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THE IMPORTANCE OF PROJECT COST MANAGEMENT

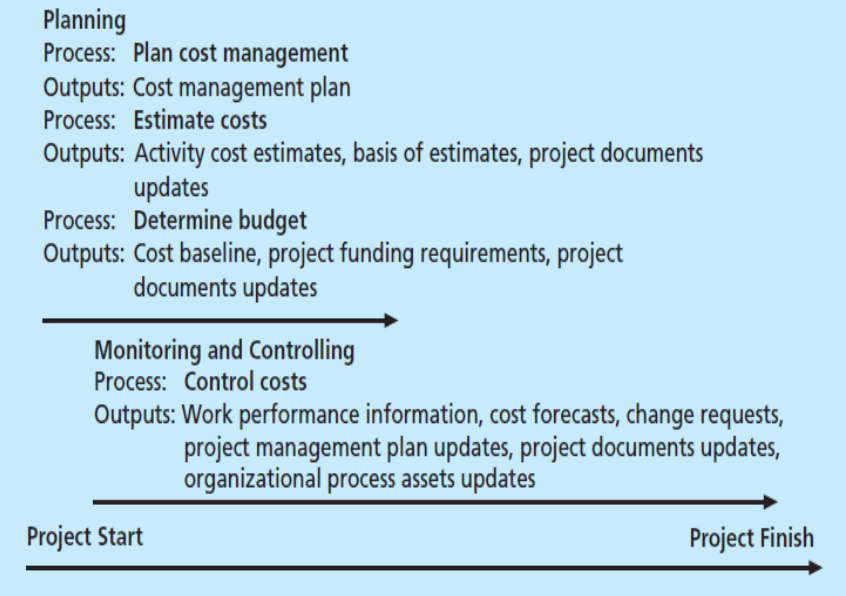
IT projects have a poor track record in meeting budget goals. The studies reported an average cost overrun—the additional percentage or dollar amount by which actual costs exceed estimates—for unsuccessful IT projects that ranged from 180 percent in 1994 to 43 percent in 2010. A 2011 study published in the Harvard Business Review examined IT change initiatives in almost 1,500 projects and reported an average cost overrun of 27 percent. Most projects incurred high expenses, with an average cost of $167 million; the largest project cost $33 billion. The most important finding of this study was the discovery of a large number of gigantic overages which had an average cost overrun of 200 percent and a schedule overrun of almost 70 percent

Cost and Project Cost Management

Cost is a resource sacrificed to achieve a specific objective. Costs are often measured in monetary amounts, such as dollars, that must be paid to acquire goods and services. **Project cost management** includes the processes required to ensure that a project team completes a project within an approved budget. It is the project manager's job to satisfy project stakeholders while continuously striving to reduce and control costs

Project Cost Management Processes

- **Planning cost management** involves determining the policies, procedures, and documentation that will be used for planning, executing, and controlling project cost
- **Estimating costs** involves developing an approximation or estimate of the costs of the resources needed to complete a project
- **Determining the budget** involves allocating the overall cost estimate to individual work items to establish a baseline for measuring performance.
- **Controlling costs** involves controlling changes to the project budget.



Basic Principles Of Cost Management

- Most members of an executive board are more interested in finance than IT, so, IT project managers need to be able to present and discuss project information both in financial terms and technical terms

- **Profits** are revenues minus expenditures.
- **Profit margin** is the ratio of revenues to profits
- **Life cycle costing** helps you develop an accurate projection of a project's financial costs and benefits
- **Cash flow analysis** is a method for determining the estimated annual costs and benefits for a project and the resulting annual cash flow
- **Learning curve theory** states that when many items are produced repetitively, the unit cost of those items decreases in a regular pattern as more units are produced
- **Reserves** are dollars included in a cost estimate to mitigate cost risk by allowing for future situations that are difficult to predict
  - **Contingency reserves** allow for future situations that may be partially planned for (sometimes called **known unknowns**) and are included in the project cost baseline
  - **Management reserves** are reserves set aside to allow for future situations that are unpredictable (sometimes called **unknown unknowns**)

Types of costs

- **Tangible costs** or **benefits** are those costs or benefits that an organization can easily measure in dollars
- **Intangible costs** or **benefits** are costs or benefits that are difficult to measure in monetary terms
- **Direct costs** are costs that can be directly related to producing the products and services of the project
- **Indirect costs** are costs that are not directly related to the products or services of the project, but are indirectly related to performing the project
- **Sunk cost** is money that has been spent in the past; when deciding what projects to invest in or continue, you should *not* include sunk costs

Planning Cost Management

- Planning how the costs will be managed throughout the life of the project. The project team uses expert judgment, analytical techniques, and meetings to develop the cost management plan

  A cost management plan includes:
  - Level of accuracy & Units of measure
  - Organizational procedures links
  - Control thresholds
  - Rules of performance measurement
  - Reporting formats
  - Process description

Estimating Costs

Project managers must take cost estimates seriously if they want to complete projects within budget constraints. It's important to know the types of cost estimates, how to prepare cost estimates, and typical problems associated with IT cost estimates.

Types of Cost Estimates

Type of Estimate	When Done	Why Done	How Accurate
Rough Order of Magnitude (ROM)	Very early in the project life cycle, often 3–5 years before project completion	Provides estimate of cost for selection decisions	–50% to +100%
Budgetary	Early, 1–2 years out	Puts dollars in the budget plans	–10% to +25%
Definitive	Later in the project, less than 1 year out	Provides details for purchases, estimates actual costs	–5% to +10%

The number and type of cost estimates vary by application area. The Association for the Advancement of Cost Engineering International identifies five types of cost estimates for construction projects: **order of magnitude, conceptual, preliminary, definitive, and control**

Estimates are usually done at various stages of a project and should become more accurate as time progresses. In additions to creating cost estimates for **the entire project** and **activity cost estimates**, it is also important to provide **supporting details** for the estimates and **updates** to project documents. The supporting details include the ground rules and assumptions used in creating the estimate, a description of the project (such as scope statement and WBS) used as a basic for the estimate, and details on the cost estimation tools and techniques used to create the estimate. Another important consideration in preparing cost estimates is **labor costs**, because a large percentage of total project costs are often labor costs.

Cost Estimation Tools and Techniques

Basic tools and techniques for cost estimates:

- **Analogous** or **top-down estimates:**
  - use the actual cost of a previous, similar project as the basis for estimating the cost of the current project
  - requires a good deal of expert judgment and is generally less costly than other techniques, but it is also less accurate
  - the groups preparing cost estimates must have the needed expertise to determine whether certain parts of the project will be more or less expensive than analogous projects
- **Bottom-up estimates or activity based estimates:**
  - involve estimating individual work items or activities and summing them to get a project total
  - The size of the individual work items and the experience of the estimators drive the accuracy of the estimates
  - drawback with bottom-up estimates is that they are usually time-intensive and therefore expensive to develop
- **Three-point estimates**
  - Involve estimating the most likely, optimistic, and pessimistic costs for items.
  - Next, project teams use a formula like the PERT
- **Parametric modeling**
  - uses project characteristics (parameters) in a mathematical model to estimate project costs

– Parametric models are most reliable when the historical information used to create the model is accurate, the parameters are readily quantifiable, and the model is flexible in terms of the project's size.

Typical Problems with IT Cost Estimates

- Estimates are done too quickly
- People lack estimating experience
- Management desires accuracy
- Human beings are biased toward underestimation

Sample Cost Estimate

One of the best ways to learn how the cost estimating process works is by studying sample cost estimates. Every cost estimate is unique, just as every project is unique. Before beginning a cost estimate, you must first gather as much information as possible about the project and ask how the organization plans to use the cost estimate. Clarify the ground rules and assumptions for the estimate. If possible, estimate costs by major WBS categories. Create a cost model to make it easy to make changes to and document the estimate.

Figure : Surveyor Pro Project Cost Estimate

Surveyor Pro Project Cost Estimate Created October 5

	# Units/Hrs.	Cost/Unit/Hr.	Subtotals	WBS Level 2 Totals	% of Total
WBS Items					
1. Project Management				**$306,300**	**20%**
Project manager	960	$100	$96,000		
Project team members	1920	$75	$144,000		
Contractors (10% of software development and testing)			$66,300		
2. Hardware				**$76,000**	**5%**
2.1 Handheld devices	100	$600	$60,000		
2.2 Servers	4	$4,000	$16,000		
3. Software				**$614,000**	**40%**
3.1 Licensed software	100	$200	$20,000		
3.2 Software development*			$594,000		
4. Testing (10% of total hardware and software costs)			$69,000	**$69,000**	**5%**
5. Training and Support				**$202,400**	**13%**
Trainee cost	100	$500	$50,000		
Travel cost	12	$700	$8,400		
Project team members	1920	$75	$144,000		
6. Reserves (20% of total estimate)			$253,540	**$253,540**	**17%**
Total project cost estimate				**$1,521,240**	

*See software development estimate.

Determining The Budget

Determining the budget involves allocating the project cost estimate to individual material resources or work items over time. The cost management plan, scope baseline, activity cost estimates, basis of estimates, project schedule, resource calendars, risk register, agreements, and organizational process assets are all inputs for determining the budget. The main goal of the cost budgeting process is to produce a **cost baseline** for measuring project performance and to determine project funding requirements. The process may also result in project documents updates

Figure: Surveyor Pro Project Cost Baseline

Surveyor Pro Project Cost Baseline Created October 10*

WBS Items	1	2	3	4	5	6	7	8	9	10	11	12	Totals
1. Project Management													
1.1 Project manager	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	96,000
1.2 Project team members	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	144,000
1.3 Contractors		6,027	6,027	6,027	6,027	6,027	6,027	6,027	6,027	6,027	6,027	6,027	66,300
2. Hardware													
2.1 Handheld devices				30,000	30,000								60,000
2.2 Servers				8,000	8,000								16,000
3. Software													
3.1 Licensed software				10,000	10,000								20,000
3.2 Software development		60,000	60,000	80,000	127,000	127,000	90,000	50,000					594,000
4. Testing			6,000	8,000	12,000	15,000	15,000	13,000					69,000
5. Training and Support													
5.1 Trainee cost									50,000				50,000
5.2 Travel cost									8,400				8,400
5.3 Project team members							24,000	24,000	24,000	24,000	24,000	24,000	144,000
6. Reserves				10,000	10,000	30,000	30,000	60,000	40,000	40,000	30,000	3,540	253,540
Totals	20,000	86,027	92,027	172,027	223,027	198,027	185,027	173,027	148,427	90,027	80,027	53,567	1,521,240

A **cost baseline** is a time-phased budget that project managers use to measure and monitor cost performance. Again, it's important for team members to document assumptions they made when developing the cost baseline and have several experts review it. Most organizations have a well-established process for preparing budgets. It is important to understand various budget categories before developing an estimate to make sure data is collected accordingly. In addition to providing input for budgetary estimates, cost budgeting provides a cost baseline. Estimating costs for each major project activity over time provides project managers and top management with a foundation for project cost control. Cost budgeting, as well as requested changes or clarifications, may result in updates to the cost management plan, which is a subsidiary part of the project management plan. Cost budgeting also provides information for project funding requirements. Some projects have all funds available when the project begins, but others must rely on periodic funding to avoid cash flow problems. If the cost baseline shows that more funds are required in certain months than are expected to be available, the organization must make adjustments to avoid financial problems.

Controlling Costs

Controlling project costs includes monitoring cost performance, ensuring that only appropriate project changes are included in a revised cost baseline, and informing project stakeholders of authorized changes to the project that will affect costs. The project management plan, project funding requirements, work performance data, and organizational process assets are inputs for controlling costs. Outputs of this process are work performance information, cost forecasts, change requests, project management plan updates, project documents updates, and organizational process asset updates.

A change control system is needed to define procedures for changing the cost baseline. This cost control change system is part of the integrated change control system. Because many projects do not progress exactly as planned, new or revised cost estimates are often required, as are estimates to evaluate alternate courses of action. Performance review meetings can be a powerful tool for helping to control project costs. People often perform better when they know they must report on their progress. Another very important tool for cost control is

performance measurement. **Earned value management (EVM)** is a powerful cost control technique that is unique to the field of project management.

Earned Value Management

Earned value management (EVM) is a project performance measurement technique that integrates scope, time, and cost data. Given a cost performance baseline, project managers and their teams can determine how well the project is meeting scope, time, and cost goals by entering actual information and then comparing it to the baseline. A baseline is the figure in the original project plan plus approved changes. Actual information includes whether or not a WBS item was completed, approximately how much of the work was completed, when the work actually started and ended, and how much the completed work actually cost. Earned value management involves calculating three values for each activity or summary activity from a project's WBS.

- **The planned value (PV),** also called the budget, is the portion of the approved total cost estimate planned to be spent on an activity during a given period.
- **The actual cost (AC)** is the total direct and indirect costs incurred in accomplishing work on an activity during a given period.
- **The earned value (EV)** is an estimate of the value of the physical work actually completed. EV is based on the original planned costs for the project or activity and the rate at which the team is completing work on the project or activity to date.
- **The rate of performance (RP)** is the ratio of actual work completed to the percentage of work planned to have been completed at any given time during the life of the project or activity.

Example:

Suppose that a project included a summary activity of purchasing and installing a new Web server. Suppose further that, according to the plan, it would take one week and cost a total of $10,000 for the labor hours, hardware, and software. Suppose that it actually took two weeks and cost $20,000 to purchase and install the new Web server. Assume that $15,000 of these actual costs were incurred during Week 1 and $5,000 was incurred during Week 2. Suppose that the server installation was halfway completed by the end of Week 1. The rate of performance would be 50 percent because by the end of Week 1, the planned schedule reflects that the task should be complete but only 50 percent of the work has been completed.

Solution: Earned value calculations for one activity after Week 1

Activity	Week 1
Earned Value (EV)	5,000
Planned Value (PV)	10,000
Actual Cost (AC)	15,000
Cost Variance (CV)	–10,000
Schedule Variance (SV)	–5,000
Cost Performance Index (CPI)	33%
Schedule Performance Index (SPI)	50%

Earned Value Formulas

Term	Formula
Earned value (EV)	EV = PV to date * RP
Cost variance (CV)	CV = EV – AC
Schedule variance (SV)	SV = EV – PV
Cost performance index (CPI)	CPI = EV/AC
Schedule performance index (SPI)	SPI = EV/PV
Estimate at completion (EAC)	EAC = BAC/CPI
Estimated time to complete	Original time estimate/SPI

- **Cost variance (CV)** is the earned value minus the actual cost. If cost variance is a negative number, it means that performing the work cost more than planned. If cost variance is a positive number, performing the work cost less than planned.
- **Schedule variance (SV)** is the earned value minus the planned value. A negative schedule variance means that it took longer than planned to perform the work, and a positive schedule variance means that the work took less time than planned to perform.
- **The cost performance index (CPI)** is the ratio of earned value to actual cost; it can be used to estimate the projected cost of completing the project. If the CPI is equal to one, or 100 percent, then the planned and actual costs are equal—the costs are exactly as budgeted. If the CPI is less than one or less than 100 percent, the project is over budget. If the CPI is greater than one or more than 100 percent, the project is under budget.
- **The schedule performance index (SPI)** is the ratio of earned value to planned value; it can be used to estimate the projected time to complete the project. An SPI of one, or 100 percent, means the project is on schedule. If the SPI is greater than one or 100 percent, then the project is ahead of schedule. If the SPI is less than one or 100 percent, the project is behind schedule.
- Negative numbers for cost and schedule variance indicate the project is costing more than planned or taking longer than planned.
- A **CPI and SPI** of less than one or less than 100 percent also indicate problems
- The cost performance index can be used to calculate the **estimate at completion (EAC**)—an estimated cost of completing a project based on performance to date.
- The **budget at completion** (BAC) is the original total budget for the project
- The **schedule performance index** can be used to calculate an **estimated time** to complete the project.

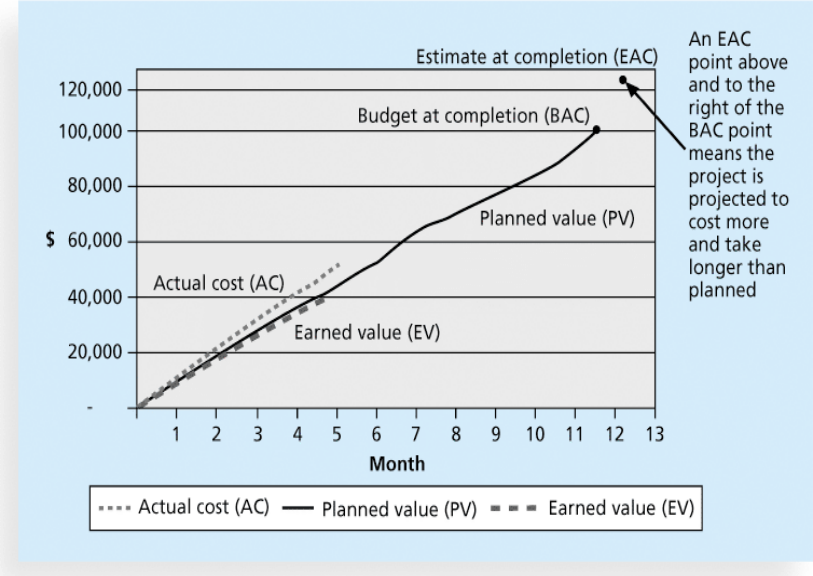
Earned Value Chart

Viewing earned value information in chart form helps you visualize how the project is performing.

- For example, you can see the planned performance by looking at the planned value line. If the project goes as planned, it will finish in 12 months and cost $100,000.

- Notice in the example that the actual cost line is always on or above the earned value line, which indicates that costs are equal to or more than planned.
- The planned value line is close to the earned value line, and is slightly higher in the last month. This relationship means that the project has been on schedule until the last month, when the project fell behind schedule

Example: Earned Value Chart for Project after Five Months



- Top managers who oversee multiple projects often like to see performance information in a graphical form
- The EACs are important inputs to budget decisions, especially if total funds are limited.
- Earned value management is an important technique when used effectively, because it helps top management and project managers evaluate progress and make sound management decisions
- If there are serious cost and schedule performance problems, top management may decide to terminate projects or take other corrective action.

Why is it Earned Value management not used by most commercial firms

- EVM's focus on tracking actual performance versus planned performance and the importance of percentage completion data in making calculations. Many projects, particularly IT projects, do not have good planning information, so tracking performance against a plan might produce misleading information. Several cost estimates are usually made on IT projects, and keeping track of the most recent cost estimate and the associated actual costs could be cumbersome.
- Estimating percentage completion of tasks might produce misleading information. What does it mean to say that a task is actually 75 percent complete after three months? Such a statement is often not synonymous with saying the task will be finished in one more month or after spending an additional 25 percent of the planned budget.

Global Issues

- EVM is used worldwide, and it is particularly popular in the Middle East, South Asia, Canada, and Europe
- Most countries require EVM for large defense or government projects,
- EVM is also used in such private-industry sectors as IT, construction, energy, and manufacturing.
- However, most private companies have not yet applied EVM to their projects because management does not require it, feeling it is too complex and not cost effective

Project portfolio management

- Many organizations now collect and control an entire suite of projects or investments as one set of interrelated activities in one place—a portfolio
- Five levels for project portfolio management, from simplest to most complex, as follows:
  1. Put all your projects in one database.
  2. Prioritize the projects in your database.
  3. Divide your projects into two or three budgets based on type of investment, such as utilities or required systems to keep things running, incremental upgrades, and strategic investments.
  4. Automate the repository.
  5. Apply modern portfolio theory, including risk-return tools that map project risk on a curve.

Benefits of Portfolio Management

- Schlumberger saved $3 million in one year by organizing 120 information technology projects into a portfolio
- ROI of implementing portfolio management software by IT departments:

❑ Savings of 6.5 percent of the average annual IT budget by the end of year one
❑ Improved annual average project timeliness by 45.2 percent
❑ Reduced IT management time spent on project status reporting by 43 percent and IT labor capitalization reporting by 55 percent
❑ Decreased the time to achieve financial sign-off for new IT projects by 20.4 percent, or 8.4 days

Organizational Process Assets (OPAs)

➢ Organizational process assets are the plans, processes, polices, procedures, and knowledge bases. (are inputs to most planning processes)
➢ Organizational process assets are grouped in two categories:

Processes, policies, and procedures;

❖ Initiating and planning
❖ Executing, monitoring and controlling
❖ Closing

Organizational knowledge bases;

- Configuration management knowledge bases
- Financial databases
- Historical information and lessons learned
- Issue and defect management databases
- Data repositories
- Project files from previous projects

- Cost control is a practice used by finance professionals that analyzes a business's overall expenses and reduces project costs to increase profit. Typically, a company hires finance professionals to monitor their cost performance, plan a budget for each project and change projects that can increase a business's financial performance.

Cost Control Techniques

- Following are some of the valuable and essential techniques used for efficient project cost control:

- Planning the Project Budget
- Keeping a Track of Costs
- Effective Time Management
- Project Change Control
- Use of Earned Value

Cost Control Process:

- *Create a baseline*. Establish a standard or baseline against which actual costs are to be compared. These standards may be based on historical results, a reasonable improvement on historical results, or the theoretically best attainable cost performance.
- *Calculate a variance*. Calculate the variance between actual results and the standard or baseline noted in the first step. Particular emphasis is placed on the detection of unfavorable variances, which are those actual costs that are higher than expected.
- *Investigate variances*. Conduct a detailed drill-down into the actual cost information to ascertain the reason for an unfavorable variance.
- *Take action*. Based on the information found in the preceding step, recommend to management whatever corrective actions are needed to reduce the risk of continued unfavorable cost variances.