

Project Resources and Time Management

PMG 605

Lecture 9

**Progress and Performance
Measurement and Evaluation**

Prepared by
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Lecture

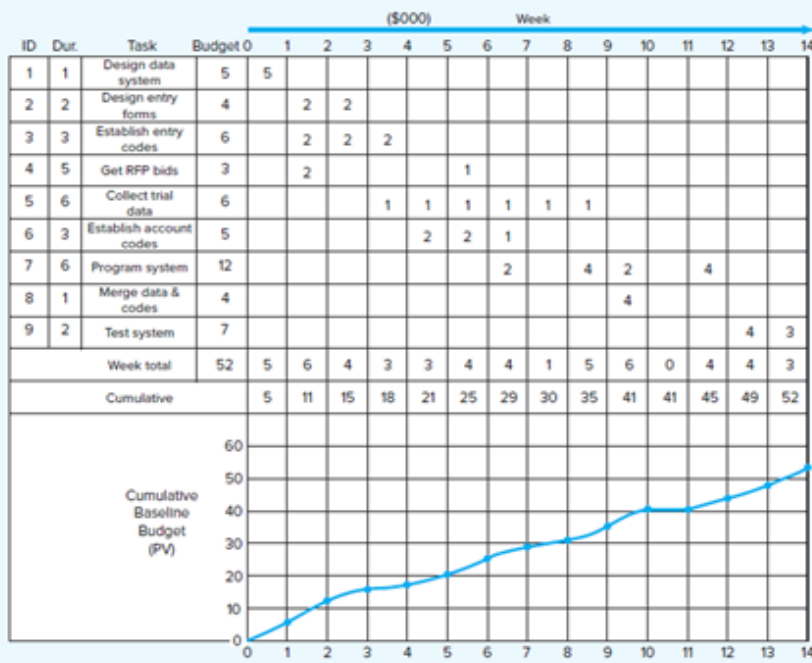
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Session Outline

Progress and Performance Measurement and Evaluation

- Structure of a Project Monitoring Information System
- The Project Control Process
- Monitoring Time Performance
- Development of an Earned Value Cost/Schedule System
- Developing a Status Report
- Indexes to Monitor Progress
- Forecasting Final Project Cost

Time- Phased Work Packages Assigned



8-32

	12/30	1/6	1/13	1/20	1/27	2/03
I. Suzuki	24 hrs	40 hrs	40 hrs	40 hrs	40 hrs	40 hrs
Hardware specifications				24 hrs	40 hrs	40 hrs
Hardware design						
Hardware documentation						
Operating system documentation						
Utilities documentation						
Architectural decisions	24 hrs	40 hrs	40 hrs	16 hrs		
J. Lopez	24 hrs	40 hrs	40 hrs	40 hrs	40 hrs	40 hrs
Hardware specifications				12 hrs	20 hrs	20 hrs
Hardware design						
Prototypes						
Kernel specifications						
Utilities specifications						
Architectural decisions	24 hrs	40 hrs	40 hrs	16 hrs		
Integration first phase						
J.J. Putz				24 hrs	40 hrs	40 hrs
Hardware documentation						
Kernel specifications				24 hrs	40 hrs	40 hrs
Operating system documentation						
Utilities documentation						
Project documentation						
R. Saxon				24 hrs	40 hrs	40 hrs
Hardware specifications				24 hrs	40 hrs	40 hrs
Prototypes						
Assemble preproduction models						
OC drivers						
Complex utilities						
Integration first phase						
System H/S test						
Integration acceptance test						

Project Weekly Resource Usage Schedule

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	January	February	March	April	May	June	July
CEBOO Project							
Hardware							
Hardware specifications	\$11,480.00	\$24,840.00	\$3,360.00				
Hardware design			\$23,320.00	\$29,920.00	\$14,960.00		
Hardware documentation					\$14,080.00	\$24,320.00	
Prototypes							
Order GXs							
Assemble preproduction models							
Operating system							
Kernel specifications	\$5,320.00	\$9,880.00					
Drivers							
OC drivers				\$3,360.00	\$12,320.00	\$11,760.00	\$12,880.00
Serial VO drivers							
Memory management							
Operating system documentation		\$10,240.00	\$21,760.00				
Network interface							
Utilities							
Utilities specifications				\$8,400.00			
Routine utilities				\$5,760.00	\$21,120.00	\$20,160.00	\$10,560.00
Complex utilities							
Utilities documentation				\$7,680.00	\$17,920.00		
Shell							
System integration							
Architectural decisions	\$20,400.00						
Integration first phase							
System H/S test							
Project documentation							
Integration acceptance test							
Total	\$37,200.00	\$44,960.00	\$48,240.00	\$55,120.00	\$80,400.00	\$56,240.00	\$23,440.00

Project Monthly Cash Flow Statement

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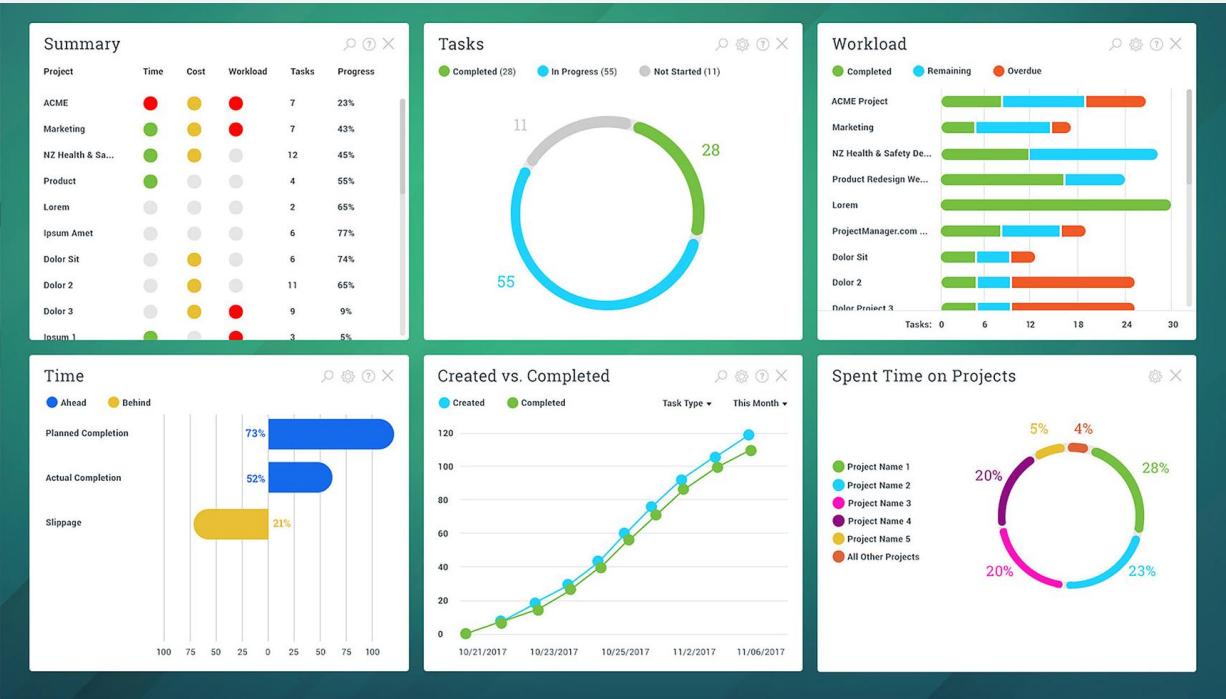
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Progress and Performance Measurement and Evaluation

- Evaluation and control are part of every project manager's job.
- Large projects need some form of formal control.
- Control holds people accountable, prevents small problems from escalating into large problems, and keeps focus.
- Except for accounting controls, project control is not performed well in most organizations.
- Control is one of the most neglected areas of project management.
- Unfortunately, it is not uncommon to find resistance to control processes.
- For effective control, the project manager needs a single information system to collect data and report progress on cost, schedule, and specifications

Progress and Performance Measurement and Evaluation

Executive dashboard PPT



Structure of a Project Monitoring Information System

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Structure of a Project Monitoring Information System

- Creating a project monitoring system involves determining
 - What data to collect
 - How, when, and who will collect the data
 - How to analyze the data
 - How to report current progress to management

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What Data Are Collected?

- Data collected are determined by which metrics will be used for project control.
- Typical key data collected are
 - actual activity duration times,
 - actual resource usage and rates,
 - actual costs,
- which are compared against ***planned*** times, resources, and budgets.

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What Data Are Collected?

- Major portion of the monitoring system focuses on cost/schedule concerns
- It is crucial to provide the project manager and stakeholders with data to answer questions such as:
 - What is the **current status** of the project in terms of **schedule and cost**?
 - **How much** will it cost to **complete** the project?
 - **When** will the project be **completed**?
 - Are there **potential problems** that need to be addressed now?
 - What, who, and where are the **causes** for cost or schedule **overruns**?
 - If there is a cost overrun midway in the project, can we **forecast the overrun** at completion?

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Collecting Data and Analysis

- Will the data be collected by the project team, contractor, independent cost engineers?
- Or will the data be derived electronically from some form of surrogate data such as cash flow, machine hours, labor hours, or materials in place?
- Should the reporting period be one hour, one day, one week, or what?
- Electronic means of collecting data have vastly improved data assembly, analysis, and dissemination.
- Currently software have tools to analyze your customized collected data and present it in a form that facilitates monitoring the project, identifying sources of problems, and updating your plan.

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Reports and Reporting

- Who gets the progress reports?
- Different stakeholders and levels of management need different kinds of project information.
- Senior management's major interests are usually,
 - "Are we on time and within budget?"
 - If not, what corrective action is taking place?"
- The reports should be designed for the right audience.

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Reports and Reporting

- A common topic format for progress reports follows:
- Progress since last report
- Current status of project
 1. Schedule
 2. Cost
 3. Scope
- Cumulative trends
- Problems and issues since last report
 1. Actions and resolution of earlier problems
 2. New variances and problems identified
- Corrective action planned

The Project Control Process

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The Project Control Process

Control is the process of *comparing actual performance **against plan** to identify deviations, evaluate possible alternative courses of actions, and take appropriate corrective action.*

- The project control steps for measuring and evaluating project performance are
 1. Setting a baseline plan.
 2. Measuring progress and performance.
 3. Comparing plan against actual.
 4. Taking action.

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Step 1: Setting a Baseline Plan

- The baseline plan provides us with the elements for measuring performance.
- The baseline is derived from the cost and duration information found in the work breakdown structure (WBS) database and time-sequence data from the network and resource scheduling decisions.

Step 2: Measuring Progress and Performance

- ***Qualitative measures*** such as meeting customer technical specifications and product function are most frequently determined by on-site inspection or actual use.
- Time and budgets are ***quantitative measures*** of performance that readily fit into the integrated information system.

Step 3: Comparing Plan against Actual

- Because plans seldom materialize as expected, it becomes imperative to measure deviations from plan to determine if action is necessary.
- Periodic monitoring and measuring the status of the project allow for comparisons of actual versus expected plans.
- It is crucial that the timing of status reports be frequent enough to allow for early detection of variations from plan and early correction of causes.

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Step 4: Taking Action

- If deviations from plans are significant, corrective action will be needed to bring the project back in line with the original or revised plan.
- In some cases, conditions or scope can change, which, in turn, will require a change in the baseline plan to recognize new information.

Monitoring Time Performance

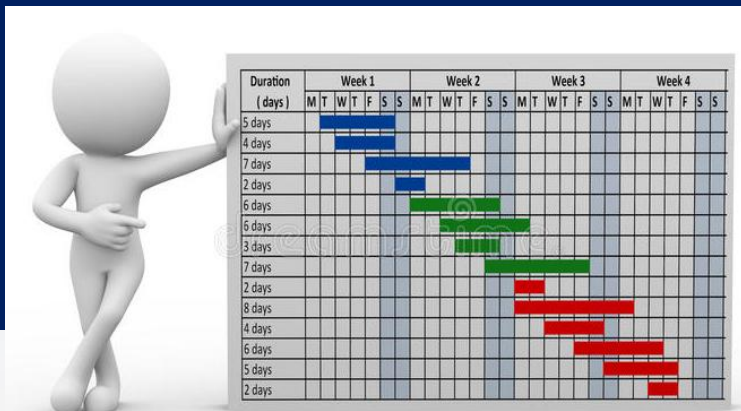
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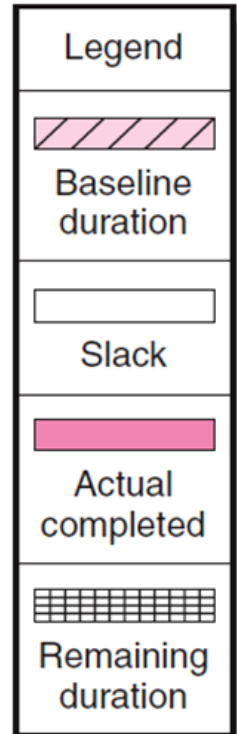


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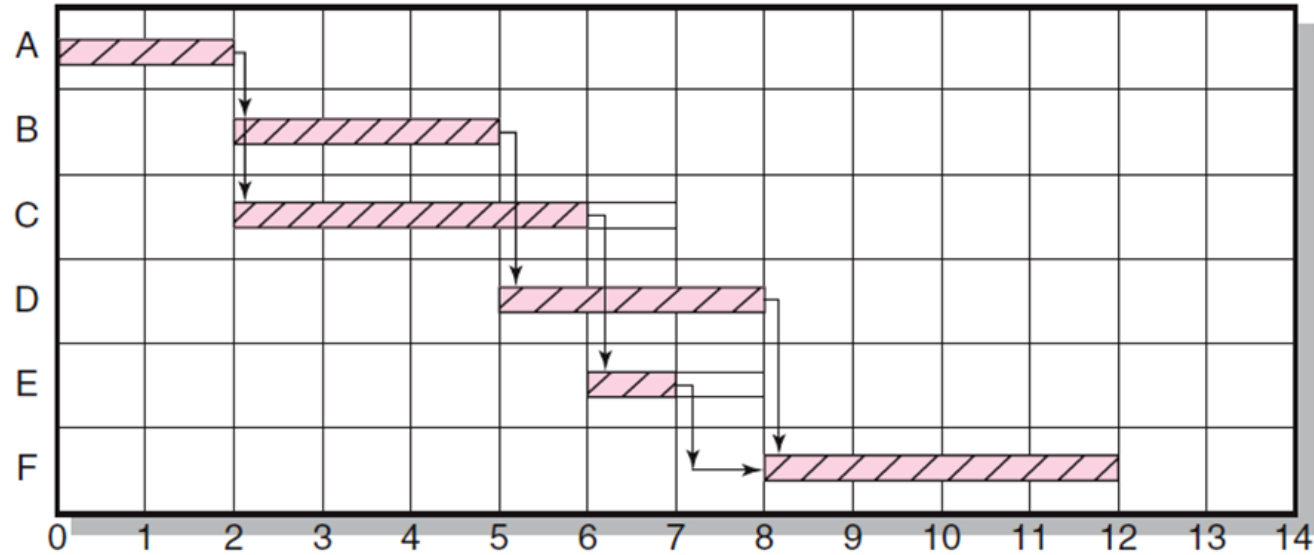
Monitoring Time Performance

- A major goal of progress reporting is to catch any negative variances from plan as early as possible to determine if corrective action is necessary.
- The project network schedule, derived from the WBS/OBS, serves as the baseline to compare against actual performance.
- Tools used
 - Tracking Gantt Chart
 - Control Chart
 - Milestone Schedules

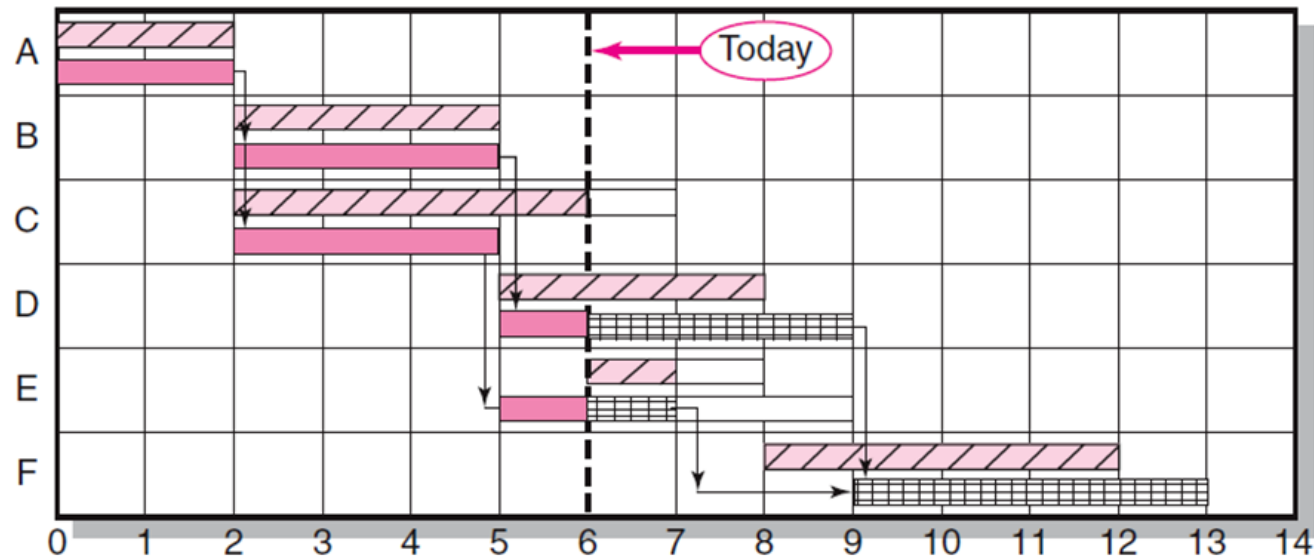
Tracking Gantt Chart



Baseline Gantt Chart



Tracking Gantt Chart Showing Status—through Period 6

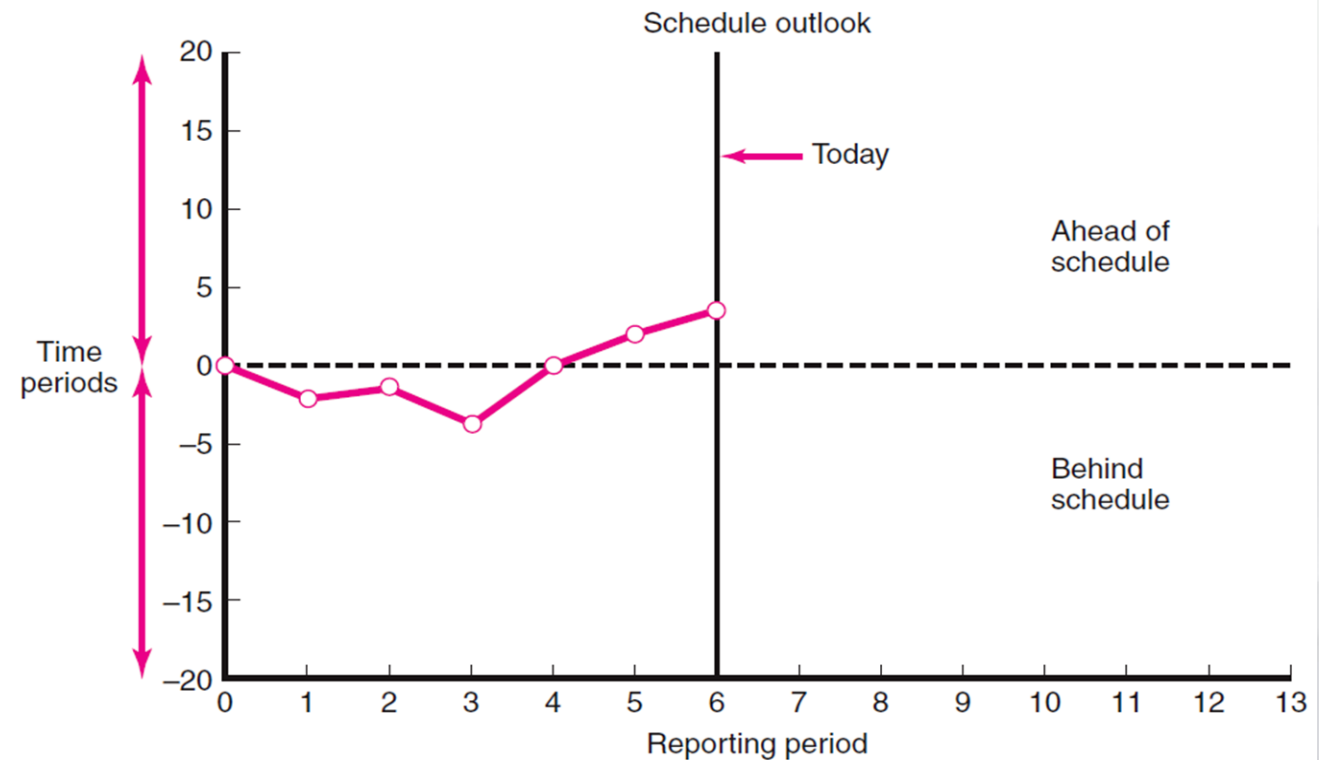


- The most favored, used, and understandable.

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Control Chart

- The chart is used to plot the difference between the scheduled time on the **critical path** at the report date with the actual point on the critical path.
- The figure shows the project was behind early in the project, the plot suggests corrective action brought the project back on track.
- Control chart trends are very useful for giving warning of potential problems so appropriate action can be taken if necessary.



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Milestone Schedules

- Stakeholders, whether it is senior management, the owner, or regulatory agencies often neither need or desire a detailed accounting of project progress.
- Instead, their interests can be satisfied by reporting progress towards major project ***milestones***.
- Remember, milestones are significant project events that mark major accomplishments.
- Project managers recognize the need to use
 - A more macro schedule of significant deliverables to keep external stakeholders informed and
 - A more detailed milestone driven schedule to manage and motivate the project team to achieve those deliverables.

WBS-Code	Milestone	Scheduled Deadline	Adapted Deadline	Actual Deadline
1.1.1	Project launched	03.12.2020	-	03.12.2020
1.2.5	As-is analysis completed	04.01.2021	15.01.2021	17.01.2021
1.3.5	Rough concept created	31.01.2021	29.02.2021	
1.4.5	Detailed concept created	20.03.2021	31.03.2021	
1.5.7	Technical implementation done	15.05.2021		
1.6.9	All tests completed	15.06.2021		
1.7.5	Operational start-up done	30.6.2021		
1.8.5	Project completed	15.07.2021		

Development of an Earned Value (EV) Cost/Schedule System

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Earned Value Cost/Schedule System

- The earned value system starts with the time-phased costs that provide the project budget baseline, which is called the ***planned budgeted value (PV)*** of the work scheduled.
- Given this time-phased baseline, comparisons are made with actual and planned schedule and costs using earned value.
- The earned value approach provides the missing links not found in conventional cost-budget systems.
- At any point in time, a status report can be developed for the project.
- The earned value cost/schedule system uses several acronyms and equations for analysis.

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Glossary of Terms

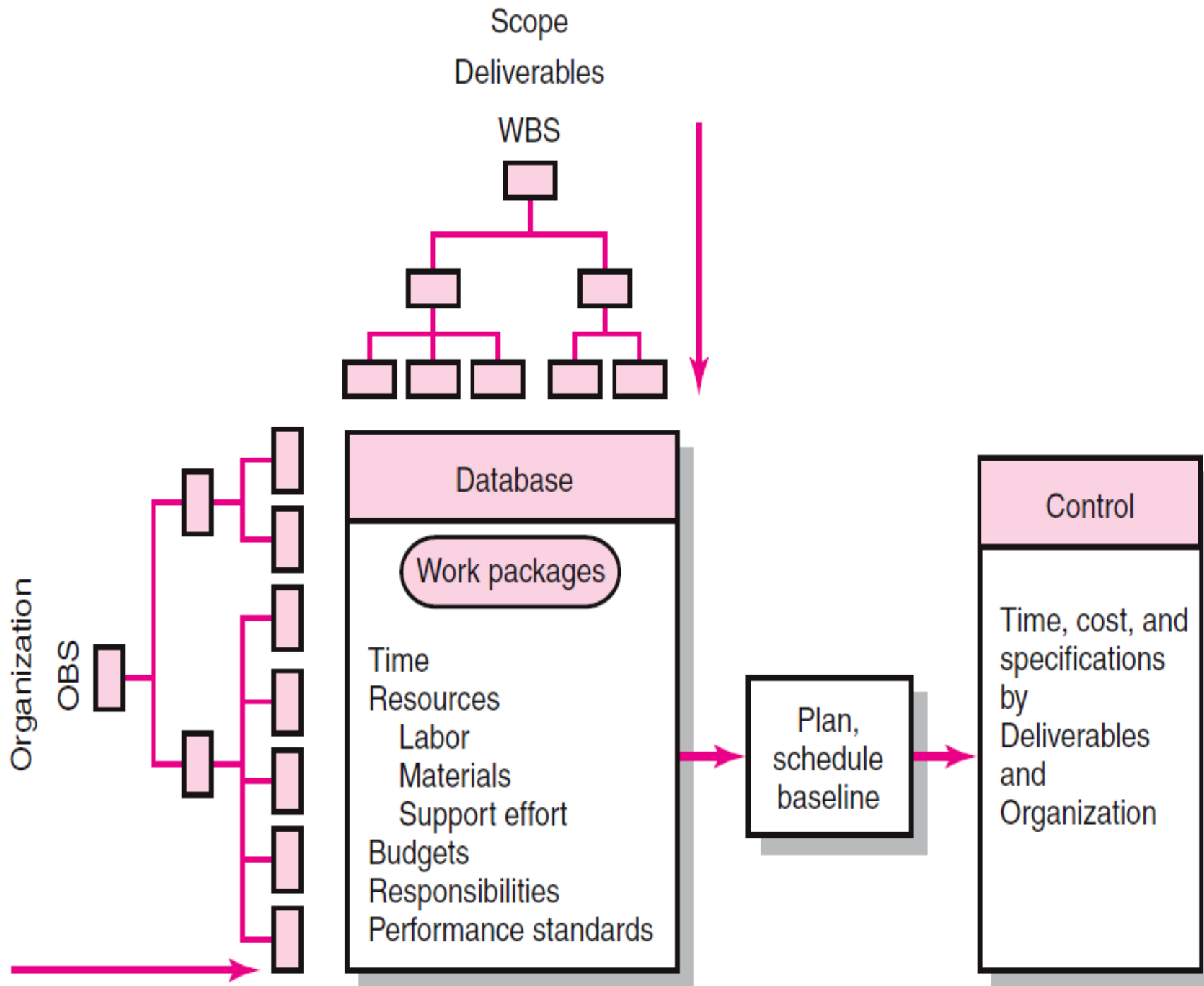
EV	Earned value for a task is simply the <i>percent complete</i> times its original budget. Stated differently, EV is the percent of the original budget that has been earned by actual work completed
PV	The planned time-phased baseline of the value of the work scheduled. An approved cost estimate of the resources scheduled in a time-phased cumulative baseline
AC	Actual cost of the work completed. The sum of the costs incurred in accomplishing work.
CV	Cost variance is the difference between the earned value and the actual costs for the work completed to date where $CV = EV - AC$.
SV	Schedule variance is the difference between the earned value and the baseline line to date where $SV = EV - PV$.
BAC	Budgeted cost at completion. Total budgeted cost of the baseline or project cost accounts.
EAC	Estimated cost at completion.
ETC	Estimated cost to complete remaining work.
VAC	Cost variance at completion. VAC indicates expected actual over- or under-run cost at completion.

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Development of an EV Cost/Schedule System

1. Define the work using a WBS.
 - a. Scope
 - b. Work packages
 - c. Deliverables
 - d. Organization units
 - e. Resources
 - f. Budgets
2. Develop work and resource schedules.
 - a. Schedule resources to activities
 - b. Time-phase work packages into a network
3. Develop a time-phased budget using work packages included in an activity. Accumulate budgets (PV).
4. At the work package level, collect the actual costs for the work performed (AC). Multiply percent complete times original budget (EV).
5. Compute the schedule variance (EV-PV) and the cost variance (EV-AC).

Project Management Information System Overview



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Project Management Information System Overview

- The major reasons for creating a baseline are to monitor and report progress and to estimate cash flow.
- Therefore, it is crucial to integrate the baseline with the performance measurement system.

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Percent Complete Rule

- **Percent Complete** is the workhorse most commonly used.
- Someone familiar with each task estimates what percent of the task has been completed or how much of the task remains.
- When measuring percent complete in the monitoring phase of the project, it is common to limit the amount earned to 80 or 90 percent until the work package is 100 percent complete.

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Methods of Variance Analysis

- The method for measuring accomplishments centers on ***Comparing Earned Value***
 - ***With the expected schedule value.***
 - ***With the actual costs.***
- These comparisons can be made at the project level or down to the cost account level.
- Project status can be determined for the
 - latest period,
 - all periods to date,
 - and estimated to the end of the project.

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Methods of Variance Analysis

- Assessing Status of a Project Required data elements
 - Data Budgeted cost of the work scheduled (PV)
 - Budgeted cost of the work completed (EV)
 - Actual cost of the work completed (AC)
- Calculate schedule and cost variances
 - A positive variance indicates a desirable condition,
 - A negative variance suggests problems or changes that have taken place.

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Cost Variance (CV)

- Indicates if the work accomplished using labor and materials costs more or less than was planned at any point in the project.
- Should be reviewed carefully to isolate the cause to either labor or materials—or to both.

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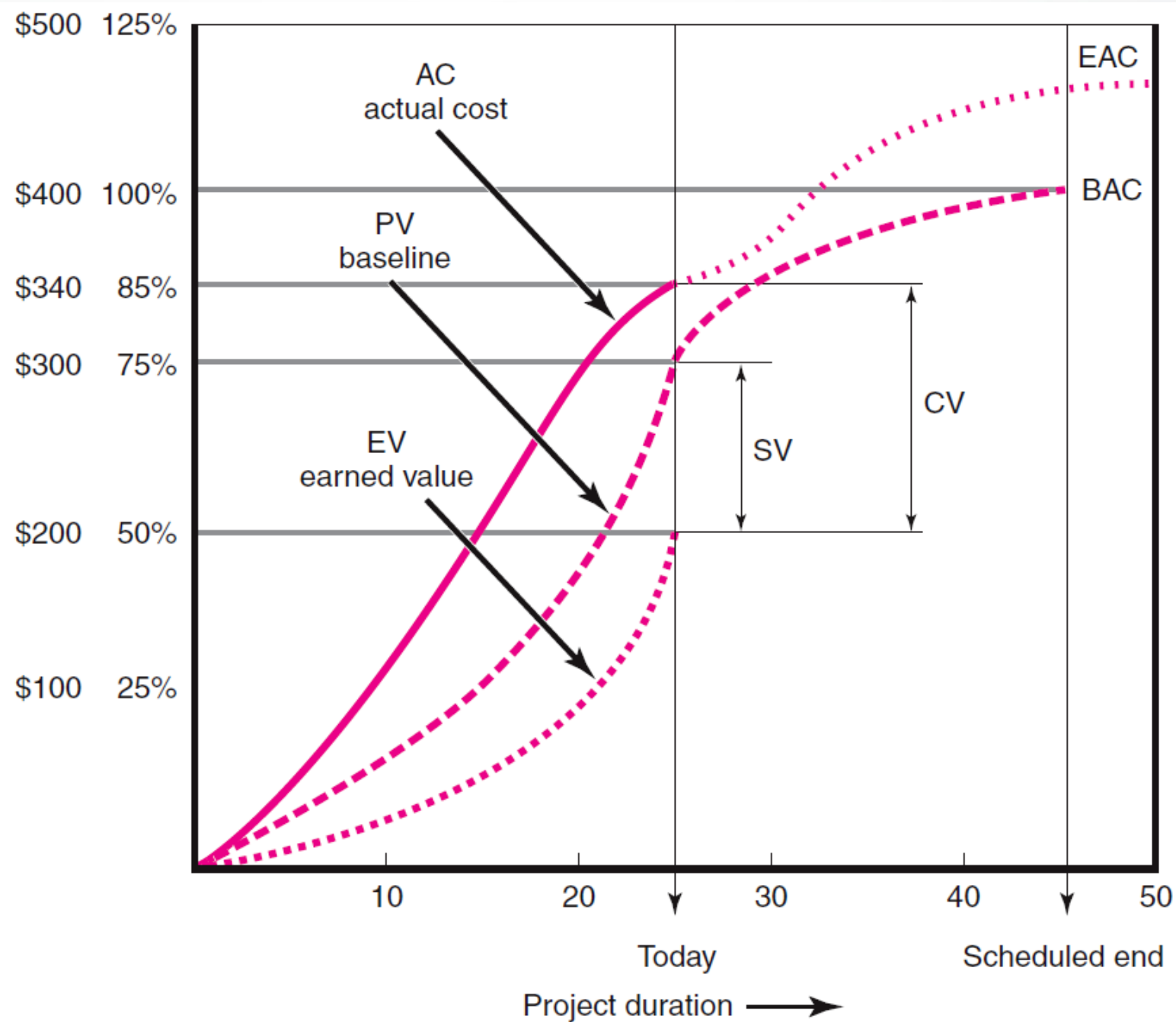
Schedule Variance (SV)

- Critical and non-critical activities are combined in the calculation.
- Schedule variance measures progress in dollars rather than time units. Therefore, it is unlikely that any translation of dollars to time will yield accurate information telling if any milestone or critical path is early, on time, or late.
- ***The only accurate method for determining the true time progress of the project is to compare the project network schedule against the actual network schedule to measure if the project is on time.***
- However, SV is very useful in assessing the direction all the work in the project is taking—*after 20 or more percent of the project has been completed.*

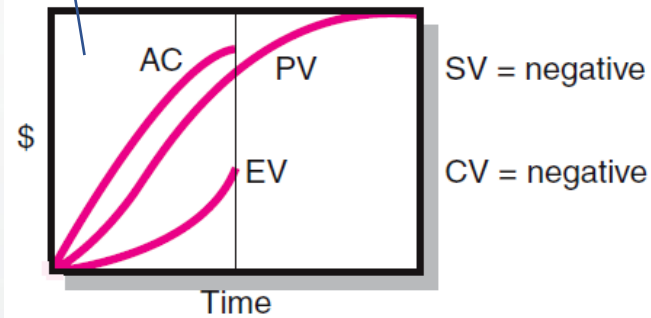
Methods of Variance Analysis

- $EV = \% \text{ completed} * \text{Original Budget}$
- $\text{Cost Variance (CV)} = EV - AC$
- $\text{Schedule Variance (SV)} = EV - PV$

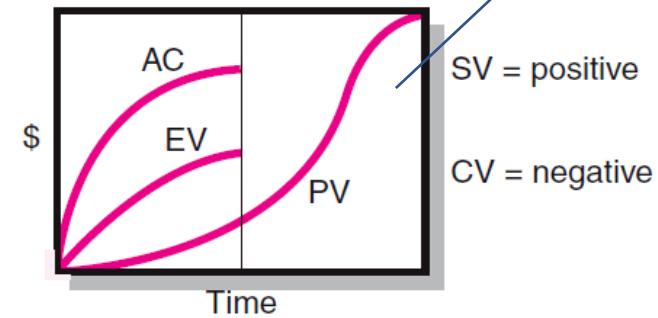
Cost/Schedule Graph



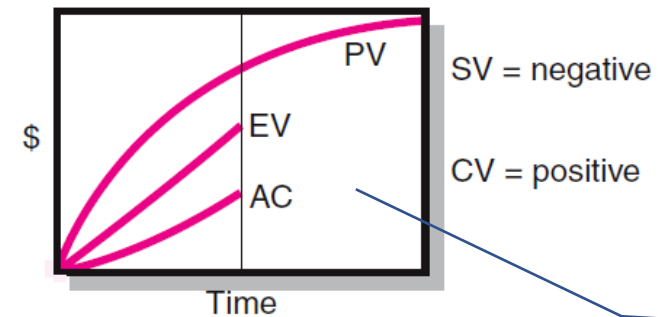
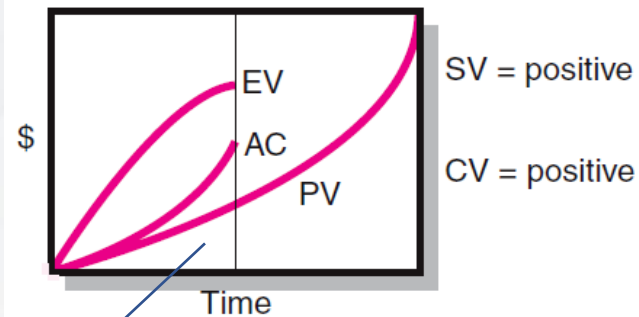
Suggests the project
behind of schedule
and over budget



Suggests the project
may be ahead of
schedule



Suggests the project
may be ahead of
schedule and under
budget



Suggests the project
behind of schedule

Developing a Status Report

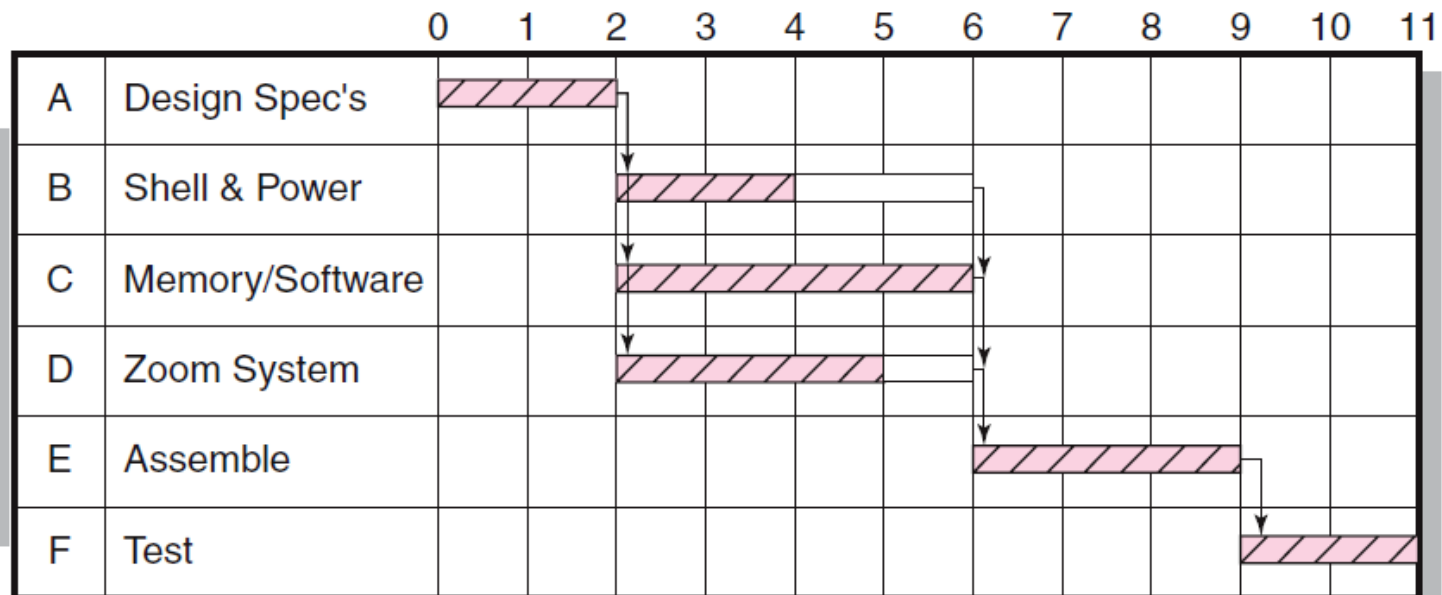
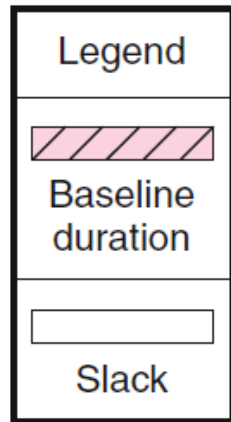
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Schedule information						Baseline budget needs											
ACT/ WP	DUR	ES	LF	SL	Total PV	Time period											
						0	1	2	3	4	5	6	7	8	9	10	11
A	2	0	2	0	20	10	10										
B	2	2	6	2	15			5	10								
C	4	2	6	0	100			20	30	30	20						
D	3	2	6	1	35			15	10	10							
E	3	6	9	0	120							30	40	50			
F	2	9	11	0	30										10	20	
Total PV by period						10	10	40	50	40	20	30	40	50	10	20	
Cumulative PV by period						10	20	60	110	150	170	200	240	290	300	320	

Schedule information						Baseline budget needs											
ACT/ WP	DUR	ES	LF	SL	Total PV	Time period											
						0	1	2	3	4	5	6	7	8	9	10	11
A	2	0	2	0	20	10	10										
B	2	2	6	2	15			5	10								
C	4	2	6	0	100			20	30	30	20						
D	3	2	6	1	35			15	10	10							
E	3	6	9	0	120							30	40	50			
F	2	9	11	0	30										10	20	
Total PV by period						10	10	40	50	40	20	30	40	50	10	20	
Cumulative PV by period						10	20	60	110	150	170	200	240	290	300	320	

Cost Variance $CV = EV - AC$
 Schedule Variance $SV = EV - PV$

Status Report: Ending Period 1

Task	%Complete	EV	AC	PV	CV	SV
A	50%	10	10	10	0	0
Cumulative Totals		10	10	10	0	0

Status Report: Ending Period 2

Task	%Complete	EV	AC	PV	CV	SV
A	Finished	20	30	20	-10	0
Cumulative Totals		20	30	20	-10	0

Status Report: Ending Period 3

Task	%Complete	EV	AC	PV	CV	SV
A	Finished	20	30	20	−10	0
B	33%	5	10	5	−5	0
C	20%	20	30	20	−10	0
D	60%	21	20	15	+1	+6
Cumulative Totals		66	90	60	−24	+6

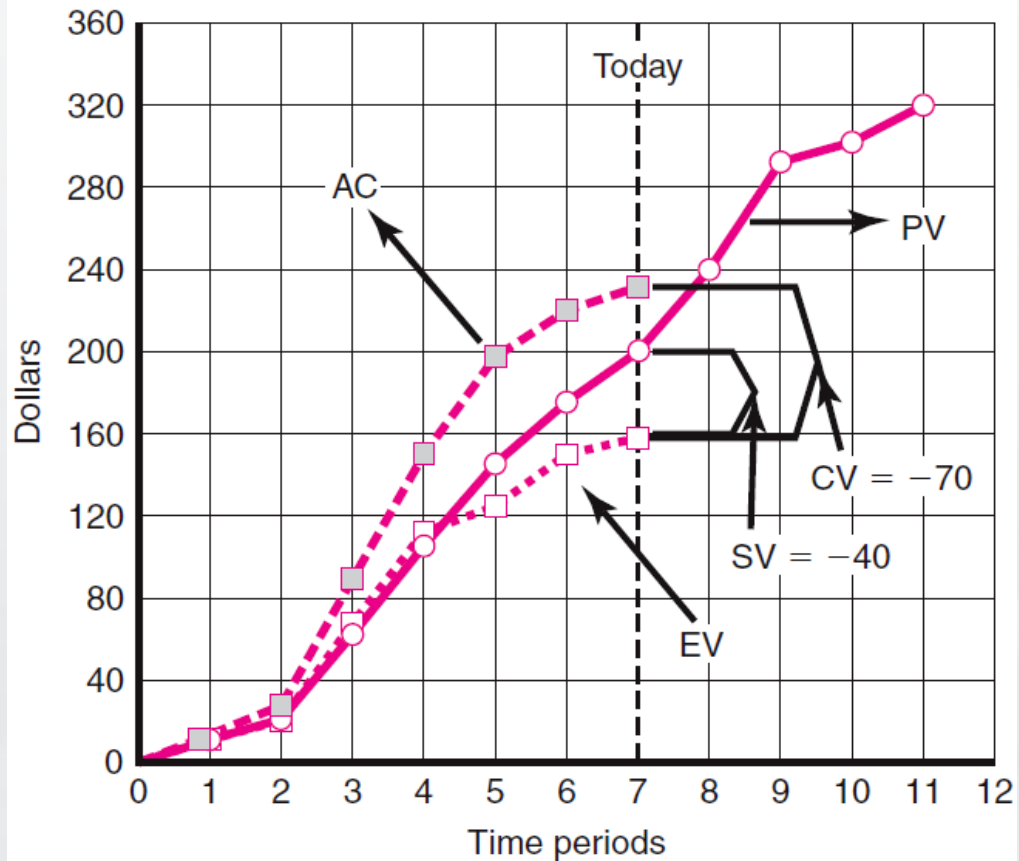
Status Report: Ending Period 4

Task	%Complete	EV	AC	PV	CV	SV
A	Finished	20	30	20	−10	0
B	Finished	15	20	15	−5	0
C	50%	50	70	50	−20	0
D	80%	28	30	25	−2	+3
Comulative Totals		113	150	110	−37	+3

Status Report: Ending Period 5

Task	%Complete	EV	AC	PV	CV	SV
A	Finished	20	30	20	−10	0
B	Finished	15	20	15	−5	0
C	60%	60	100	80	−40	−20
D	80%	28	50	35	−22	−7
Cumulative Totals		123	200	150	−77	−27

Schedule information						Baseline budget needs															
ACT/ WP	DUR	ES	LF	SL	Total PV	Time period															
						0	1	2	3	4	5	6	7	8	9	10	11				
A	2	0	2	0	20	10	10														
B	2	2	6	2	15			5	10												
C	4	2	6	0	100			20	30	30	20										
D	3	2	6	1	35			15	10	10											
E	3	6	9	0	120							30	40	50							
F	2	9	11	0	30											10	20				
Total PV by period						10	10	40	50	40	20	30	40	50	10	20					
Cumulative PV by period						10	20	60	110	150	170	200	240	290	300	320					



Status Report: Ending Period 6

Task	%Complete	EV	Ac	PV	CV	SV
A	Finished	20	30	20	-10	0
B	Finished	15	20	15	-5	0
C	80%	80	110	100	-30	-20
D	Finished	35	60	35	-25	0
Cumulative Totals		150	220	170	-70	-20

Status Report: Ending Period 7

Task	%Complete	EV	AC	PV	CV	SV
A	Finished	20	30	20	-10	0
B	Finished	15	20	15	-5	0
C	90%	90	120	100	-30	-10
D	Finished	35	60	35	-25	0
E	0%	0	0	30	0	-30
F	0%	0	0	0	0	0
Cumulative Totals		160	230	200	-70	-40

Indexes to Monitor Progress

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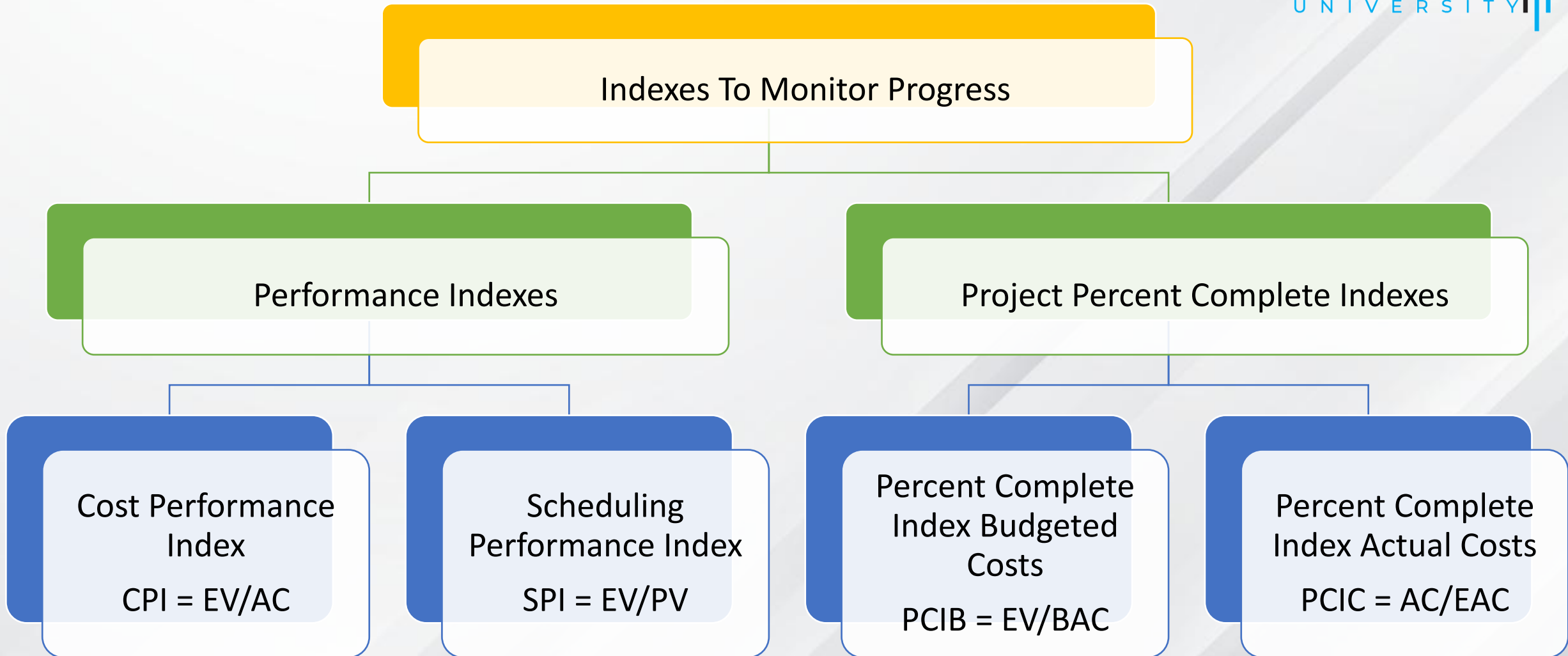
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Indexes to Monitor Progress

- Practitioners sometimes prefer to use schedule and cost indexes over the values of SV and CV, because indexes can be considered efficiency ratios.
- Indexes are typically used at the cost account level and above.



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Performance Indexes- Cost Performance Index (CPI)

- Cost Performance Index (CPI) measures cost efficiency of the work accomplished to date
- Most accurate, reliable, and stable
- The CPI can provide an “early warning signal” as to cost overruns so that adjustments can be made to the budget or scope of a project
- $CPI = EV/AC = 160/230 = .7$

Index	Cost (CPI)
>1.00	Under cost
=1.00	On cost
<1.00	Over cost

Status Report: Ending Period 7

Task	%Complete	EV	AC	PV	CV	SV
A	Finished	20	30	20	-10	0
B	Finished	15	20	15	-5	0
C	90%	90	120	100	-30	-10
D	Finished	35	60	35	-25	0
E	0%	0	0	30	0	-30
F	0%	0	0	0	0	0
Cumulative Totals		160	230	200	-70	-40

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Performance Indexes- Scheduling Performance Index (SPI)

- Scheduling Performance Index (SPI) measures scheduling efficiency to date
- $SPI = EV/PV = 160/200 = .8$

Index	Cost (CPI)	Schedule (SPI)
>1.00	Under cost	Ahead of schedule
=1.00	On cost	On schedule
<1.00	Over cost	Behind schedule

Status Report: Ending Period 7

Task	%Complete	EV	AC	PV	CV	SV
A	Finished	20	30	20	−10	0
B	Finished	15	20	15	−5	0
C	90%	90	120	100	−30	−10
D	Finished	35	60	35	−25	0
E	0%	0	0	30	0	−30
F	0%	0	0	0	0	0
Cumulative Totals		160	230	200	−70	−40

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Project Percent Complete Indexes – Percent Complete Index Budgeted Costs (PCIB)

- This index is favored by many project managers when there is a high level of confidence in the original budget estimates (BAC).
- $PCIB = EV/BAC = 160/320 = .50$ (50%)
- Indicates the work accomplished represents 50 percent of the total budgeted (BAC) dollars to date.

Status Report: Ending Period 7

Task	%Complete	EV	AC	PV	CV	SV
A	Finished	20	30	20	-10	0
B	Finished	15	20	15	-5	0
C	90%	90	120	100	-30	-10
D	Finished	35	60	35	-25	0
E	0%	0	0	30	0	-30
F	0%	0	0	0	0	0
Cumulative Totals		160	230	200	-70	-40

Schedule information						Baseline budget needs											
ACT/ WP	DUR	ES	LF	SL	Total PV	Time period											
						0	1	2	3	4	5	6	7	8	9	10	11
A	2	0	2	0	20	10	10										
B	2	2	6	2	15			5	10								
C	4	2	6	0	100			20	30	30	20						
D	3	2	6	1	35			15	10	10							
E	3	6	9	0	120							30	40	50			
F	2	9	11	0	30										10	20	
Total PV by period						10	10	40	50	40	20	30	40	50	10	20	
Cumulative PV by period						10	20	60	110	150	170	200	240	290	300	320	

Lecture
09

Project Percent Complete Indexes – Percent Complete Index Actual Costs (PCIC)

- This index assumes the actual costs-to-date and expected cost at completion are the most reliable for measuring project percent complete (EAC_{re}).
- Example, at the end of period 7 the staff re-estimates that the EAC_{re} will be 575 instead of 320.

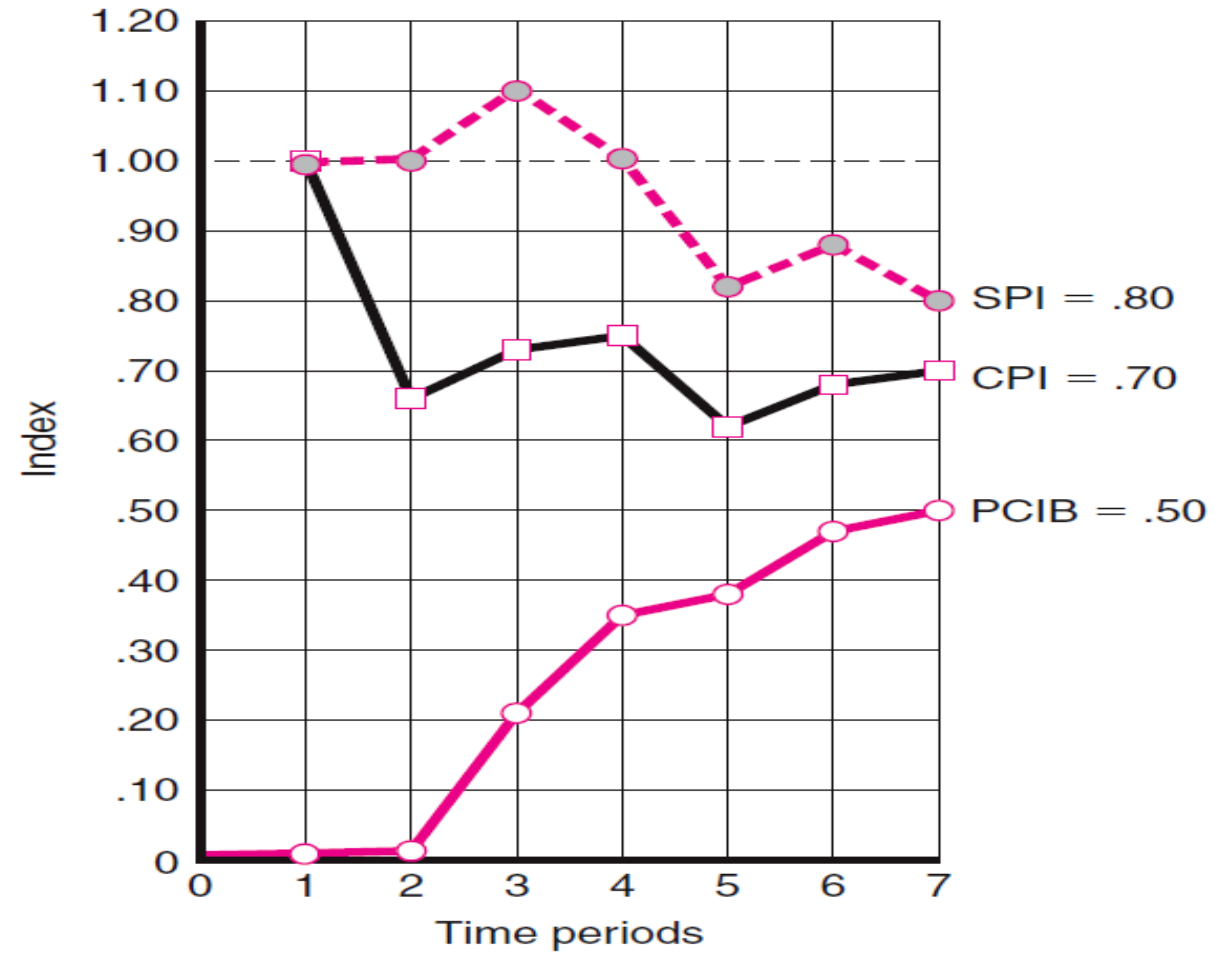
Status Report: Ending Period 7						
Task	%Complete	EV	AC	PV	CV	SV
A	Finished	20	30	20	-10	0
B	Finished	15	20	15	-5	0
C	90%	90	120	100	-30	-10
D	Finished	35	60	35	-25	0
E	0%	0	0	30	0	-30
F	0%	0	0	0	0	0
Cumulative Totals		160	230	200	-70	-40

- $PCIC = AC/EAC_{re} = 230/575 = .40$ (40%)
- Some managers favor this index because it contains actual and revised estimates that include newer, more complete information.

Lecture
09

Performance Indexes

Index	Cost (CPI)	Schedule (SPI)
>1.00	Under cost	Ahead of schedule
=1.00	On cost	On schedule
<1.00	Over cost	Behind schedule



Forecasting Final Project Cost

Lecture

08

Progress and Performance
Measurement and Evaluation

PMG 605

Project Resources and Time Management

Lecture
09

Forecasting Final Project Cost

- Basically, two methods used to revise estimates of future project costs.
1. Revised Estimated Cost At Completion (EAC_{re})
 - Allows experts in the field to change original baseline durations and costs because new information tells them the original estimates are not accurate.
 - Almost always used on smaller projects.
 2. Forecasted Total Cost At Completion (EAC_f)
 - Used in large projects where the original budget is reliable.

Revised Estimated Cost At Completion (EAC_{re})

$$EAC_{re} = AC + ETC_{re}$$

Where

- EAC_{re} = revised estimated cost at completion.
- AC = cumulative actual cost of work completed to date.
- ETC_{re} = revised estimated cost to complete remaining work.

Lecture
09

Forecasted Total Cost At Completion (EAC_f)

$$EAC_f = AC + ETC = AC + \frac{BAC - EV}{CPI} = AC + \frac{BAC - EV}{EV/AC}$$

Where

- EAC_f = forecasted total cost at completion.
- ETC = estimated cost to complete remaining work.
- AC = cumulative actual cost of work completed to date.
- CPI = cumulative cost index to date.
- BAC = total budget of the baseline.
- EV = cumulative budgeted cost of work completed to date.

Total baseline budget (BAC) for the project	\$320
Cumulative earned value (EV) to date	\$160
Cumulative actual cost (AC) to date	\$230

$$EAC_f = \frac{320 - 160}{160/230} + 230 = \frac{160}{.7} + 230 = 229 + 230$$

$$EAC_f = 459$$

Project number: 163

Project manager: Connor Gage

Project priority now: 4

Status as of: April 1

Earned value figures:

PV	EV	AC	SV	CV	BAC
588,240	566,064	596,800	-22,176	-30,736	1,051,200
EAC	VAC	EAC _f	CPI	PCIB	PCIC
1,090,640	-39,440	1,107,469	.95	.538	.547

Project description: A computer-controlled conveyor belt that will move and position items on the belt with accuracy of less than one millimeter.

Status summary: The project is approximately 25 days behind schedule. The project has a cost variance of (\$30,736).

Explanations: The schedule variance has moved from noncritical activities to those on the critical path. Integration first phase, scheduled to start 3/26, is now expected to start 4/19, which means it is approximately 25 days behind schedule. This delay is traced to the loss of the second design team which made it impossible to start utilities documentation on 2/27 as planned. This loss illustrates the effect of losing valuable resources on the project. The cost variance to date is largely due to a design change that cost \$21,000.

Major changes since last report: The major change was loss of one design team to the project.

Total cost of approved design changes: \$21,000. Most of this amount is attributed to the improved design of the serial I/O drivers.

Projected cost at completion: EAC_f is estimated to be \$1,107,469. This represents an overrun of \$56,269, given a CPI of .95. The CPI of .95 causes the forecast to be greater than the VAC -\$39,440.

Risk watch: Nothing suggests the risk level of any segments has changed.

Monthly Status Report - Example

Basics		Calculation	Comments
PV	The planned time-phased value of the work that is scheduled		MS Project: BCWS – Budgeted cost of the work scheduled
EV	Earned value is simply percent complete times its budgeted cost of the work	$EV = \% \text{ Complete} * PV$	MS Project: BCWP – Budgeted cost of the work performed
AC	Actual cost of the work completed		MS Project: ACWP – Actual cost of the work performed
BAC	The total planned value of the project		Budgeted cost at completion
Cost			
CV	Cost variance adjusted budget costs to the actual spent costs	$CV = EV - AC$	Negative number indicates over budget. Positive number indicates under budget. Need to know % over budget to indicate magnitude.
CPI	Cost performance index is a measure of cost efficiency on a project	$CPI = EV / AC$	A value less than 1 indicates a cost overrun. A value greater than 1 indicates cost savings. CPI = .90 means “we are only earning 90 cents of planned work for each dollar spent.” Found on the EV Cost Indicators Table in MS Project.
TCPI	To complete performance index	$TCPI = (BAC - EV) / (BAC - AC)$	The amount of value each remaining dollar must earn for the project to stay within budget. A number greater than 1 means there is more work than there is budget left. A number less than 1 means there is less work than there is budget left. Found on the EV Cost Indicators Table in MS Project.
Schedule			
SV	Schedule variance: How much work that has been done compared with how much should have done at this point in time	$SV = EV - PV$	Negative number indicates work that was suppose to be done at this time has not been done. Positive number indicates work that was not suppose to be done by this time has been accomplished. SV = -1,000 means \$1,000 worth of work that was scheduled to be done at this time has not been accomplished.
SPI	Schedule performance index is a measure of schedule efficiency on a project	$SPI = EV / PV$	A value less than 1 indicates that work on the project is behind schedule. A value greater than 1 indicates work on the ahead of schedule. SPI = 1.10 means “\$1.10 worth of work has been accomplished for each \$1 worth of scheduled work.” Found at MS EV Schedule Indicators Table.
Critical Path	Look at current activity on the critical path or most recent milestone to see if it is on schedule		Compare the planned early start of most recent critical activity with the actual start. Alternative compare most recent milestone date and actual milestone date.
PCIB	Percent complete in terms of <i>budget</i>	$PCIB = EV / BAC$	What percentage of work has been completed to date based on planned budget. A good indicator of how much of the project has been completed. <u>Not available in MS Project.</u>
PCIC	Percent complete in terms of <i>expected costs</i>	$PCIC = AC / EAC_e$	What percentage of work has been completed to date based on revised estimates of total project costs. Preferred when you have confidence in revised estimates and or budget is not fixed. <u>Not available in MS Project.</u>
Forecast			
EAC_f	Forecasted estimate cost at completion	$EAC_f = AC + [(BAC - EV) / CPI]$	Gray & Larson refer to this as FAC or EAC_f . If we continue to earn ?? (CPI) on the project, how much will the total cost be? Reliability increases as PCIB or PCIC increases.
EAC_e	Revised estimate cost at completion	$EAC_e = AC + ETC$	ETC equals the revised estimates for remaining work. Only valid if revised estimates have been entered.
VAC	Forecasted cost variance	$VAC = BAC - EAC_f$	Positive number indicates that the project will be completed under budget. A negative number suggests that it will be completed over budget. Gray & Larson refer to it as VAC_f . Preferred on large projects and when it is not practical to obtain valid revised estimates.
VAC_e	Revised estimate cost variance	$VAC_e = BAC - EAC_e$	Positive number indicates that the project will be completed under budget. A negative number suggests that it will be completed over budget.

Summary of Today Session

Lecture

08

Progress and Performance
Measurement and Evaluation

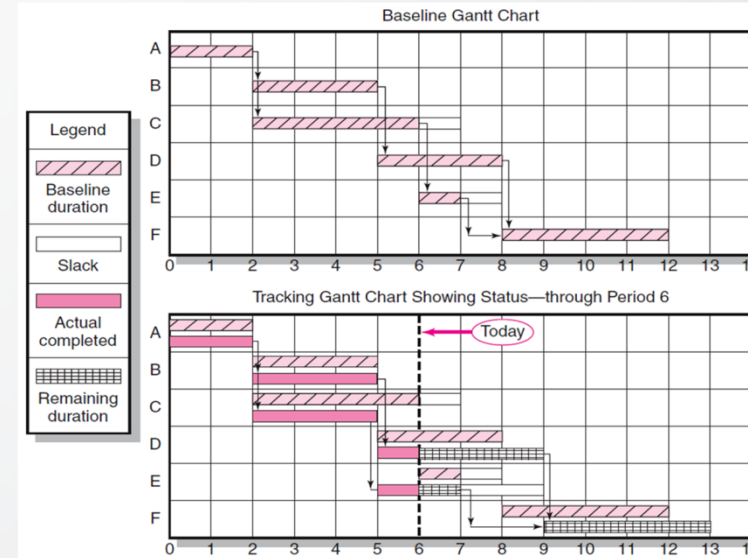
PMG 605

Project Resources and Time Management

Development of an EV Cost/Schedule System

1. Define the work using a WBS.
 - a. Scope
 - b. Work packages
 - c. Deliverables
 - d. Organization units
 - e. Resources
 - f. Budgets
2. Develop work and resource schedules.
 - a. Schedule resources to activities
 - b. Time-phase work packages into a network
3. Develop a time-phased budget using work packages included in an activity. Accumulate budgets (PV).
4. At the work package level, collect the actual costs for the work performed (AC). Multiply percent complete times original budget (EV).
5. Compute the schedule variance (EV-PV) and the cost variance (EV-AC).

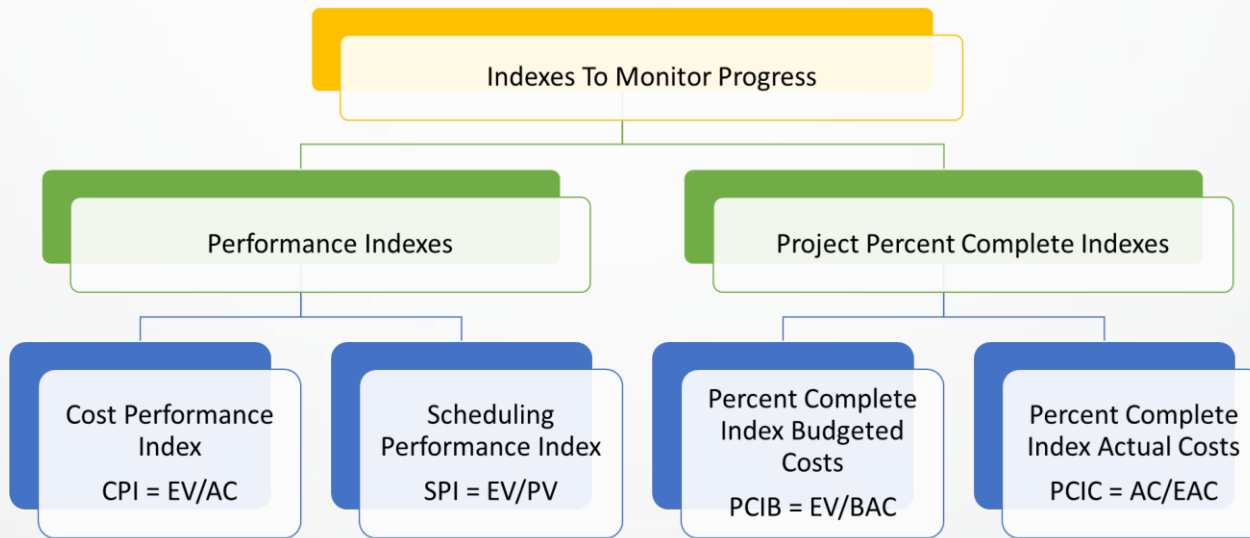
Tracking Gantt Chart



- The most favored, used, and understandable.

Glossary of Terms

EV	Earned value for a task is simply the <i>percent complete</i> times its original budget. Stated differently, EV is the percent of the original budget that has been earned by actual work completed
PV	The planned time-phased baseline of the value of the work scheduled. An approved cost estimate of the resources scheduled in a time-phased cumulative baseline
AC	Actual cost of the work completed. The sum of the costs incurred in accomplishing work.
CV	Cost variance is the difference between the earned value and the actual costs for the work completed to date where $CV = EV - AC$.
SV	Schedule variance is the difference between the earned value and the baseline line to date where $SV = EV - PV$.
BAC	Budgeted cost at completion. Total budgeted cost of the baseline or project cost accounts.
EAC	Estimated cost at completion.
ETC	Estimated cost to complete remaining work.
VAC	Cost variance at completion. VAC indicates expected actual over- or under-run cost at completion.



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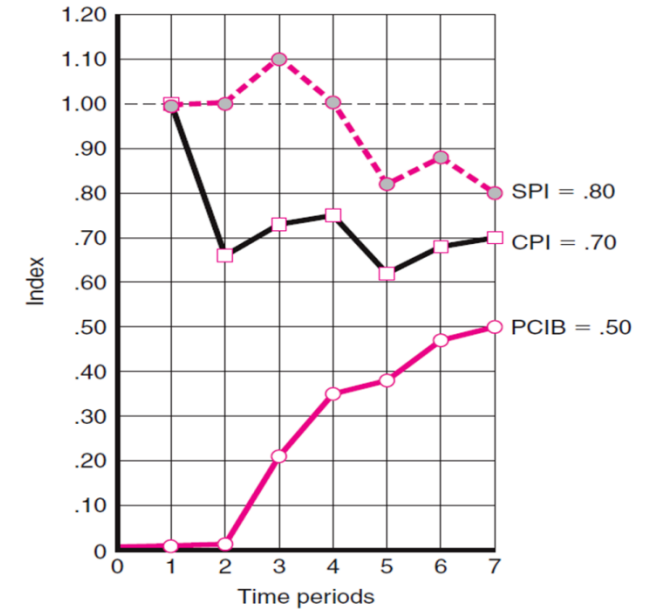
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Resources

- Project Management: The Managerial Process
Fifth Edition. By: Erik W. Larson, Oregon State
University, Clifford F. Gray, Oregon State
University



Thank You