


|   |   |                   |                              |  |
|---|---|-------------------|------------------------------|--|
|  | Case Name: C2016-54   | Sector            | IT                           |  |
|   | OR-AS<br>Operations Research -<br>Applications and Solutions<br>www.or-as.be<br>info@or-as.be | Baseline schedule | Schedule with resources      |  |
|   |   |                   | Schedule with costs          |  |
|   |   | Risk analysis     | Random Simulation            |  |
| Submitted by  | Mayté & Thymo   |                   | One of nine std. scenarios   |  |
| Date  | 2016  |                   | User defined distributions   |  |
| File Name   | C2016-54  | Project Control   | Automatic tracking           |  |
|   |   |                   | Tracking based on user input |  |

## 1. Project description

Project Authenticity

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                    |                |
|----------------------------|----------------|
| # Activities               | 39             |
| Planned Duration (PD)      | 350 days*      |
| Budget at Completion (BAC) | € 1.703.350,00 |
| Renewable Resources        | 8              |
| Consumable Resources       | -              |

\* Standard eight-hour working days

| Network Topology           |     |
|----------------------------|-----|
| Serial/Parallel (SP)       | 38% |
| Activity Distribution (AD) | 54% |
| Length of Arcs (LA)        | 1%  |
| Topological Float (TF)     | 41% |

### 2.2. Risk analysis

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

|          | Cost sensitivity |             |          |
|----------|------------------|-------------|----------|
|          | avg (%)          | std dev (%) | skew (-) |
| CRI-r    | 11,11            | 16,47       | 1,8      |
| CRI-rho  | 34,54            | 18,90       | -0,5     |
| CRI-thau | 54,40            | 43,55       | 0,0      |

|          | Resource sensitivity |             |          |
|----------|----------------------|-------------|----------|
|          | avg (%)              | std dev (%) | skew (-) |
| CRI-r    | 26,88                | 32,28       | 1,2      |
| CRI-rho  | 45,50                | 23,16       | 0,0      |
| CRI-thau | 56,63                | 38,62       | -0,1     |

|          | Time sensitivity |             |          |
|----------|------------------|-------------|----------|
|          | avg (%)          | std dev (%) | skew (-) |
| CI       | 40,6             | 49,1        | 0,4      |
| SI       | 47,5             | 43,9        | 0,3      |
| SSI      | 7,8              | 13,0        | 2,1      |
| CRI-r    | 17,7             | 15,8        | 1,7      |
| CRI-rho  | 17,0             | 15,7        | 1,6      |
| CRI-thau | 11,1             | 11,0        | 1,8      |

## 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 |          |         |
|----------------------------|----------|---------|
| Method - PF                | MAPE (%) | MPE (%) |
| PV - 1                     | 9,42%    | 0,29%   |
| PV - SPI                   | 19,66%   | -7,64%  |
| PV - SCI                   | 21,34%   | -8,62%  |
| ED - 1                     | 10,01%   | 1,55%   |
| ED - SPI                   | 19,24%   | -8,07%  |
| ED - SCI                   | 20,86%   | -8,98%  |
| ES- 1                      | 8,48%    | -2,68%  |
| ES- SPI(t)                 | 10,75%   | -4,32%  |
| ES - SCI(t)                | 12,20%   | -4,87%  |

| simulated EAC accuracy |          |         |
|------------------------|----------|---------|
| Method - PF            | MAPE (%) | MPE (%) |
| 1                      | 0,39%    | 0%      |
| CPI                    | 2,09%    | -0,20%  |
| SPI                    | 12,23%   | -8,30%  |
| SPI (t)                | 3,75%    | -1,05%  |
| SCI                    | 14,57%   | -9,31%  |
| SCI (t)                | 5,75%    | -1,66%  |
| 0.8 CPI + 0.2 SPI      | 2,96%    | -0,15%  |
| 0.8 CPI + 0.2 SPI (t)  | 2,32%    | -0,30%  |

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

### 2.3.2. Tracking description

Tracking Authenticity

Manual tracking was performed over 23 tracking periods with *regular* lengths of approximately one month. 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.

### 2.3.3. Earned Value Management

#### 2.3.3.1. Performance metrics

|         | CV (€)    | SV (€)    | SV(t) (d) | CPI(-) | SPI (-) | SPI(t) (-) | p-factor (-) |
|---------|-----------|-----------|-----------|--------|---------|------------|--------------|
| avg     | -8254,94  | -9716,94  | 2,26      | 0,97   | 0,96    | 0,98       | 1,00         |
| std dev | 3735,31   | 135010,29 | 80,63     | 0,06   | 0,17    | 0,08       | 0,01         |
| final   | -11683,00 | 0,00      | 0,00      | 0,99   | 1,00    | 1,00       | 1,00         |

#### 2.3.3.2. Time forecasting

|    |          |               |          |      |    |
|----|----------|---------------|----------|------|----|
| PD | 350 days | Real duration | 350 days | Late | 0% |
|----|----------|---------------|----------|------|----|

| EAC (t)     | Real Accuracy |             |          |         |  |
|-------------|---------------|-------------|----------|---------|--|
| Method - PF | avg (d)       | std dev (d) | MAPE (%) | MPE (%) |  |
| PV - 1      | 352,26        | 28,27       | 2,8      | 0,5     |  |
| PV - SPI    | 405,22        | 245,19      | 15,7     | 13,0    |  |
| PV - SCI    | 420,04        | 260,80      | 18,9     | 16,4    |  |
| ED - 1      | 352,09        | 18,94       | 2,0      | 0,5     |  |
| ED - SPI    | 405,22        | 245,19      | 15,7     | 13,0    |  |
| ED - SCI    | 418,10        | 260,10      | 19,0     | 15,0    |  |
| ES- 1       | 350,00        | 10,37       | 1,4      | 0,0     |  |
| ES- SPI(t)  | 359,70        | 33,81       | 4,3      | 2,3     |  |
| ES - SCI(t) | 370,91        | 68,77       | 6,9      | 4,9     |  |

#### 2.3.3.3 Cost forecasting

|     |                |           |                |             |       |
|-----|----------------|-----------|----------------|-------------|-------|
| BAC | € 1.703.350,00 | Real cost | € 1.715.033,00 | Over Budget | 0,69% |
|-----|----------------|-----------|----------------|-------------|-------|

| EAC                   | Real Accuracy |             |          |         |  |
|-----------------------|---------------|-------------|----------|---------|--|
| Method - PF           | avg (€)       | std dev (€) | MAPE (%) | MPE (%) |  |
| 1                     | 1711604,93    | 3735,30     | 0,2      | -0,2    |  |
| CPI                   | 1754923,20    | 130870,91   | 1,9      | 1,9     |  |
| SPI                   | 1969036,92    | 1041244,76  | 5,3      | 4,7     |  |
| SPI (t)               | 1761384,17    | 135345,04   | 2,4      | 2,2     |  |
| SCI                   | 2031481,55    | 1114704,98  | 6,8      | 6,3     |  |
| SCI (t)               | 1816651,45    | 318839,35   | 4,0      | 3,9     |  |
| 0.8 CPI + 0.2 SPI     | 1766072,60    | 144186,50   | 2,5      | 2,4     |  |
| 0.8 CPI + 0.2 SPI (t) | 1756131,79    | 131636,96   | 2,0      | 1,9     |  |