



Politechnika Wroclawska

SOFTWARE PROJECT IN MANAGEMENT

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Controlling of project realization



CONTROLLING THE PROGRESS OF THE WORKS

- Traditional approach
 - The difference between the value of real costs and the value of the planned expenses
- New approach
 - Valuation of the worth of the works carried out up to the moment t (the value of products, services)



THE METHOD OF EARNED VALUE (EV)

- Standard for measuring the project performances
- Controlling the project realization by comparing up to the moment t
 - As for the carried out project scope,
 - As for the time being invested,
 - As for the incurred costs.
- With the agreed values of the schedule and of the budget in the base plan



THE METHOD OF EARNED VALUE (EV)

- Is the project implementation ahead of the schedule plan or is the project delayed?
- How implement the tasks planned in the project schedule effectively ?
- How implement the tasks to be completed in the project schedule effectively ?
- Is the project below or above the budget plan?
- How use the resources available in the project effectively?
- What will be the cost of project implementation?
- When will the project be completed?



THE METHOD OF EARNED VALUE (EV)

- If the project is delayed and / or implemented above the budget, the project manager may use the earned value method to identify:
 - Where are the problems?
 - Are these critical issues or not?
 - What corrective action should be taken?



THE METHOD OF EARNED VALUE (EV)

- Before introducing the Earned Value (EV) method, you should prepare a measurement of the status of your project based on:
 - Gantt diagram;
 - Critical Path Method (CPM);
 - analysis of differences between planned and current costs (no correlation between these methods of measuring project progress).

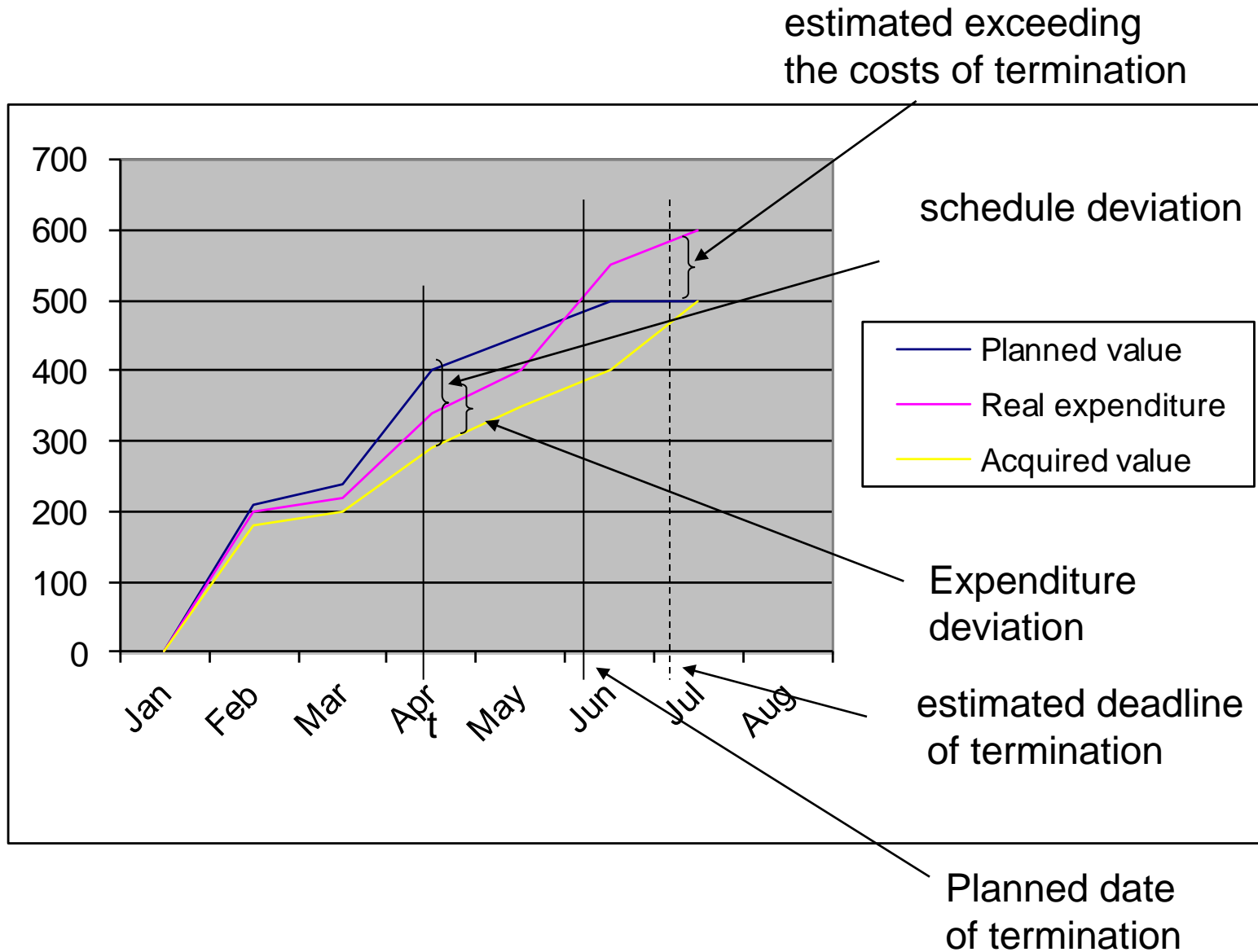


CONDITIONS FOR USING THE METHOD

- Project scope (activities divided into sufficiently small units)
- Schedule
- Planned budget
- Units of measurement used: hours, amounts, number of work packages



THE GRAPH OF THE EV ANALYSIS





VARIANCES

- Cost variance (CV) calculation:

$$CV(t) = EV(t) - AC(t)$$

EV(t) – the value obtained in the moment t

AC(t) – the real expenditure in the moment t

- Schedule variance (SV) calculation:

$$SV(t) = EV(t) - PV(t)$$

PV(t) – the planned expenditure in the moment t



THE RATIO OF EFFECTIVENESS

- The indicator for carrying out costs

$$CPI = EV(t)/AC(t)$$

- The indicator of progression of the schedule

$$SPI = EV(t)/PV(t)$$



PROJECT ESTIMATED VALUES

- Estimate At Completion (EAC)

$$EAC = BAC/CPI$$

BAC – Budget At Completion

- Estimation of the duration

$$SAC = BAS/SPI$$

BAS – the planned project duration (aggregated value)



INTERPRETATION OF BASIC EVM PERFORMANCE INDICATORS

Performance measures		Schedule		
		SV>0 and SPI>1	SV=0 and SPI=1	SV<0 and SPI<1
Costs	CV>0 and CPI>1	Ahead of the schedule plan, below the budget plan	According to the schedule plan, below the budget plan	Delayed schedule plan, below budget plan
	CV=0 and CPI=1	Ahead of the schedule plan, according to the budget plan	According to the planned schedule and budget	Delayed schedule plan and according to the budget plan
	<0 and CV CPI<1	Ahead of the schedule plan and above the budget plan	According to the schedule plan, above the budget plan	Delayed schedule plan, above the budget plan



ASSUMPTIONS AS FOR ESTIMATIONS BY MEANS OF THE EV METHOD IN THE VERSION (0:100)

- Gained value
 - The task being completed accounts for the value of 100% of the planned expenditure
 - The task being initiated and the one not to be initiated amount to 0
- The real cost AC may amount to the equal, lesser, or greater value in comparison with the planned expenditure PV , due to simplification one assumes that $AC=PV$



EV METHOD IN THE TIME T (0:100 VERSION)

Task	PV	AC=PV	Progression [%]	EV	EAC
1	6000	6000	100	6000	
2	5000	5000	85	0	
3	4000	4000	50	0	
4	2000	2000	30	0	
5	3000	3000	0	0	
6 and ...					
Accumulatively	BAC=50 000	ΣAC=20 000		ΣEV=6 000	166 666,6

$$EAC = BAC/CPI = BAC * \Sigma AC / \Sigma EV$$

BAC – the planned expenditure on the whole project from the base plan

PV – the planned costs of the task

AC - the real costs of the task

EV - the obtained value of the task

EAC – the estimated expenditure of the project termination

The tasks 1 to 5 should be terminated within the time t



ASSUMPTIONS AS FOR ESTIMATIONS BY MEANS OF THE EV METHOD IN THE VERSION (50:50)

- Gained value
 - Carrying out a task is estimated at the half or more – it amounts to the value of 50 % of the expenditure on planned the task
 - Carrying out a task estimated at less than 50 % of the planned expenditure is 0.
 - Carrying out a task amounts to the 100 % of the planned expenditure on the task
- The real cost AC may account for the equal, lesser, or greater value than the planned expenditure PV , due to simplification one assumes that $AC = PV$



EV METHOD IN THE TIME T (50:50 VERSION)

Task	PV	AC=PV	Progression [%]	EV	EAC
1	6000	6000	100	6000	
2	5000	5000	85	2500	
3	4000	4000	50	2000	
4	2000	2000	30	0	
5	3000	3000	0	0	
6 i ...					
Accumulatively	BAC=50 000	ΣAC=20 000		ΣEV=10 500	95 238,09

$$EAC = BAC/CPI = BAC * \Sigma AC / \Sigma EV$$

BAC – the planned expenditure on the whole project from the base plan

PV – the planned costs of the task

AC - the real costs of the task

EV - the obtained value of the task

EAC – the estimated expenditure of the project termination

The tasks 1 to 5 should be terminated within the time t



ASSUMPTIONS AS FOR ESTIMATION BY MEANS OF THE EV METHOD – DETAILED VERSION

- The gained value is calculated according to percentage assessment of the planned value of the task
- The real expenditure AC may amount to the equal, lesser, or greater value than the planned expenditure PV, due to simplification, one assumes that $AC=PV$



EV METHOD (THE DETAILED VERSION) IN THE TIME T

Task	PV	AC=PV	Progression [%]	EV	EAC
1	6000	6000	100	6000	
2	5000	5000	85	4250	
3	4000	4000	50	2000	
4	2000	2000	30	600	
5	3000	3000	0	0	
6 i ...					
Accumulatively	BAC=50 000	ΣAC=20 000		ΣEV=12 850	77 821,01

$$EAC = BAC/CPI = BAC * \Sigma AC / \Sigma EV$$

BAC – the planned expenditure on the whole project from the base plan

PV – the planned costs of the task

AC - the real costs of the task

EV - the obtained value of the task

EAC – the estimated expenditure of the project termination

The tasks 1 to 5 should be terminated within the time t



PRINCIPLES FOR PRACTICAL USE OF EV METHOD

- Establishment of a Performance Measurement Baseline (PMB):
 - ✓ decomposition of the project scope to a reasonable level (WBS - Work Breakdown Structure),
 - ✓ assignment of explicit responsibility for management (RAM - Responsibility Assignment Matrix),
 - ✓ assignment an appropriate budget to each task in the project schedule,
 - ✓ selection of the method of earned value for all tasks in the project schedule,
 - ✓ maintaince of the integrity of the Performance Measurement Baseline (PMB), with scope, schedule and project costs being integrated.



PRINCIPLES FOR PRACTICAL USE OF EV METHOD

- Performance Measurement Baseline:
 - ✓ recording resource consumption during project implementation,
 - ✓ objective measurement of the works actually carried out in the project,
 - ✓ measurement of earned value in accordance with the measurement technique adopted for the project,
 - ✓ analysis and forecasting of project costs / schedule,
 - ✓ reporting project implementation problems and / or taking corrective actions.



REPORTING MEASUREMENTS OF EARNED VALUE IN EVM

The Department of Defense has developed two earned value reporting standards:

- Cost Performance Report – developed for complex and expensive projects. Requires rigorous cost level and work package estimation and applies to 5 formats:
 - data on the earned value according to WBS,
 - data on the earned value by functional category (design, implementation, testing, implementation, maintenance, etc.),
 - baseline changes
 - actual and projected employment levels,
 - explanation of variance analysis.



REPORTING MEASUREMENTS OF EARNED VALUE IN EVM

- Cost/Schedule Status Report – developed for simpler and less expensive projects (simplified version of CPR). It can be used at any logical level considered by the project manager. Contains two formats:
 - data on the earned value according to WBS,
 - explanation of variance analysis.



EARNED VALUE (EV)

- The application of the earned value method gives only a limited picture of the project.
- Nothing says what's really going on with the project.
- The EV method may show the existence of slips in the implementation of the planned schedule or exceeding the planned costs, but does not give the reasons for these negative phenomena or ways to improve the state of the project.
- Typical documentation of the progress of works carried out in the project must be stored in the project control system, including written explanations of the reasons for deviations from the plan, forecasts, list of design issues (problems), etc.