EVA (C/SCSC) **(Cost/Schedule Control Systems**

and Basics of Project Control

Topics

- Monitoring cont'd
  - EVA (C/SCSC) Definitions and examples
  - Forecasting
- Project Control
  - General
  - Performance-adjustments
  - Target Adjustments
  - Problem diagnosis

Earned Value Approach

(Cost/Schedule Control Systems Criteria) Definitions

Integrating cost, schedule, and work performed

by ascribing monetary values to each.

Budgeted Cost of Work Scheduled (BCWS, $) ("Earned value of work accomplished") the value of work scheduled to be accomplished in a given period of time.

Actual Cost of Work Performed (ACWP, $): the costs actually incurred in accomplishing the work performed within the control time.

Budgeted Cost of Work Performed (BCWP, $): the monetary value of the work actually performed within the control time (= Earned Value).

Actual Time of Work Performed (ATWP, time)

Schedule Time of Work Performed (STWP, time)

Cost Variance

Is project spending more or less money than anticipated for the work that I did?

Cost Variance (CV = BCWP - ACWP)

+ (Underrun); - (Overrun); 0 (On Budget)

Cost Index (CI = BCWP/ACWP)

> 1 (Underrun); < 1 (Overrun); 1 (On Budget)

Schedule Variance

One metric for judging if project making is "progressing" faster or slower than expected

More precisely: "How does the value of the work I have actually performed compare to the work I anticipated performing during this time?"

"Progress" here is measured in value of the work ($)
Calculated in $ -- but here this is a proxy for value

Schedule Variance (SV = BCWP - BCWS)

+ (Ahead); - (Behind); 0 (On Schedule)

Even if just slightly ahead/behind in time, may be large if working on very expensive component of project

Schedule Index (SI = BCWP/BCWS)

> 1 (Ahead); < 1 (Behind); 1 (On Schedule)

Time Variance

Is project spending more or less time than anticipated for the work that I did?

Measured in units of time

May be very close even if big difference in the resource spending

Time Variance (TV = STWP - ATWP)

+ (Ahead); - (Delay); 0 (On Schedule)

Time Index (TI = STWP / ATWP)

> 1 (Ahead); < 1 (Delay); 1 (On Schedule)

Resource Flow Variance

Compares how much expecting to spend during this timeframe with what actually spent – regardless of how much work got done.

Warning: Doesn't indicate bad or good. e.g. = if

Going faster but more cheaply than expected

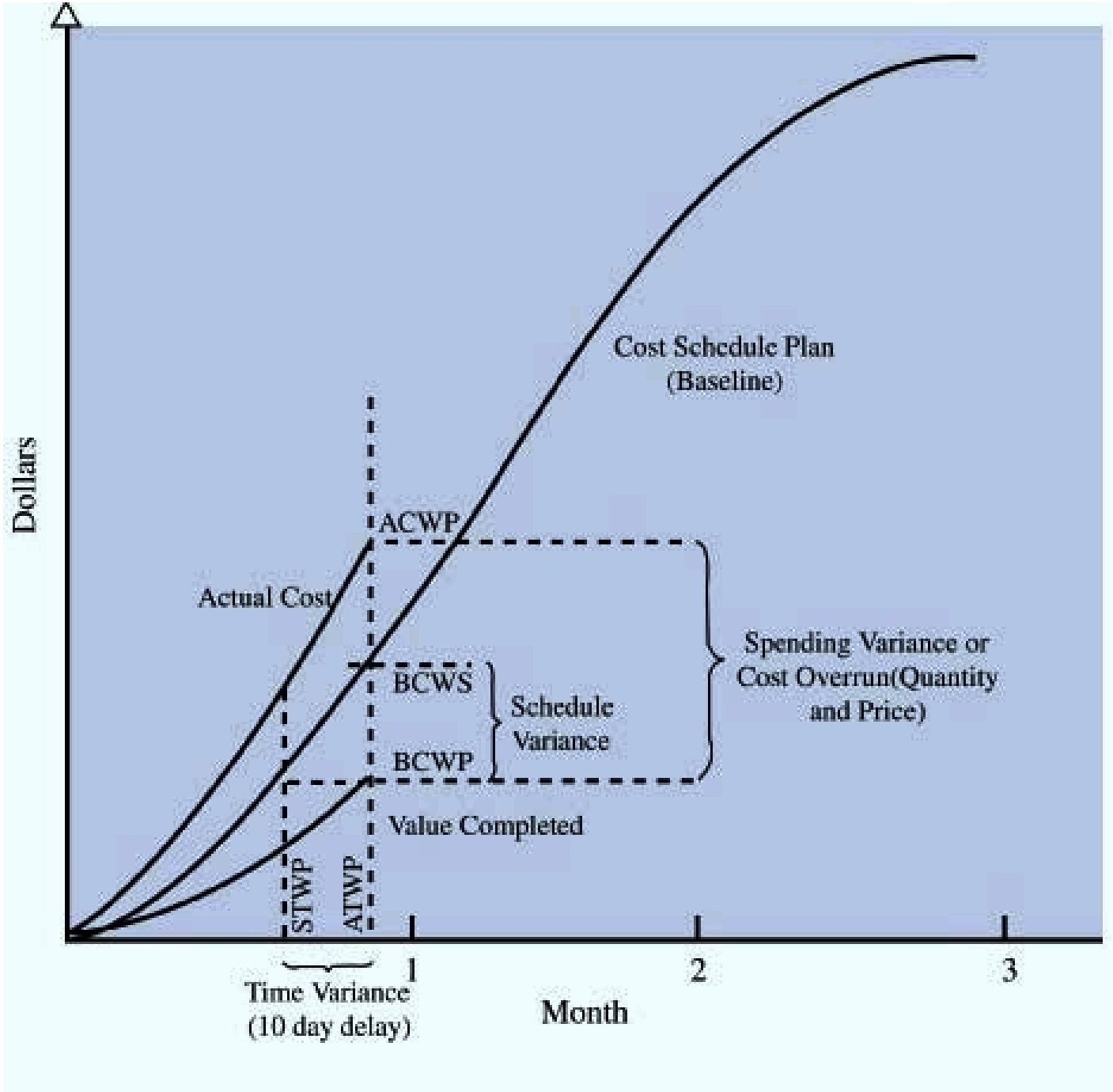
Going slower but more expensively than expected

Resource Flow Variance (RV = BCWS - ACWP)

+ (Underrun); - (Overrun); 0 (On Target)

Resource Flow Index (RI = BCWS / ACWP)

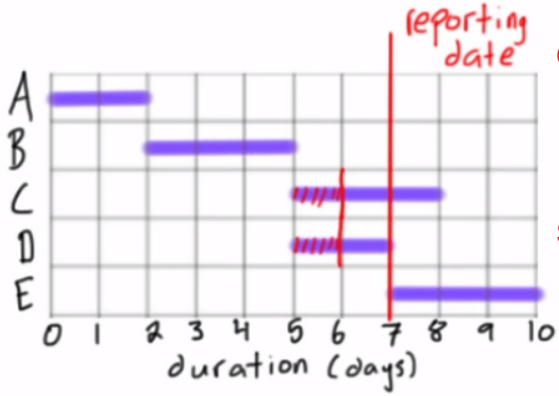
> 1 (Underrun); < 1 (Overrun); 1 (On Target)



Earned Value Chart

Activity	Predecessor	Duration (days)	Cost / Day	Total Cost
A	-	2	300	600
B	A	3	400	1200
C	B	3	400	1200
D	B	2	200	400
E	D	3	100	300

Activities



Cost Variance (CV = BCWP - ACWP)

+ (Underrun); - (Overrun); 0 (On Budget)

Cost Index (CI = BCWP/ACWP)

> 1 (Underrun); < 1 (Overrun); 1 (On Budget)

Schedule Index (SI = BCWP/BCWS)

> 1 (Ahead); < 1 (Behind); 1 (On Schedule)

Schedule Variance (SV = BCWP - BCWS)

+ (Ahead); - (Behind); 0 (On Schedule)

Resource Flow Variance (RV = BCWS - ACWP)

+ (Underrun); - (Overrun); 0 (On Target)

Resource Flow Index (RI = BCWS / ACWP)

> 1 (Underrun); < 1 (Overrun); 1 (On Target)

Time Variance (TV = STWP - ATWP)

+ (Ahead); - (Delay); 0 (On Schedule)

Time Index (TI = STWP / ATWP)

> 1 (Ahead); < 1 (Delay); 1 (On Schedule)

Field report at end of day 7		
Activity	Actual % Complete	Incurred Cost
A	100	600
B	100	1400
C	33	500
D	50	200
E	0	0

Activity	ACWP	BCWP	BCWS	CPI	CV	SPI	SV
A	600	600	600				
B	1400	1200	1200				
C	500	400	800				
D	200	200	400				
E	0	0	0				
Total to Date	2,700	2,400	3,000				

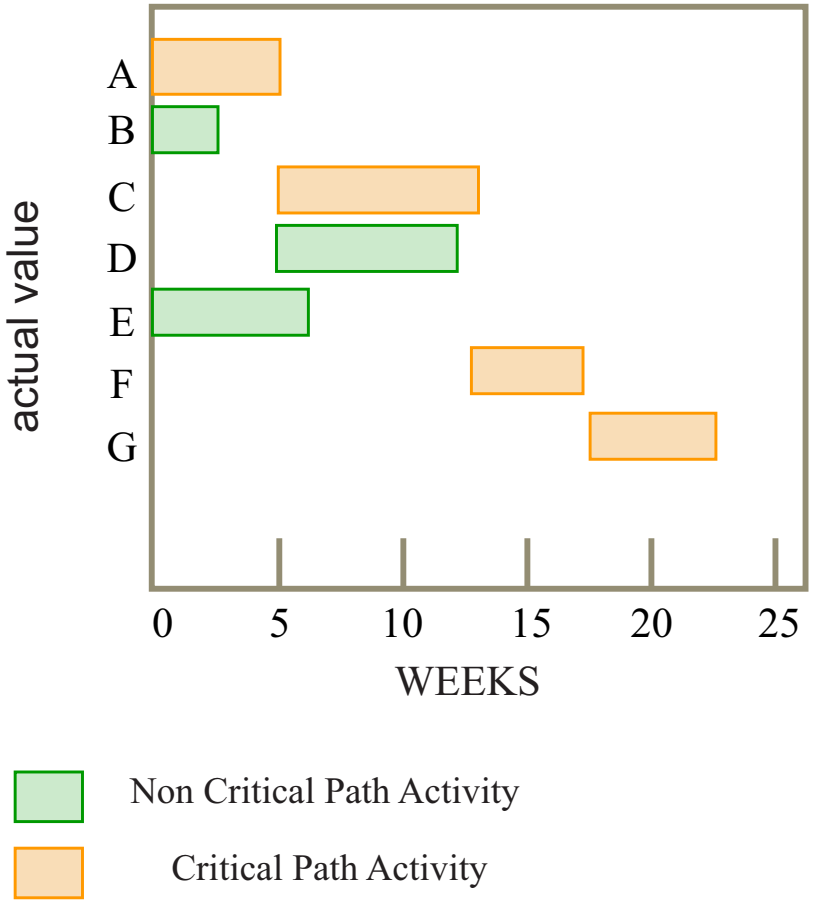
Budgeted Cost of Work Scheduled (BCWS, $)
Actual Cost of Work Performed (ACWP, $):
Budgeted Cost of Work Performed (BCWP, $):
Actual Time of Work Performed (ATWP, time)
Schedule Time of Work Performed (STWP, time)

$$SPI = \frac{BCWP}{BCWS} \qquad CPI = \frac{BCWP}{ACWP}$$

$$CV = BCWP - ACWP$$

$$SV = BCWP - BCWS$$

Example: Gantt Chart Schedule



Example: Traditional Reporting

ACTIVITY	A	B	E
DURATION (WEEKS)	5	3	7
COST (IN $)	1,500	3,000	5,700
COST PER WEEK (IN $)	300	1,000	814

ACTIVITY	WEEK 1		WEEK 2		WEEK 3		WEEK 4	
	ACTIVITY STATUS	ACTUAL COST	ACTIVITY STATUS	ACTUAL COST	ACTIVITY STATUS	ACTUAL COST	ACTIVITY STATUS	ACTUAL COST
A	STARTED	$ 500	IN PROCESS	$ 1,000	IN PROCESS	$ 1,300	COMPLETED	$ 1,500
B	STARTED	1,000	IN PROCESS	2,000	IN PROCESS	2,500	COMPLETED	3,000
E	STARTED	814	IN PROCESS	1,500	IN PROCESS	2,500	IN PROCESS	2,900

Example: Earned Value Reporting

SUMMARY REPORT FOR WEEKS 1 - 4

ACTIVITY	A	B	E
ACTUAL COST (IN $)	1,500	3,000	2,900
BUDGETED COST (IN $)	300 × 4 = 1,200	3,000	814 × 4 = 3,256
WORK PERFORMED AS % OF WORK CONTENT	100	100	2/7 = 28.6

Example: Activity Analysis

ACTIVITY	BCWP
A	$ 1,500
B	$ 3,000
E	$ 1,628

ACTIVITY	ACWP
A	$ 1,500
B	$ 3,000
E	$ 2,900

ACTIVITY	BCWS
A	300 × 4 = $ 1,200
B	$ 3,000
E	814 × 4 = 3,256

Example: Variances

ACTIVITY	BCWP - ACWP = CV
A	$ 1,500 - $ 1,500 = $ 0
B	$ 3,000 - $ 3,000 = $ 0
E	$ 1,628 - $ 2,900 = -$ 1,272
	CUMULATIVE VARIANCE = -$ 1,272

ACTIVITY	BCWP - BCWS = SV
A	$ 1,500 - $ 1,200 = $ 300
B	$ 3,000 - $ 3,000 = $ 0
E	$ 1,628 - $ 3,256 = -$ 1,628
	CUMULATIVE VARIANCE = -$ 1,328

Variances II

ACTIVITY	STWP - ATWP = TV
A	5 - 4 = 1
B	3 - 4= -1
E	2 - 4= -2
	Cumulative Variance = -2

Example: Activity Indexes

Activity	$\frac{BCWP}{BCWS}$ = SI	$\frac{BCWP}{ACWP}$ = CI
A	$\frac{1,500}{1,200} = 1.25$	$\frac{1,500}{1,500} = 1$
B	$\frac{3,000}{3,000} = 1$	$\frac{3,000}{3,000} = 1$
E	$\frac{1,628}{3,256} = 0.5$	$\frac{1,628}{2,900} = 0.56$

Example: Project Indexes

The Aggregate Cost Index is:

$$SI = \frac{1{,}500 + 3{,}000 + 1{,}628}{1{,}200 + 3{,}000 + 3{,}256} = 0.82$$

$$CI = \frac{1{,}500 + 3{,}000 + 1{,}628}{1{,}500 + 3{,}000 + 2{,}900} = 0.83$$

Example: Earned Value Reporting

Values (in Dollars) of BCWS, BCWP, and ACWP for Weeks 1-4

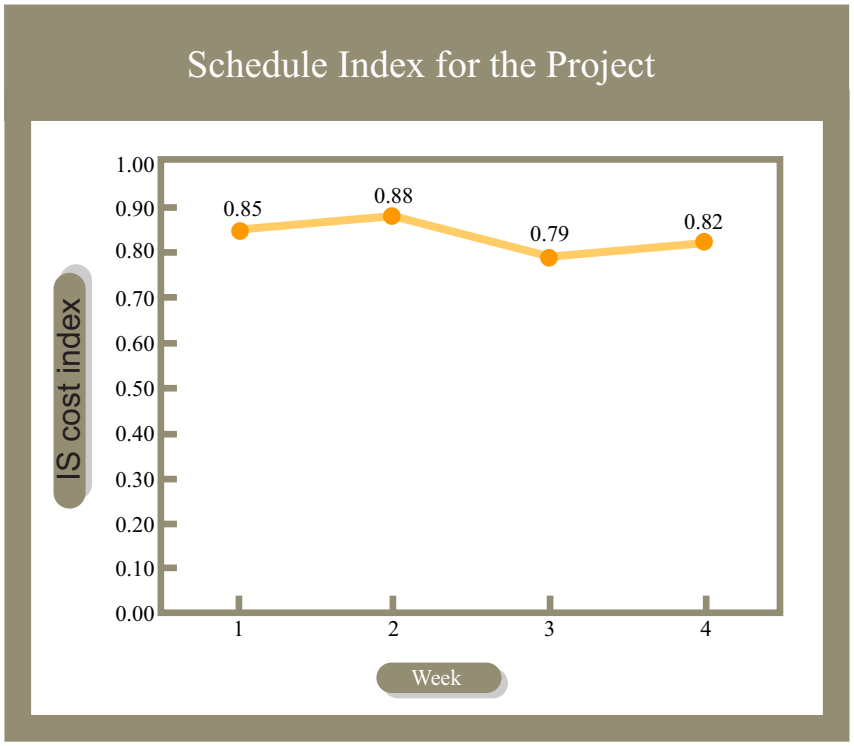
	Week 1			Week 2			Week 3			Week 4		
Activity	BCWS	BCWP	ACWP	BCWS	BCWP	ACWP	BCWS	BCWP	ACWP	BCWS	BCWP	ACWP
A	300	500	500	300	500	500	300	300	300	300	200	200
B	1,000	1,000	1,000	1,000	1,000	1,000	1,000	500	500	0	500	500
E	814	300	814	814	400	686	814	500	1,000	814	428	400
	2,114	1,800	2,314	2,114	1,900	2,186	2,114	1,300	1,800	1,114	1,128	1,100

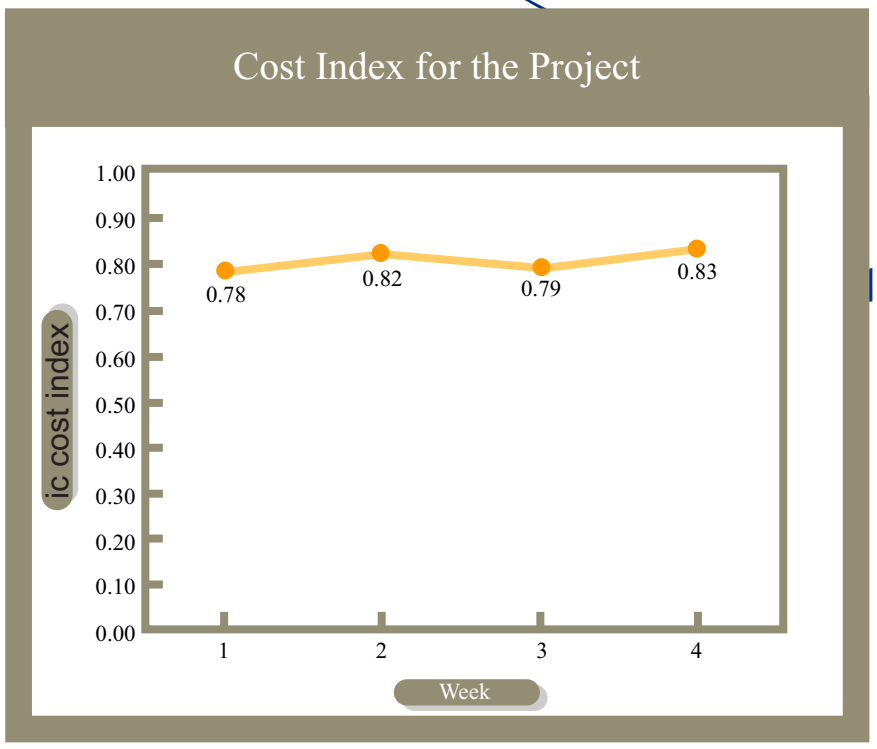
Example: Earned Value Analysis

Values of SI and CI for Weeks 1-4

Week	BCWS ($)	BCWP ($)	ACWP ($)	$CI = \frac{BCWP}{ACWP}$	$SI = \frac{BCWP}{BCWS}$
1	2,114	1,800	2,314	0.78	0.85
2	4,228	3,700	4,500	0.82	0.88
3	6,342	5,000	6,300	0.79	0.79
4	7,456	6,128	7,400	0.83	0.82

Example: Schedule and Cost Index





Example: Integrating CI and SI