

Application of Earned Value Management (EVM) in projects with open scope



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Agenda

- **The earned value theory applied to projects scheduling control**
- **Example of application of Earned Value Management in a project with open scope:**
 - ✓ Initial planning
 - ✓ Project evaluation
 - ✓ Project rebaselining based on actual data
- **Conclusions**

The earned value theory applied to projects scheduling control (I)

➤ The earned value theory:

- ✓ Introduces an “objective” measure about the status of projects.
- ✓ Introduces measures for deviations in costs and schedule.
- ✓ It permits a quick evaluation of the status of projects with regards to execution timelines, costs and tasks.
- ✓ It is a unique and simple system which integrates multiple evaluations into a unique reporting system.

➤ Schedule Performance Index:

$$SPI = \frac{EV}{PV} = \frac{BCWP}{BCWS}$$

➤ Cost Performance Index:

$$CPI = \frac{EV}{AC} = \frac{BCWP}{ACWP}$$

➤ Being:

- ✓ PV, *Planned Value*; or BCWS, *Budgeted Cost Work Scheduled*.
- ✓ AC, *Actual Costs*; or ACWP, *Actual Costs Work Performed*.
- ✓ EV, *Earned Value*; or BCWP, *Budgeted Cost Work Performed*.

The earned value theory applied to projects scheduling control (II)

➤ Schedule Performance Index:

$$SPI = \frac{EV}{PV} = \frac{BCWP}{BCWS}$$

Considers the work that has been completed (for instance in terms of number and type of deliverables).

This completed work is translated into monetary value just multiplying the number of completed deliverables times the approved budget for those deliverables (calculated in the planning phase).

Considers the work that has been planned (for instance in terms of number of type of deliverables).

As in the case of the EV, this planned work is translated into monetary value just multiplying the number of planned deliverables times the approved budget for those deliverables (calculated in the planning phase).

What happens if this planned work (or planned deliverables), which defines the project scope, is not defined when the project starts?

➤ Being:

- ✓ EV, *Earned Value*; or BCWP, *Budgeted Cost Work Performed*.
- ✓ PV, *Planned Value*; or BCWS, *Budgeted Costs Work Scheduled*.

Example of application of Earned Value Management in a project with open scope

- **Network deployment project (network build) to provide cellular coverage to rural areas in a certain country.**
- **Project scope:**
 - ✓ Full turnkey deployment of a number of base stations to provide cellular coverage to rural areas in a certain country.
 - ✓ Integration of those new base stations in the existing customer network.
 - ✓ For everyone of those base stations, scope includes:
 - Terrain acquisition where to build the base station.
 - Design and planning of the new installation.
 - Civil works project.
 - Licenses and approvals.
 - Civil works.
 - Equipment installation.
 - Equipment integration in the existing network.
 - Final acceptance with customer.

Example of application of Earned Value Management in a project with open scope

➤ Time:

- ✓ Whole project: 1 year (2012).
- ✓ **Assume** 3 months as average to build (from site acquisition to customer acceptance) **ONE SINGLE** base station.

➤ Cost:

- ✓ Contract won with a sales value of € 36,000,000 (customer project budget).
- ✓ Customer **estimates** that this budget could cover the installation of around 600 new base stations (with different configurations or types):
 - If customer project budget is spent with less than 600 base stations, project is considered as finished.
 - If 600 new base stations are built and customer project budget has not been totally spent, then project will continue with the installation of new base stations till complete spending of customer project budget (€ 36,000,000).
- ✓ Revenue recognition method: *PoC, percentage of completion.*

Example of application of Earned Value Management in a project with open scope

- **Based on previous project definition, it is clear that:**
 - ✓ Customer project budget (our sales value) is known, € 36,000,000.
 - ✓ Project execution duration is known, 1 year.
 - ✓ Project scope (in terms of number of base stations to built) is not known.
- **So, in order to plan the project (needed if we want to apply EVM) we could assume:**
 - ✓ Contract won with a sales value of € 36,000,000 (customer project budget).
 - ✓ Customer **estimates** that this budget could cover the installation of around 600 new base stations.
 - ✓ Simply dividing previous values, they would give an average sales value of € 60,000 per base station.
 - ✓ Based on our experience, and considering the mix of the different types or configurations for the base stations, we could use an average cost of a new base station around € 45,000.
 - ✓ This would give us an acceptable 25% gross margin.
 - ✓ Our total project cost would then be around € 27,000,000.

Example of application of Earned Value Management in a project with open scope – **Initial planning**

- Let's consider the construction of 600 base stations.
- As we are going to apply PoC, *Percentage of Completion*, as revenue recognition method, let's define some intermediate milestones where we will recognize our costs (through subcontractor invoicing once those milestones are met).
- Let's assume, based on our experience, the following cost distribution:

Cost distribution (weights)	
Site acquisition	8%
Engineering	22%
Civil work, equipment installation & integration	70%

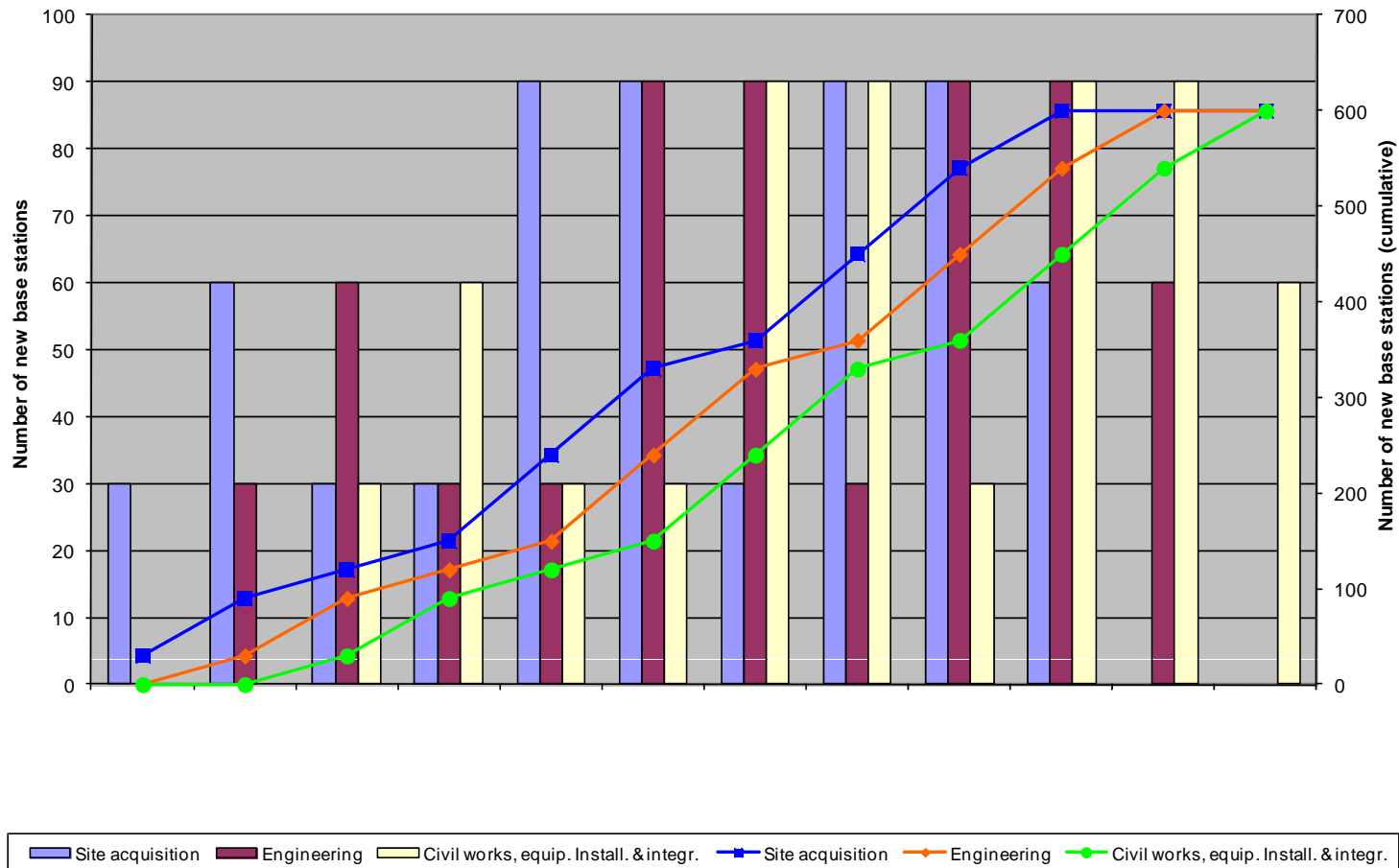
INITIAL PLANNING (Planned number of new base stations)	TOTAL		
	Site acquisition	Engineering	Civil works, equip. Install. & integr.
Jan'12	30	0	0
Feb'12	60	30	0
Mar'12	30	60	30
Apr'12	30	30	60
May'12	90	30	30
Jun'12	90	90	30
Jul'12	30	90	90
Aug'12	90	30	90
Sep'12	90	90	30
Oct'12	60	90	90
Nov'12	0	60	90
Dec'12	0	0	60
TOTAL	600	600	600



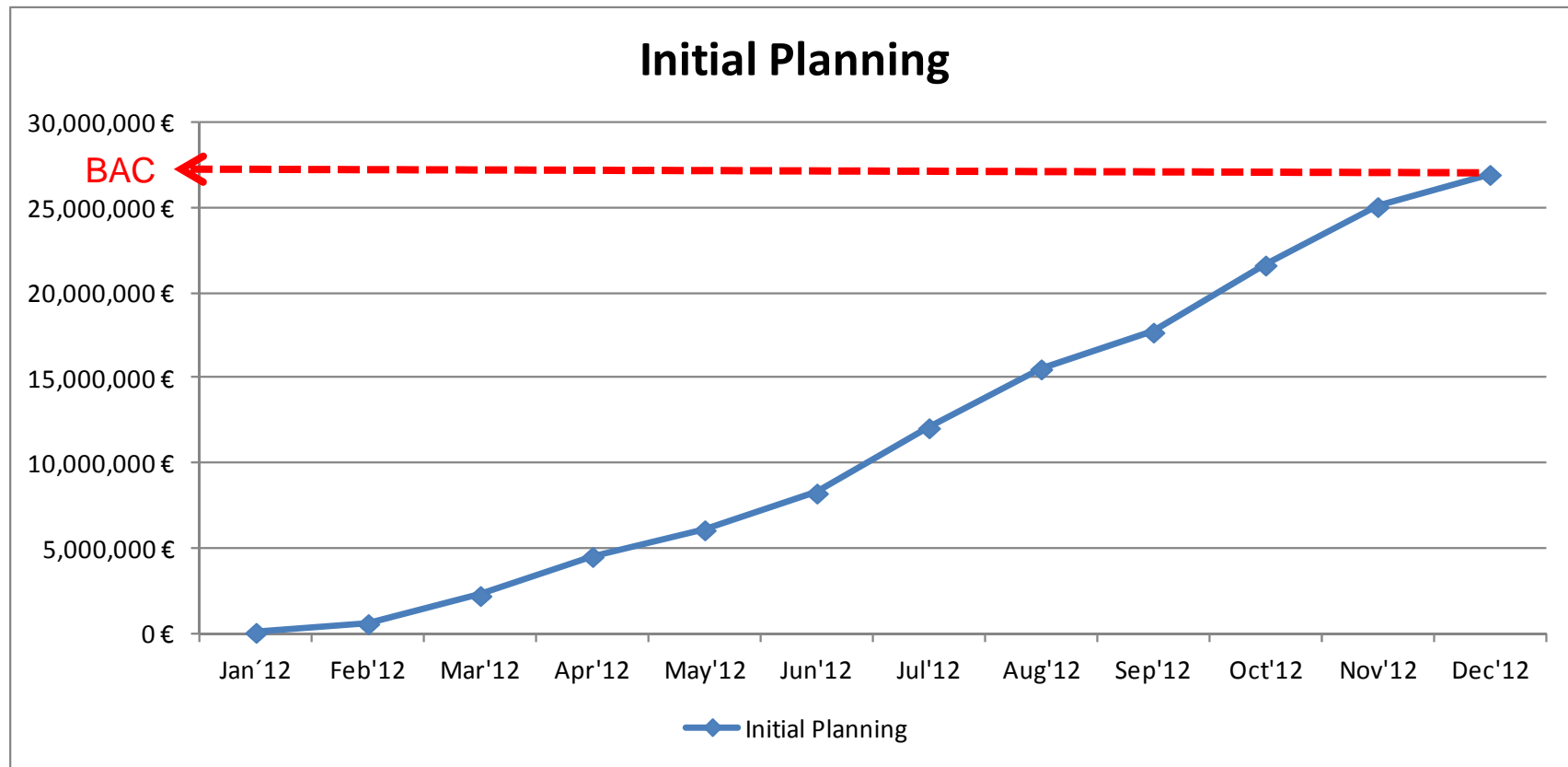
INITIAL PLANNING (Planned cost of the planned base stations)	TOTAL			
	Site acquisition	Engineering	Civil works, equip. Install. & integr.	TOTAL
Jan'12	108,000 €	0 €	0 €	108,000 €
Feb'12	216,000 €	297,000 €	0 €	513,000 €
Mar'12	108,000 €	594,000 €	945,000 €	1,647,000 €
Apr'12	108,000 €	297,000 €	1,890,000 €	2,295,000 €
May'12	324,000 €	297,000 €	945,000 €	1,566,000 €
Jun'12	324,000 €	891,000 €	945,000 €	2,160,000 €
Jul'12	108,000 €	891,000 €	2,835,000 €	3,834,000 €
Aug'12	324,000 €	297,000 €	2,835,000 €	3,456,000 €
Sep'12	324,000 €	891,000 €	945,000 €	2,160,000 €
Oct'12	216,000 €	891,000 €	2,835,000 €	3,942,000 €
Nov'12	0 €	594,000 €	2,835,000 €	3,429,000 €
Dec'12	0 €	0 €	1,890,000 €	1,890,000 €
TOTAL	2,160,000 €	5,940,000 €	18,900,000 €	27,000,000 €

Example of application of Earned Value Management in a project with open scope – Initial planning

Initial Planning



Example of application of Earned Value Management in a project with open scope – **Initial planning**



Example of application of Earned Value Management in a project with open scope – Project evaluation

- Project evaluation on 31st July, 2012:
 - ✓ Planned Value (PV) calculation

PLANNED VALUE (Planned number of new base stations)	TOTAL		
	Site acquisition	Engineering	Civil works, equip. Install. & integr.
Jan'12	30	0	0
Feb'12	60	30	0
Mar'12	30	60	30
Apr'12	30	30	60
May'12	90	30	30
Jun'12	90	90	30
Jul'12	30	90	90
Aug'12			
Sep'12			
Oct'12			
Nov'12			
Dec'12			
TOTAL	360	330	240



PLANNED VALUE (Planned cost of the planned base stations)	TOTAL			
	Site acquisition	Engineering	Civil works, equip. Install. & integr.	TOTAL
Jan'12	108,000 €	0 €	0 €	108,000 €
Feb'12	216,000 €	297,000 €	0 €	513,000 €
Mar'12	108,000 €	594,000 €	945,000 €	1,647,000 €
Apr'12	108,000 €	297,000 €	1,890,000 €	2,295,000 €
May'12	324,000 €	297,000 €	945,000 €	1,566,000 €
Jun'12	324,000 €	891,000 €	945,000 €	2,160,000 €
Jul'12	108,000 €	891,000 €	2,835,000 €	3,834,000 €
Aug'12	0 €	0 €	0 €	0 €
Sep'12	0 €	0 €	0 €	0 €
Oct'12	0 €	0 €	0 €	0 €
Nov'12	0 €	0 €	0 €	0 €
Dec'12	0 €	0 €	0 €	0 €
TOTAL	1,296,000 €	3,267,000 €	7,560,000 €	12,123,000 €

Example of application of Earned Value Management in a project with open scope – Project evaluation

- Project evaluation on 31st July, 2012:
 - ✓ Earned Value (EV) calculation

EARNED VALUE (Completed works in terms of completed base stations)		TOTAL		
		Site acquisition	Engineering	Civil works, equip. Install. & integr.
Jan'12	26	0	0	
Feb'12	53	26	0	
Mar'12	15	53	26	
Apr'12	36	15	53	
May'12	81	36	15	
Jun'12	93	81	36	
Jul'12	26	93	81	
Aug'12				
Sep'12				
Oct'12				
Nov'12				
Dec'12				
TOTAL	330	304	211	



EARNED VALUE (Budgeted value of the completed base stations)		TOTAL			TOTAL
		Site acquisition	Engineering	Civil works, equip. Install. & integr.	
Jan'12	93,600 €	0 €	0 €	93,600 €	
Feb'12	190,800 €	257,400 €	0 €	448,200 €	
Mar'12	54,000 €	524,700 €	819,000 €	1,397,700 €	
Apr'12	129,600 €	148,500 €	1,669,500 €	1,947,600 €	
May'12	291,600 €	356,400 €	472,500 €	1,120,500 €	
Jun'12	334,800 €	801,900 €	1,134,000 €	2,270,700 €	
Jul'12	93,600 €	920,700 €	2,551,500 €	3,565,800 €	
Aug'12	0 €	0 €	0 €	0 €	
Sep'12	0 €	0 €	0 €	0 €	
Oct'12	0 €	0 €	0 €	0 €	
Nov'12	0 €	0 €	0 €	0 €	
Dec'12	0 €	0 €	0 €	0 €	
TOTAL	1,188,000 €	3,009,600 €	6,646,500 €	10,844,100 €	

Example of application of Earned Value Management in a project with open scope – Project evaluation

- Project evaluation on 31st July, 2012:
 - ✓ Actual Cost (AC) calculation

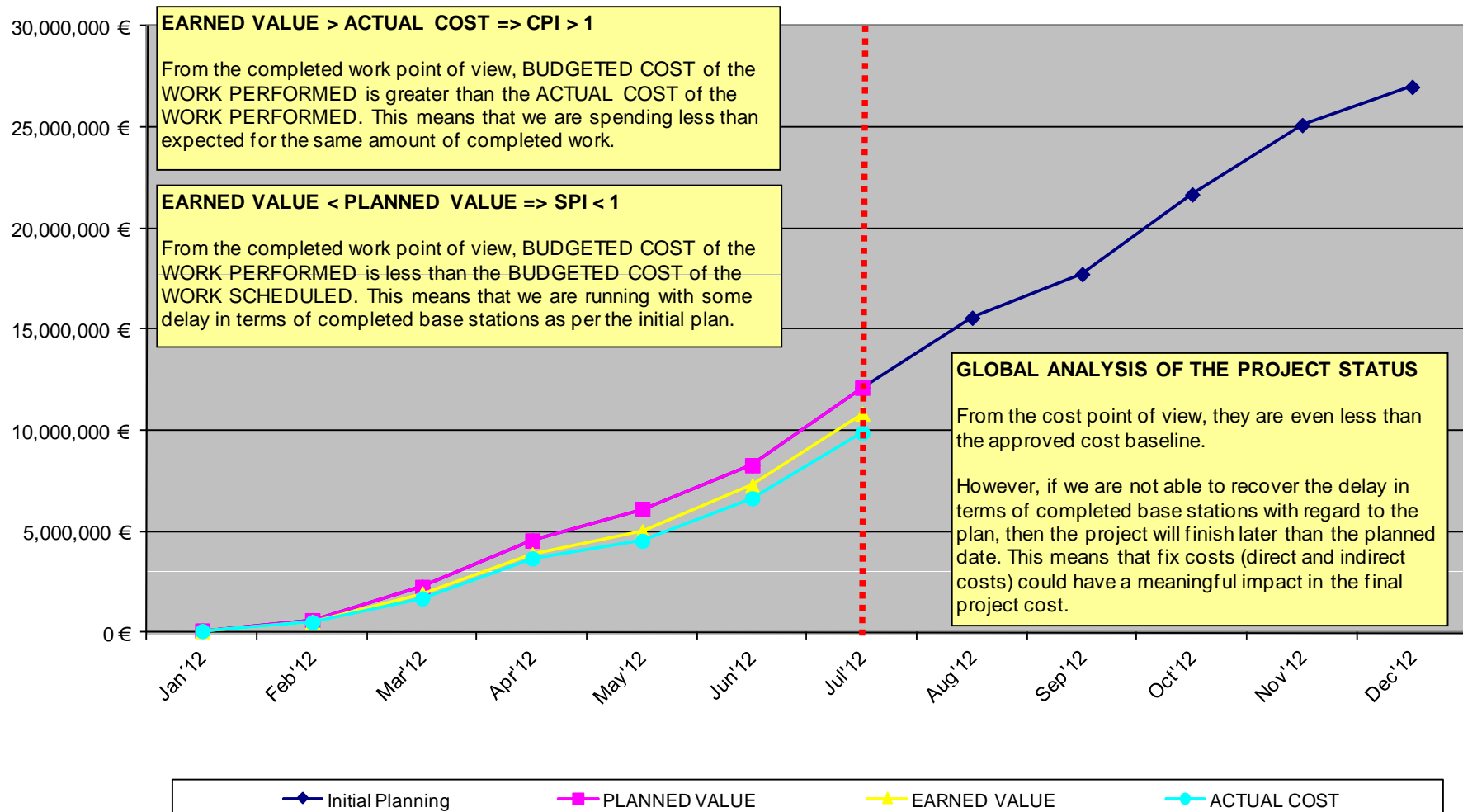
ACTUAL COST (Completed works in terms of completed base stations)		TOTAL		
		Site acquisition	Engineering	Civil works, equip. Install. & integr.
Jan'12	N/A	N/A	N/A	
Feb'12	N/A	N/A	N/A	
Mar'12	N/A	N/A	N/A	
Apr'12	N/A	N/A	N/A	
May'12	N/A	N/A	N/A	
Jun'12	N/A	N/A	N/A	
Jul'12	N/A	N/A	N/A	
Aug'12	N/A	N/A	N/A	
Sep'12	N/A	N/A	N/A	
Oct'12	N/A	N/A	N/A	
Nov'12	N/A	N/A	N/A	
Dec'12	N/A	N/A	N/A	
TOTAL	N/A	N/A	N/A	

➔

ACTUAL COST (Actual cost of the completed base stations)		TOTAL			TOTAL
		Site acquisition	Engineering	Civil works, equip. Install. & integr.	
Jan'12	N/A	N/A	N/A	N/A	85,468 €
Feb'12	N/A	N/A	N/A	N/A	433,445 €
Mar'12	N/A	N/A	N/A	N/A	1,184,209 €
Apr'12	N/A	N/A	N/A	N/A	1,974,302 €
May'12	N/A	N/A	N/A	N/A	870,898 €
Jun'12	N/A	N/A	N/A	N/A	2,101,607 €
Jul'12	N/A	N/A	N/A	N/A	3,241,904 €
Aug'12					
Sep'12					
Oct'12					
Nov'12					
Dec'12					
TOTAL	0 €	0 €	0 €	0 €	9,891,833 €

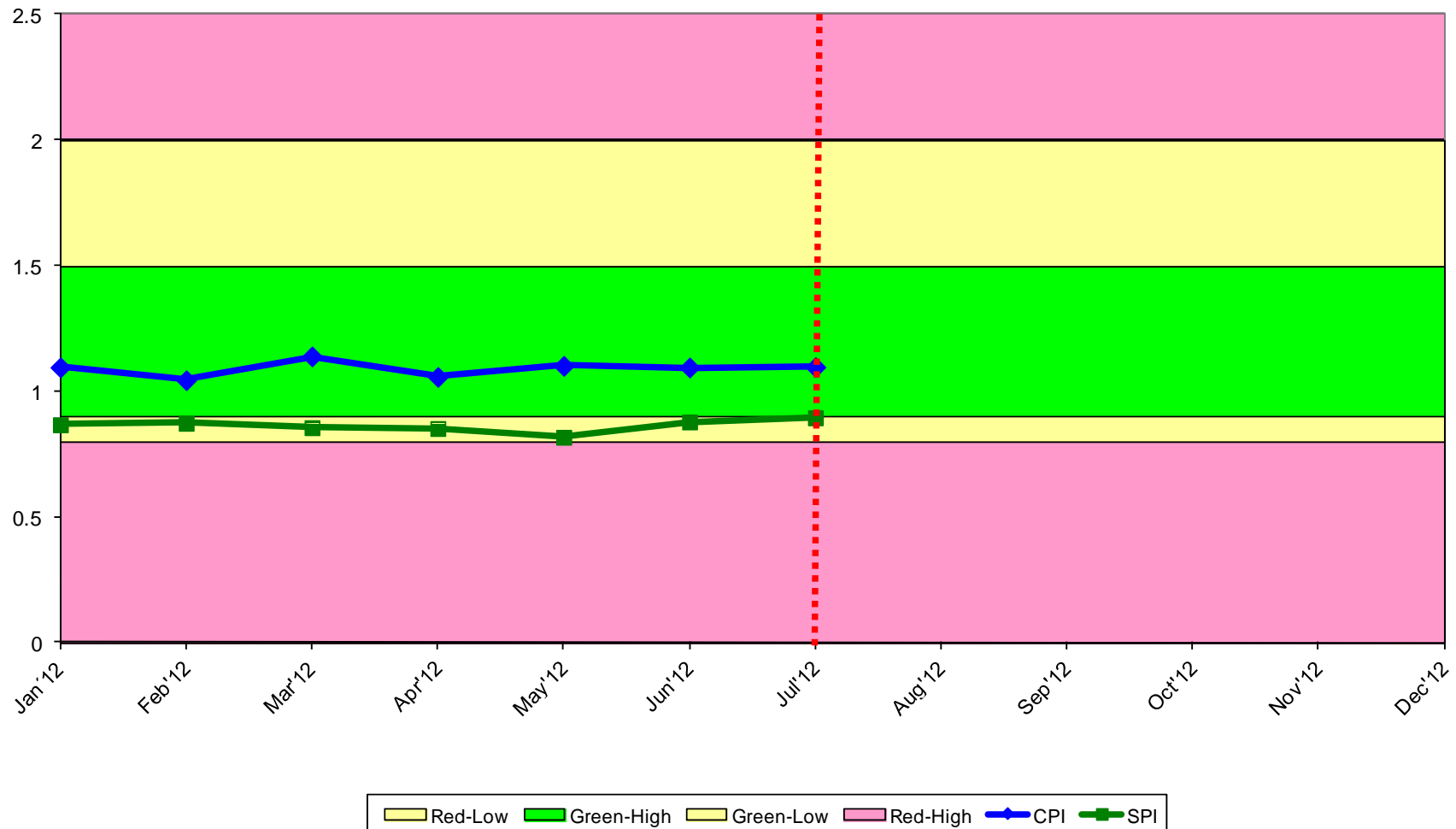
Example of application of Earned Value Management in a project with open scope – Project evaluation

Project evaluation by 31st July, 2012



Example of application of Earned Value Management in a project with open scope – Project evaluation

Project evaluation by 31st July, 2012 - CPI & SPI



Example of application of Earned Value Management in a project with open scope – Project rebaselining based on actual data (I)

- What if, once completed a project evaluation, we realize that the final number of completed sites is going to be, let's say 500 (instead of the 600 initially planned) ?
- This could be due, for instance, because as we go on with the deployment, we realize sites are being more expensive than initially planned. So, customer will spend its budget with less sites than the 600 initially planned.
- In order to keep on using EVM indicators, we could rebaseline the project with an updated “average planned cost per site” and with the new number of “planned sites”.
- If doing that, we would guarantee that SPI, upon project completion, will continue tending to 1.

$$SPI = \frac{EV}{PV} = \frac{BCWP}{BCWS} = \frac{\# \text{ completed_sites} \times \text{new_average_planned_cost_per_site}}{\# \text{ new_planned_sites} \times \text{new_average_planned_cost_per_site}} \rightarrow 1$$

Upon project completion

Nokia Siemens Networks



Example of application of Earned Value Management in a project with open scope – Project rebaselining based on actual data (II)

- But we could also decide to keep (for reporting purposes) the “initial number of planned sites” with the “initial average planned cost per site”.
- If doing that, we should use the “new average planned cost per site” from the rebaseline date onwards and only in the upper part of the SPI equation.
- By doing it in this way, we would still guarantee that SPI, upon project completion, will continue tending to 1.

$$SPI = \frac{EV}{PV} = \frac{BCWP}{BCWS} = \frac{\#completed_sites \times new_average_planned_cost_per_site}{\#initial_planned_sites \times initial_average_planned_cost_per_site} \rightarrow 1$$

Upon project completion

Conclusions

- Introduces an “objective” measure about the status of projects.
- Introduces measures for deviations in costs and schedule.
- It permits a quick evaluation of the status of projects with regards to execution timelines, costs and tasks.
- It is a unique and simple system which integrates multiple evaluations into a unique reporting system.
- If the Project Manager is going to use the data provided by the Finance Department about project costs, he / she must take into account that those costs are “recognized” costs (according to the agreed revenue recognition method).
- So, during the planning of project costs (planning phase), the Project Manager should know (and take into account) the method that will be used to recognize those project costs during the executing phase.
- Calculation of EVM indexes (mainly CPI and SPI) will depend on the way to measure and track the degree of project progress.
- If scope is not totally defined at the beginning of the project, and we want to use EVM in the monitoring and control phase, some “assumptions” should be made about the scope, for instance, making use of average values for the number and type of deliverables.

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