



Project Management Supplemental Deck #9

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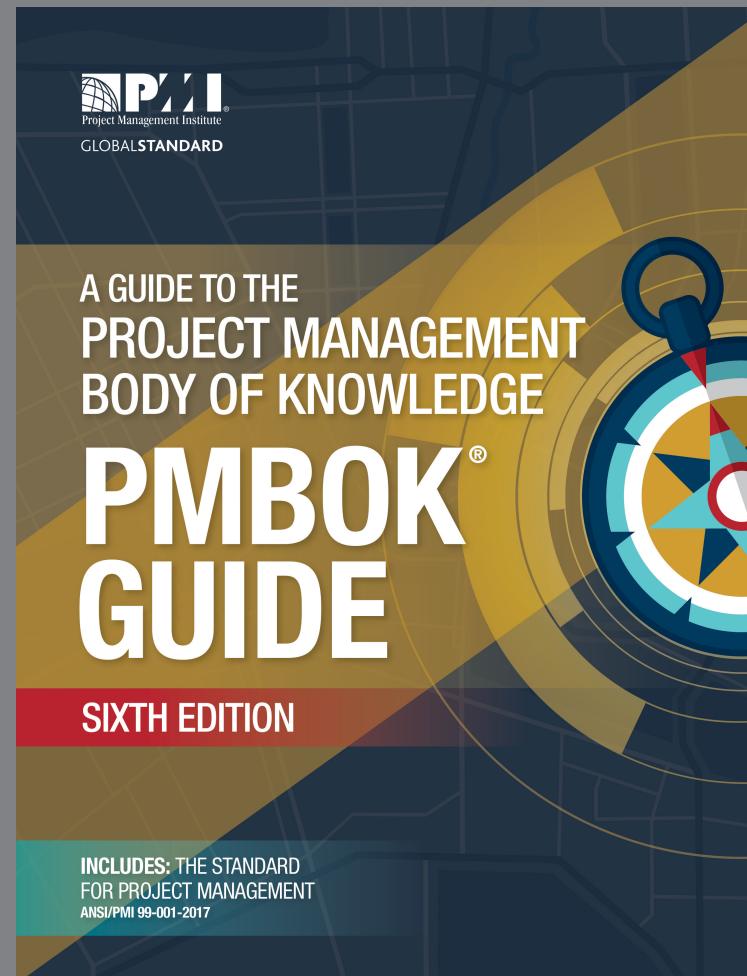


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Project Management

This is accepted in the Project Management Field as the main guide which is used to train and certify Project management Professionals

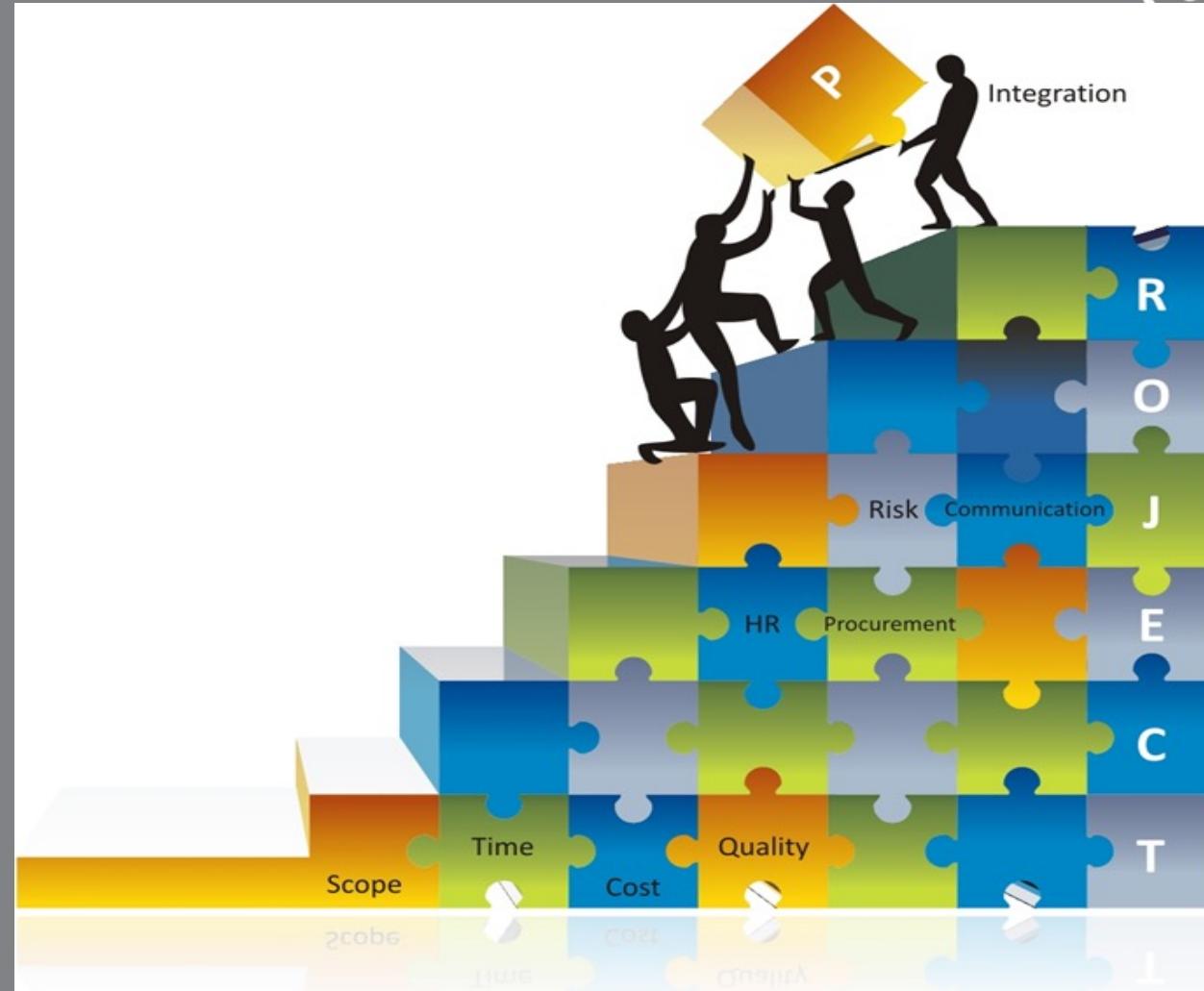
All Supplemental Slide decks will be relating to this and the information from them will be included on any possible tests/assignments etc...



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Chapter 7

Project Cost Management



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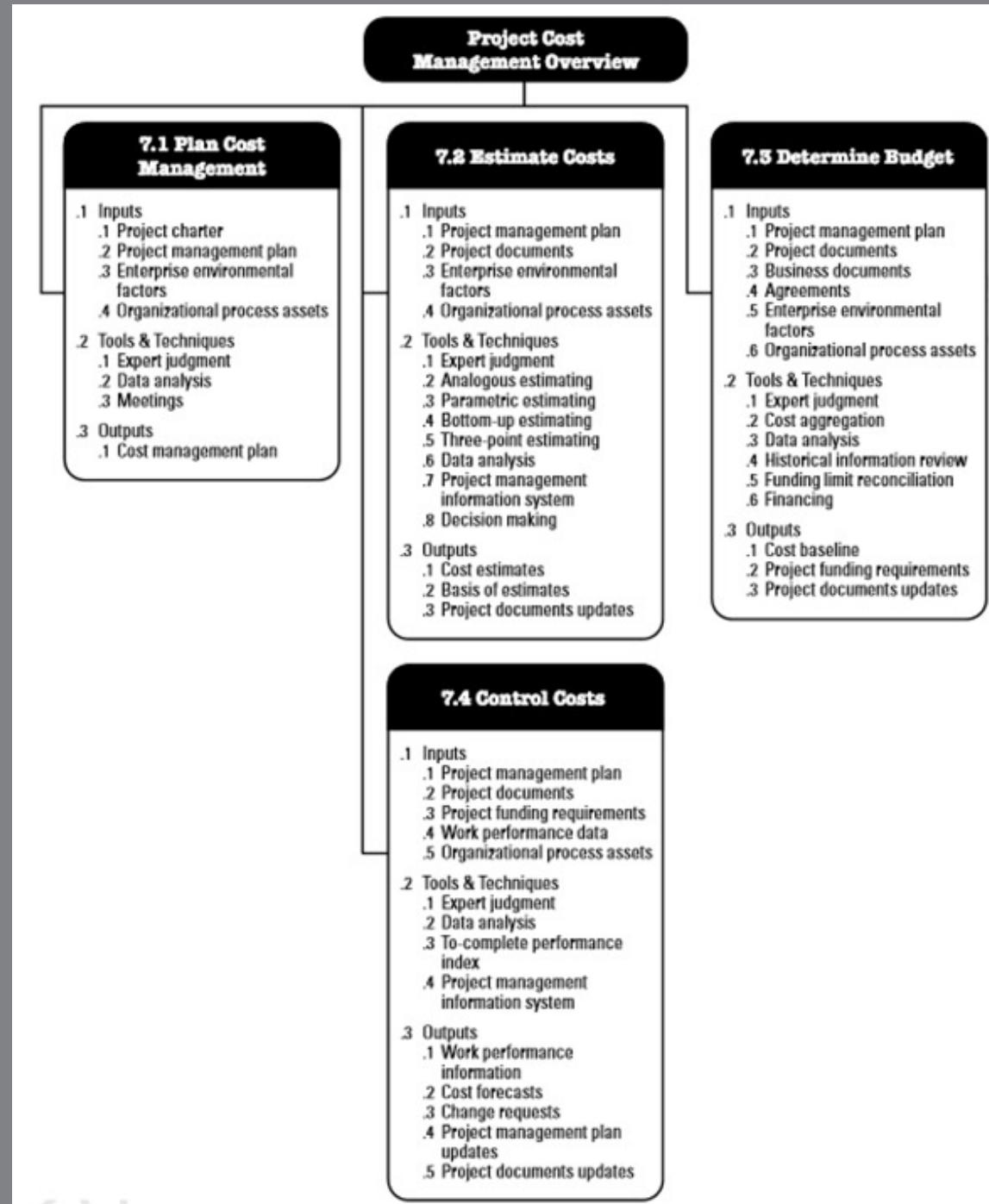
Project Cost Management



- Poor project cost management is one of the easiest ways to make a project go awry. Hence, good project management requires a firm grasp on the concepts and techniques in project budgeting and cost control. Thankfully, the Project Management Body of Knowledge (PMBOK) gives us a strong foundation in this area.



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Plan Cost Management



- The first of the processes within the knowledge area is called Plan Cost Management. It involves the production of a cost management plan, which is a component of the overall project management plan. This document describes how the project costs will be planned, structured, and controlled.
- It can feature elements such as the level of accuracy and precision, control thresholds, and rules of performance measurement for earned value management.
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Project Cost Management



- Costing is different from Pricing. Costing includes the monetary resource required to complete the project and pricing normally include a profit margin.
- Costing is based on WBS and controlled by Control Accounts
- Costing shall be ideally done by a team who perform the work



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Estimate Costs

- This process represents the tasks involved in determining the monetary resources needed to complete the project activities. Most of the time it involves bottom up estimating, that is, determining the monetary resources for each project task and rolling it up into an overall project estimate. However, a top down approach is usually quicker and less accurate but can be appropriate for the circumstances. Each [task](#) is estimated using techniques such as analogous, parametric, and three-point estimating.

- **Inputs**

- Cost management plan
- Human resource management plan
- Scope baseline
- Project schedule
- Risk register
- Enterprise environmental factors
- Organizational process assets

- **Tools and Techniques**

- Expert judgment
- Analogous estimating
- Parametric estimating
- Bottom-up estimating
- Three-point estimating
- Reserve analysis
- Cost of quality
- Project management software
- Vendor bid analysis
- Group decision-making techniques

- **Outputs**

- Activity cost estimates
- Basis of estimates
- Project documents updates



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Determine Budget



- This process refers to the aggregation of individual project task budgets into an overall project budget. It refers to the production of a time-phased project cost baseline which can provide a graduated ceiling for project funding limits throughout the project. Management reserves (overall project contingencies) are also allocated.
- For small projects, the Estimate Costs and Determine Budget processes can be viewed as one single process, because a time phased cost baseline is often not necessary.

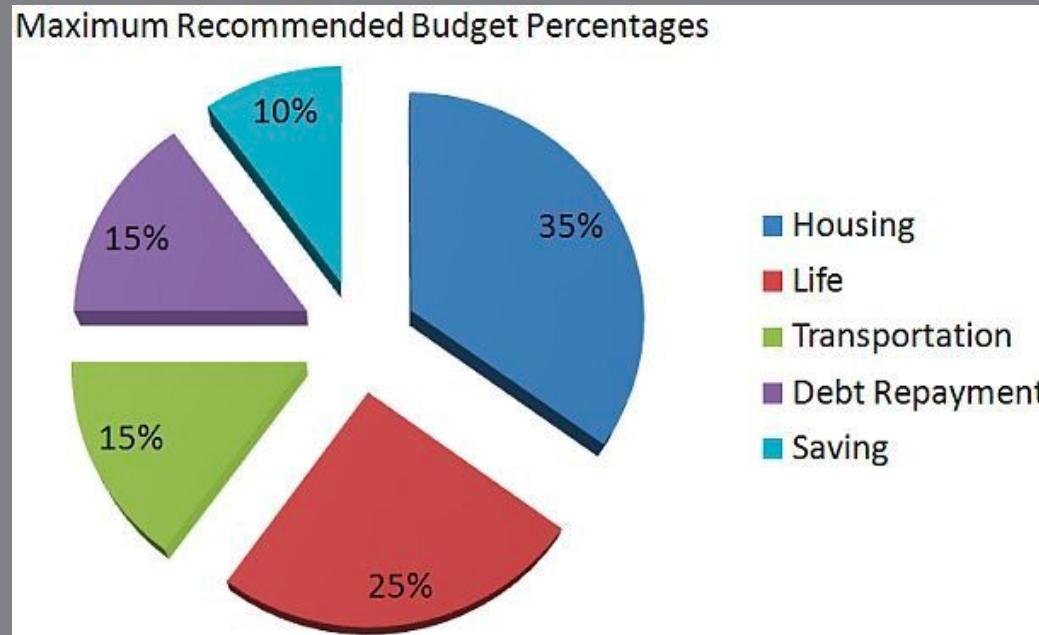


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Determine Budget



- **Inputs**
 - Cost management plan
 - Scope baseline
 - Activity cost estimates
 - Basis of estimates
 - Project schedule
 - Resource calendars
 - Risk register
 - Agreements
 - Organization process assets
- **Tools and Techniques**
 - Cost aggregation
 - Reserve analysis
 - Expert judgment
 - Historical relationships
 - Funding limit reconciliation
- **Outputs**
 - Cost baseline
 - Project funding requirements
 - Project documents updates



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Control Costs



- Although it's only one single process (out of 4 within the knowledge area and 47 within the PMBOK), it's arguably the most important one. Keeping project costs under control requires the application of earned value management. At any point in time (usually right now) the project manager collects three pieces of information for each task within the project:
- **Planned value.** The value of the work planned to be completed.
- **Earned value.** The actual value of all the work completed (earned).
- **Actual cost.** The actual cost of all the work completed.
- Four values are then calculated which indicate the current status of the project, two from a budget perspective (CV and CPI) and two from a schedule perspective (SV and SPI).
- Four more values are calculated which extrapolate the current project status to the end of the project (ETC, EAC, VAC, ad TCPI).
- These values can be compiled into a project status report and distributed to stakeholder



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Control Costs



- **Inputs**
 - Project management plan
 - Project funding requirements
 - Work performance data
 - Organization process assets
- **Tools and Techniques**
 - Earned value management
 - Forecasting
 - To-complete performance index (TCPI)
 - Performance reviews
 - Project management software
 - Reserve analysis
- **Outputs**
 - Work performance information
 - Cost forecasts
 - Change requests
 - Project management plan updates
 - Project documents updates
 - Organizational process assets updates



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Tools and Techniques

Earned Value Management (EVM)



Actual Cost (AC)

It indicates the actual money that has been spent for work that has been completed.

- Example: Work package XX have a 4 stages and each stage will take one week to complete with \$500 estimated cost per stage. End of 2nd week 3 stages were completed and contractor has spend 1700. What is the PV, EV & AC
- PV on 2nd Week = Total value of planned work to be completed on second week in monetary terms ($500 \times 2 = 1000$)
- EV on 2nd week = Estimated value of work completed ($500 \times 3 = 1500$)
- AC on 2nd Week = Actual cost spend of work already completed (1700)



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Tools and Techniques

Earned Value Management (EVM)



- SV (Schedule Variance) = EV-PV (Difference between estimated value of work completed and estimated value of work planned)
- CV (Cost Variance) = EV-AC (Difference between estimated value of work completed and actual cost of work completed)
- SPI (Schedule Performance Index) = EV/PV
- CPI (Cost Performance Index) = EV/AC



Tips

- EV comes first in all equations.
- For Schedule related equation there is PV and AC for cost related



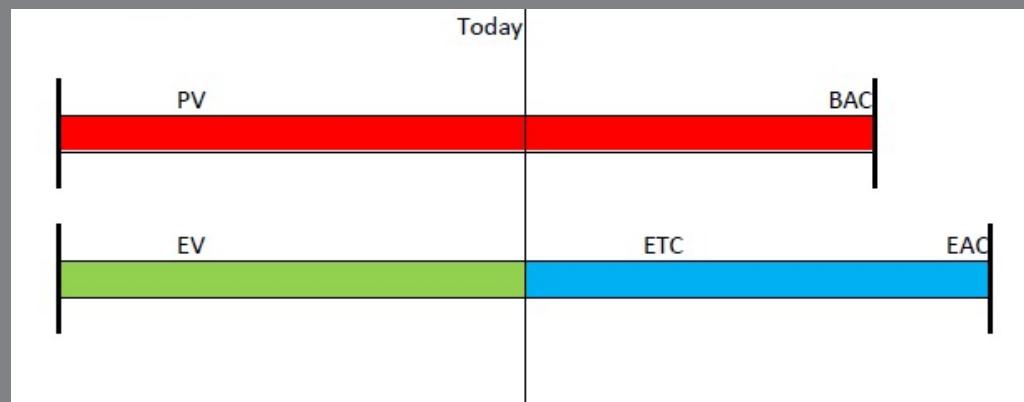
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Control Costs- Tools and Techniques



Forecasting

- Using the earned value analysis, team can now forecast the project performance.
- Estimate at completion (EAC) may differ from Budget at Completion (BAC)
- Estimate to complete (ETC) is the estimate of remaining work. Now
 $\text{Estimate at completion} = \text{AC} + \text{ETC}$.



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Control Costs- Tools and Techniques



EAC can be calculated by:

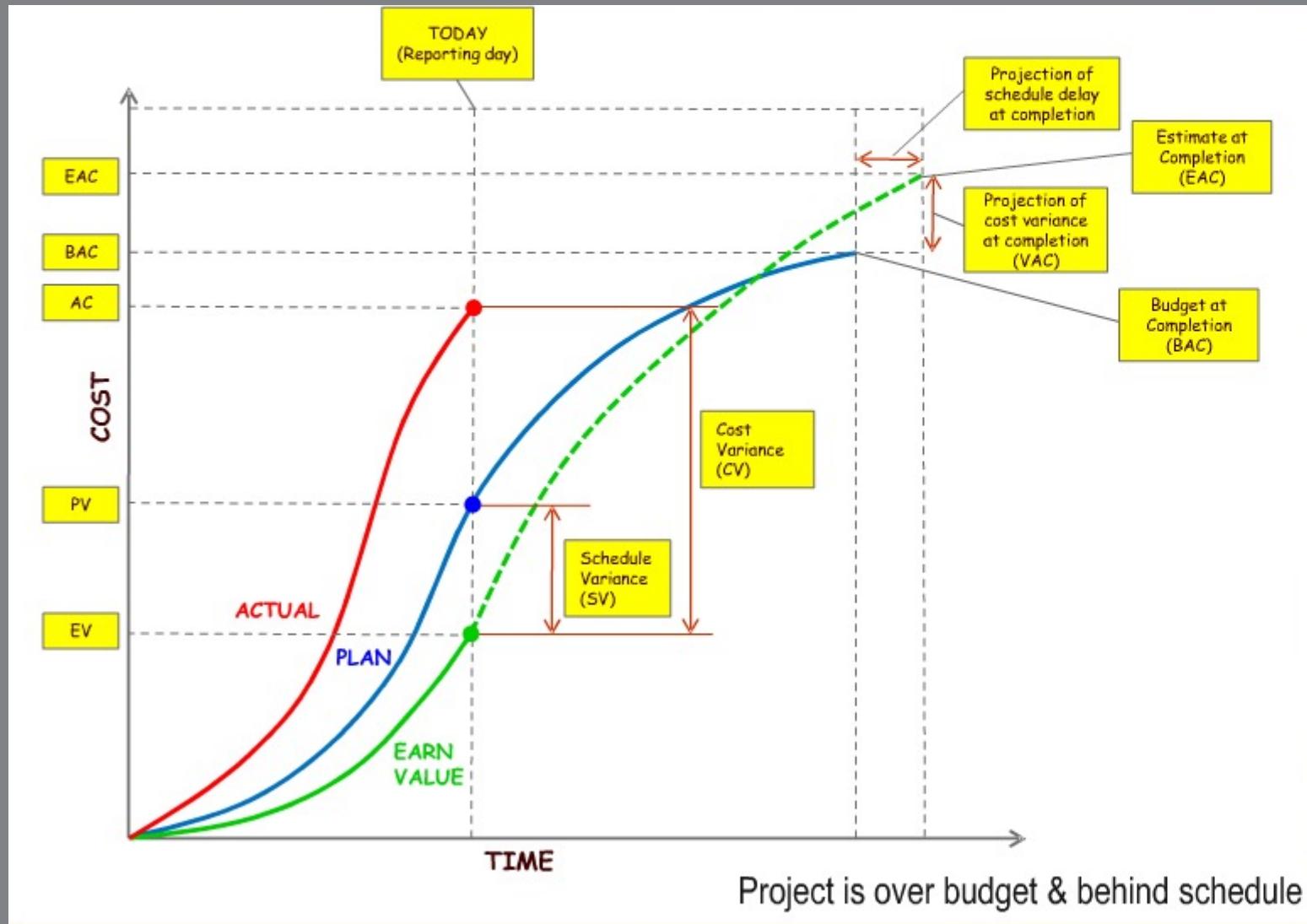
- There will be no variation for remaining work and will progress as planned before $ETC = BAC - EV$
& that means $EAC = AC + ETC (BAC-EV)$
- The changes project experience will continue to occur for remaining work.
- $EAC = BAC/CPI$ (Only cost efficiency is considered now)
- Here team considers that remaining work will be completed at the same efficiency rate considering cost and schedule performance

$$\mathbf{EAC = AC + (ETC/CPI \times SPI) \text{ & } ETC = BAC - EV.}$$



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Earned Value: Graphical Representation



Earned Value Management (EVM)



| Terms and formulas | Definition | Example |
|--|---|----------------------|
| Earned Value (EV) | As of today, what is the estimated value of the work actually accomplished? | \$100 k |
| Actual cost (AC) | As of today, what is the actual cost incurred for the work accomplished? | \$200k |
| Planned Value (PV) | As of today, what is the estimated value of work planned to be done? | \$300 k |
| Cost Variance (CV)=EV-AC | Negative is over budget Positive is under budget | \$100k-\$200k=-\$100 |
| Schedule Variance (SV)=EV-PV | Negative is behind schedule Positive is ahead schedule | \$100k-\$300k=-\$200 |
| Cost Performance Index(CPI)=EV/AC | We are getting \$.....worth of work out of every \$1 spent. Are funds being used efficiently? | \$100k/\$200k=.5 |
| Schedule Performance Index (SPI)=EV/PV | We are(only) progressing at>>> percent of the rate originally planed | \$100k/\$300k=.33 |
| Revised total duration | Baseline duration/schedule performance index | 4/.33=12 months |



Earned Value Technique



| Terms and Formulas | Definition |
|--------------------------------------|--|
| Budget at Completion (BAC) | How much did we budget for the total project effort? |
| Estimate at Completion (EAC)=BAC/CPI | What do we currently expect the total project cost(a forecast)? |
| Estimate to Complete (ETC)=EAC-AC | From this point on, how much MORE do we expect it to cost to finish the project (a forecast) |
| Variance at Completion (VAC)=BAC-EAC | As of today how much over or under budget do we expect to be at the end of the project? |

EAC is an important **forecasting** value



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Exercise



- You have a project to build a box. The box is six sided, each side is to take one day to build and is budgeted for \$1000 per side. The sides are planned to be completed one after the other. Today is the end of day three.
- Using the following project status chart, calculate PV, EV, AC, BAC, CV, CPI, SV, SPI, EAC, BTC, VAC.
- Describe your interpretation based on the calculation:

| Task | Progress | Cost spent |
|--------|----------|------------|
| Side 1 | 100% | 1,200 |
| Side 2 | 100% | 1,000 |
| Side 3 | 75% | 750 |
| Side 4 | 50% | 500 |
| Side 5 | 0% | 0 |
| Side 6 | 0% | 0 |

**Project is
below/over budget?
Project is late/a
head schedule?
How much more
money we need?**



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Exercise

| Parameter | Calculation | Result |
|-----------|--|---------|
| PV | $1000+1000+1000$ | 3000 |
| EV | $(100\% \times 1000) + (100\% \times 1000) + (755 \times 1000) + 50\% \times 1000$ | 3025 |
| AC | $1200+1000+750+500$ | 3450 |
| BAC | 6×1000 | 6000 |
| CV | $3025/3450$ | -425 |
| CPI | $3025/3450$ | .88 |
| SV | $3025/3000$ | 25 |
| SPI | $3025/3000$ | 1.01 |
| EAC | $6000/.88$ | 6818.18 |
| ETC | $6818.18 - 3450$ | 3368.18 |
| VAC | $6000 - 6818.18$ | -818.18 |

- Over budget, getting .88 dollar we spent
- Ahead schedule, progressing 101% of the rate planned
- Probably will spend \$ 6818 at the end (estimation)
- Need \$ 3368 to complete
- Over budget at the end for about \$ 818 (estimation)



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Control Costs- Tools and Techniques



To Complete Performance Index (TCPI)

- TCPI predicts the efficiency that must be achieved for remaining work to complete the remaining works with available budget.
- $$\text{TCPI} = \frac{\text{Work Remaining}}{\text{Funds remaining}} = \frac{(\text{Budget At Completion} - \text{Earned Value})}{(\text{BAC} - \text{Actual cost})} = \frac{(\text{BAC}-\text{EV})}{(\text{BAC}-\text{AC})}$$



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Control Costs- Tools and Techniques



To Complete Performance Index (TCPI)

If it is obvious that earlier estimated budget at completion can not be achieved, Project manager develops a forecasted estimate at completion (EAC). Once approved through integrative change control process, EAC will supersede BAC and cost baselines will be revised.

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

Now $TCPI = \text{Work Remaining}/\text{Funds remaining as per forecasted EAC}$ = **(Budget At Completion – Earned Value) / (EAC – Actual cost)**.

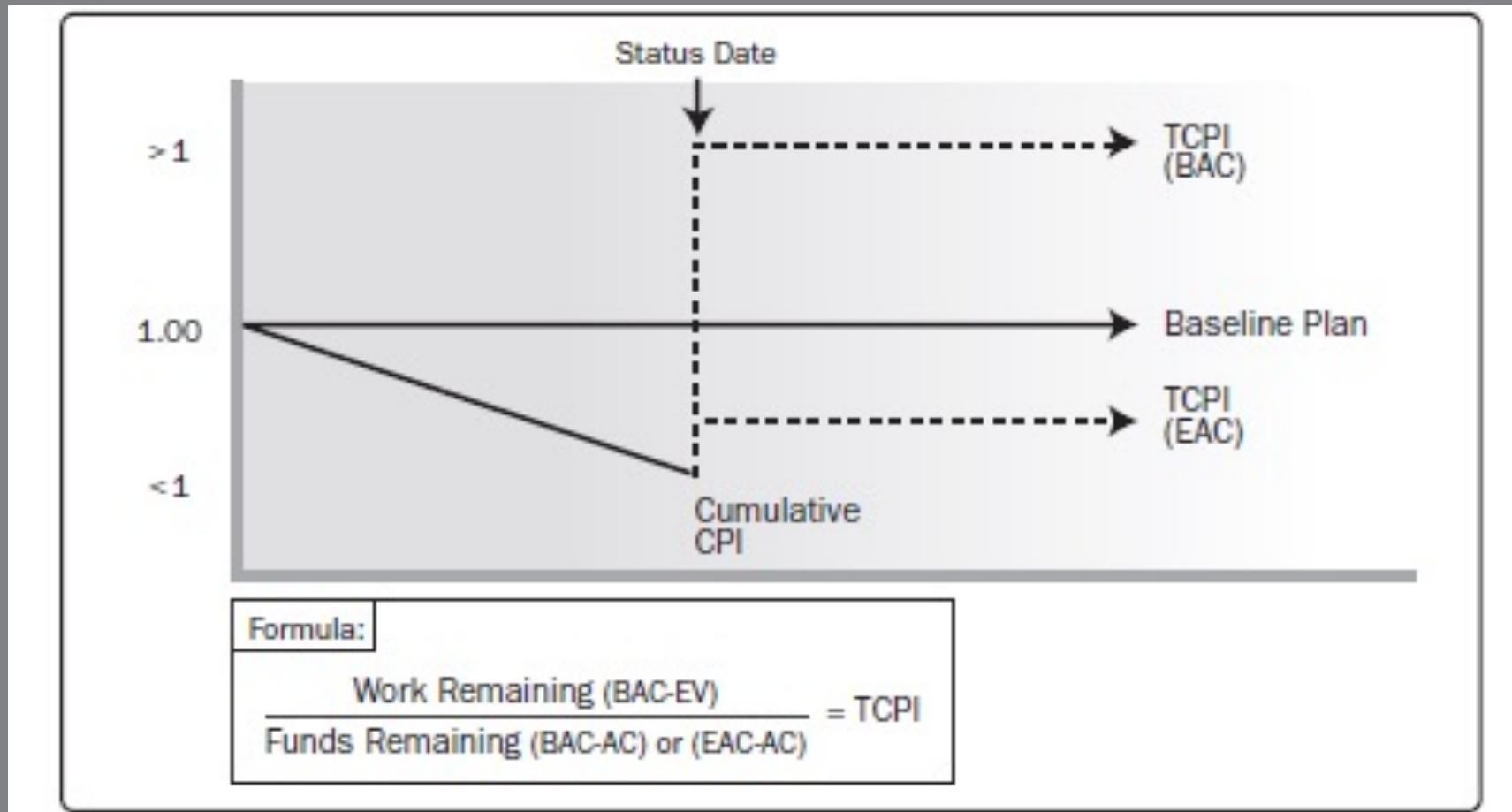


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Control Costs- Tools and Techniques



To Complete Performance Index (TCPI)



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Control Costs- Tools and Techniques



- TCPI (based on original estimate or forecasted budget) will set a new baseline for performance efficiency to be achieved to complete the works with funds remaining.
- If CPI falls below TCPI baseline, remaining works will not be completed with available funds. All future works shall be accelerated to bring CPI within TCPI range.



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Control Costs- Tools and Techniques



- TCPI value >1 means in future, more work must be achieved per every dollar spent in the future compared to actual work achieved previously per dollar.
- TCPI value <1 means in future lesser work need to be achieved for every dollar spent compared to past performance.



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Control Costs- Tools and Techniques



Examples

A project has the following Earned value data assessed: AC: \$ 4,000,000 CV: \$ -500,000 SPI: 1.12

BAC: \$ 9,650,000 What is the Earned value of the project? What is the CPI? What is the TCPI?

In your project, there have been several changes in the cost and schedule estimates and the original estimating assumptions are no longer valid. What is the Estimate at Complete for your project?

BAC = \$ 300,000, AC = \$

100,000, EV = \$ 150,000, CPI = \$ 1.2, ETC = \$ 120,000.



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Control Costs- Tools and Techniques



| Cost Formulas | Calculation |
|--|--|
| Cost Performance Index (CPI) | $CPI = EV / AC$ |
| Estimate to Complete (ETC) Estimate at Completion (EAC) using new estimate | $ETC = BAC - EV \text{ or } (BAC - EV) / CPI$ $EAC = AC + ETC$ |
| Estimate at Completion (EAC) using remaining budget | $EAC = AC + BAC - EV$ $EAC = AC + ((BAC - EV) / CPI) \text{ or } EAC = BAC / CPI$ |
| Estimate at Completion (EAC) using CPI | $TCPI = (BAC - EV) / (BAC - AC)$ |
| To-Complete Performance Index (TCPI) based on BAC | $TCPI = (BAC - EV) / (EAC - AC)$ |
| To-Complete Performance Index (TCPI) based on EAC | $(BAC - EV) / (BAC - PV)$ |
| To-Schedule Performance Index (TSPI) | |

