Earned Value Management

Monitoring & Controlling Project Cost & Schedule

EVM

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Introduction

- EVM is a methodology used compare the project's actual data with the planned data, and conclude performance of the project in reference to its cost and schedule.

- The following example helps you understand the various terms and equations related to this topic

Flooring Example

Flooring a meeting room of 100x10 meters using ceramic tiles size 0.5x0.5 meters and one person will do the job.

Project Plan

- Total Area: 100m x 10 m = 1000 m^2
- Number of ceramic tiles: 4 tiles/m^2 x 1000m^2 =

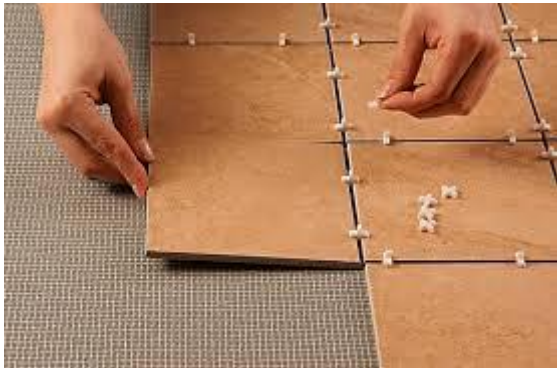
- Cost Estimates:
  - Material:
    - Cost of 1 ceramic tile: 50 SAR
    - Adhesive material: 10 SAR
  - Labor:
    - Daily cost of one labor 100 SAR

- Time Estimates:
  - Daily production: 20 m^2 (80 ceramic tiles)
  - Total duration: 50 working days (10 weeks)

Project Progress: 1st week

- Results found by end of the 1st week (after 5 working days)

- Work finished: 350 tiles
- Actual costs:
  - Tiles: 18000 SAR (including scrap material)
  - Adhesive: 4000 SAR (including scrap material)
  - Labor: 500 SAR (one person)



Project Performance: 1st week

	Planned	Actual
Scope		
Area (m^2)	100	87.5
No. of tiles	400	350
Cost		
Cost of tiles	20,000	18,000
Cost of adhesive	4,000	4,000
Cost of labor	500	500
Total Cost	24,500	22,500
Total Cost per Tile	61.25	64.29

Budget cost of work performed (350 tiles x 64.29 = 21,438)

Project Data: 1st week

Term		Meaning	Calculation
PV	Planned Value	Budget Cost of Work Scheduled (**BCWS**)	**24,500**
AC	Actual Cost	Actual Cost of Work Performed (**ACWP**)	**22,500**
EV	Earned Value	Budget Cost of Work Performed (**BCWP**)	**21,438**

Cost Performance: 1st week

Cost Variance:

CV = EV – AC

= 21,438 – 22,500

= - 1,062

Cost Performance Index:

CPI = EV / AC

= 21,438 / 22,500

= 0.9528

Understand the sign (+/-):

0 spending as planned

+: spending less budget

-: spending more budget

Understand the value:

=1 as planned

>1: favorable

<1: un-favorable

Project is over budget by 1062 SAR

Schedule Performance: 1st week

Schedule Variance:

SV = EV – PV

= 21,438 – 24,500

= - 3,062

Sch. Performance Index

SV = EV / PV

= 21,438 / 24,500

= 0.875

Understand the sign (+/-):

0 moving as planned

+: faster than planned

-: slower than planned

Understand the value:

=1 as planned

>1: favorable

<1: un-favorable

Project is behind schedule by 3062 SAR

Evaluating & Forecasting Project Progress

- In the 1st week, the project spent more budget than planned, and completed work less than planned.

- Reasons for project deviation to be understood, explained and judged by the project manager.

- Performance of next weeks (i.e.: forecast) may be:
  - According to the current performance (**typical**)
  - According to its original plan, the deviation is considered non-repeatable (**atypical**)
  - According to new estimates not necessarily related to the original plan (**new**)

Revising Cost Estimates

- Original budget is called Budget At Completion (**BAC**)

  (4,000 tiles x 60 SAR/tile) + (10 weeks x 500SAR/week)= 245,000 SAR

- New budget is called Estimate At Completion (**EAC**) and consists of two items:
  - Actual Cost (**AC**): the amount spend in the previous period
  - Estimate To Complete (**ETC**): the amount forecasted to complete the remaining work. This is calculated according to the forecast model.

EAC = AC + ETC

= 18,000 + **?**

ETC – atypical case

- Atypical (not typical) means that the causes of deviation are exceptional and are not repeated.
- ETC = the original budget of the remaining work

ETC = BAC – EV

= 240,000 – 21,438

= 223,562

EAC = AC + ETC

= 22,500 + 223,562

= 246,062

VAC = BAC – EAC

= 245,000 – 246,062

= - 1,062

ETC – new estimates

- New estimates means that the plan is invalid, and new estimates are to be considered
- ETC = new figure
- Example:
  - Total cost per tile = 70 SAR

ETC = new figure

= (4000 – 350) x 70

= 255,500

EAC = AC + ETC

= 22,500 + 255,500

= 278,000

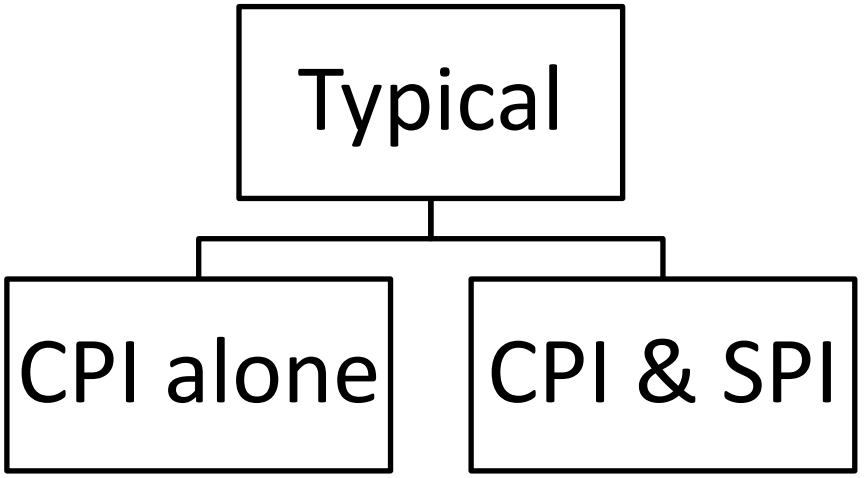
VAC = BAC – EAC

= 245,000 – 278,000

= - 33,000

ETC – typical case

- Typical means the project forecast will follow the previous progress and can be affected by the:
  - CPI alone, or
  - CPI and SPI together
- Consider combined impact (CPI & SPI) when the labor cost is significant to the project



ETC – typical case (continued)

CPI impact only

ETC = (BAC – EV) / CPI

= (245,000 – 21,438)/0.9528

= 234,637

EAC = AC + ETC

= 22,500 + 234,637

= 257,137

VAC = BAC – EAC

= 245,000 – 257,137

= - 12,137

CPI & SPI impact

ETC = (BAC–EV)/(CPIxSPI)

= (245,000– 21,438) /

(0.9528 x 0.875)

= 299,600

EAC = AC + ETC

= 22,500 + 299,600

= 322,100

VAC = BAC – EAC

= 245,000 – 322,100

= - 77,100

Revising the Project Budget

- Revising the project budget requires justification by the project manager and approval by senior management who may accept or deny changing the project budget.

- To Complete Performance Index (**TCPI**) measures the targeted CPI that must be achieved in the next period in order to meet the project budget.

New budget status	TCPI formula
Not approved	**TCPI = (BAC-EV) / (BAC-AC)**
Approved	**TCPI = (BAC-EV) / (EAC-AC)**

New budget status: not approved

- In most situations this occurs when the senior management considers the deviation as exceptional, and the project team must find a solution to substitute the deviation.

- Refer to the case: **atypical**

TCPI = (BAC-EV) / (BAC-AC)

= (245,000 – 21,438) / (245,000 – 22,500)

= 223,562 / 222,500

= 1.005

New budget status: approved

- The senior management is accepting the forecast scenario (new, typical based on CPI only, typical based on CPI & SPI) and as a result it accepts revising the project budget

- Refer to the case: **typical based on CPI**

TCPI = (BAC-EV) / (EAC-AC)

= (245,000 – 21,438) / (257,137 – 22,500)

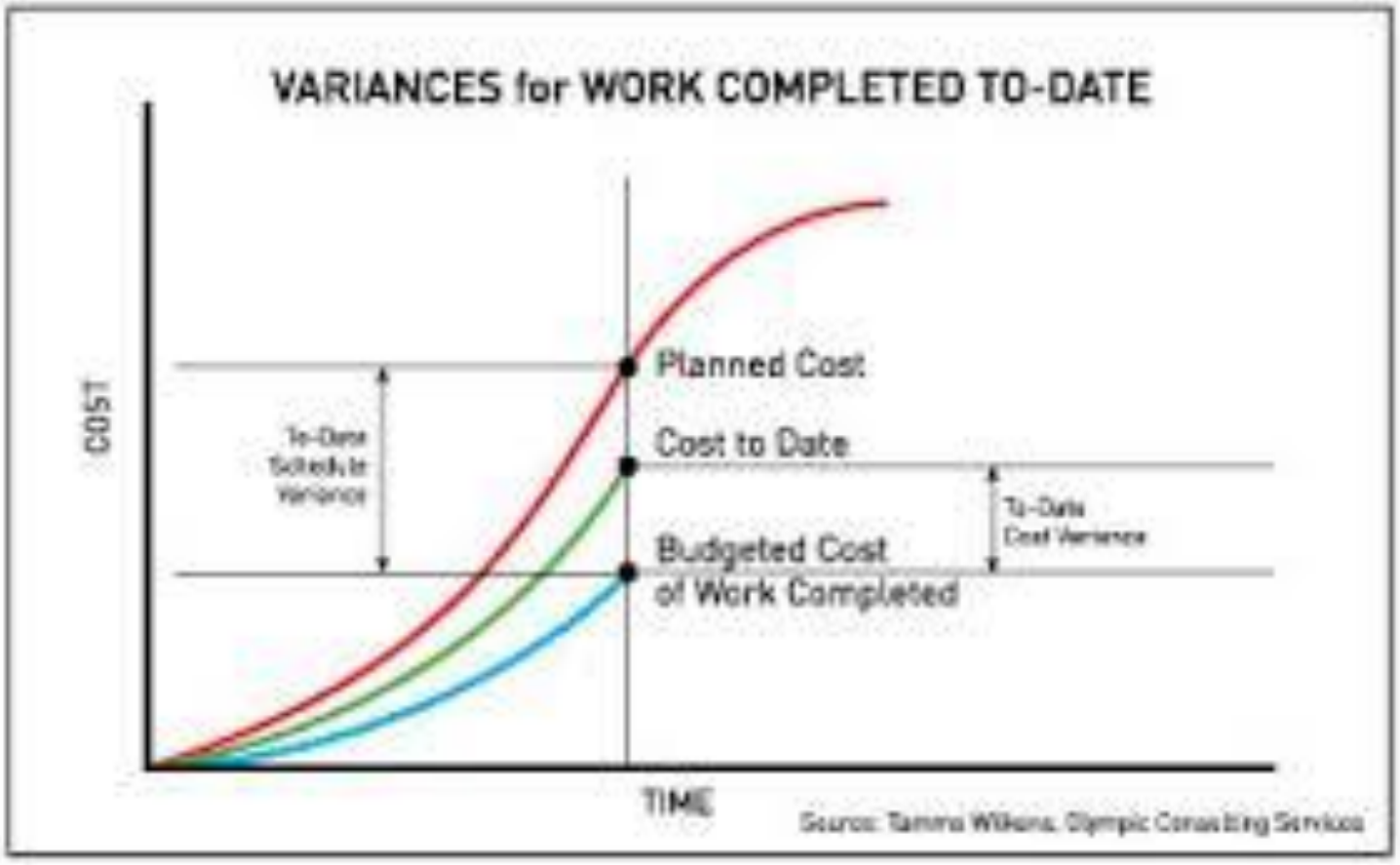
= 223,562 / 234,637

= 0.9528 (same as CPI of the 1st week)

Summary of EVM Formulas

- CV = EV – AC, CPI = EV / AC
- SV = EV – PV, SPI = EV / PV
- ETC (typical on CPI) = (BAC – EV) / CPI
- ETC (typical on CPI & SPI) = (BAC–EV) / (CPI x SPI)
- EAC = AC + ETC
- VAC = BAC – EAC
- TCPI (original budget) = BAC-EV) / (BAC-AC)
- TCPI (new budget) = (BAC-EV) / (EAC-AC)

EVM – graphical representation



Cumulative Periods

- The mentioned EVM terms and equations refer to the 1st week which is the period of analysis.
- For the 2nd week, the same terms are used and same formulas are applied concerning 2nd week alone

- Cumulative period (weeks 1 + 2) are referred to as:
  PVc, ACc,EVc,CVc, CPIc, SVc, SPIc.

- Pay attention to formulas, add/subtract can be applied on single results while multiply/divide should use the

- PVc = PV1 + PV2
- SPIc = EVc / PVc (i.e.: not average of SPI1 & SPI2)