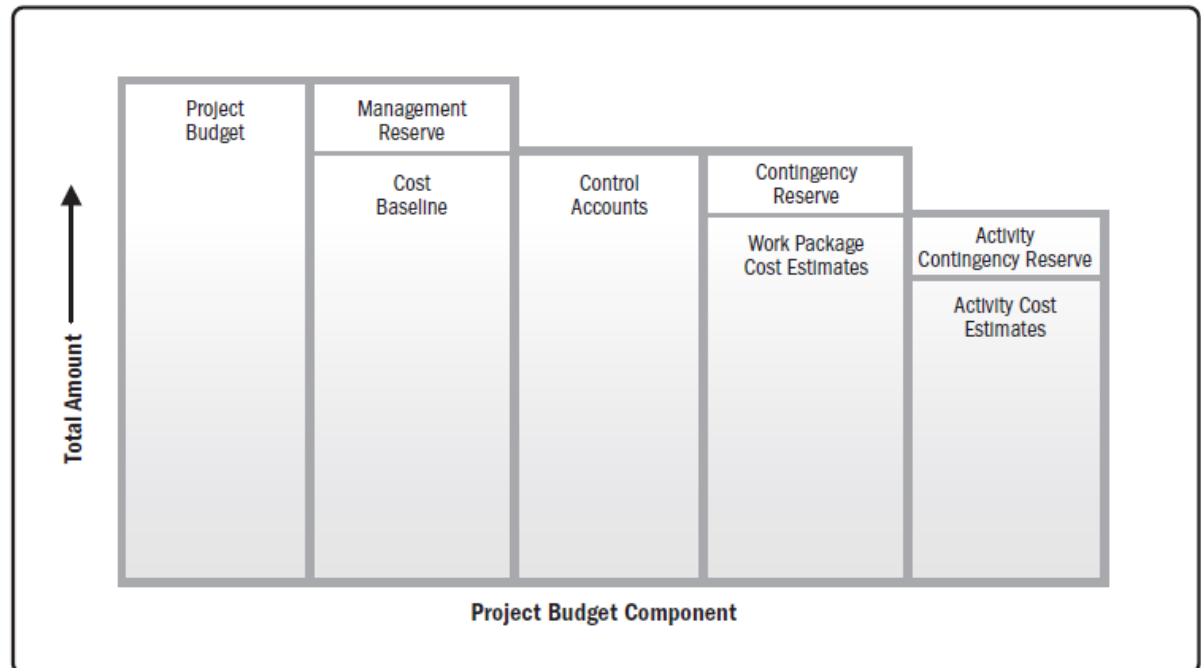


Figure 7-8. Project Budget Components

**This definition is taken from the Glossary of the Project Management Institute, A Guide to the Project Management Body of Knowledge, (PMBOK® Guide) – Sixth Edition, Project Management Institute, Inc., 2017. Project Management Institute, A Guide to the Project Management Body of Knowledge, (PMBOK® Guide) – Sixth Edition, Project Management Institute, Inc., 2017, Figure 7-8, Page 213.*

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DETERMINE BUDGET



OUTPUTS

Project funding
requirements »

*** Project Funding Requirements.** Forecast project costs to be paid that are derived from the cost baseline for total or periodic requirements, including projected expenditures plus anticipated liabilities.

22**DETERMINE BUDGET****OUTPUTS****Project documents updates »**

Project documents updates examples:

- **Risk register**
- **Activity cost estimates**
- **Project schedule**

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CONTROL COSTS



* **Control Costs.** The process of monitoring the status of the project to update the project costs and managing changes to the cost baseline.

Control costs includes:

- Influencing the factors that create changes to the authorized cost baseline
- Ensuring that all change requests are acted on in a timely manner
- Managing the actual changes when and as they occur
- Ensuring that cost expenditures do not exceed the authorized funding by period, by WBS component, by activity, and in total for the project
- Monitoring cost performance to isolate and understand variances from the approved cost baseline
- Monitoring work performance against funds expended
- Preventing unapproved changes from being included in the reported cost or resource usage
- Informing appropriate stakeholders of all approved changes and associated cost
- Bringing expected cost overruns within acceptable limits

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CONTROL COSTS



INPUTS

- » Project management plan
 - Cost management plan
 - Cost baseline
 - Performance measurement baseline
- » Project documents
 - Lessons learned register
- » Project funding requirements
- » Work performance data
- » Organizational Process Assets

TOOLS & TECHNIQUES

- ✓ Expert judgment
- ✓ Data analysis
 - Earned value analysis
 - Variance analysis
 - Trend analysis
 - Reserve analysis
- ✓ To-complete performance index (TCPI)
- ✓ Project management information system

OUTPUTS

- Work performance information »
- Cost forecasts »
- Change requests »
- Project management plan updates »
 - Cost management plan
 - Cost baseline
 - Performance measurement baseline
- Project documents updates »
 - Assumption log
 - Basis of estimates
 - Cost estimates
 - Lessons learned register
 - Risk register

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CONTROL COSTS



TOOLS & TECHNIQUES

✓ Earned value management

* **Earned Value Management.** A methodology that combines scope, schedule, and resource measurements to assess project performance and progress.

Earned value management (EVM) develops and monitors three key dimensions for each work package and control account:

- * **Planned Value (PV).** The authorized budget assigned to scheduled work. The total planned value for the project is also known as budget at completion (BAC).
How much it was planned to spend for the planned work?
- * **Actual Cost (AC).** The realized cost incurred for the work performed on an activity during a specific time period.
How much it was spent on the performed work?
- * **Earned Value (EV).** The measure of work performed expressed in terms of the budget authorized for that work.
How much it was budgeted for the work actually accomplished?

The three parameters of planned value, earned value, and actual cost can be monitored and reported on both a **period-by-period basis** (typically weekly or monthly) and on a **cumulative basis**.

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CONTROL COSTS



TOOLS & TECHNIQUES

✓ Earned value management

Variances from the approved baseline will be monitored:

Schedule Variance (SV)	A measure of schedule performance expressed as the difference between the earned value and the planned value	SV = EV – PV	Positive = Ahead of Schedule Neutral = On schedule Negative = Behind Schedule
Cost Variance (CV)	The amount of budget deficit or surplus at a given point in time, expressed as the difference between the earned value and the actual cost	CV = EV – AC	Positive = Under planned cost Neutral = On planned cost Negative = Over planned cost
Schedule Performance Index (SPI)	A measure of schedule efficiency expressed as the ratio of earned value to planned value	SPI = EV/PV	Greater than 1.0 = Ahead of schedule Exactly 1.0 = On schedule Less than 1.0 = Behind schedule
Cost Performance Index (CPI)	A measure of the cost efficiency of budgeted resources expressed as the ratio of earned value to actual cost	CPI = EV/AC	Greater than 1.0 = Under planned cost Exactly 1.0 = On planned cost Less than 1.0 = Over planned cost
Burn rate		1/CPI	

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CONTROL COSTS



TOOLS & TECHNIQUES

✓ Forecasting

- **Estimate at Completion (EAC).** The expected total cost of completing all work expressed as the sum of the actual cost to date and the estimate to complete.
- **Estimate to Complete (ETC).** The expected cost to finish all the remaining project work.
- **Variance at Completion (VAC).** A projection of the amount of budget deficit or surplus, expressed as the difference between the budget at completion and the estimate at completion.

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CONTROL COSTS



TOOLS & TECHNIQUES

✓ Forecasting

Estimate at Completion (EAC) when original estimates are flawed	EAC=AC + bottom-up ETC ETC = reestimate
Estimate at Completion (EAC)) when variances are atypical	EAC= AC + (BAC-EV) or EAC= BAC -CV
Estimate at Completion (EAC) future performance = past performance	EAC = (BAC/CPI) BAC = Budget at completion CPI = Past Cost performance index
Estimate at Completion (EAC)) when variances are typical	EAC= AC + (BAC-EV)/(CPI*SPI) or EAC= AC + (BAC-EV)/CPI CPI = future CPI, SPI = future SPI
Estimate to Complete (ETC)	ETC = EAC - AC
Percent Complete	EV / BAC * 100
Variance at Completion (VAC)	BAC - EAC

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CONTROL COSTS



TOOLS & TECHNIQUES

- ✓ To-complete performance index (TCPI)

*** To-Complete Performance Index (TCPI).** A measure of the cost performance that is required to be achieved with the remaining resources in order to meet a specified management goal, expressed as the ratio of the cost to finish the outstanding work to the remaining budget.

TCPI to complete in BAC (The efficiency that must be maintained in order to complete on plan)

$$TCPI = (BAC - EV) / (BAC - AC)$$

TCPI to complete in EAC (The efficiency that must be maintained in order to complete the current EAC)

$$TCPI = (BAC - EV) / (EAC - AC)$$

23**CONTROL COSTS****TOOLS & TECHNIQUES**✓ **Reserve analysis**

- It is used to monitor the status of contingency and management reserves for the project to determine if these reserves are still needed or if additional reserves need to be requested.
- As work on the project progresses, these reserves may be used as planned to cover the cost of risk mitigation events or other contingencies.
- If the probable risk events do not occur, the unused contingency reserves may be removed from the project budget to free up resources for other projects or operations.

23**CONTROL COSTS****OUTPUTS**

Work performance
information »

Work performance information examples:

- **SV**
- **CV**
- **SPI**
- **CPI**

23**CONTROL COSTS****OUTPUTS****Cost forecasts »**

Cost forecasts examples:

- EAC
- ETC

23**CONTROL COSTS****OUTPUTS****Project documents updates »**

Project documents examples:

- **Cost estimates**
- **Bases of estimates**
- **Change Log**

Project Cost Management

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Project Cost Management



- Rough Order of Magnitude
- Budget estimate
- Definitive estimate
- Type of Cost
- Sunk Costs
- Depreciation
- Present Value
- NPV
- IRR
- Discounted Cashflow
- Payback Period
- BCR
- Opportunity Cost
- ROI
- Life Cycle Costing

- Cost Management Plan Content
- Analogous vs parametric estimating
- Three point estimating
- Triangular distribution vs Beta distribution
- Contingency reserve vs Management reserve
- Cost of Quality
- Vendor Bid Analysis
- Cost aggregation
- Historical relationships
- Funding limit reconciliation
- Project funding requirements
- EVM formulas
- TCPI

Project Cost Management

25 Questions
25 minutes