

 OR-AS Operations Research Applications and Solutions	Case Name: Security	Sector	IT
	OR-AS Operations Research - Applications and Solutions www.or-as.be info@or-as.be	Baseline Schedule	Schedule with resources
			Schedule with costs
		Risk Analysis	Random simulation
Submitted by	Stef Pauwels and Emile Van de Walle		One of nine std. scenarios
Date	June 04, 2023		User defined distributions
File Name	C2023-02	Project Control	Automatic tracking
			Tracking based on user input

1. Project description

Project authenticity

The security of a building, ranging from software to hardware. The project was performed as fast as possible, given the resources at hand. However, it was clear that with extra resources and a designated project manager, the project could have been finished faster if intended. The first steps consisted mostly of sequential steps including a lot of activities that had to be approved by both parties. Throughout the middle part of the project, the project could have been performed quicker. There was however a limit on the number of technicians that were available. Additionally, there was no real incentive to execute this project before the planned date.

The project consists of activity, resource and cost data that were obtained directly from the actual project owner.

2. Project properties

2.1. Baseline Schedule

General		Network topology	
# Activities	66	Serial/Parallel (SP)	33%
Planned Duration (PD)	189 days*	Activity Distribution (AD)	54%
Budget At Completion (BAC)	€ 607,575	Length of Arcs (LA)	5%
Renewable Resources	3	Topological Float (TF)	15%
Consumable Resources	-		

* standard eight-hour working days

2.2. Risk Analysis

Random simulation by ProTrack was performed using the default symmetric triangular risk distribution profiles.

	Cost sensitivity				Time sensitivity		
	avg [%]	std dev [%]	skew [-]		avg [%]	std dev [%]	skew [-]
CRI-r	8	11,25	3,6	CI	4	18,89	5,1
CRI-rho	11	14,54	2,5	SI	13	13,92	1,6
CRI-tau	11	23,05	3,4	SSI	0	1,32	5,1
				CRI-r	9	9,36	2,0
				CRI-rho	10	11,89	2,1
				CRI-tau	9	18,85	4,3

	Resource sensitivity		
	avg [%]	std dev [%]	skew [-]
CRI-r	-	-	-
CRI-rho	-	-	-
CRI-tau	-	-	-

2.3. Project Control

2.3.1. Simulated forecasting accuracy

The accuracy of time and cost forecasting methods has been evaluated based on Monte Carlo simulation runs using the risk profiles described in section “2.2. Risk Analysis”. Based on these risk profiles, the Mean Absolute Percentage Error (MAPE) and Mean Percentage Error (MPE) has been calculated to evaluate the expected accuracy of the time and cost predictions, EAC(t) and EAC, respectively.

Simulated EAC(t) accuracy			Simulated EAC accuracy		
method - PF	MAPE [%]	MPE [%]	method (PF)	MAPE [%]	MPE [%]
PV - 1	-	-	1	-	-
PV - SPI	-	-	CPI	-	-
PV - SCI	-	-	SPI	-	-
ED - 1	-	-	SPI(t)	-	-
ED - SPI	-	-	SCI	-	-
ED - SCI	-	-	SCI(t)	-	-
ES - 1	-	-	0.8 CPI + 0.2 SPI	-	-
ES - SPI(t)	-	-	0.8 CPI + 0.2 SPI(t)	-	-
ES - SCI(t)	-	-			

According to the MAPE values¹ the best performance for time forecasting can be expected from the unweighted Earned Schedule method. For cost forecasting the unweighted and CPI-weighted methods should yield the best results.

2.3.2. Tracking description

Tracking authenticity

Manual tracking was performed over 28 tracking periods with a length of approximately one week. The Real Duration and Real Cost mentioned in section “2.3.3. Earned Value Management” are based on manual user input.

The tracking information obtained from the project owner and introduced in ProTrack includes actual activity start dates, durations and costs.

¹ The MAPE gives the best indication for the forecast accuracy (the lower the MAPE, the more accurate the method) since all deviations from the targeted real duration (real cost) are cumulated, whereas for the MPE underestimates can be compensated by overestimates and vice versa, possibly leading to an overly positive evaluation of a certain method. However, the MPE can provide useful information about the nature of the deviations, i.e. does the method rather underestimate or overestimate the real duration (real cost)?

2.3.3. Earned Value Management

2.3.3.1. Performance metrics

	CV [€]	SV [€]	SV(t) [d]	CPI [-]	SPI [-]	SPI(t) [-]	p-factor [-]
avg	-	-	-	-	-	-	-
std dev	-	-	-	-	-	-	-
final	-	-	-	-	-	-	-

2.3.3.2. Time forecasting

PD	-	Real Duration	-		-
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EAC(t)	Real Accuracy			
method - PF	avg [d]	std dev [d]	MAPE [%]	MPE [%]
PV - 1	-	-	-	-
PV - SPI	-	-	-	-
PV - SCI	-	-	-	-
ED - 1	-	-	-	-
ED - SPI	-	-	-	-
ED - SCI	-	-	-	-
ES - 1	-	-	-	-
ES - SPI(t)	-	-	-	-
ES - SCI(t)	-	-	-	-

2.3.3.3. Cost forecasting

BAC	-	Real Cost	-		-
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EAC	Real Accuracy			
method (PF)	avg [€]	std dev [€]	MAPE [%]	MPE [%]
1	-	-	-	-
CPI	-	-	-	-
SPI	-	-	-	-
SPI(t)	-	-	-	-
SCI	-	-	-	-
SCI(t)	-	-	-	-
0.8 CPI + 0.2 SPI	-	-	-	-
0.8 CPI + 0.2 SPI(t)	-	-	-	-