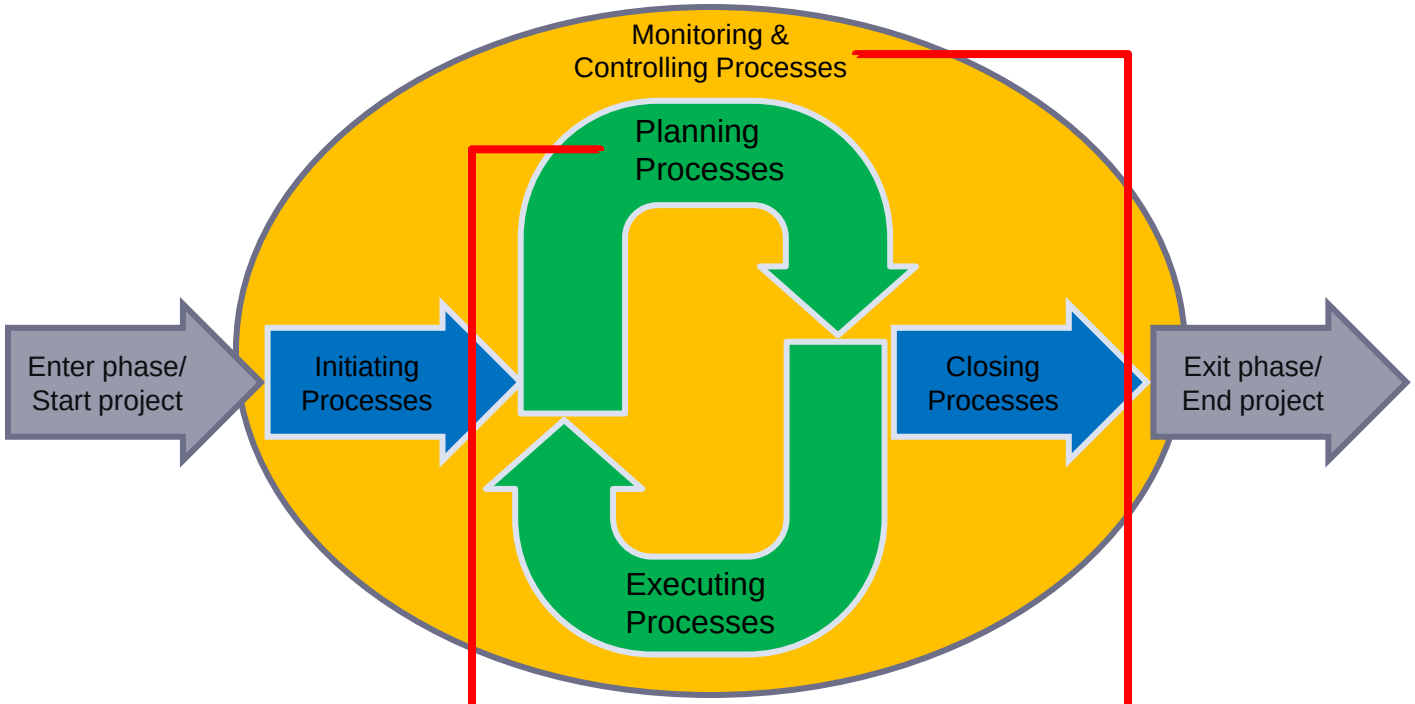
BY: AHMED ABBAS

PROJECT MANAGEMENT

COST MANAGEMENT

PROJECT COST MANAGEMENT



Knowledge Area	Process				
	Initiating	Planning	Executing	Monitoring & Control	Closing
Cost		• Plan Cost Management • Cost Estimating • Cost Budgeting		• Cost Control	

PROJECT COST MANAGEMENT

The process involved in estimating, budgeting, and controlling cost so that the project can be completed within approved budget

Life cycle costing

- Looking at the cost of whole life of the product (include maintenance)

Value analysis (value engineering)

- Looking at less costly way to do the same work within the same scope

Law of Diminishing Returns

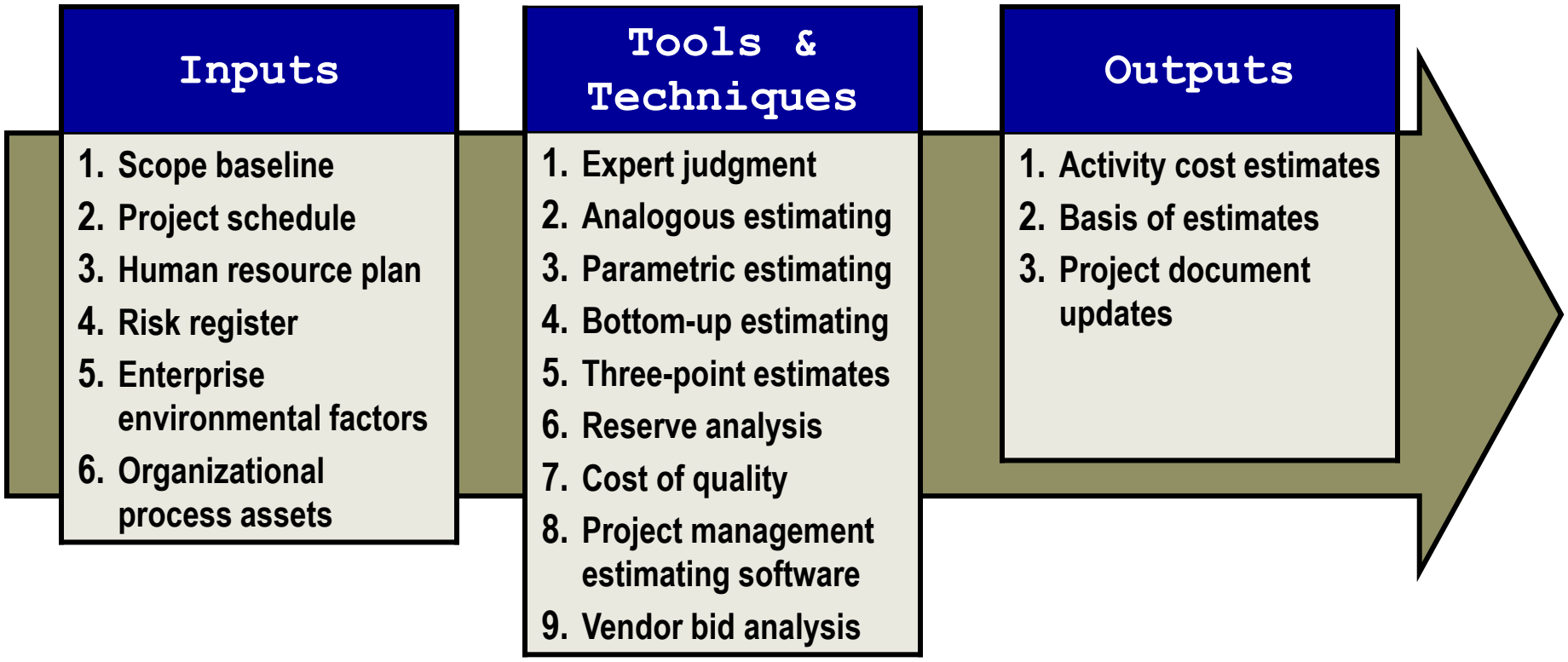
- E.g. adding twice resource to task may not get the task done in half cost/time

- Time value of money (depreciation)
- Cost will also affect the schedule
- Cost risk vs. Type of contract

7.2 ESTIMATE COST

The process of developing approximation of the monetary resources needed to complete project activities

- Cost trade-offs & risk must be considered
- Cost estimates should be refined



TYPES OF COST

Variable Costs

- Change with the amount of production/work
- e.g. material, supplies, wages

Fixed Costs

- Do not change as production change
- e.g. set-up, rental

Direct Costs

- Directly attributable to the work of project
- e.g. team travel, recognition, team wages

Indirect Costs

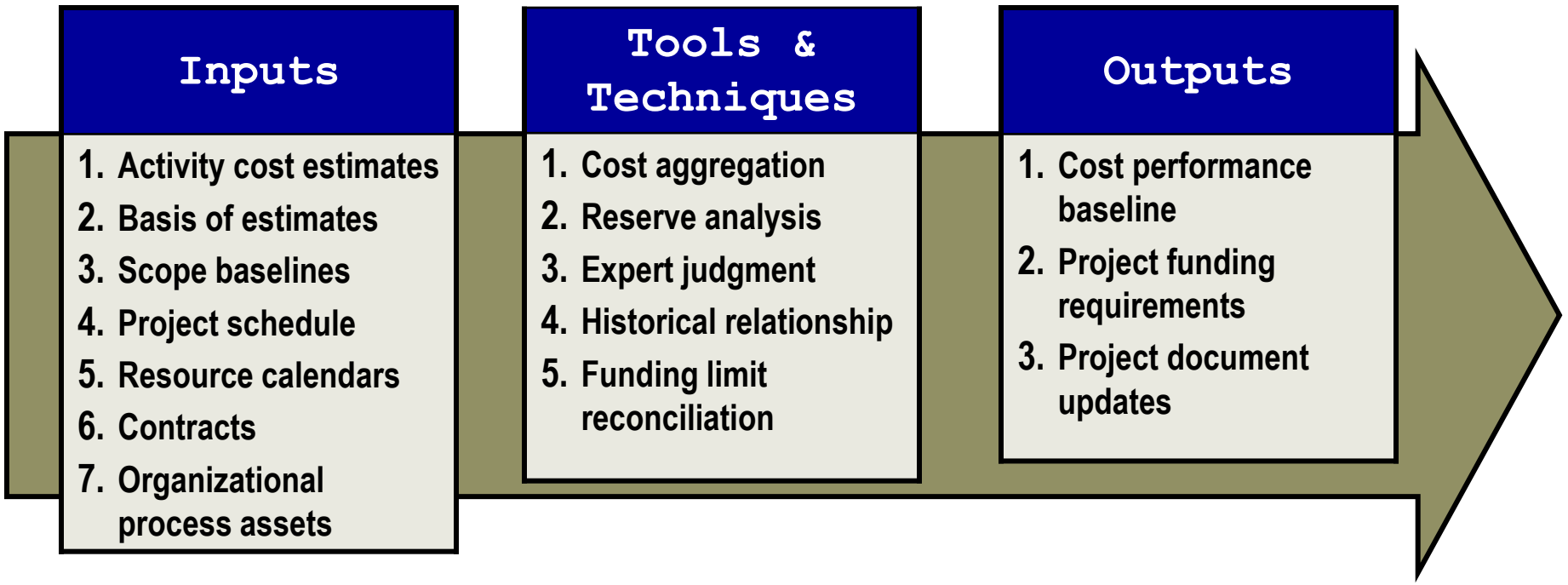
- overhead or cost incurred for benefit of more than one project
- e.g. taxes, fringe benefit, janitorial services

QUALITY/ACCURACY OF COST ESTIMATION

Estimate	Accuracy	
Rough Order of Magnitude (ROM)	-25% +75%	• Most difficult to estimate as very little project info is available, made during **initiating process**
Budget Estimate	-10% +25%	• Used to finalize the Request for Authorization (RFA), and establish commitment, made during **planning phase**
Definitive Estimate	-5% 10%	• **During the project** and refined
Preliminary estimate	-15% + 50%	• **During the Initiation**
Final estimate	0%	• **When complete identification done**

7.3 DETERMINE BUDGET

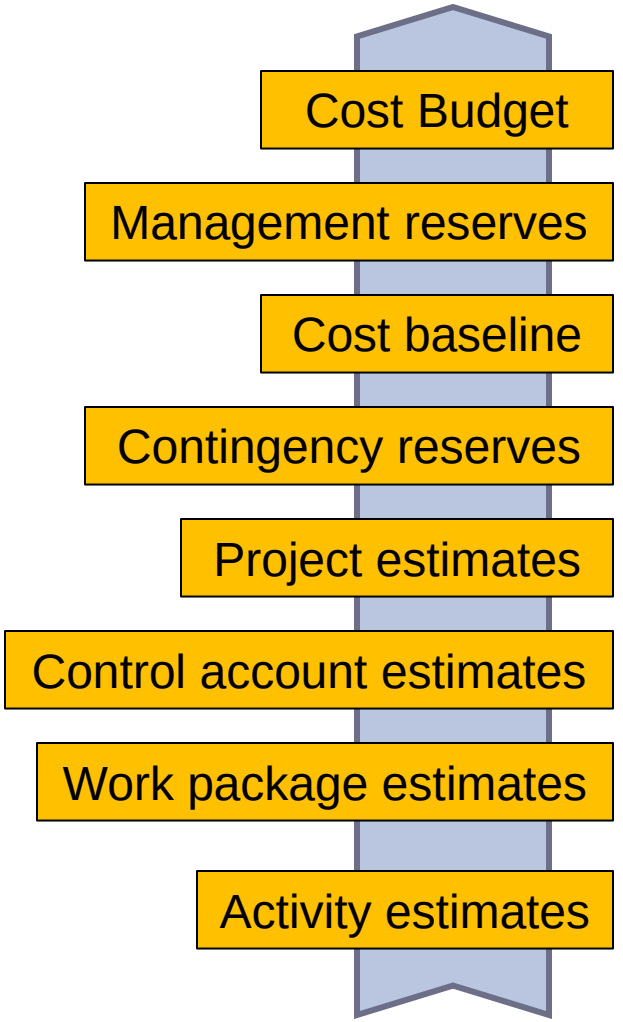
Process of aggregating the estimated cost of individual activities or work packages to establish an authorized cost baseline.



COST AGGREGATION (TOOLS & TECHNIQUE)

Reserves & risk management are important while estimating!

- **Contingency reserve** is used to manage identified risks
- while **management reserve** is used to manage unidentified risks.
- Contingency reserve is an estimated figure. Management reserve is a percentage of the cost or duration of the project. The project manager has authority over the contingency reserve.



DETERMINES BUDGET: OTHER CONSIDERATIONS

High level parametric estimate as a rule of thumb

- E.g. testing cost 50% of development cost

Funding limit reconciliation = checking cash flow

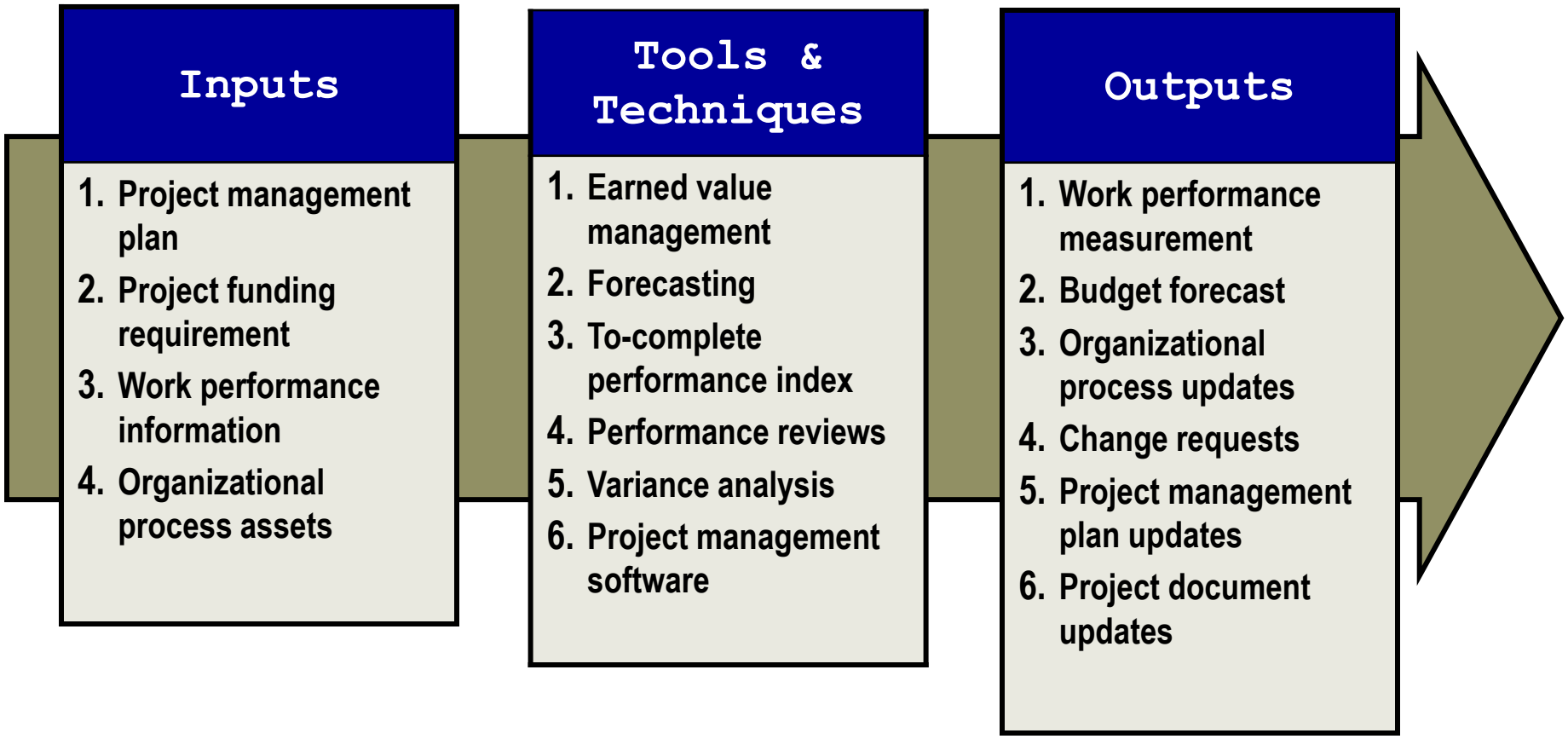
- When the money will be available?

Reconciliation needed before proposed cost baseline and cost budget become final

- Such reconciliation is part of integration management

7.4 CONTROL COST

The process of monitoring the status of the project to update the project budget and managing changes to the cost baseline



EARNED VALUE MANAGEMENT (EVM)

ASSUMPTIONS AND DEFINITIONS

- **Assumptions:**
  - Manpower = Cost: (plotting effort or cost is equivalent)
  - Actual manpower = Actual Cost
  - Progress = Money
- **Definitions:**
  - **Planned Value(PV):** the cumulative costs planned for the project.

    Also called: Budgeted Costs of Work Scheduled (**BCWS**)
  - **Actual Costs (AC):** the cumulative costs actually incurred into.

    Also called: Actual Costs of Work Performed (**ACWP**)
  - **Earned Value (EV):** the actual progress, expressed as the quantity of planned value which has generated results, known as Budgeted Costs of Work Performed (**BCWP**)

HOW ACHIEVED EVM

1. **The first step is to define the work. Create WBS, most detailed work of WBS is called an activity or task**
2. **The second step is to assign a value, called planned value (PV), to each activity**
3. **The third step is to define "earning rules" for each activity**
    - Rule 1
        - Earned value should be determined by examining products
    - Rule 2.
        - 50/50 Rule (50% of Planned Value at start and 50% at end)
        - 20/80 Rule (20% at start and 80% at end)
        - 0/100 Rule (0% at start and 100% at end) (mostly default rule)

EARNED VALUE TECHNIQUE

Example:
Project Budget: $400K
Project Schedule: 4 months

At the 3 month checkpoint:
Spent: $200K
Work completed: $100K

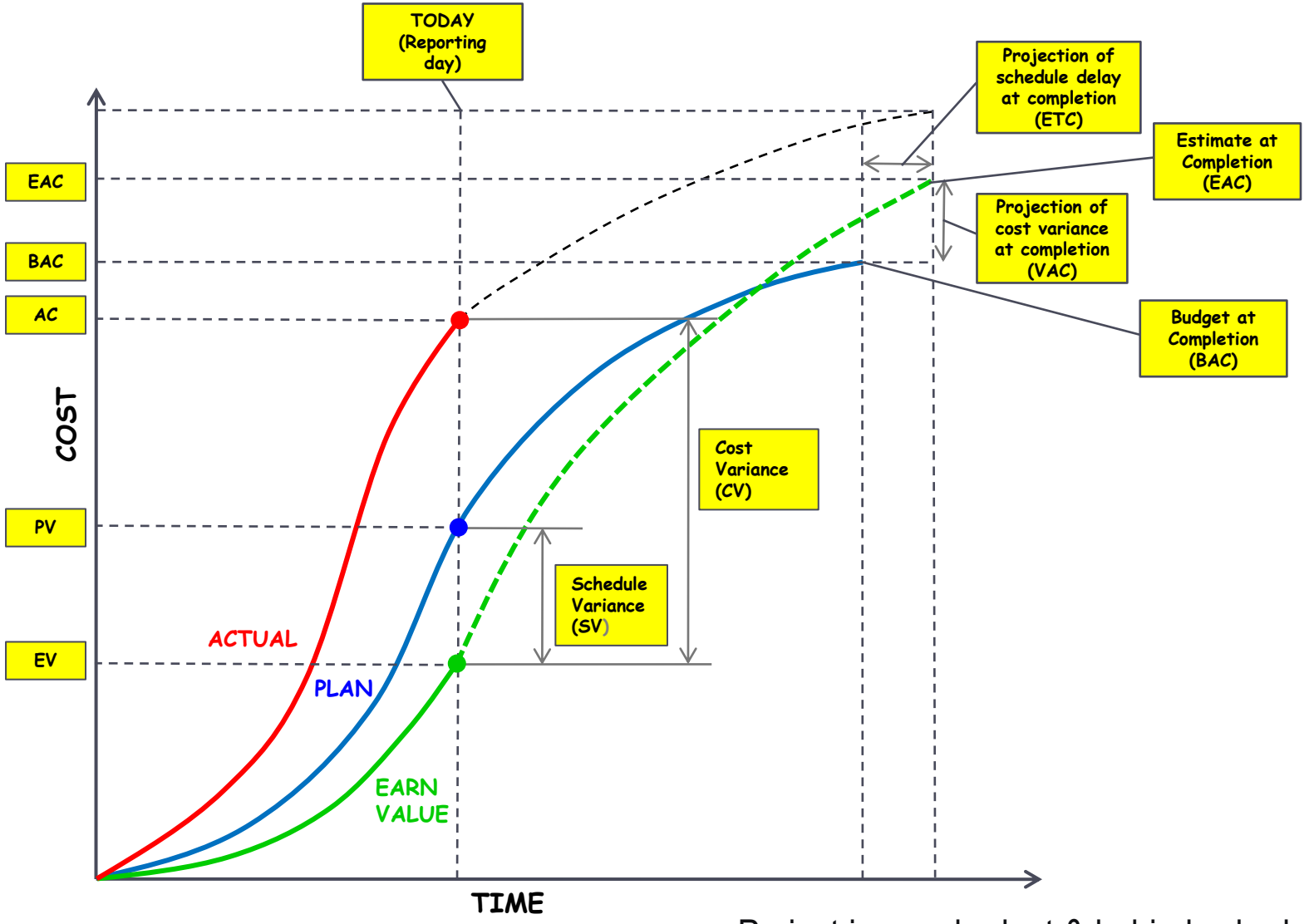
Terms and Formulas	Definition	Example
Earned Value (EV)	As of today, what is the estimated value of the work actually accomplished?	$100K
Actual Cost (AC)	As of today, what is the actual cost incurred for the work accomplished?	$200K
Planned Value (PV)	As of today, what is the estimated value of work planned to be done?	$300K
Cost Variance (CV) = EV - AC	Negative is over budget Positive is under budget	$100K – $200K = ($100K)
Schedule Variance (SV) = EV - PV	Negative is behind schedule Positive is ahead schedule	$100K - $300K = ($200K)
Cost Performance Index (CPI) = EV/AC	We are getting $__ worth of work out of every $1 spent. Are funds being used efficiently?	$100K/$200K = 0.5 i.e. 50%
Schedule Performance Index (SPI) = EV/PV	We are (only) progressing at __ percent of the rate originally planed	$100K/$300K = 0.33 i.e 33%
Revised Total Duration	Baseline Duration/Schedule Performance Index	4/0.33 = 12 months

EARNED VALUE TECHNIQUE

Terms and Formulas	Definition
Budget at completion (BAC)	How much did we BUDGET for the TOTAL project effort?
Estimate at Completion (EAC) = BAC / CPI	What do we currently expect the TOTAL project cost (a forecast)?
Estimate to Complete (ETC) = EAC - AC	From this point on, how much MORE do we expect it to cost to finish the project (a forecast)?
Variance at Completion (VAC) = BAC – EAC	As of today, how much over or under budget do we expect to be at the end of the project?

EAC is an important forecasting value.

EARNED VALUE: GRAPHICAL REPRESENTATION



Project is over budget & behind schedule

EARNED VALUE MANAGEMENT

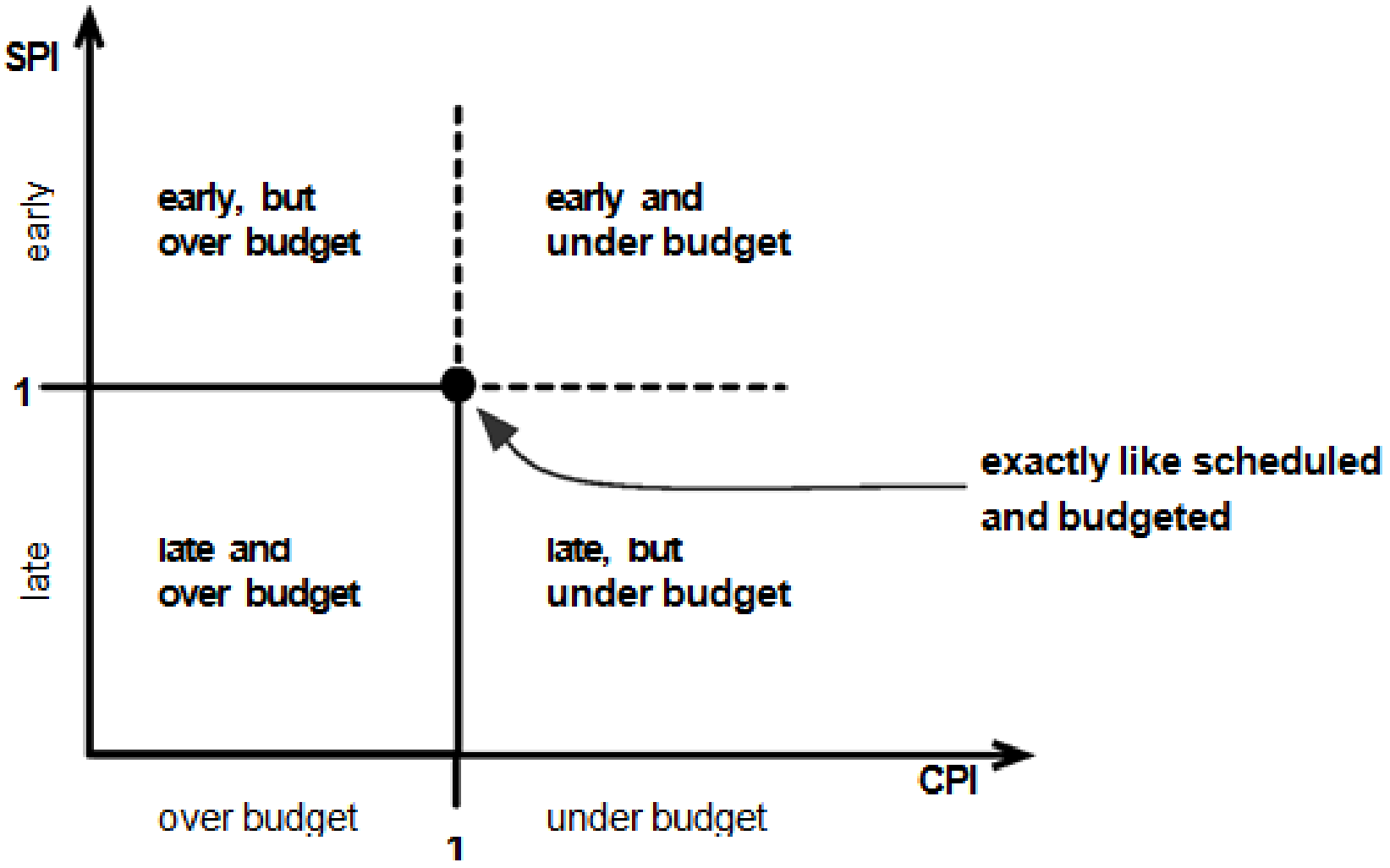
Method to measure project performance against scope, schedule and cost baseline (performance measurement baseline)

Interpretation of basic EVM performance measures

- **Cost Performance Index (CPI)**
- **Schedule Performance Index (SPI)**

Performance Measures		Schedule		
		SV > 0 & SPI > 1.0	SV = 0 & SPI = 1.0	SV < 0 & SPI < 1.0
Cost	CV > 0 & CPI > 1.0	Ahead of Schedule Under Budget	On Schedule Under Budget	Behind Schedule Under Budget
	CV = 0 & CPI = 1.0	Ahead of Schedule On Budget	On Schedule On Budget	Behind Schedule On Budget
	CV < 0 & CPI < 1.0	Ahead of Schedule Over Budget	On Schedule Over Budget	Behind Schedule Over Budget

MEASURING SPI & CPI (ANOTHER VIEW)

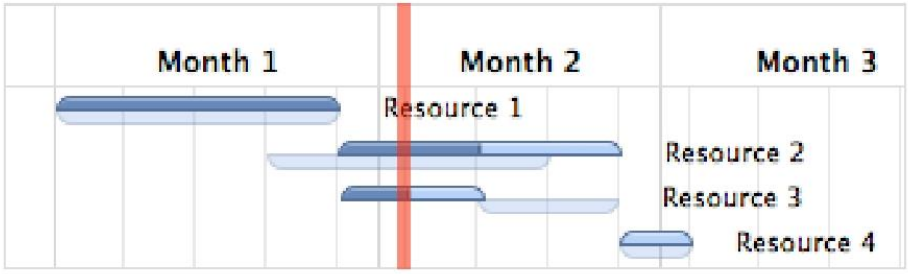


EARNED VALUE ANALYSIS
EXAMPLES

Image captured from Practice Standard for Earned Value Management, PMI © 2005

Example

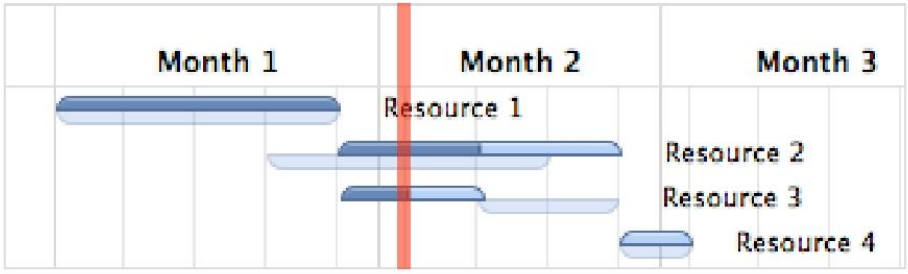
Task	Effort	Resources Cost	Task Cost
1) Paint Wall	4w	€3,200.00	€3,600.00
2) Paint Ceiling	4w	€3,200.00	€2,000.00
3) Refurnish	2w	€800.00	€400.00
4) Clean	1w	€400.00	



- **Remarks:**
  - Lower part = baseline; upper part: actual & progress
- **Questions:**
  - Are we late?
  - Are we over budget?

Example

Task	Effort	Resources Cost	Task Cost
1) Paint Wall	4w	€3,200.00	€3,600.00
2) Paint Ceiling	4w	€3,200.00	€2,000.00
3) Refurnish	2w	€800.00	€400.00
4) Clean	1w	€400.00	



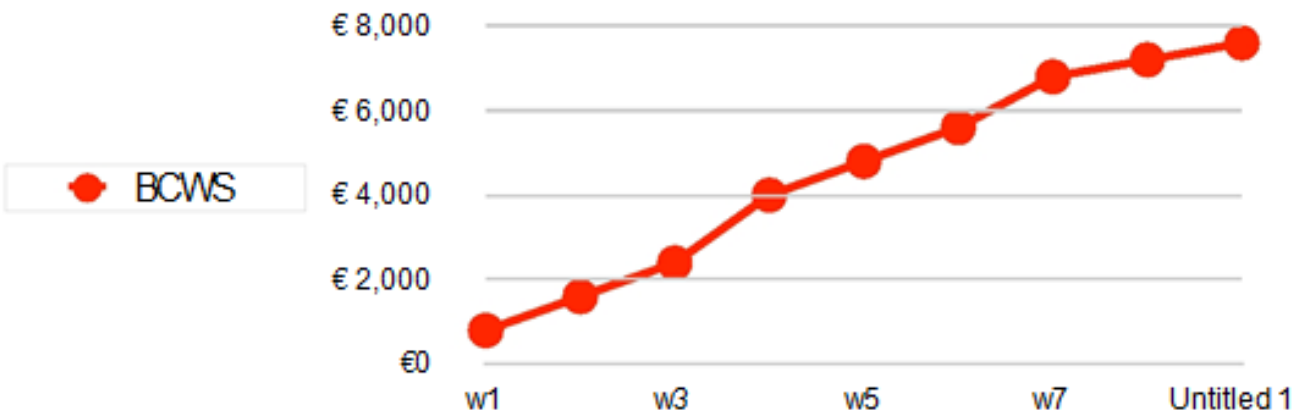
- **Remarks:**
  - Lower part = baseline;
    upper part: actual & progress
- **Questions:**
  - Are we late?
  - Are we over budget?

- Activity 1: as scheduled (time)
- Activity 2: started late; ahead of schedule
- Activity 3: started earlier; progress same as time elapsed
- Activity 4: not started yet

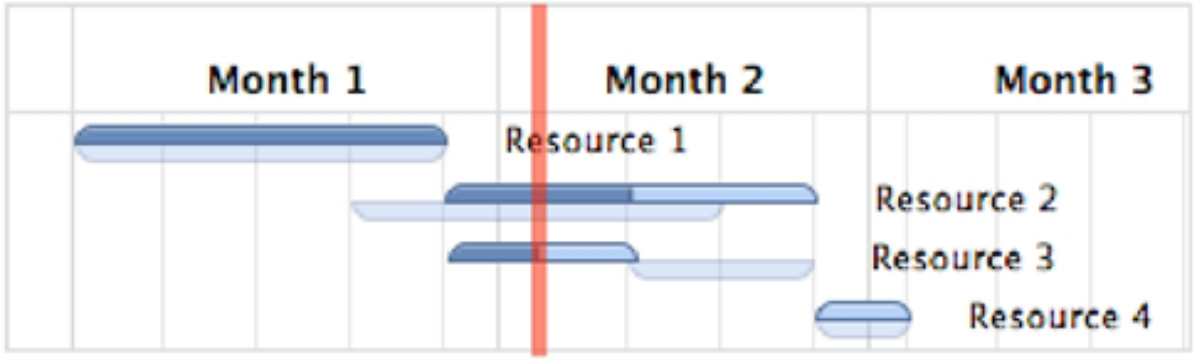
Example: BCWS (Planned Value)

Task	Effort	Resources Cost	Task Cost
• 1) Paint Wall	4w	€3,200.00	€3,600.00
• 2) Paint Ceiling	4w	€3,200.00	€2,000.00
• 3) Refurnish	2w	€800.00	€400.00
• 4) Clean	1w	€400.00	

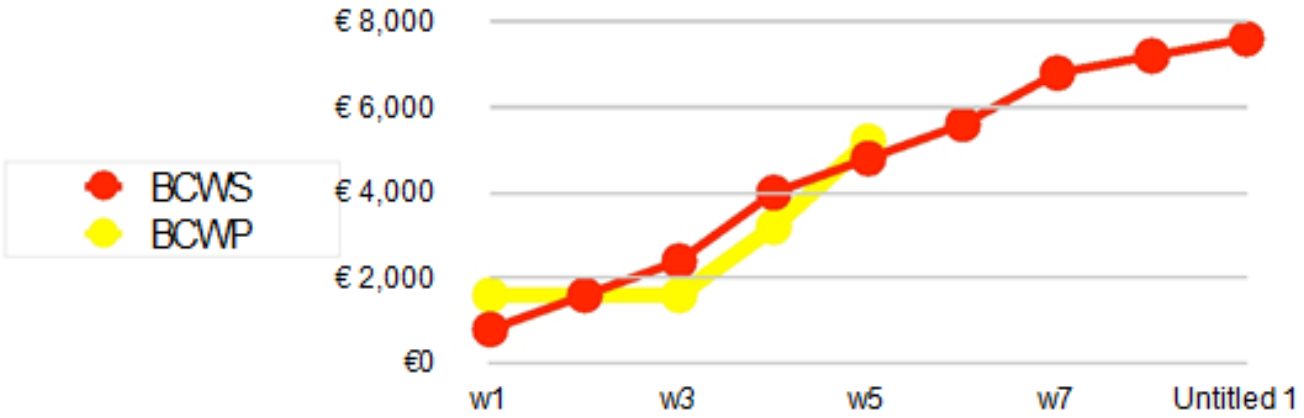
Paint Wall	800	800	800	800					
Paint Ceiling				800	800	800	800		
Refurnish							400	400	
Clean									400
Budgeted Cost of Work Scheduled (BCWS)	800	1600	2400	4000	4800	5600	6800	7200	7600



Example: BCWP (Earned Value)



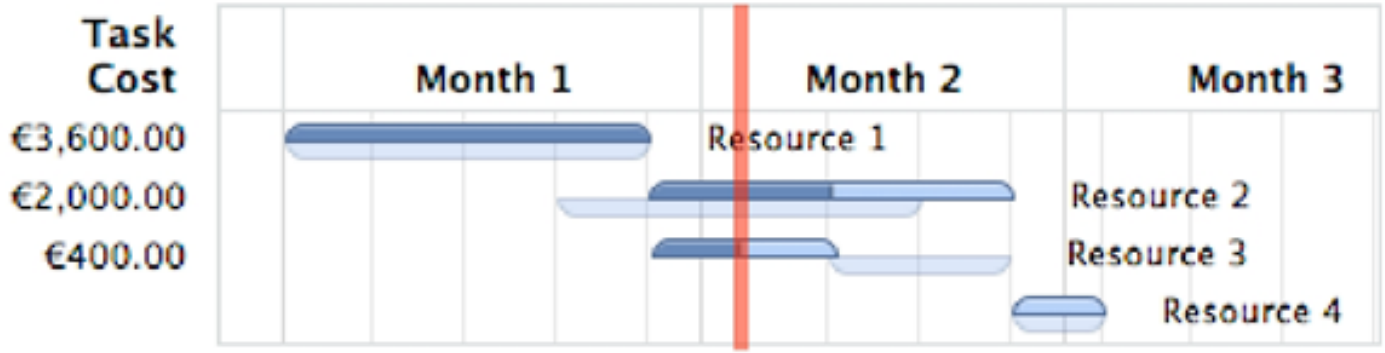
Paint Wall	1600			1600					
Paint Ceiling				0	1600				
Refurnish					400				
Clean									
Budgeted Cost of Work Plan (BCWP)	1600	1600	1600	3200	5200				



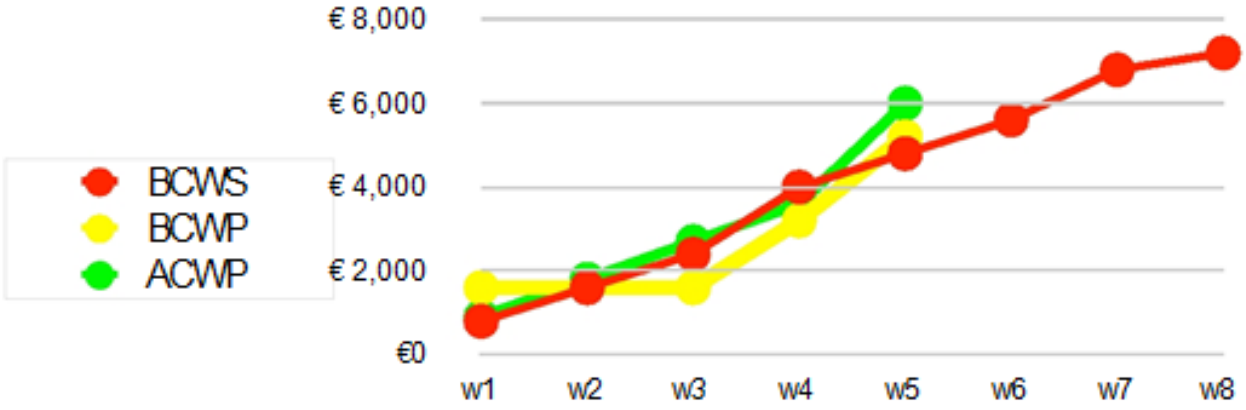
Comments

- Ahead of schedule on week 1 because of the noise of the 50%-50% rule (analogously the delay on w2 and w3)
- **w4:** we are behind schedule (activity 2 did not start as expected)
- **w5:** we are again ahead of schedule, because of activity 3.
- Since the 50%-50% rule only counts start and end of activities, the fact that progress in activity 2 is better than expected is not taken into account in the EVA graph

Example: ACWP (Actual Costs)



Paint Wall	900	900	900	900					
Paint Ceiling				0	2000				
Refurnish					400				
Clean									
Actual Cost of Work Performed (ACWP)	900	1800	2700	3600	6000				



Another Example:

A project has a budget of PKR10M and schedule for 10 months. It is assumed that the total budget will be spent equally each month until the 10th month is reached. After 2 months the project manager finds that only 5% of the work is finished and a total of PKR1M spent.

Solution:

PV = 2M

EV = 10M * 0.05 = 0.5M

AV = 1M

CV = EV-AC = 0.5-1 = -0.5M

CV% = 100 * (CV/EV) = 100*(-0.5/0.5) = -100% overrun

SV = EV-PV = 0.5-2 = -1.5 months

SV% = 100 * (SV/PV) = 100*(-1.5/2) = -75% behind

Continue Example …..

CPI = EV/AC = 0.5/1 = 0.5

SPI = EV/PV = 0.5/2 = 0.25

EAC = BAC/CPI = 10/0.5 = 20M

ETC = (BAC-EV) / CPI = (10-0.5)/0.5 = 19M

Time to compete = (BAC-EV)/SPI= (10-0.5)/0.25 = 38 Months

This project will take TOTAL 20M (19+1) and 40 (38+2) Months to complete.

EXERCISE

- You have a project to build a box. The box is six sided. Each side is to take one day to build and is budgeted for $1000 per side. The sides are planned to be completed one after the other. Today is the end of day three.

- Using the following project status chart, calculate PV, EV, AC, BAC, CV, CPI, SV, SPI, EAC, ETC, VAC.
- Describe your interpretation based on the calculation!

Task	Progress	Cost spent
Side 1	100%	$1,200
Side 2	100%	$1,000
Side 3	75%	$750
Side 4	50%	$500
Side 5	0%	$0
Side 6	0%	$0

EXERCISE SOLUTION

Parameter	Calculation	Result
PV		
EV		
AC		
BAC		
CV		
CPI		
SV		
SPI		
EAC		
ETC		
VAC		

Project is below/over budget?

Project is late/ahead schedule?

How much more money we need?

EXERCISE SOLUTION

Parameter	Calculation	Result
PV	1000 + 1000 + 1000	3000
EV	(100% x 1000) + (100% x 1000) + (75% x 1000) + (50% x 1000)	3025
AC	1200 + 1000 + 750 + 500	3450
BAC	6 x 1000	6000
CV	3025 - 3450	-425
CPI	3025 / 3450	0.88
SV	3025 - 3000	25
SPI	3025 / 3000	1.01
EAC	6000 / 0.88	6818.18
ETC	6818.18 - 3450	3368.18
VAC	6000 - 6818.18	-818.18

- over budget, getting 0.88 dollar for every dollar we spent,
- ahead schedule, progressing 101% of the rate planned,
- probably will spend $6818 at the end (estimation),
- need $3368 to complete,
- over budget at the end for about $818 (estimation)

FORECASTING EAC

There are many ways to calculate EAC, depending on the assumption made.

Simple EAC calculation (EAC = BAC/CPI) assume that the cumulative CPI adequately reflects past performance that will continue to the end of the project.

AC+(BAC-EV)

- Used when current variances are thought to be atypical (not relevant) of the future

AC+[(BAC-EV)/(Cumulative CPI + Cumulative SPI)]

- It assumes poor cost performance and **need to hit a firm completion date.**

TO-COMPLETE PERFORMANCE INDEX (TCPI)

Helps the team determine the efficiency that must be achieved on the remaining work for a project to meet a specified endpoint, such as BAC or the team's revised EAC

$$\text{TCPI} = \frac{\text{Work Remaining}}{\text{Funds Remaining}} \quad \frac{(\text{BAC} - \text{EV})}{(\text{BAC} - \text{AC}) \text{ or } (\text{EAC} - \text{AC})}$$

SUMMARY

FORECASTING EAC

Common alternative way to calculate EAC

Assumption	Example Formula
Future cost performance will be the same as all past cost performance	$EAC = AC + [(BAC - EV) / CPI] = BAC / CPI$
Future cost performance will be the same as the last three measurement periods (i, j, k)	$EAC = AC + [(BAC - EV) / ((EV_i + EV_j + EV_k) / (AC_i + AC_j + AC_k))]$
Future cost performance will be influenced additionally by past schedule performance	$EAC = AC + [(BAC - EV) / (CPI \times SPI)]$
Future cost performance will be influenced jointly in some proportion by both indices	$EAC = AC + [(BAC - EV) / (.8\ CPI + .2\ SPI)]$

Table captured from Practice Standard for Earned Value Management, PMI © 2005

EARNED SCHEDULE - AN EMERGING EVM PRACTICE

SPI($)

- At project start SPI is reliable
- At some point SPI accuracy diminishes
- Toward the project end it is useless (SPI = 1 at project end)
- Doest not show weeks/months of schedule variance

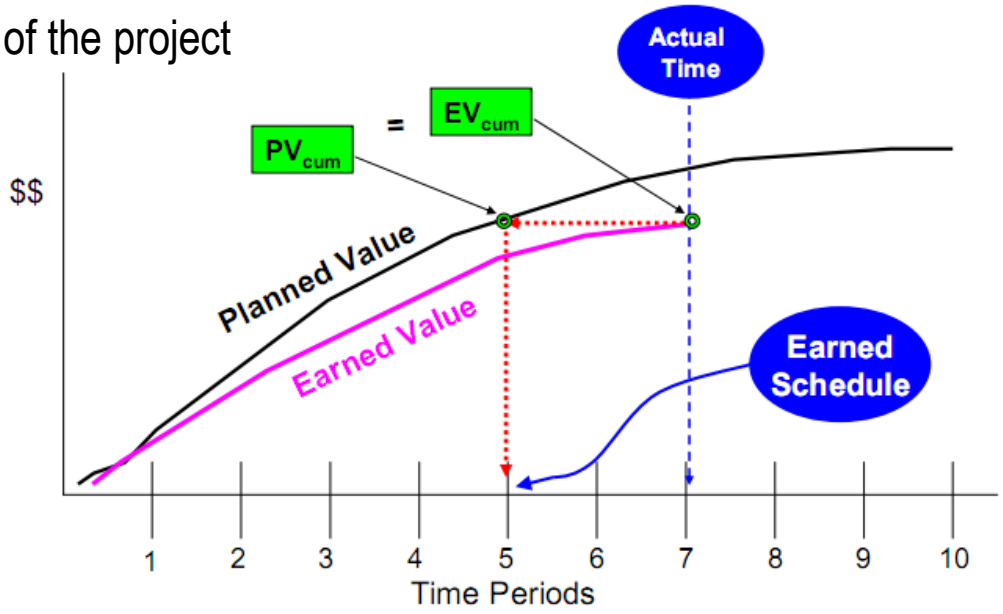
SPI(t)

- Time based schedule measures
- Create a SPI that is accurate to the of the project

SV(t) = ES – AT
SPI(t) = ES / AT

ES = Earned Schedule (Planned time)

AT = Actual time



EVM – HINTS TO REMEMBER

- **EV comes first in every formula**
- **If it's variance, the formula is EV – something**
- **If it's index, EV / something**
- **If it relates to cost, use Actual Cost**
- **If it relates to schedule, use PV**
- **Negative numbers are bad, positive is good**

Copied from Rita's book

NEXT TOPIC:
PROJECT QUALITY MANAGEMENT

Thank You