Test--Week 8

5 process groups

Knowledge Areas	Project Management Process Groups				
	Initiating Process Group	Planning Process Group	Executing Process Group	Monitoring and Controlling Process Group	Closing Process Group
4. Project Integration Management	4.1 Develop Project Charter	4.2 Develop Project Management Plan	4.3 Direct and Manage Project Work	4.4 Monitor and Control Project Work 4.5 Perform Integrated Change Control	4.6 Close Project or Phase
5. Project Scope Management		5.1 Plan Scope Management 5.2 Collect Requirements 5.3 Define Scope 5.4 Create WBS		5.5 Validate Scope 5.6 Control Scope	
6. Project Time Management		6.1 Plan Schedule Management 6.2 Define Activities 6.3 Sequence Activities 6.4 Estimate Activity Resources 6.5 Estimate Activity Durations 6.6 Develop Schedule		6.7 Control Schedule	
7. Project Cost Management		7.1 Plan Cost Management 7.2 Estimate Costs 7.3 Determine Budget		7.4 Control Costs	
8. Project Quality Management		8.1 Plan Quality Management	8.2 Perform Quality Assurance	8.3 Control Quality	
9. Project Human Resource Management		9.1 Plan Human Resource Management	9.2 Acquire Project Team 9.3 Develop Project Team 9.4 Manage Project Team		
10. Project Communications Management		10.1 Plan Communications Management	10.2 Manage Communications	10.3 Control Communications	
11. Project Risk Management		11.1 Plan Risk Management 11.2 Identify Risks 11.3 Perform Qualitative Risk Analysis 11.4 Perform Quantitative Risk Analysis 11.5 Plan Risk Responses		11.6 Control Risks	
12. Project Procurement Management		12.1 Plan Procurement Management	12.2 Conduct Procurements	12.3 Control Procurements	12.4 Close Procurements
13. Project Stakeholder Management	13.1 Identify Stakeholders	13.2 Plan Stakeholder Management	13.3 Manage Stakeholder Engagement	13.4 Control Stakeholder Engagement	

10 knowledge areas

Watching the bottom line!

4. Cost Management

1. Plan Cost Management
2. Estimate Costs
3. Determine Budget
4. Control Cost

Test--Week 8

- 1. Alice is a project manager. She estimates each activity and resource that the team is going to need. Then she adds up all the estimates into "rolled-up" categories. From there she adds up the categories into an overall budget number. Which tool is Alice using?
- A、Parametric Estimation
- B、Analogous Estimation
- C、Bottom-up estimating
- D、Three-point Estimating

Test--Week 8

2. Alice is estimating cost for a software project using the three point estimating method. If the optimistic estimate is 1,000 dollars, the pessimistic estimate is 9,000 dollars, and the most likely estimate is 2,000 dollars, what is the expected cost under the Beta Distribution?

- A、2,000 dollars
- B、3,000 dollars
- C、4,000 dollars
- D、5,000 dollars

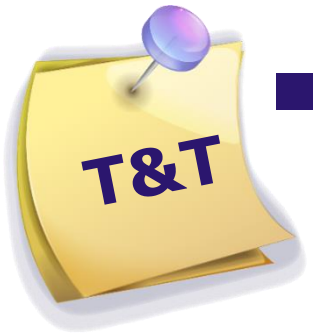
Beta Distribution

$$cE=(cO+4cM+cP)/6$$

Test--Week 8

- 3. Calculations
  (1)According to the tables below, please calculate the UFC, TCF and FP for this software project.
- (2) If the productivity of this project is 15 hours/FP, then please calculate the workload of this project.
- (3) If the cost for each labor hour is ¥100/hour, what is the total cost of this project.

Software Project Cost Estimating



- Function Point （FP）
  - FP =UFC*TCF
    - UFC(Unadjusted Function Point Count)
    - TFC(Technical Complexity Factor)

Software Project Cost Estimating

UFC's calculation method

Feature Count items	Complexity Weight		
	simple	medium	complex
External input	3	4	6
External Output	4	5	7
External inquiry	3	4	6
External interface file	5	7	10
Internal documents	7	10	15

Software Project Cost Estimating

Feature Count items	counts	Complexity weight
External input	1 medium	4
External Output	1 complex	7
External inquiry	1 simple	3
External interface file	1 simple, 2 medium	5,7,7
Internal documents	2 simple	7,7

UFC=1*4+1*7+1*3+1*5+2*7+2*7=47

Software Project Cost Estimating

Technical complexity factors					
F1	Reliable backup and recovery	1	F2	data communication	3
F3	Distributed function	2	F4	performance	2
F5	Large use of configuration	1	F6	On-line data entry	4
F7	Simplicity of operation	1	F8	Online upgrade	2
F9	Complex interface	1	F10	Complex data processing	3
F11	Reusability	4	F12	Installation simplicity	2
F13	Multiple Sites	2	F14	Easy to modify	3

sum(Fi)=31

TCF=0.65+0.01(sum(Fi))=0.65+0.01*31=0.96

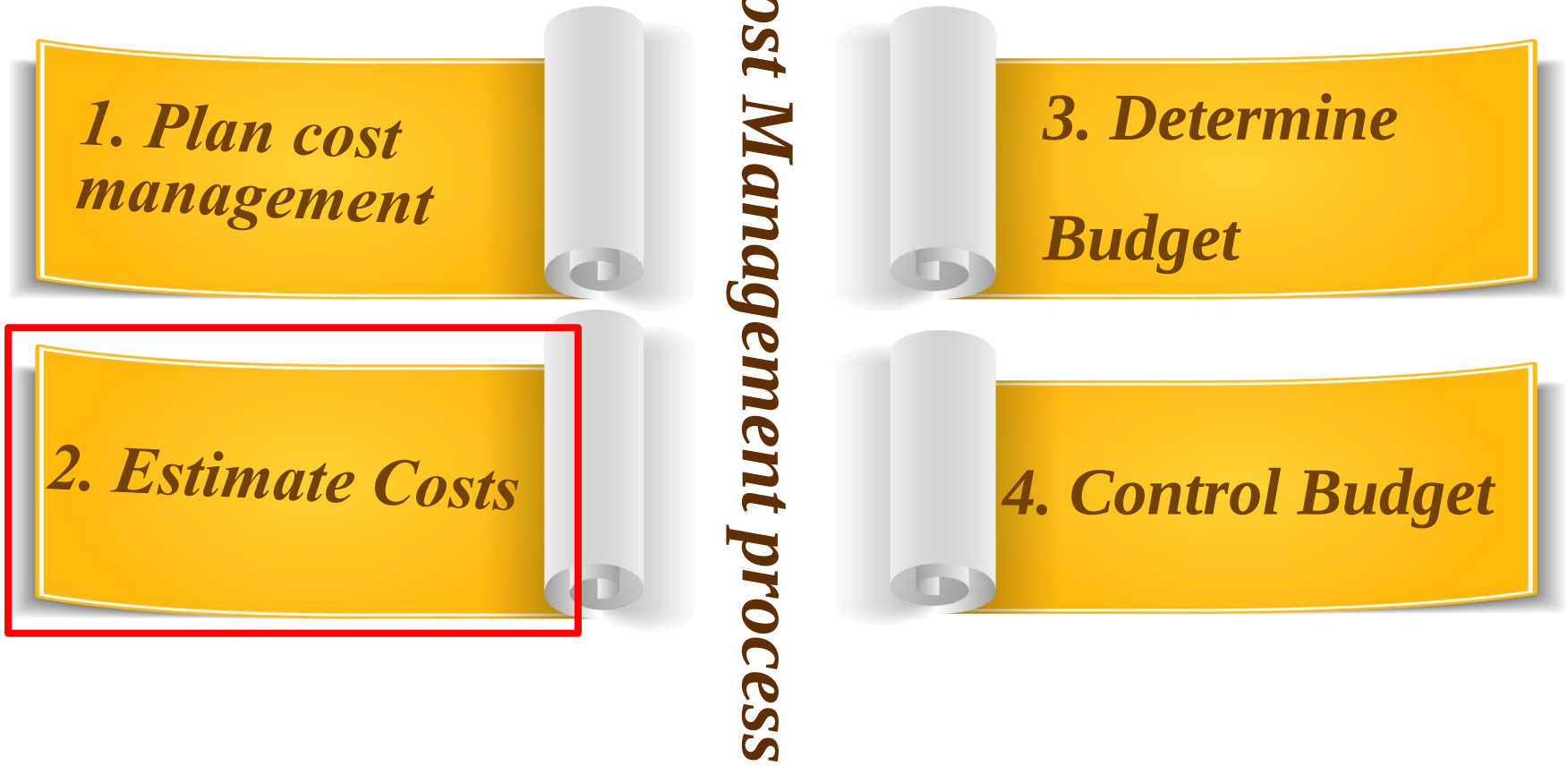
Test--Week 8

- 3. Calculations
  (1)According to the tables below, please calculate the UFC, TCF and FP for this software project.
- (2) If the productivity of this project is 15 hours/FP, then please calculate the workload of this project.
- (3) If the cost for each labor hour is ¥100/hour, what is the total cost of this project.
  - UFC=1*4+1*7+1*3+1*5+2*7+2*7=47
  - sum(Fi)=31
  - TCF=0.65+0.01(sum(Fi))=0.65+0.01*31=0.96
  - FP =UFC*TCF=45.12
  - Workload=15*45.12=676.8 hours
  - Total cost=676.8*100=67680¥

Software Project Management

Chapter 5: Cost Management

Cost Management Overview

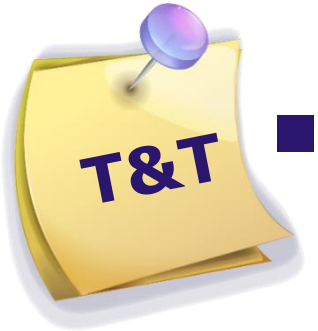


Section 5.2 Estimate Costs—software project

Software project cost estimating

1. Lines of Code (LOC)
2. Function point (FP)
3. Expert estimation method
4. A practical software cost estimation process

Software Project Cost Estimating



- 3. Expert estimation method
  - By a number of application areas and development environment has extensive experience of experts to estimate the cost.
  - In order to avoid a single expert bias, as far as possible by a number of experts to estimate, to obtain multiple estimates, and finally come to a comprehensive estimate.

Expert estimation method -Delphi

Software Project Cost Estimating

Expert estimation method -Delphi

- The organizers send each expert a software system specifications and a record of the estimated value of the form, then they estimate.
- After a detailed study of the software specifications, the software proposed 3 work (or cost) of the estimated value:
  - Minimum a_i
  - The most likely value m_i
  - Maximum b_i
- Calculating the average estimate of each expert. $E_i=(a_i+4m_i+b_i)/6$ and total average $E=(E1+E2+\ldots+En)/n$ (n represents n experts)。

Software Project Cost Estimating

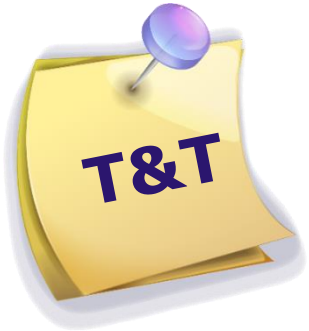
Expert estimation method -Delphi

- Organize experts to fill out the form, compare the estimates, and find out the reason.
- If the estimated differences between the various experts outside the specified range (for example: 15%), need to repeat the process, and ultimately obtained a majority consensus of expert software effort (or cost) estimates.

Software Project Cost Estimating

- **Example**
  - **Expert 1：1，8，9 ⟶ （1+9+4*8）/6=7（ten thousands）**
  - **Expert 2：4，6，8 ⟶ （4+8+4*6）/6=6（ten thousands）**
  - **Estimate=（6+7）/2=6.5**

Software Project Cost Estimating



- **4. A practical software cost estimation process:**
  1. **Task decomposition(activity): T1, T2,…,Ti,…,Tn**
  2. **Estimate the cost of each task Ci**
  3. **Direct cost of the project $=C_1+C_2+\ldots+C_i+\ldots+Cn$**
  4. **Indirect cost estimation**
  5. **Total project cost = direct cost + indirect cost**

Software Project Cost Estimating

Step 2. Estimate the cost of each task

- First estimate the workload of the task Ei (Generally in the man-month as the unit)
- Then estimate the cost of the task Ci= Ei* Human cost parameters

For example: if a software project workload is 3 person-months, and the company's human cost parameter is 20,000 yuan / person-months, the cost of the project is $ 60,000.

Software Project Cost Estimating

Step 3. Direct cost estimation

- The structure of direct cost: development cost, management cost, quality cost
- A simple estimation method of management and quality cost:
  - Development workload: Effort(Dev)
  - Management and quality work :Effort(Mgn)=a*Effort(Dev)

    a is scaling factor， According to the specific circumstances of the enterprise， such as:20%--25%。

- Direct cost = Effort(Dev) + a*Effort(Dev)

Software Project Cost Estimating

Step 4. Indirect cost estimation

- Calculated based on firm-specific cost model.
- Simplified Estimation:
  - Indirect costs = Direct costs *Indirect cost factor
  - The indirect cost coefficient is determined according to the specific circumstances of the enterprise， such as:0.3。

Software Project Cost Estimating

Step 5. Total project cost estimate

- **Total estimated cost**

  = direct cost + indirect cost

  = direct cost + direct cost *Indirect cost coefficient

  = direct cost (1+ Indirect cost coefficient)

  = workload * human cost parameters （1+ Indirect cost coefficient）

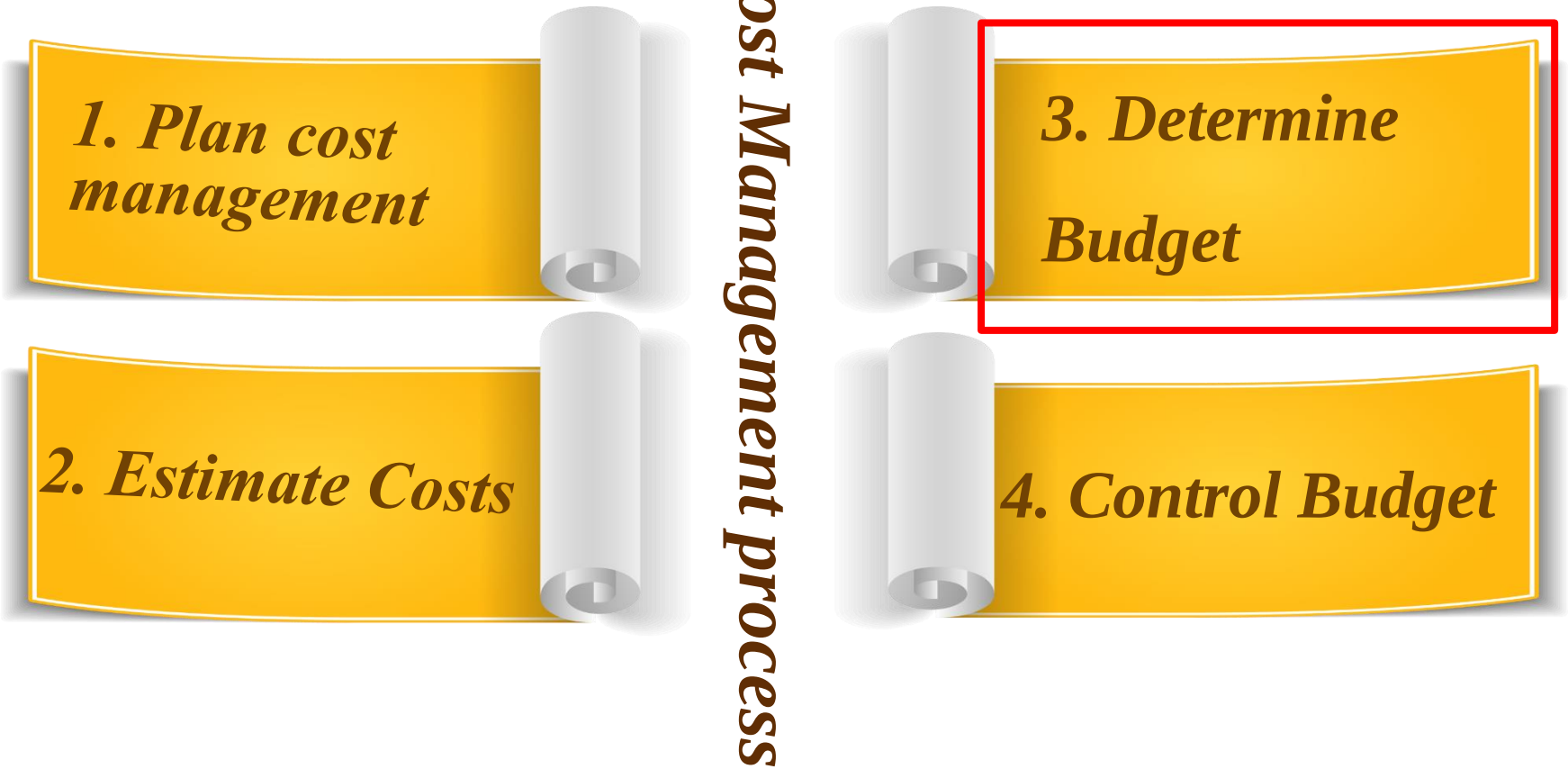
- **Cost coefficient**

  = human cost parameters *（1+ Indirect cost coefficient）

- **Total estimated cost = workload * cost coefficient**

For example: The workload of a project is 40 months, Cost coefficient of 20 thousand yuan/man-month, the total estimated cost of the project is 40*20=800 thousand.

Cost Management Overview



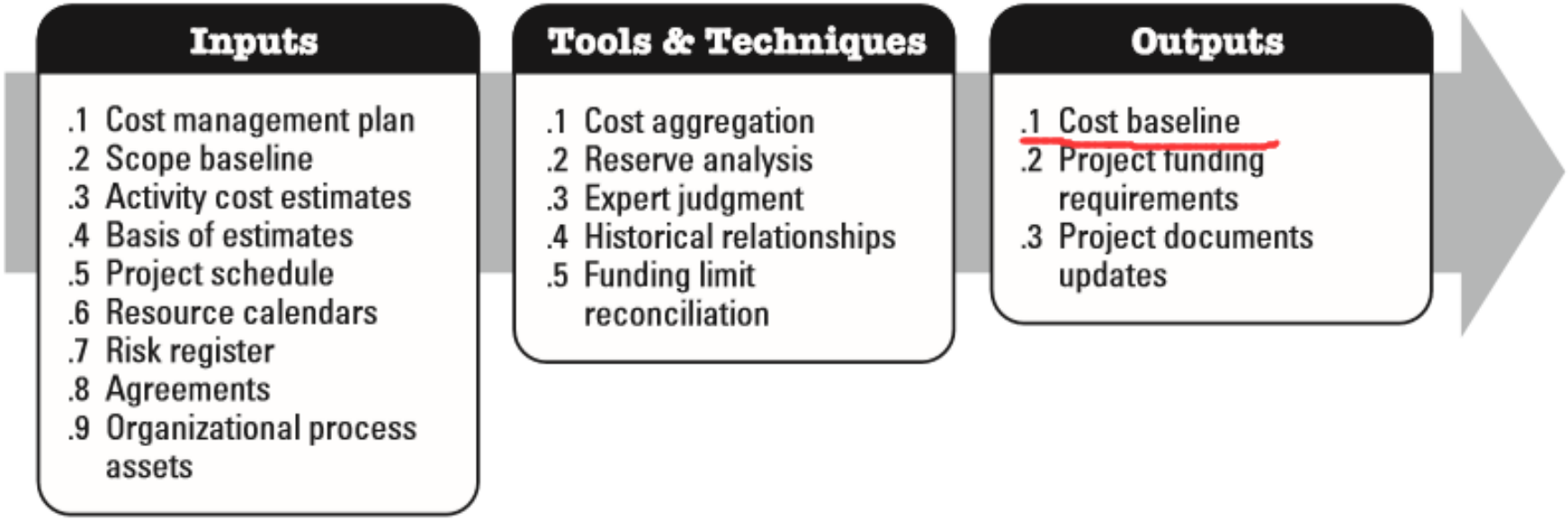
Section 5.3 Determine Budget

Determine Budget

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

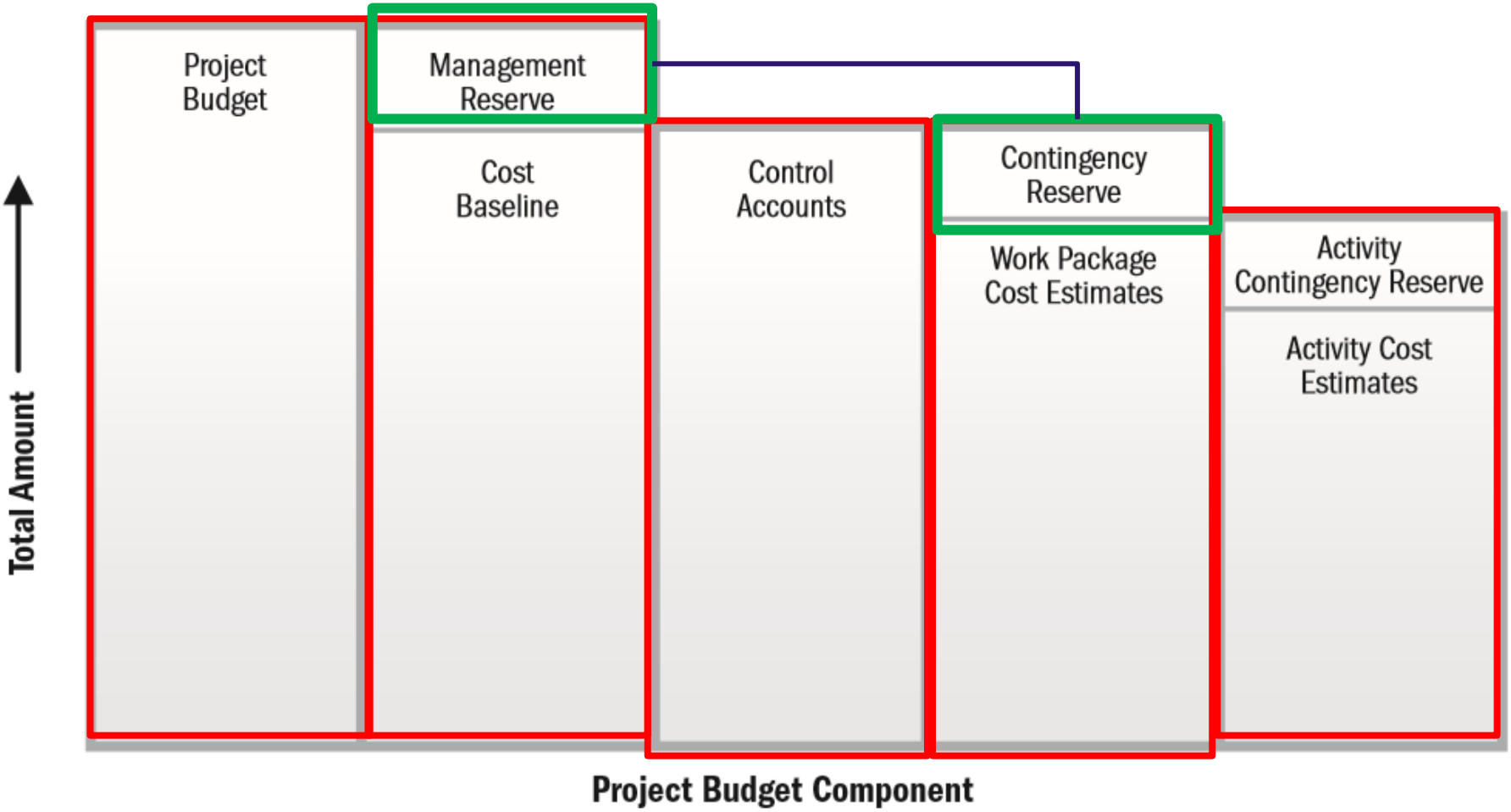
The key benefit of this process is that it **determines the cost baseline** against which project performance can be monitored and controlled.

Section 5.3 Determine Budget



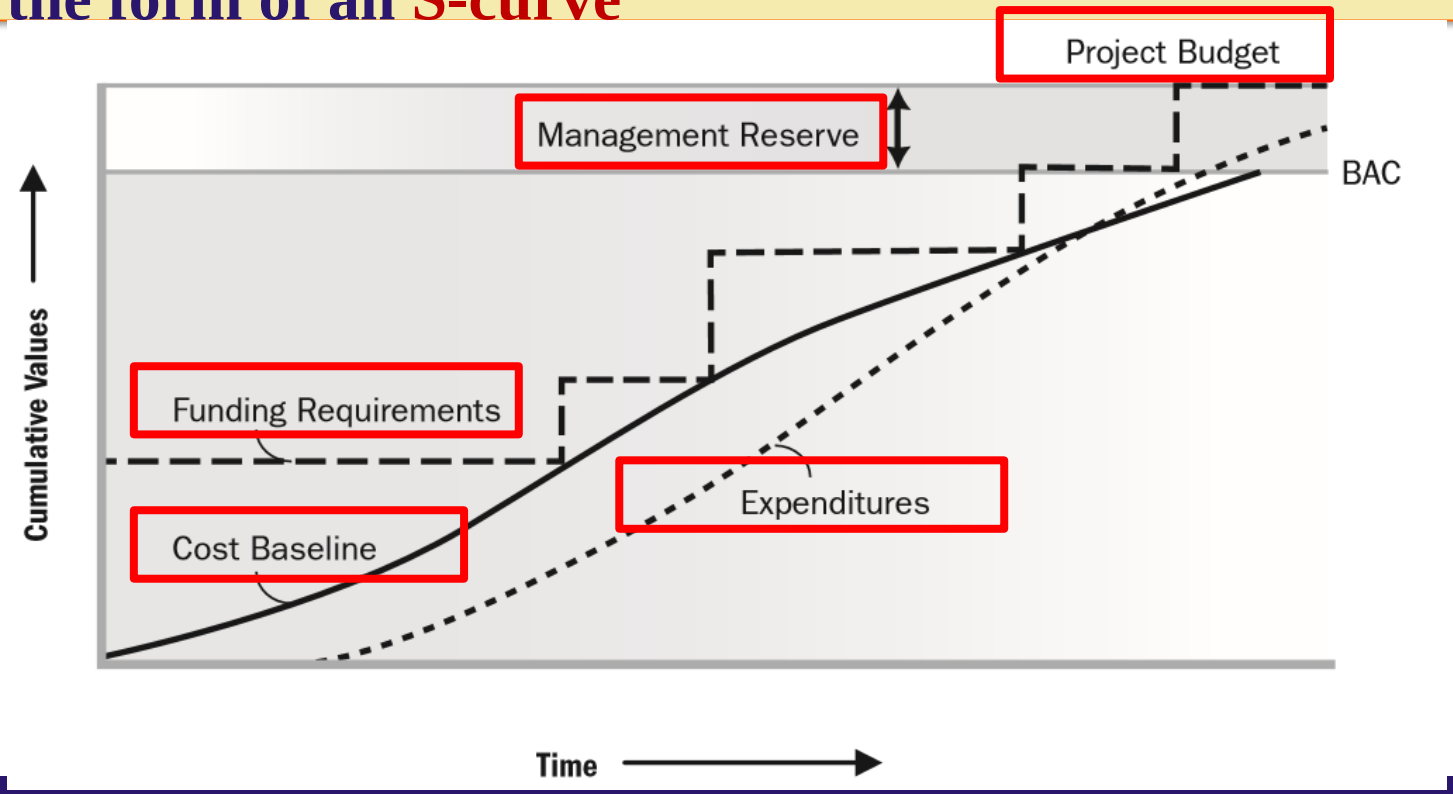
The cost baseline is the approved version of the time-phased project budget, excluding any management reserves, which can only be changed through formal change control procedures and is used as a basis for comparison to actual results.

Section 5.3 Determine Budget



Section 5.3 Determine Budget

Since the cost estimates that make up the cost baseline are directly tied to the schedule activities, this enables a time-phased view of the cost baseline, which is typically displayed in the form of an S-curve

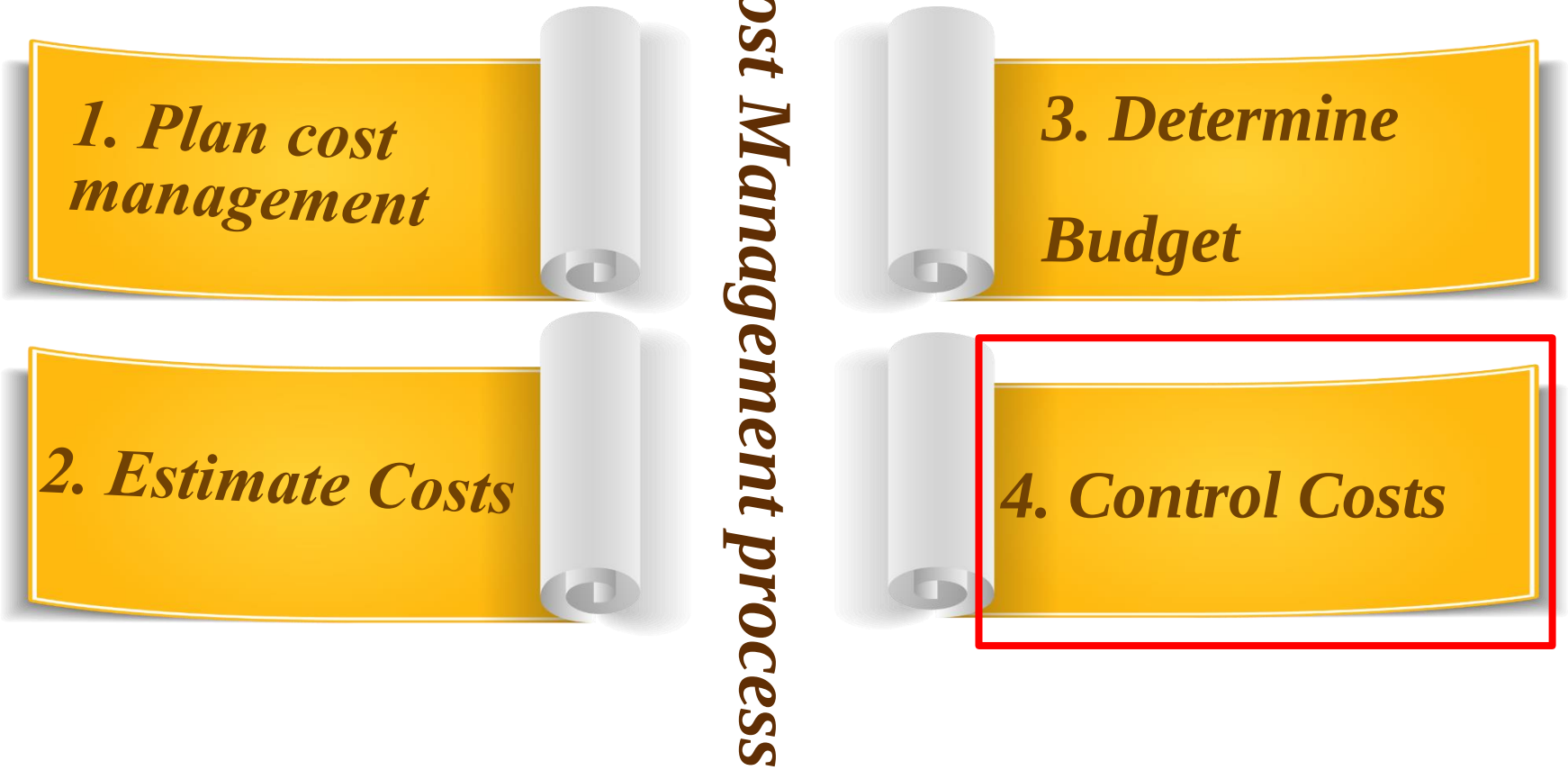


Summary

- **Scope management----plan, baseline**
- **Time management----plan, baseline**
- **Cost management---plan, baseline**

- **Assignment: Project management plan**
  - **Scope baseline:**
    - scope statement, WBS, WBS dictionary
  - **Schedule baseline**
    - Schedule model: Bar charts, Milestone charts, Project schedule network diagrams
  - **Cost baseline: S-curve**

Cost Management Overview



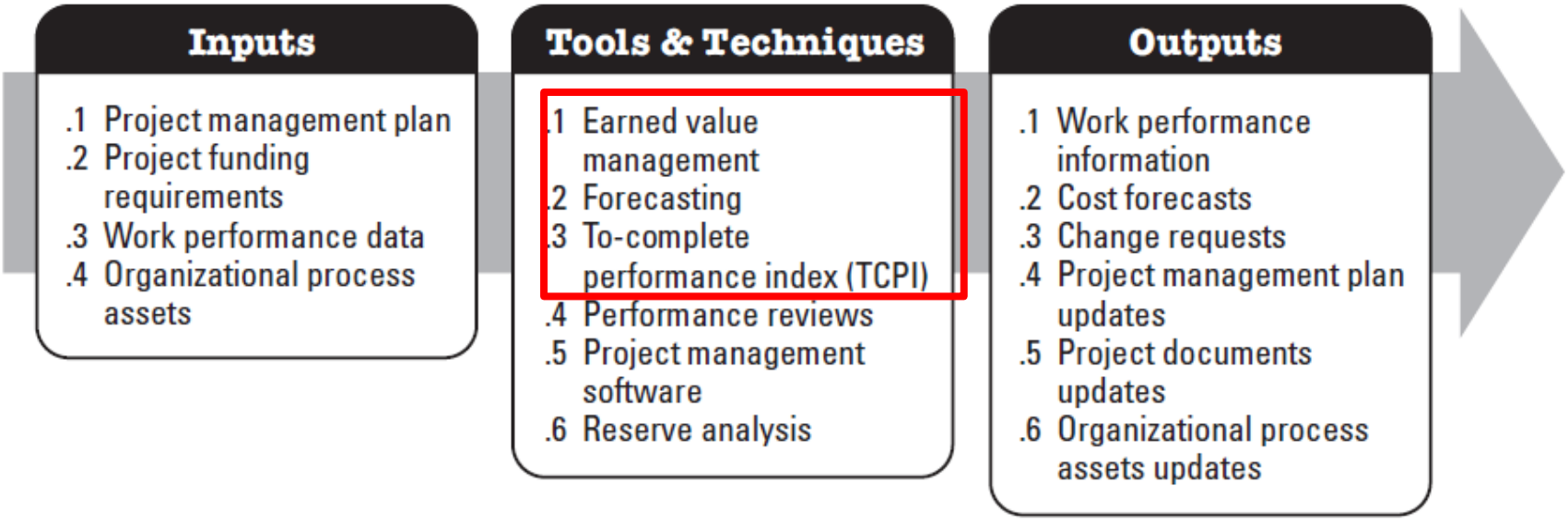
Section 5.4 Control Costs

Control Costs

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

The key benefit of this process is that it **provides the means to recognize variance from the plan** in order to take corrective action and minimize risk.

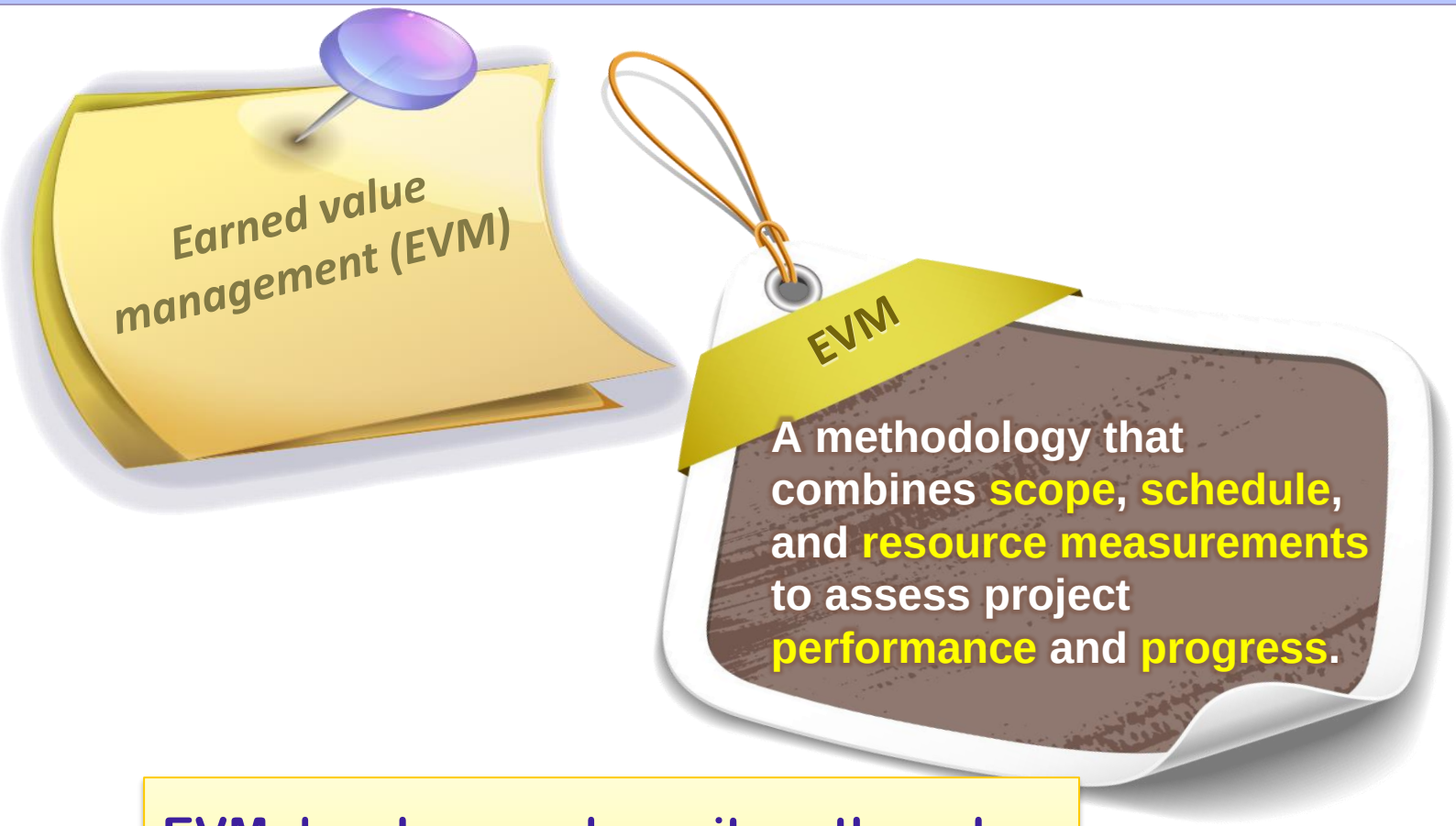
Section 5.4 Control Costs



Section 5.4 Control Costs

1. Earned Value Management （EVM）
2. Forecasting
3. To-Complete Performance Index (TCPI)
4. Performance Reviews
5. Project Management Software
6. Reserve Analysis

Section 5.4 Control Costs



EVM develops and monitors three key dimensions for each work package and control account

Section 5.4 Control Costs

The total of the PV is sometimes referred to as the performance measurement baseline (PMB)

PV

Planned value is the authorized budget assigned to scheduled work.

The total planned value for the project is also known as budget at completion (BAC)

EV

Earned value is a measure of work performed expressed in terms of the budget authorized for that work

AC

Actual cost is the realized cost incurred for the work performed on an activity during a specific time period.

EV being measured needs to be related to the PMV
EV is often used to calculate the percent complete of a project.

AC needs to correspond in definition to what was budgeted in the PV and measured in the EV

How to calculate PV and EV

1. Write down your **BAC** (Budget at completion)

2. Multiply that by your **planned % complete**

$$PV = BAC \times \text{planned \% complete}$$

3. Multiply that by your **actual % complete**

$$EV = BAC \times \text{actual \% complete}$$

Section 5.4 Control Costs

Variances from the approved baseline will also be monitored

SV

Schedule variance is a measure of schedule performance expressed as the difference between EV and PV

SV=EV-PV

A useful metric in that it indicate when a project is falling behind (sv<0) or is ahead of (sv>0) its baseline schedule

project is completed SV=0

CV

Cost variance is the amount of budget deficit or surplus at a given point in time, expressed as the difference between EV minus the AC

CV=EV-AC

CV is particularly critical because it indicates the relationship of physical performance to the costs spent.

CV<0 over budget

Section 5.4 Control Costs

PV = 预算单价 * 预算工程量

EV = 预算单价 * 实际工程量

AC= 实际单价 * 实际工程量

CV= EV- AC
=预算单价 * 实际工程量
- 实际单价 * 实际工程量

SV= EV- PV
=预算单价 * 实际工程量
- 预算单价 * 预算工程量

PV = BAC* planned % complete

EV = BAC* Actual % complete

Section 5.4 Control Costs

The SV and CV values can be converted to efficiency indicators to reflect the cost and schedule performance of any project for comparison against all other projects or within a portfolio of projects.

SPI

Schedule performance index is a measure of schedule efficiency expressed as the ratio of EV to PV

SPI=EV/PV

SPI<1.0 indicates less work was completed than was planned.
SPI>1.0 more work was completed than was planned

CPI

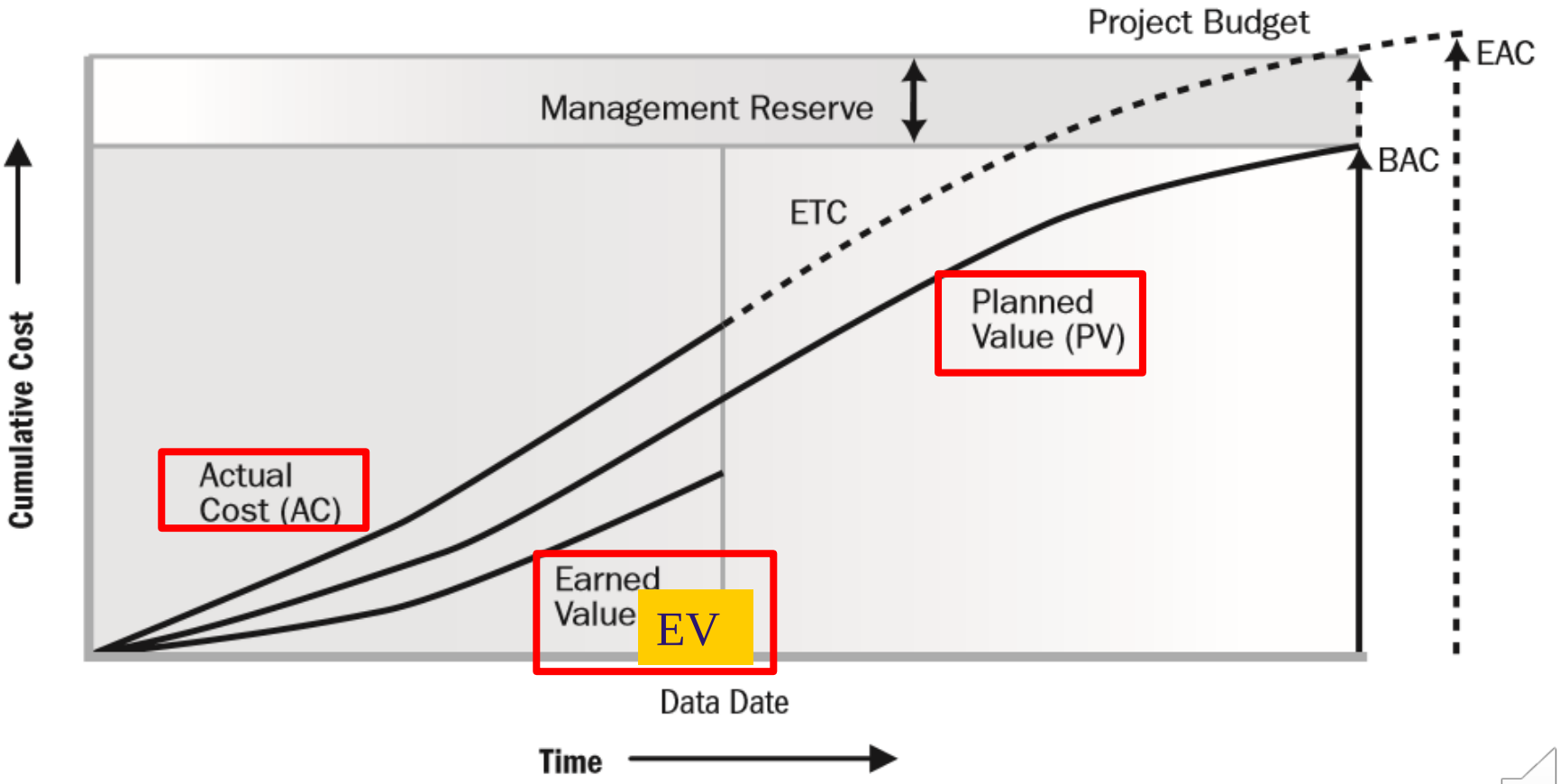
Cost performance index is a measure of the cost efficiency of budgeted resources, expressed as a ratio of EV to AC

CPI=EV/AC

CPI<1.0 indicates a cost overrun for work completed;
CPI>1.0 indicates a cost underrun of performance to date.

Section 5.4 Control Costs

Use S-curves to display EV data for a project that is performing over budget and behind the schedule



Test

Your project has a total budget of $300,000. You check your records and find that you've spent $175,000 so far. The team has completed 40% of the project work, but when you check the schedule it says that they should have completed 50% of the work. Calculating the following:

BAC= $_____

AC = $_____

PV = $_____ × ___ % = $_____

EV = **$**_____ × ___ **%** = **$**_____

SV = **$**_____ − **$**_____ = **$**_____

CV = **$**_____ − **$**_____ = **$**_____

$$SPI = \frac{\$}{\$} = \_\_\_\_\_$$

$$CPI = \frac{\$}{\$} = \_\_\_\_\_$$

Test

Your project has a total budget of $300,000. You check your records and find that you've spent $175,000 so far. The team has completed 40% of the project work, but when you check the schedule it says that they should have completed 50% of the work. Calculating the following:

BAC= $ 300000

AC = $ 175000

PV = $ BAC × 50 % = $ 150000

EV = $ BAC × 40 % = $ 120000

SV = $ EV − $ PV = $ -30000

CV = $ EV − $ AC = $ -55000

$$SPI = \frac{\$\ EV}{\$\ PV} = 0.8$$

$$CPI = \frac{\$\ EV}{\$\ AC} = 0.68$$

Cost overrun and schedule falling behind

Section 5.4 Control Costs

As the project progresses, the project team may develop a forecast for the estimate at completion (EAC) that may differ from the BAC based on the project performance

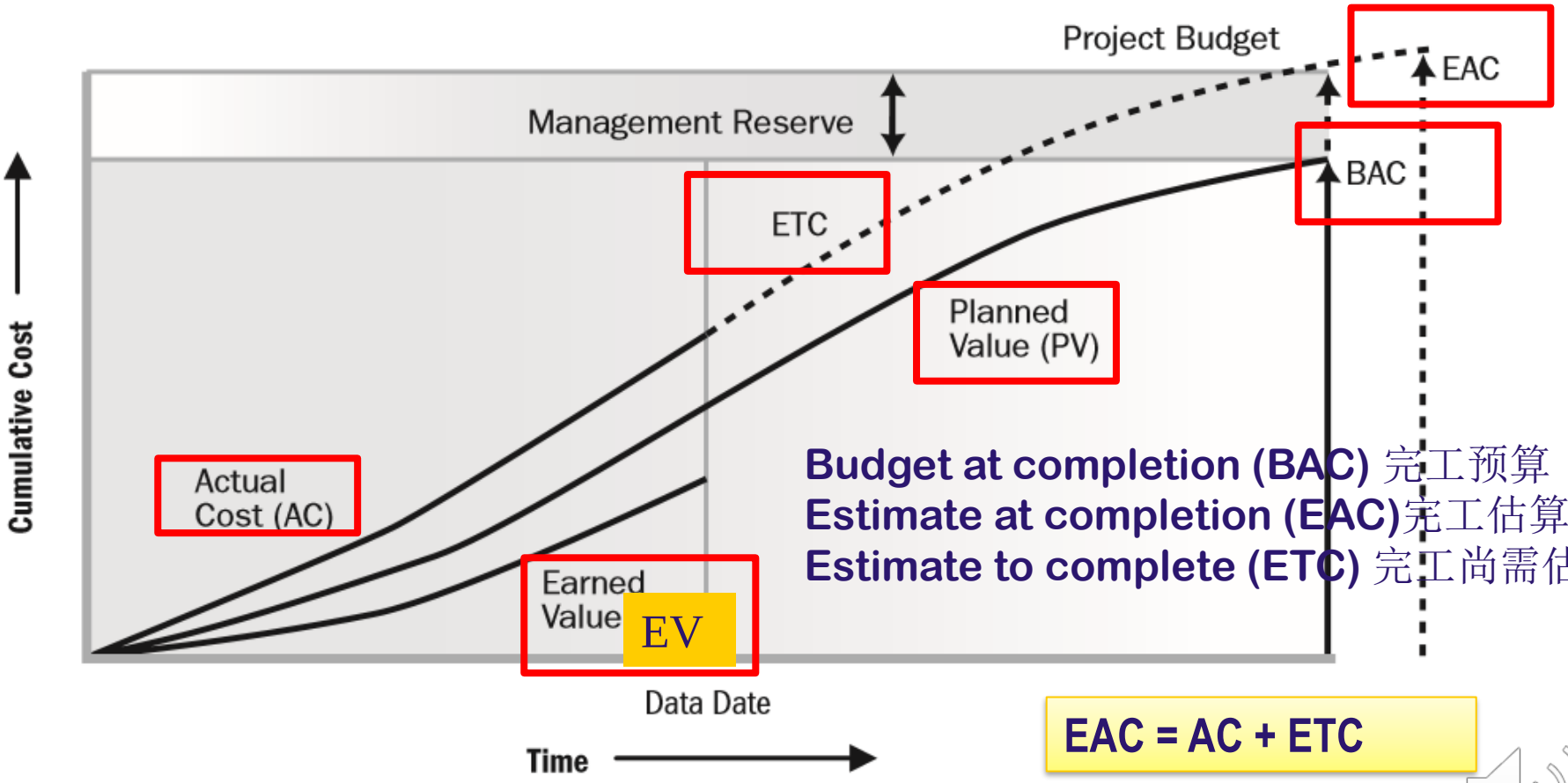
Budget at completion (BAC) 完工预算
Estimate at completion (EAC)完工估算
Estimate to complete (ETC) 完工尚需估算

EACs are typically based on the actual costs incurred for work completed, plus an estimate to complete (ETC) the remaining work

EAC = AC + ETC

Section 5.4 Control Costs

Use S-curves to display EV data for a project that is performing over budget and behind the schedule



Budget at completion (BAC) 完工预算
Estimate at completion (EAC)完工估算
Estimate to complete (ETC) 完工尚需估算

EAC = AC + ETC

Section 5.4 Control Costs

EAC = AC + Bottom-Up ETC

Three commonly used methods are as follows:

Budget at completion (BAC) 完工预算
Estimate at completion (EAC)完工估算
Estimate to complete (ETC) 完工尚需估算

悬崖勒马

EAC forecast for ETC work performed at the budgeted rate

EAC = AC + (BAC – EV)

执迷不悟

EAC forecast for ETC work performed at the present CPI

EAC = BAC/CPI

痛改前非

EAC forecast for ETC work considering both SPI and CPI factors

EAC = AC + [(BAC-EV)/(CPI×SPI)]

Variance at completion (VAC = BAC – EAC)

Test

It's nine months into your project. The total budget for your project is $4,200,000. You've spent $1,650,000 so far, and you've got a CPI of 0.875. Use the Earned Value Technique formulas from forecasting to figure out where things stand.

$$EAC = \frac{\$\ 4200000}{\$\ 0.875} = 4800000$$

EAC = BAC/CPI

ETC = $4800000 - $1650000 = $3150000

EAC = AC + ETC

VAC = $4200000 - $4800000 = $-600000

VAC = BAC – EAC

Will the project be over or under budget when it's complete?

-600000 over budget

Section 5.4 Control Costs

TCPI is 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.

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

If it becomes obvious that the BAC is no longer viable, the project manager should consider the forecasted EAC. Once approved, the EAC may replace the BAC in the TCPI calculation.

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

EV calculation summary

Section 5.4 Control Costs

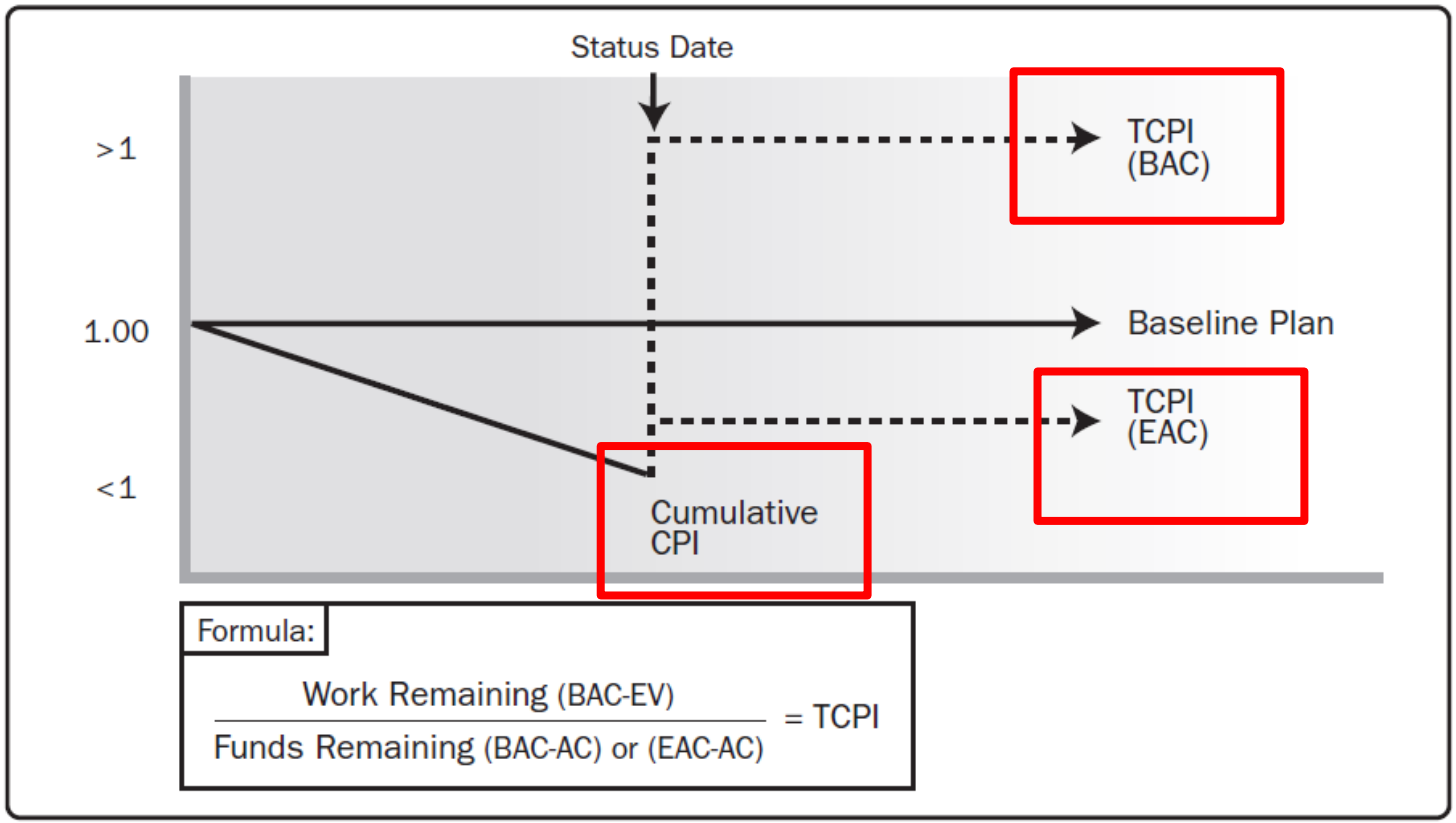


Figure 7-13. To-Complete Performance Index (TCPI)

Section 5.4 Control Costs

- PMBOK p224

Earned Value Analysis

Abbreviation	Name	Lexicon Definition	How Used	Equation	Interpretation of Result
PV	Planned Value	The authorized budget assigned to scheduled work.	The value of the work planned to be completed to a point in time, usually the data date, or project completion.		
EV	Earned Value	The measure of work performed expressed in terms of the budget authorized for that work.	The planned value of all the work completed (earned) to a point in time, usually the data date, without reference to actual costs.	EV = sum of the planned value of completed work	
AC	Actual Cost	The realized cost incurred for the work performed on an activity during a specific time period.	The actual cost of all the work completed to a point in time, usually the data date.		
BAC	Budget at Completion	The sum of all budgets established for the work to be performed.	The value of total planned work, the project cost baseline.		
CV	Cost Variance	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.	The difference between the value of work completed to a point in time, usually the data date, and the actual costs to the same point in time.	CV = EV - AC	Positive = Under planned cost Neutral = On planned cost Negative = Over planned cost
SV	Schedule Variance	The amount by which the project is ahead or behind the planned delivery date, at a given point in time, expressed as the difference between the earned value and the planned value.	The difference between the work completed to a point in time, usually the data date, and the work planned to be completed to the same point in time.	SV = EV - PV	Positive = Ahead of Schedule Neutral = On schedule Negative = Behind Schedule
VAC	Variance at Completion	A projection of the amount of budget deficit or surplus, expressed as the difference between the budget at completion and the estimate at completion.	The estimated difference in cost at the completion of the project.	VAC = BAC - EAC	Positive = Under planned cost Neutral = On planned cost Negative = Over planned cost
CPI	Cost Performance Index	A measure of the cost efficiency of budgeted resources expressed as the ratio of earned value to actual cost.	A CPI of 1.0 means the project is exactly on budget, that the work actually done so far is exactly the same as the cost so far. Other values show the percentage of how much costs are over or under the budgeted amount for work accomplished.	CPI = EV/AC	Greater than 1.0 = Under planned cost Exactly 1.0 = On planned cost Less than 1.0 = Over planned cost
SPI	Schedule Performance Index	A measure of schedule efficiency expressed as the ratio of earned value to planned value.	An SPI of 1.0 means that the project is exactly on schedule, that the work actually done so far is exactly the same as the work planned to be done so far. Other values show the percentage of how much costs are over or under the budgeted amount for work planned.	SPI = EV/PV	Greater than 1.0 = Ahead of schedule Exactly 1.0 = On schedule Less than 1.0 = Behind schedule
EAC	Estimate At Completion	The expected total cost of completing all work expressed as the sum of the actual cost to date and the estimate to complete.	If the CPI is expected to be the same for the remainder of the project, EAC can be calculated using: If future work will be accomplished at the planned rate, use: If the initial plan is no longer valid, use: If both the CPI and SPI influence the remaining work, use:	EAC = BAC/CPI EAC = AC + BAC - EV EAC = AC + Bottom-up ETC EAC = AC + [(BAC - EV)/(CPI x SPI)]	
ETC	Estimate to Complete	The expected cost to finish all the remaining project work.	Assuming work is proceeding on plan, the cost of completing the remaining authorized work can be calculated using: Reestimate the remaining work from the bottom up.	ETC = EAC - AC ETC = Reestimate	
TCPI	To Complete Performance Index	A measure of the cost performance that must 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 budget available.	The efficiency that must be maintained in order to complete on plan. The efficiency that must be maintained in order to complete the current EAC.	TCPI = (BAC - EV)/(BAC - AC) TCPI = (BAC - EV)/(EAC - AC)	Greater than 1.0 = Harder to complete Exactly 1.0 = Same to complete Less than 1.0 = Easier to complete Greater than 1.0 = Harder to complete Exactly 1.0 = Same to complete Less than 1.0 = Easier to complete

Earned Value Calculations Summary Table

Chapter 5 Summary

A Understand the concept of Cost Management and Plan cost management

B Mastering the estimation method used for estimating cost and the S-curve

C Mastering the Tools and Techniques used for control costs (EVM, forecasting, TCPI)

Summary

5 process groups

Knowledge Areas	Project Management Process Groups				
	Initiating Process Group	Planning Process Group	Executing Process Group	Monitoring and Controlling Process Group	Closing Process Group
4. Project Integration Management	4.1 Develop Project Charter	4.2 Develop Project Management Plan	4.3 Direct and Manage Project Work	4.4 Monitor and Control Project Work 4.5 Perform Integrated Change Control	4.6 Close Project or Phase
5. Project Scope Management		5.1 Plan Scope Management 5.2 Collect Requirements		5.5 Validate Scope 5.6 Control Scope	
		Activity Durations 6.6 Develop Schedule			
7. Project Cost Management		7.1 Plan Cost Management 7.2 Estimate Costs 7.3 Determine Budget		7.4 Control Costs	
8. Project Quality Management		8.1 Plan Quality Management	8.2 Perform Quality Assurance	8.3 Control Quality	
9. Project Human Resource Management		9.1 Plan Human Resource Management	9.2 Acquire Project Team 9.3 Develop Project Team 9.4 Manage Project Team		
10. Project Communications Management		10.1 Plan Communications Management	10.2 Manage Communications	10.3 Control Communications	
11. Project Risk Management		11.1 Plan Risk Management 11.2 Identify Risks 11.3 Perform Qualitative Risk Analysis 11.4 Perform Quantitative Risk Analysis 11.5 Plan Risk Responses		11.6 Control Risks	
12. Project Procurement Management		12.1 Plan Procurement Management	12.2 Conduct Procurements	12.3 Control Procurements	12.4 Close Procurements
13. Project Stakeholder Management	13.1 Identify Stakeholders	13.2 Plan Stakeholder Management	13.3 Manage Stakeholder Engagement	13.4 Control Stakeholder Engagement	

It guarantees the project can be completed within the approved budget.

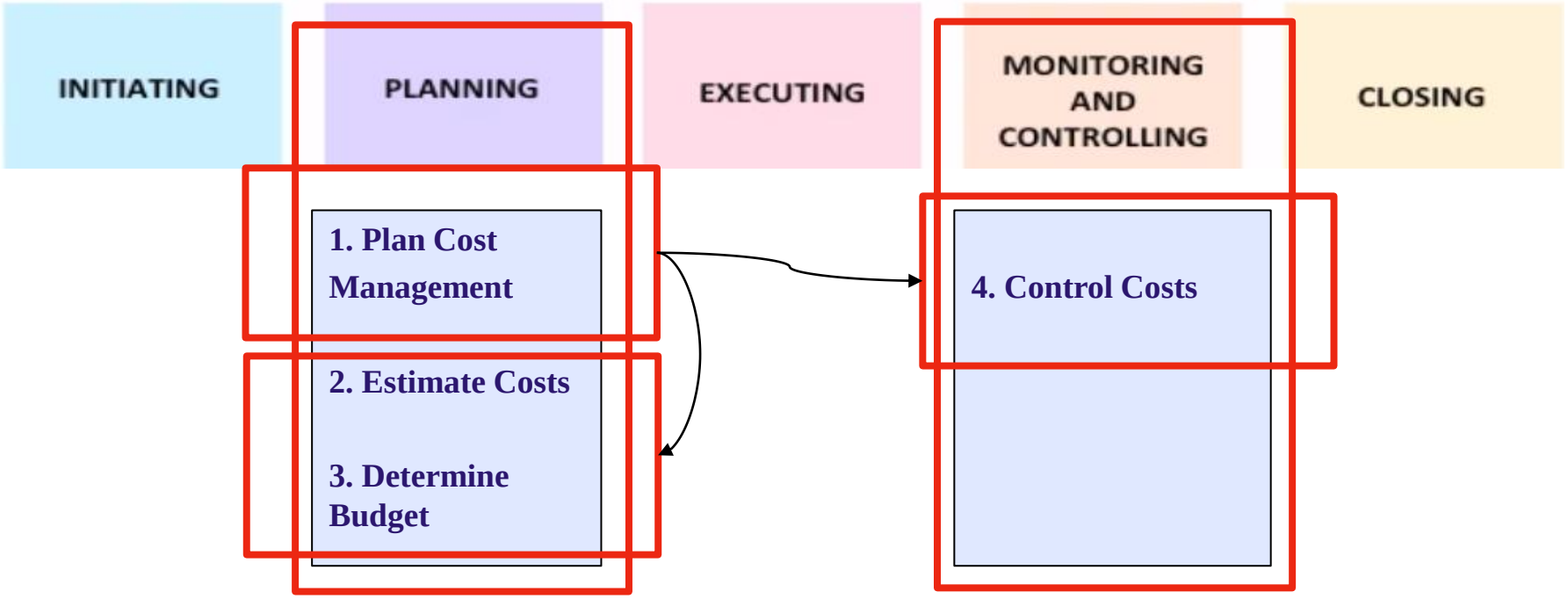
10 knowledge areas

4. Cost Management

1. Plan Cost Management
2. Estimate Costs
3. Determine Budget
4. Control Costs

Summary

5 Process Groups



4 Cost Management processes

Summary

5 Process Groups

It determines the amount of cost required to complete project work.

G

CONTROLLING

CLOSING

1. Plan Cost Management

2. Estimate Costs

3. Determine Budget

4. Control Costs

T&T:

1. Bottom-Up estimating
2. Lines Of Code (LOC)
3. Function point (FP)
4. Expert estimation method

4 Cost Management processes

Summary

5 Process Groups

It determines the cost baseline against which project performance can be monitored and controlled.

G

CONTROLLING

CLOSING

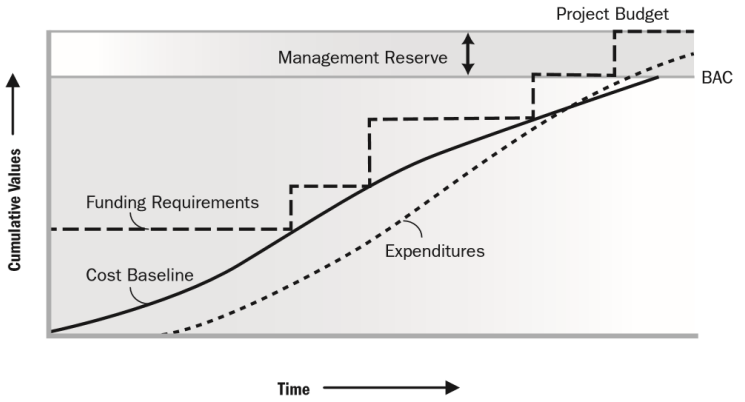
1. Plan Cost Management

2. Estimate Costs

3. Determine Budget

4. Control Costs

Output: Cost baseline



4 Cost Managem

Summary

It provides the means to recognize variance from the plan.

rocess Groups

EXECUTING	MONITORING AND CONTROLLING	CLOSING

4. Control Costs

nage

T&T:

1. Earned Value Management (EVM)
   BAC, PV, EV, AC, SV, CV, SPI, CPI
2. Forecasting: EAC
3. To-Complete Performance Index (TCPI)

Earned Value Analysis

Abbreviation	Name	Lexicon Definition	How Used	Equation	Interpretation of Result
PV	Planned Value	The authorized budget assigned to scheduled work.	The value of the work planned to be completed to a point in time, usually the data date, or project completion.		
EV	Earned Value	The measure of work performed expressed in terms of the budget authorized for that work.	The planned value of all the work completed (earned) to a point in time, usually the data date, without reference to actual costs.	EV = sum of the planned value of completed work	
AC	Actual Cost	The realized cost incurred for the work performed on an activity during a specific time period.	The actual cost of all the work completed to a point in time, usually the data date.		
BAC	Budget at Completion	The sum of all budgets established for the work to be performed.	The value of total planned work, the project cost baseline.		
CV	Cost Variance	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.	The difference between the value of work completed to a point in time, usually the data date, and the actual costs to the same point in time.	CV = EV – AC	Positive = Under planned cost Neutral = On planned cost Negative = Over planned cost
SV	Schedule Variance	The amount by which the project is ahead or behind the planned delivery date, at a given point in time, expressed as the difference between the earned value and the planned value.	The difference between the work completed to a point in time, usually the data date, and the work planned to be completed to the same point in time.	SV = EV – PV	Positive = Ahead of Schedule Neutral = On schedule Negative = Behind Schedule
VAC	Variance at Completion	A projection of the amount of budget deficit or surplus, expressed as the difference between the budget at completion and the estimate at completion.	The estimated difference in cost at the completion of the project.	VAC = BAC – EAC	Positive = Under planned cost Neutral = On planned cost Negative = Over planned cost
CPI	Cost Performance Index	A measure of the cost efficiency of budgeted resources expressed as the ratio of earned value to actual cost.	A CPI of 1.0 means the project is exactly on budget, that the work actually done so far is exactly the same as the cost so far. Other values show the percentage of how much costs are over or under the budgeted amount for work accomplished.	CPI = EV/AC	Greater than 1.0 = Under planned cost Exactly 1.0 = On planned cost Less than 1.0 = Over planned cost
SPI	Schedule Performance Index	A measure of schedule efficiency expressed as the ratio of earned value to planned value.	An SPI of 1.0 means that the project is exactly on schedule, that the work actually done so far is exactly the same as the work planned to be done so far. Other values show the percentage of how much costs are over or under the budgeted amount for work planned.	SPI = EV/PV	Greater than 1.0 = Ahead of schedule Exactly 1.0 = On schedule Less than 1.0 = Behind schedule
EAC	Estimate At Completion	The expected total cost of completing all work expressed as the sum of the actual cost to date and the estimate to complete.	If the CPI is expected to be the same for the remainder of the project, EAC can be calculated using: If future work will be accomplished at the planned rate, use: If the initial plan is no longer valid, use: If both the CPI and SPI influence the remaining work, use:	EAC = BAC/CPI EAC = AC + BAC – EV EAC = AC + Bottom-up ETC EAC = AC + [(BAC – EV)/(CPI x SPI)]	
ETC	Estimate to Complete	The expected cost to finish all the remaining project work.	Assuming work is proceeding on plan, the cost of completing the remaining authorized work can be calculated using: Reestimate the remaining work from the bottom up.	ETC = EAC – AC ETC = Reestimate	
TCPI	To Complete Performance Index	A measure of the cost performance that must 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 budget available.	The efficiency that must be maintained in order to complete on plan. The efficiency that must be maintained in order to complete the current EAC.	TCPI = (BAC – EV)/(BAC – AC) TCPI = (BAC – EV)/(EAC – AC)	Greater than 1.0 = Harder to complete Exactly 1.0 = Same to complete Less than 1.0 = Easier to complete Greater than 1.0 = Harder to complete Exactly 1.0 = Same to complete Less than 1.0 = Easier to complete