PROJECT MANAGEMENT

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PMP® Certification Training

Lesson 09: Project Cost Management

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PROJECT MANAGEMENT

Objectives

- Define Project Cost Management
- Differentiate between cost estimation and cost budgeting
- Explain control accounts
- Describe the Project Cost Management processes
- Apply earned value management technique to track project performance
- Identify key terminologies used in Project Cost Management

Project Cost Management

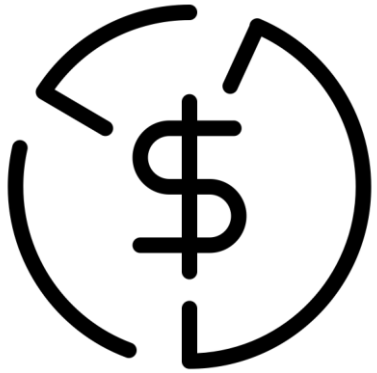
The definition of *Project Cost Management is as follows:

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

*Definition 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, Page 231

Cost Management Plan

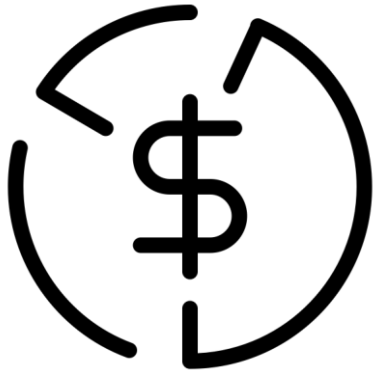
- The Cost Management Plan is concerned with the costs of the resources needed to complete project activities.
- It provides details on how to plan, manage, and control the project cost in relation to the cost baseline and manage the cost variances.
- The project cost management plan is a subsidiary of the project management plan.
- The techniques involved in estimating the cost of each project activity is similar to the ones used in estimating project time.
- Expert judgment, analogous estimating, bottom-up estimating, and reserve analysis are some of the techniques used in cost management.



Key Concepts

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

- Another aspect involves recognizing that different stakeholders measure project costs in different ways and at different times.



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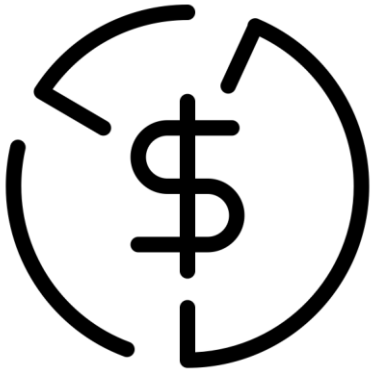
Trends and Emerging Practices in Project Cost Management

- Within the practice of project cost management, trends include expansion of earned value management (EVM) to include the concept of earned schedule (ES).
- ES theory replaces the schedule variance measures used in traditional EVM (Earned value - Planned value) with ES and Actual Time (AT).
- Schedule Variance (SV) is ES-AT.
- Schedule performance index (SPI) using earned schedule metrics is ES/AT.



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Tailoring Considerations

Knowledge Management

Does the organization have a formal knowledge management and financial database repository that a project manager is required to use and that is readily accessible?

Estimating and Budgeting

Does the organization have existing formal or informal cost estimating and budgeting-related policies, procedures, and guidelines?

Earned Value Management

Does the organization use EVM in managing projects?

Use of Agile Approach

Does the organization use agile methodologies in managing projects? How does this impact cost estimating?

Governance

Does the organization have formal or informal audit and governance policies, procedures, and guidelines?

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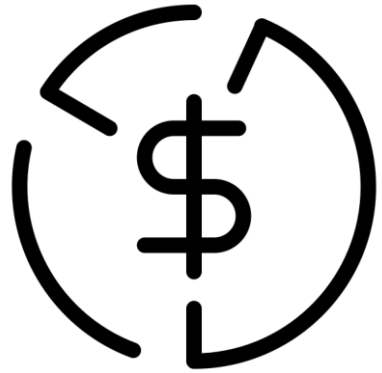
Considerations for Agile/Adaptive Environments

- Projects with high degrees of uncertainty or those where the scope is not yet fully defined may not benefit from detailed cost calculations due to frequent changes.
- Lightweight estimation methods can be used to generate a fast, high-level forecast of project labor costs, which can then be easily adjusted as changes arise.
- In cases where high-variability projects are also subject to strict budgets, the scope and schedule are more often adjusted to stay within cost constraints.



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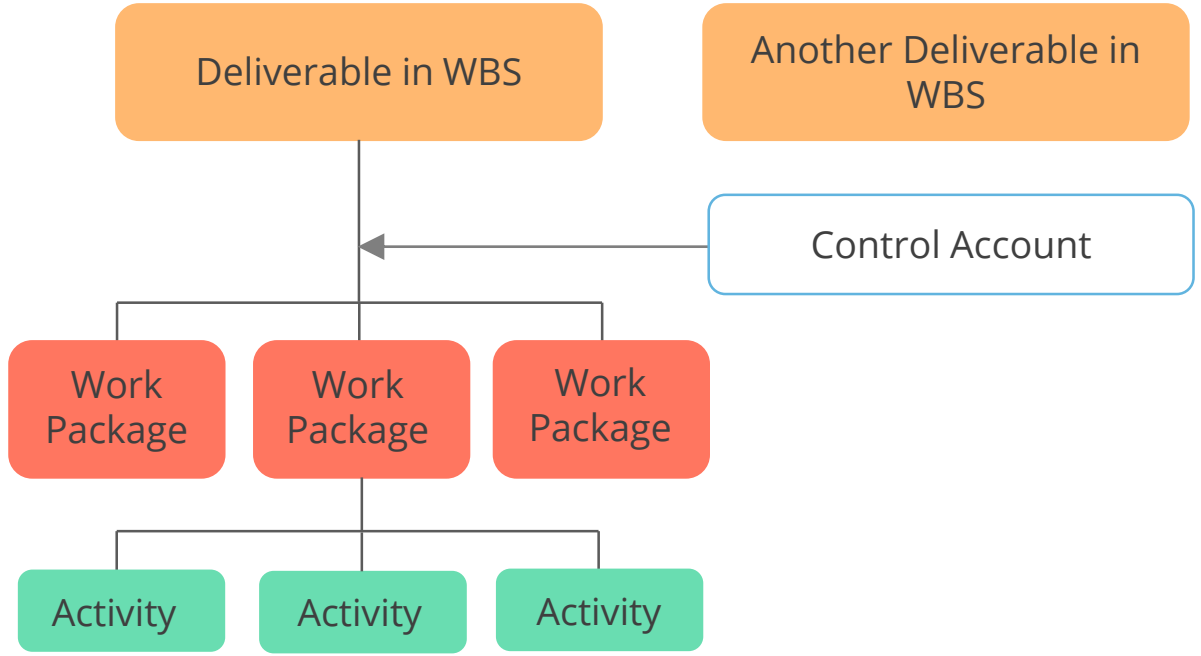
Control Account

In larger projects, costs are managed at a higher level rather than at an individual activity level. Under control account technique, related activities are grouped and their costs are managed as one unit.

The scope of a project is decomposed through a Work Breakdown Structure (WBS). The lowest level deliverable in the WBS is called a work package.



Project Cost Management Processes

Knowledge Areas		Project Integration Management	Project Scope Management	Project Schedule Management	Project Cost Management	Project Quality Management	Project Resource Management	Project Communications Management	Project Risk Management	Project Procurement Management	Project Stakeholder Management
Project Management Process Groups	**Initiating**	4.1 Develop Project Charter									13.1 Identify Stakeholders
	Planning	4.2 Develop Project Management Plan	5.1 Plan Scope 5.2 Collect Requirements 5.3 Define Scope 5.4 Create WBS	6.1 Plan Schedule Management 6.2 Define Activities 6.3 Sequence Activities 6.4 Estimate Activity Durations 6.5 Develop Schedule	7.1 Plan Cost Management 7.2 Estimate Costs 7.3 Determine Budget	8.1 Plan Quality Management	9.1 Plan Resource Management 9.2 Estimate Activity Resources	10.1 Plan Communications 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 Response	12.1 Plan Procurement Management	13.2 Plan Stakeholder Engagement
	Executing	4.3 Direct and Manage Project Work 4.4 Manage Project Knowledge				8.2 Manage Quality	9.3 Acquire Resources 9.4 Develop Team 9.5 Manage Team	10.2 Manage Communications	11.6 Implement Risk Response	12.2 Conduct Procurements	13.3 Manage Stakeholder Engagement
	Monitoring and Controlling	4.5 Monitor and Control Project Work 4.6 Perform Integrated Change Control	5.5 Validate Scope 5.6 Control Scope	6.6 Control Schedulel	7.4 Control Costs	8.3 Control Quality	9.6 Control Resource	10.3 Monitor Communications	11.7 Monitor Risks	12.3 Control Procurements	13.4 Monitor Stakeholder Engagements
	Closing	4.7 Close Poject or Phase									

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Plan Cost Management

"Plan Cost Management is the process of defining how the project costs will be estimated, budgeted, managed, monitored, and controlled." It is part of the Planning Process Group.

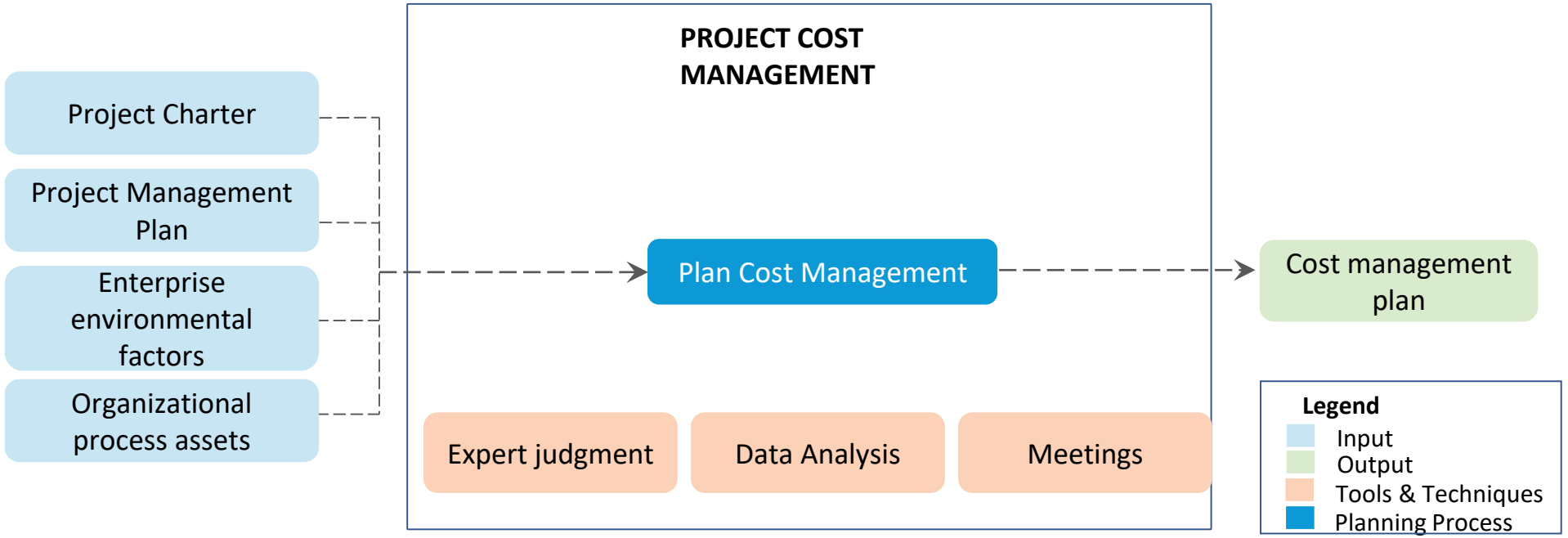

Figure 7-2. Plan Cost Management: Inputs, Tools & Techniques, and Outputs

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Estimate Costs

"Estimate Costs is the process of developing an approximation of the cost of resources needed to complete project work." It belongs to the Planning Process Group.

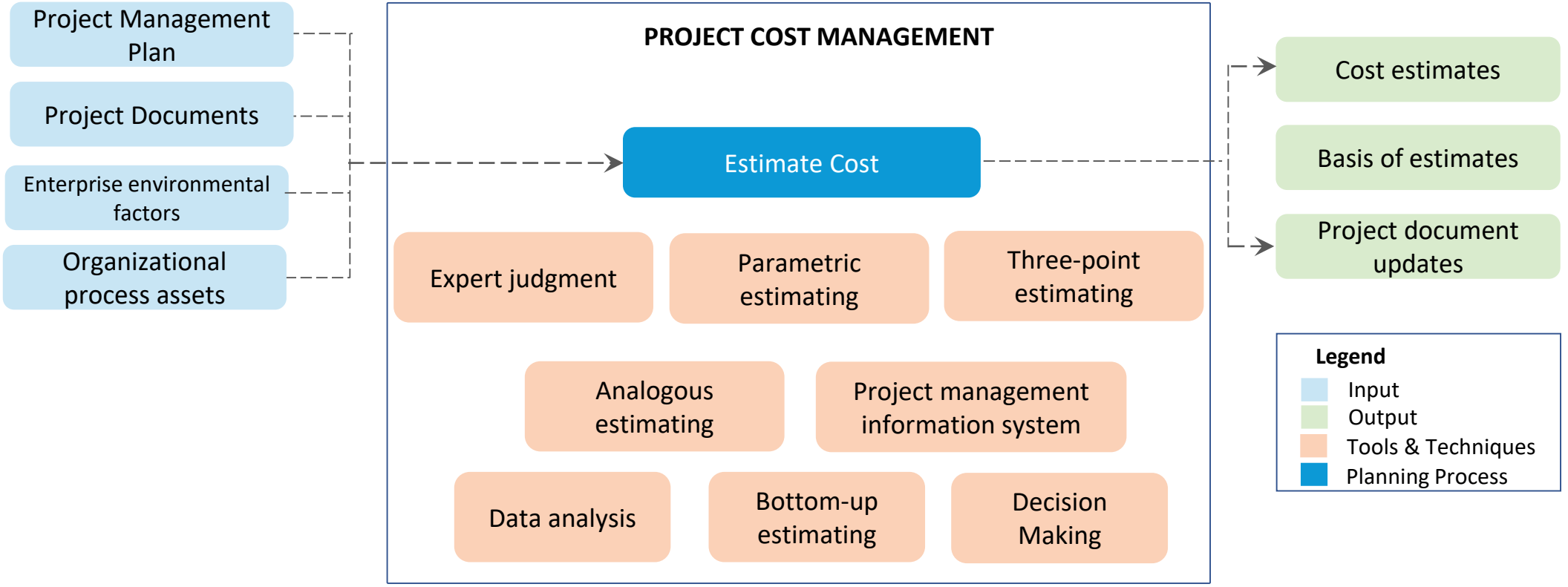

Figure 7-4. Estimate Costs: Inputs, Tools & Techniques, and Outputs

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Determine Budget

"Determine Budget is the process of aggregating the estimated costs of individual activities or work packages to establish an authorized cost baseline." It is part of the Planning Process Group.
The cost baseline includes all authorized budgets but excludes management reserves.

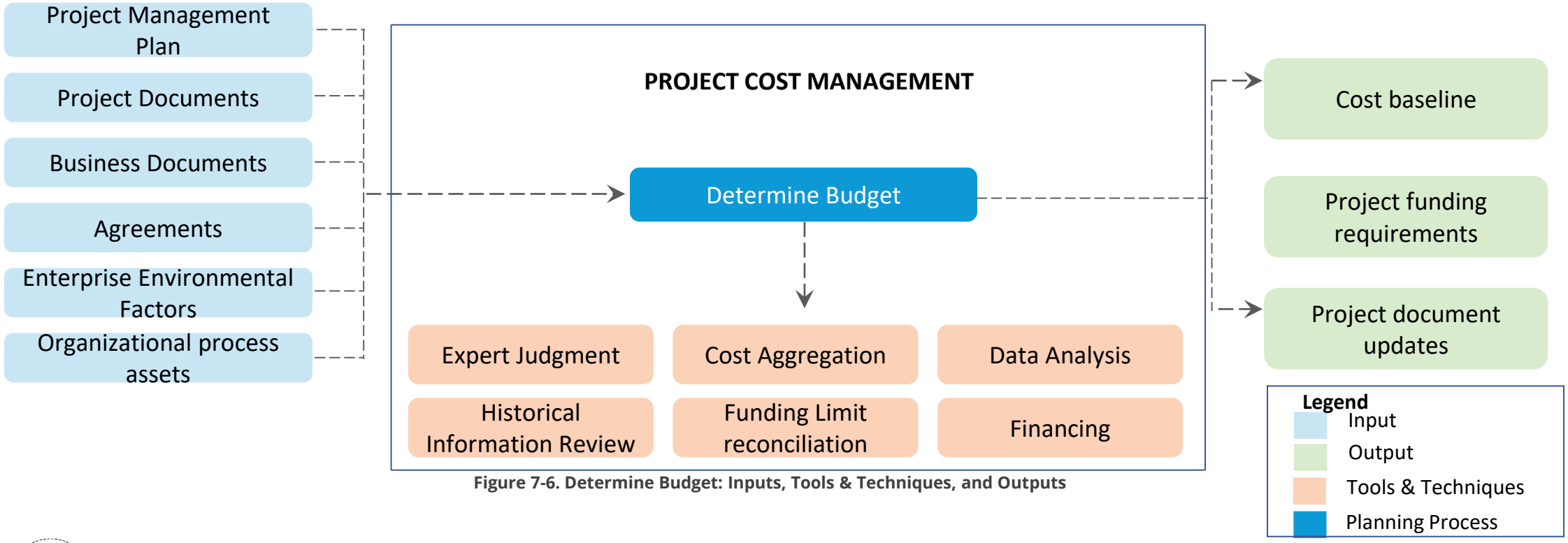

Figure 7-6. Determine Budget: Inputs, Tools & Techniques, and Outputs

An understanding of how to determine a project budget is important for the PMP exam.

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Control Costs

"Control Costs is the process of monitoring the status of the project to update the project costs and managing changes to the cost baseline." It belongs to the Monitoring and Controlling Process Group.

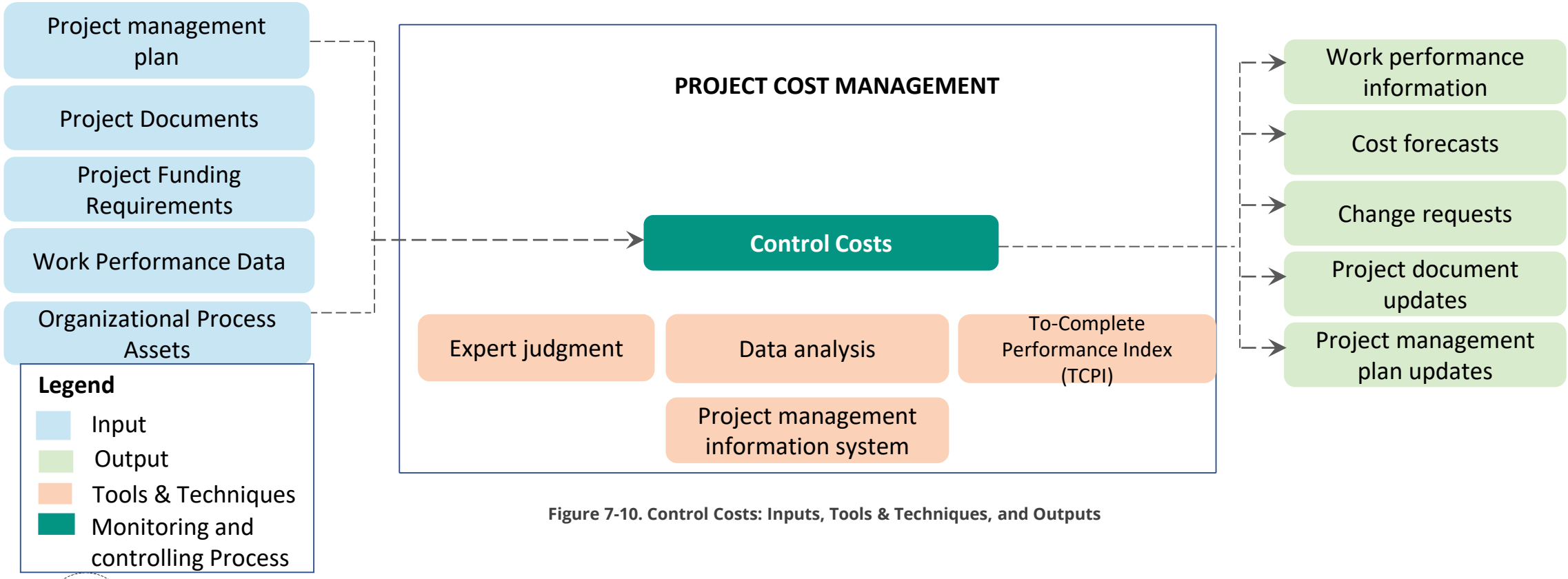

Figure 7-10. Control Costs: Inputs, Tools & Techniques, and Outputs

Business scenario based questions on project cost control can be expected in the exam.

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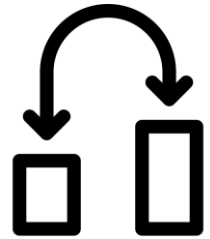
Difference Between Planned Value and Earned Value

- Earned value is the total of budget allocated to each of the activities that have been completed at that point of time.

- We can compare the earned value (budget allocated for a specific period of time) to the planned value (the total of all work planned) to determine if the project is on track.



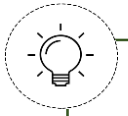
- If the planned value of a project is $340, then the total of all the work packages planned for the project is $340.

Earned Value Management

Earned Value Management (EVM) is a method to measure project performance against the project baselines. It results from an earned value analysis and indicates potential deviation of the project from the cost and/or schedule baselines.

The various terms used in earned value are as follows:

Acronym	Term	Explanation
PV	Planned Value	Authorized budget assigned to scheduled work
EV	Earned Value	Work performed in terms of budget authorized for that work
AC	Actual Cost	Actual cost incurred in work performed
BAC	Budget at Completion	Budgeted amount for the total work
EAC	Estimate at Completion	Expected total cost for the project
ETC	Estimate to Complete	Expected cost to finish all the remaining project work
VAC	Variance at Completion	Projected budget surplus or deficit at the end of the project



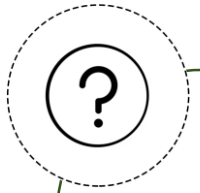
Questions based on earned value management can be expected in the exam.

Earned Value Formulae

The following table gives the formulae used in EVM and their interpretations:

Term	Formula	Interpretation
Cost Variance (CV)	EV – AC	Negative is over budget; positive is under budget
Schedule Variance (SV)	EV – PV	Negative is behind schedule; positive is ahead of schedule
Cost Performance Index (CPI)	EV / AC	Worth of work got out of every $1 spent
Schedule Performance Index (SPI)	EV / PV	Percentage progress made against the planned rate
Estimate at Completion (EAC)	BAC / CPI AC + (BAC – EV) AC + [(BAC – EV)/(CPI * SPI)] AC + ETC	Work performed at current CPI Rest of the project at budgeted rate Factoring in both CPI and SPI Reevaluated based on forecast value for ETC
Estimate to complete (ETC)	EAC – AC	Amount that the project would cost from the current date to the end of the project
Variance at Completion	BAC – EAC	Amount the project would exceed or fall short of the planned budget by the end of the project (over budget or under budget)
To-Complete Performance Index (TCPI)	(BAC – EV)/(BAC – AC) (BAC – EV)/(EAC – AC)	For managing to budget For managing to a specified value (EAC)

Business Scenario: Problem Statement



- Cynthia is a subject matter expert and Director of the Store Renovation Department. Because of her expertise and experience in managing store remodels for the corporation, she and her team are the 'go to' people for many project managers.
- Donnell is the Project Manager for one of the stores in the southeast region. Because of the age of the store, it has been classified as a Tier 1 Remodel, meaning it requires more work and a higher budget allocation.
- Donnell has a budget of $850K to complete the entire schedule that has been defined for the project.
- At the 30% mark of work completed on the project, Donnell's team has spent $310K.
- What does this tell Donnell about the status of his project? What should he do?

Business Scenario: Solution

- Donnell's project is 30% complete, and has a total budget of $850K. The earned value at this point is $255K; however, the actual costs of the project is $310K. The Cost Performance Index (CPI), EV/AC, is at .82. This means that the project is spending only 82 cents of every dollar productively.
- Donnell is concerned especially as the project has not yet made it to the halfway mark. His previous Tier 1 remodels had a better CPI at this point in the project.
- The project has faced some unexpected events (unknown unknowns), which the team had neither planned for nor anticipated based on past performance. The money allocated in the management reserve is able to cover most of the expenses, but not all.
- After evaluating the root cause of these risk factors, Donnell is able to link the problems to the age of the store and the fact that none of the previous stores completed in the remodel initiative were as old.
- Donnell is asked to reassess the risk and collaborate with their structural engineer to re-evaluate the remaining activities so he can determine a revised budget and an estimate of what is needed to complete remaining activities based on new information.

Earned Value Management: Example 1

A software development project has four phases. Each phase takes a month to complete and is estimated to cost $10,000 per phase. The phases are planned to be completed one after the other. Given the project status at the end of three months, calculate the CV, SV, CPI, and SPI.

Project Phases	Month 1	Month 2	Month 3	Month 4	Status at the End of Month 3
Requirement Definition	S---------F				Complete, spent $10,000
Architecture & Design		S-------PF	---F		Complete, spent $12,000
Development & Unit Testing			S----PF		50% done, spent $9,000
System Testing & Go Live					Not yet started

Legend

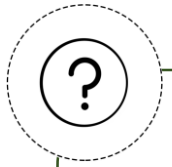
S – Start time F – Finish time PF – Partly finished

Earned Value Management: Example 1

Calculation of project cost related attributes are as follows:

Term	Calculation	Value	Interpretation of the Answer
Planned Value (PV)	$10,000+$10,000 +$10,000	$30,000	By third month, $30,000 worth of work should have been completed.
Earned Value (EV)	$10,000+$10,000 +$5,000	$25,000	The accomplished work is worth $25,000.
Actual Cost (AC)	$10,000+$12,000 +$9,000	$31,000	The amount actually spent is $31,000.
Cost Variance (CV)	$25,000-$31,000	-$6,000	The project is over budget by $6,000.
Schedule Variance (SV)	$25,000-$30,000	-$5,000	The project is behind schedule.
Cost Performance Index (CPI)	$25,000/$31,000	0.80	$0.80 worth is got out of every dollar spent.
Schedule Performance Index (SPI)	$25,000/$30,000	0.83	The project is progressing at 83% of the originally planned rate.

Earned Value Management: Example 2

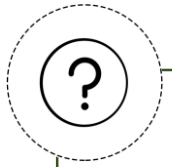


John is managing a three month project to enhance a financial system. He is working on his EVM analysis to report to management on status of project. Calculate the following based on the information given below:

Q1. John is comparing his actuals to the Earned Value of his project. He has finished the first month of his project schedule, and the earned value for his project is $65,000. The actuals from the financial system are $57,850. What is the CPI for his project?

CPI is calculated as EV/AC. CPI = $65,000/$57,850 = **1.12**

Earned Value Management: Example 2

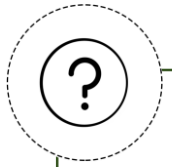


John is managing a three month project to enhance a financial system. He is working on his EVM analysis to report to management on status of project. Calculate the following based on the information given below:

Q2. Based on the CPI and a Budget at Completion (BAC) of $200,000, what is the Estimate at Completion (EAC)?

EAC is calculated as BAC/CPI. EAC = $200,000/1.12 = **$178,571**

Earned Value Management: Example 2

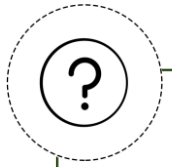


John is managing a three month project to enhance a financial system. He is working on his EVM analysis to report to management on status of project. Calculate the following based on the information given below:

Q3. John's management is interested in understanding how much more money is required for the project to be completed. What is the Estimate To Complete (ETC)?

ETC is calculated as EAC - AC. ETC = $178,571 – $57,850 = **$120,721**

Earned Value Management: Example 2



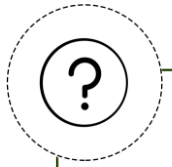
John is managing a three month project to enhance a financial system. He is working on his EVM analysis to report to management on status of project. Calculate the following based on the information given below:

Q4. John also needs to understand how his project is tracking against its schedule. After the first month of work effort, his Planned Value (PV) was $60,000. What is the SPI for his project?

SPI is calculated as EV/PV. From our previous calculations, EV was $65,000.

SPI = $65,000/$60,000 = **1.08**

Earned Value Management: Example 2



John is managing a three month project to enhance a financial system. He is working on his EVM analysis to report to management on status of project. Calculate the following based on the information given below:

Q5. John wants to see if the positive SPI of the project will offset the CPI. He decides to rerun his EAC calculations. How can he incorporate both CPI and SPI?

EAC can also be calculated as AC + [(BAC – EV)/(CPI * SPI)]. Based on our previous answers we can determine: $57,850 + ($200,000 - $65,000)/(1.12 * 1.08) = **$169,457.14**

Key Terms

Given below are the key terms related to the cost concept:

Law of diminishing returns

The more you put into something, the less you get out of it

For example: doubling the number of resources working on a project will not necessarily halve the time

Working Capital

The amount of money the company has to invest on the project and the day-to-day company operations

Funding limit reconciliation

The process of comparing the planned expenditure in a given period with the available funding for that period

Key Terms

Given below are the key terms related to the cost concept:

Depreciation

Large assets purchased by the company lose value over time. The two forms of depreciation are straight line depreciation and accelerated depreciation.

Straight line depreciation

The same amount of depreciation is provided for every year for the asset.

For example, a car with a price tag of $10,000 and a useful life of 10 years is depreciated by $1,000 every year.

Accelerated depreciation

The asset depreciates faster than the straight line depreciation.

For example, a car with a price tag of $10,000 depreciates $3,000 the first year, $1,500 the second year, $1,000 the third year, and so on.

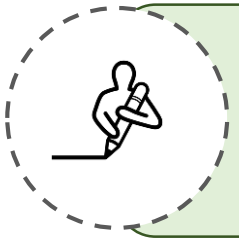
PROJECT MANAGEMENT

Key Takeaways

- Project cost management includes the processes involved in estimating, budgeting, and controlling costs so that the project can be completed within the approved budget.
- Cost management plan contains details on how to plan, manage, and control the project cost in relation to the cost baseline and manage the cost variances.
- Cost estimate is an educated guess of how much an activity or a project will cost. Budget considers the cost estimate and accordingly sets aside funds for the completion of the project.
- Under control account technique, related activities are clubbed and their costs are managed as one unit.
- The four Project Cost Management processes are Plan Cost Management, Estimate Costs, Determine Budget, and Control Costs.
- Earned Value Management technique indicates potential deviation of the project from the cost and/or schedule baselines.

Additional Reading

(Refer to the exercises provided in the PMP Classroom Exercises)



- Exercise 12
- Exercise 13

PROJECT MANAGEMENT

Quiz

Quiz

1. If Earned Value (EV) is $550, Actual Cost (AC) is $650, and Planned Value (PV) is $600, what is the Cost Variance (CV)?

A. -100

B. +50

C. -50

D. +100

Quiz

1. **If Earned Value (EV) is $550, Actual Cost (AC) is $650, and Planned Value (PV) is $600, what is the Cost Variance (CV)?**

A ▸ -100

B ▸ +50

C ▸ -50

D ▸ +100

The correct answer is: **A**

Apply the formula CV = EV – AC to get the answer. Note that although PV is provided, it is not used in solving this problem.

Quiz

2. You, as a project manager, are in the process of midway review at the end of the first year of a $50K project. The earned value analysis shows that the PV is $25K, the EV is $20K, and the AC is $15K. What can be determined from these figures?

A. The project is behind schedule and over budget

B. The project is ahead of schedule and under budget

C. The project is ahead of schedule and over budget

D. The project is behind schedule and under budget

Quiz

2. You, as a project manager, are in the process of midway review at the end of the first year of a $50K project. The earned value analysis shows that the PV is $25K, the EV is $20K, and the AC is $15K. What can be determined from these figures?

A. The project is behind schedule and over budget

B. The project is ahead of schedule and under budget

C. The project is ahead of schedule and over budget

D. The project is behind schedule and under budget

The correct answer is: **D**

SV = (EV-PV)=$20K-$25K= -$5K. CV = (EV-AC)=$20K-$15K = $5K. Looking at the data, it is evident that the project is behind schedule and is also under budget.

Quiz

3. What does a Cost Performance Index (CPI) of 0.73 mean?

A. The project would cost 73% more than originally planned

B. The project would cost 27% more than originally planned

C. The project would cost 73% less than originally planned

D. The project is only getting $0.73 for every $1 spent

Quiz

3. What does a Cost Performance Index (CPI) of 0.73 mean?

A. The project would cost 73% more than originally planned

B. The project would cost 27% more than originally planned

C. The project would cost 73% less than originally planned

D. The project is only getting $0.73 for every $1 spent

The correct answer is: **D**

CPI = EV/AC, therefore if the CPI is 0.73, it means that the EV is less than the AC.

Quiz

4. What does a Schedule Performance Index (SPI) of 0.67 mean?

A. You are ahead of schedule by 33%

B. You are behind schedule by 67%

C. You are progressing at only 67% of the rate originally planned

D. You are progressing at only 33% of the rate originally planned

Quiz

4. What does a Schedule Performance Index (SPI) of 0.67 mean?

A. You are ahead of schedule by 33%

B. You are behind schedule by 67%

C. You are progressing at only 67% of the rate originally planned

D. You are progressing at only 33% of the rate originally planned

The correct answer is: **C**

Since the SPI (SPI = EV/PV) measures all project work, the critical path must also be analyzed to determine whether the project will finish ahead or behind schedule.

Quiz

5. As a project manager, when you present your initial cost estimate to the project sponsor for approval, you are asked to cut the cost of the project by 10%. What would you do?

A. Replace the originally planned resources with lesser skilled resources at lower rates

B. Cut specific project activities and obtain the sponsor's approval

C. Strongly say no to the sponsor and walk away from the project

D. Ask all the team members to reduce the cost of their activities by 10%

Quiz

5. As a project manager, when you present your initial cost estimate to the project sponsor for approval, you are asked to cut the cost of the project by 10%. What would you do?

A. Replace the originally planned resources with lesser skilled resources at lower rates

B. Cut specific project activities and obtain the sponsor's approval

C. Strongly say no to the sponsor and walk away from the project

D. Ask all the team members to reduce the cost of their activities by 10%

The correct answer is: **B**

A project manager is responsible for managing cost overruns. If you have estimated cost in a certain way and it's required to be reduced, you should determine the impact of any cost reduction actions. Replacing the originally planned resources with lesser skilled resources is also an option, but the risks associated with this action should be carefully investigated.

Quiz

6. Which of the following is not a tool or technique used in the process of determining budget?

A. Cost aggregation

B. Reserve analysis

C. Funding limit reconciliation

D. Resource calendars

Quiz

6. Which of the following is not a tool or technique used in the process of determining budget?

A. Cost aggregation

B. Reserve analysis

C. Funding limit reconciliation

D. Resource calendars

The correct answer is: **D**

All the above tools and techniques, except resource calendars, are used to determine budget process. Resource calendars are an input to this process.

Quiz

7. What is not a valid technique to estimate costs?

A. Three point estimating

B. Earned value management

C. Parametric estimating

D. Analogous estimating

Quiz

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A. Three point estimating

B. Earned value management

C. Parametric estimating

D. Analogous estimating

The correct answer is: **B**

Earned Value Management is a technique used to Control Costs.

Quiz

8. Peter is a project manager of a large commercial construction project. The cost of concrete has risen substantially as the forecasted economic growth of the region has increased demand. Peter is concerned his project will be over-budget. What should he do?

A. Submit a change request for more budget to cover any potential shortfall

B. Review the contingency reserve

C. As this is a result of an external variable, it should not be included in the project budget

D. Substitute concrete for a cheaper material like wood or plastic

Quiz

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A. Submit a change request for more budget to cover any potential shortfall

B. Review the contingency reserve

C. As this is a result of an external variable, it should not be included in the project budget

D. Substitute concrete for a cheaper material like wood or plastic

The correct answer is: **B**

As the increase in concrete costs are a result of forecasted economic growth, this was likely identified as a risk, and an associated contingency was determined. Peter can use these funds now that the risk has materialized.

This concludes
"Project Cost Management."

The next lesson is
"Project Quality Management."

This course is based on the Project Management Institute, *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)—Sixth Edition.*