Cost Management

CS413 - Software Engineering Project Management

Department of Computer Engineering, Bilkent University

Dr. Mustafa Değerli
Key Terms

- **Budget.** The approved estimate for the project or any work breakdown structure component or any schedule activity

- **Budget at Completion (BAC).** The sum of all budgets established for the work to be performed
Key Terms

- **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.
Key Terms

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

• **Cost of Quality (CoQ).** All costs incurred over the life of the product by investment in preventing nonconformance to requirements, appraisal of the product or service for conformance to requirements, and failure to meet requirements.
Key Terms

- **Cost Performance Index (CPI)**. A measure of the cost efficiency of budgeted resources expressed as the ratio of earned value to actual cost

- **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
Key Concepts

• Project Cost Management is primarily concerned with the cost of the resources needed to complete project activities, but it should also consider the effect of project decisions on the subsequent recurring cost of using, maintaining, and supporting project deliverables.
Key Concepts

- Different stakeholders will measure project costs in different ways and at different times. Stakeholder requirements for managing costs should be considered explicitly.
Key Concepts

- Predicting and analyzing the prospective financial performance of the project's product may be performed outside the project, or it may be part of 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
Cost Management Processes

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

• 2 Estimate Costs
• The process of developing an approximation of the monetary resources needed to complete project work
Cost Management Processes

• **3 Determine Budget**
• The process of aggregating the estimated costs of individual activities or work packages to establish an authorized cost baseline
Cost Management Processes

- 4 Control Costs
- The process of monitoring the status of the project to update the project costs and manage changes to the cost baseline
Software Engineering Project Management

Cost Management

Plan Cost Management

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Tools &amp; Techniques</th>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>.1 Project charter</td>
<td>.1 Expert judgment</td>
<td>.1 Cost management plan</td>
</tr>
<tr>
<td>.2 Project management plan</td>
<td>.2 Data analysis</td>
<td></td>
</tr>
<tr>
<td>• Schedule management plan</td>
<td>• Alternative analysis</td>
<td></td>
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<tr>
<td>• Risk management plan</td>
<td>.3 Meetings</td>
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<td>.3 Enterprise environmental</td>
<td></td>
<td></td>
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<tr>
<td>factors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>.4 Organizational process</td>
<td></td>
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<tr>
<td>assets</td>
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<td></td>
</tr>
</tbody>
</table>
Software Engineering Project Management

Cost Management

4.1 Develop Project Charter
- Project charter

Project Management Plan
- Project management plan
  - Schedule management plan
  - Risk management plan

Enterprise/Organization
- Enterprise environmental factors
- Organizational process assets

7.1 Plan Cost Management
- Cost management plan

Project Management Plan
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Cost Management

**Estimate Costs**

**Inputs**
- 1. Project management plan
   - Cost management plan
   - Quality management plan
   - Scope baseline
- 2. Project documents
   - Lessons learned register
   - Project schedule
   - Resource requirements
   - Risk register
- 3. Enterprise environmental factors
- 4. Organizational process assets

**Tools & Techniques**
- 1. Expert judgment
- 2. Analogous estimating
- 3. Parametric estimating
- 4. Bottom-up estimating
- 5. Three-point estimating
- 6. Data analysis
   - Alternatives analysis
   - Reserve analysis
   - Cost of quality
- 7. Project management information system
- 8. Decision making
   - Voting

**Outputs**
- 1. Cost estimates
- 2. Basis of estimates
- 3. Project documents updates
   - Assumption log
   - Lessons learned register
   - Risk register
Cost Management

Project Management Plan
- Cost management plan
- Quality management plan
- Scope baseline

Project Documents
- Project documents
  - Lessons learned register
  - Project schedule
  - Resource requirements
  - Risk register

7.2 Estimate Costs
- Cost estimates
- Basis of estimates

Project Documents
- Project documents updates
  - Assumption log
  - Lessons learned register
  - Risk register

Enterprise/Organization
- Enterprise environmental factors
- Organizational process assets
### Software Engineering Project Management

# Cost Management

## Determine Budget

<table>
<thead>
<tr>
<th><strong>Inputs</strong></th>
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| .1 Project management plan  
  - Cost management plan  
  - Resource management plan  
  - Scope baseline  
 .2 Project documents  
  - Basis of estimates  
  - Cost estimates  
  - Project schedule  
  - Risk register  
 .3 Business documents  
  - Business case  
  - Benefits management plan  
 .4 Agreements  
 .5 Enterprise environmental factors  
 .6 Organizational process assets  | .1 Expert judgment  
 .2 Cost aggregation  
 .3 Data analysis  
  - Reserve analysis  
 .4 Historical information review  
 .5 Funding limit reconciliation  
 .6 Financing  | .1 Cost baseline  
 .2 Project funding requirements  
 .3 Project documents updates  
  - Cost estimates  
  - Project schedule  
  - Risk register  |
Software Engineering Project Management

Cost Management

- Project Management Plan
  - Project management plan
  - Cost management plan
  - Resource management plan
  - Scope baseline

- Project Documents
  - Project documents
  - Basis of estimates
  - Cost estimates
  - Project schedule
  - Risk register

- Business Documents
  - Business case
  - Benefits management plan

- 12.2 Conduct Procurements
  - Agreements

- Project Management Plan
  - Cost baseline

- 7.3 Determine Budget
  - Project funding requirements

- 7.4 Control Costs
  - Project documents updates
  - Cost estimates
  - Project schedule
  - Risk register

- Project Documents

- Enterprise/ Organization
  - Enterprise environmental factors
  - Organizational process assets
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Cost Management

Diagram showing the relationship between cumulative values, time, funding requirements, cost baseline, management reserve, expenditures, and project budget. The diagram illustrates the progression of costs over time.
Control Costs

Inputs
.1 Project management plan
   • Cost management plan
   • Cost baseline
   • Performance measurement baseline
.2 Project documents
   • Lessons learned register
.3 Project funding requirements
.4 Work performance data
.5 Organizational process assets

Tools & Techniques
.1 Expert judgment
.2 Data analysis
   • Earned value analysis
   • Variance analysis
   • Trend analysis
   • Reserve analysis
.3 To-complete performance index
.4 Project management information system

Outputs
.1 Work performance information
.2 Cost forecasts
.3 Change requests
.4 Project management plan updates
   • Cost management plan
   • Cost baseline
   • Performance measurement baseline
.5 Project documents updates
   • Assumption log
   • Basis of estimates
   • Cost estimates
   • Lessons learned register
   • Risk register
## Earned Value Analysis

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Name</th>
<th>Lexicon Definition</th>
<th>How Used</th>
<th>Equation</th>
<th>Interpretation of Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>PV</td>
<td>Planned Value</td>
<td>The authorized budget assigned to scheduled work.</td>
<td>The value of the work planned to be completed to a point in time, usually the data date, or project completion.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EV</td>
<td>Earned Value</td>
<td>The measure of work performed expressed in terms of the budget authorized for that work.</td>
<td>The planned value of all the work completed (earned) to a point in time, usually the data date, without reference to actual costs.</td>
<td>EV = sum of the planned value of completed work</td>
<td></td>
</tr>
<tr>
<td>AC</td>
<td>Actual Cost</td>
<td>The realized cost incurred for the work performed on an activity during a specific time period.</td>
<td>The actual cost of all the work completed to a point in time, usually the data date.</td>
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<td></td>
</tr>
<tr>
<td>BAC</td>
<td>Budget at Completion</td>
<td>The sum of all budgets established for the work to be performed.</td>
<td>The value of total planned work, the project cost baseline.</td>
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</tbody>
</table>
### Cost Management

<table>
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<tr>
<th>CV</th>
<th>Cost Variance</th>
<th>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.</th>
<th>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.</th>
<th>CV = EV – AC</th>
<th>Positive = Under planned cost Neutral = On planned cost Negative = Over planned cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>SV</td>
<td>Schedule Variance</td>
<td>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.</td>
<td>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.</td>
<td>SV = EV – PV</td>
<td>Positive = Ahead of Schedule Neutral = On schedule Negative = Behind Schedule</td>
</tr>
<tr>
<td>VAC</td>
<td>Variance at Completion</td>
<td>A projection of the amount of budget deficit or surplus, expressed as the difference between the budget at completion and the estimate at completion.</td>
<td>The estimated difference in cost at the completion of the project.</td>
<td>VAC = BAC – EAC</td>
<td>Positive = Under planned cost Neutral = On planned cost Negative = Over planned cost</td>
</tr>
</tbody>
</table>
| 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 |
## Cost Management

| 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. | 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 |

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## Cost Management

<table>
<thead>
<tr>
<th>Knowledge Areas</th>
<th>Project Management Process Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Initiating Process Group</td>
</tr>
<tr>
<td></td>
<td>Planning Process Group</td>
</tr>
<tr>
<td></td>
<td>Executing Process Group</td>
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<td>Monitoring and Controlling Process Group</td>
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<td>Closing Process Group</td>
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<td></td>
<td>7.2 Estimate Costs</td>
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<td></td>
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<tr>
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</tbody>
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Tailoring Considerations

• **Knowledge management**
• Does the organization have a formal knowledge management and financial databases repository that a project manager is required to use and is readily accessible?
Tailoring Considerations

• **Estimating and budgeting**

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

- Earned value management
- Does the organization use earned value management in managing projects?
Tailoring Considerations

- Use of agile approach
- Does the organization use agile methodologies in managing projects?
- How does this impact cost estimating?
Tailoring Considerations

- Governance

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