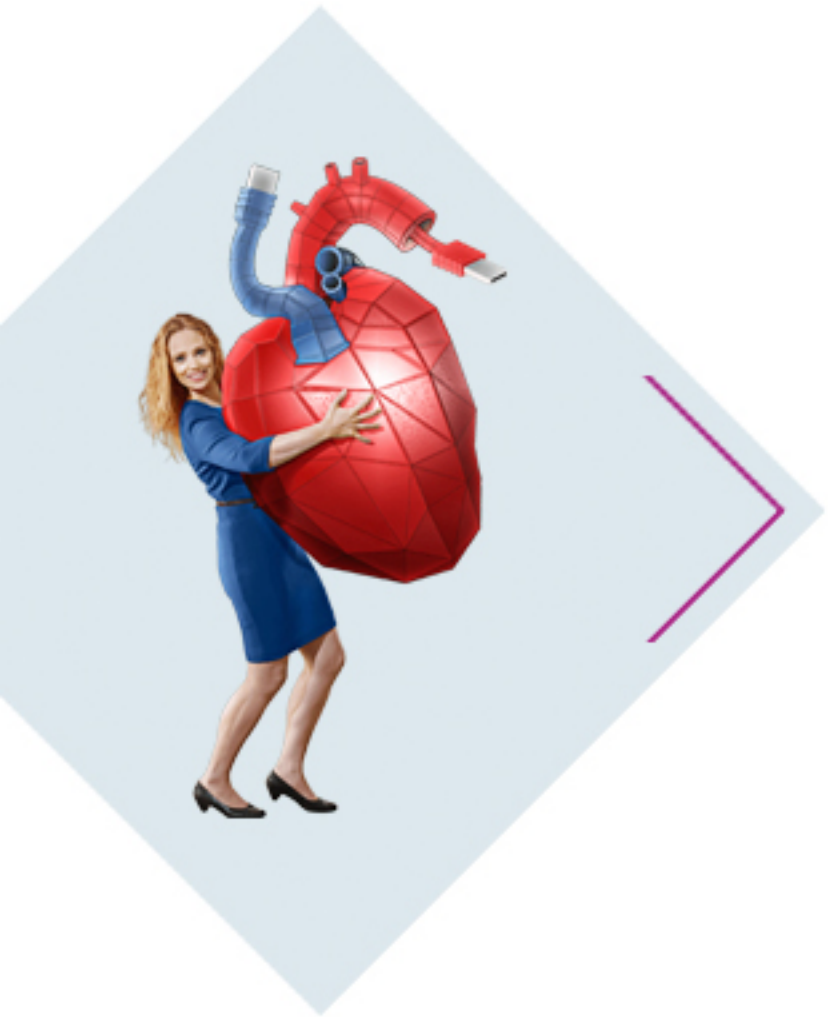
Software Estimation Challenge

Seabed Observatory Control System (SOCS)

November 2021

Adhoc team (Smals, Belgium)

Smals
ICT for society



Agenda

- **Background**
  - **Smals**
  - **Adhoc team**
  - **Timeline**
- Hypotheses
- Approach
- Estimates

About Smals

- Shared ICT services for Belgian public institutions
  - Strong focus on ***social security*** & ***health care***
  - Since 1939
- In-house organization
  - Governed by member institutions
  - Working strictly for member institutions only
- >2.000 employees
- 383 million EUR turnover (2020)



© Smals – Cannot be copied & distributed outside of the 2021 Software Estimation Challenge organized by COSMIC & NESMA

Smals ICT for society

About Adhoc team

Franck Zschau (SDO - Software Development Office)

Ludovic Diepdael (Business Analyst)

Patrick Vanden Bossche (Project Manager)

Sylvie Harrie (PMO - Project Management Office)

Tom Van Medegael (PMO - Project Management Office)

Delphine Lanotte (Project Manager)

Laurence Ulrix (Business Analyst)

Stéphane Flamme (Solution Architect)

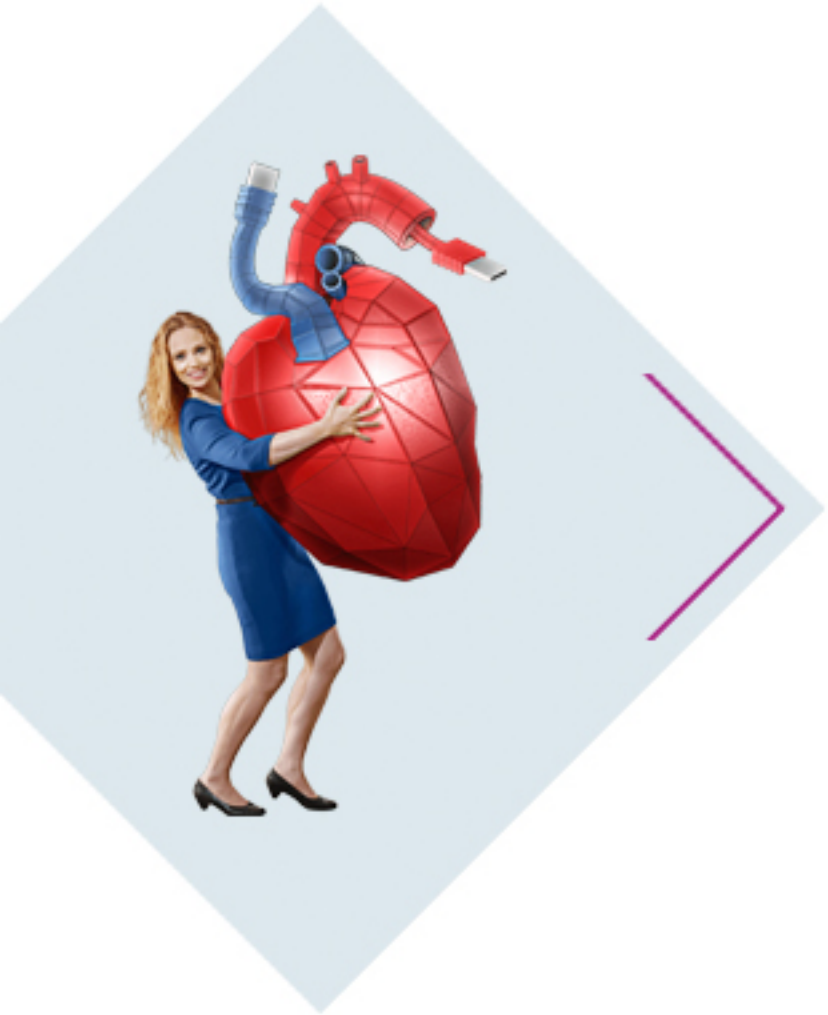
© Smals – Cannot be copied & distributed outside of the 2021 Software Estimation Challenge organized by COSMIC & NESMA

Smals ICT for society

Timeline Adhoc team

What	When
Kick-off meeting	06/10/2021
Q/A case study - Alain Abran	12/10/2021
Cosmic training - Safae Laqrichi	20/10/2021
ISBSG data analysis (hours/CFP)	25/10/2021
First (independent) estimates (**Delphi**)	26/10/2021
Team meeting 1 (Delphi)	27/10/2021
Cosmic coaching - **approximate sizing**	29/10/2021
Second estimates (Delphi)	05/11/2021
Team meeting 2 (Delphi)	05/11/2021
Third estimates (Delphi) + **Monte Carlo**	08/11/2021
Submission estimates	08/11/2021
Presentation	09/11/2021

© Smals – Cannot be copied & distributed outside of the 2021 Software Estimation Challenge organized by COSMIC & NESMA
Smals ICT for society



Agenda

- Background
- **Hypotheses**
  - **Choices**
  - **Requirements**
  - **Delphi**
  - **Availability**
- Approach
- Estimates

Choices

Options: you may elect to estimate

- all of the requirements that will impact the software development effort, or
- make your own selection about:
  - which subset(s)of the requirements you will elect to estimate and & present your corresponding estimates;
  - which subset(s) of the requirements you have elected to NOT estimate, and the rationale for this decision.

© Smals – Cannot be copied & distributed outside of the 2021 Software Estimation Challenge organized by COSMIC & NESMA

Smals
ICT for society

Requirements

- Only a few requirements are clearly described
- A large majority of requirements are not clearly described and have to be approximated
- Non functional requirements that can be allocated to software functions are sized using COSMIC method

© Smals – Cannot be copied & distributed outside of the 2021 Software Estimation Challenge organized by COSMIC & NESMA
Smals
ICT for society

Delphi sizing experiment Smals (2017)

Round 1 (individual)		Round 2 (groups)	
answers	gap	answers	gap
300	-89%	2.400	-9%
700	-73%	2.500	-5%
1.000	-62%	2.750	+5%
1.000	-62%	3.600	+37%
1.500	-43%		
1.500	-43%		
1.750	-33%		
1.800	-32%		
2.050	-22%		
2.100	-20%		
3.000	+14%		
3.600	+37%		
4.000	+52%		
6.000	+128%		

high/low factor	20		1,5	
avg	2.164	-18%	2.813	+7%
median	1.775	-33%	**2.625**	**-0%**

real size	2.630

Conclusions sizing experiment 2017:

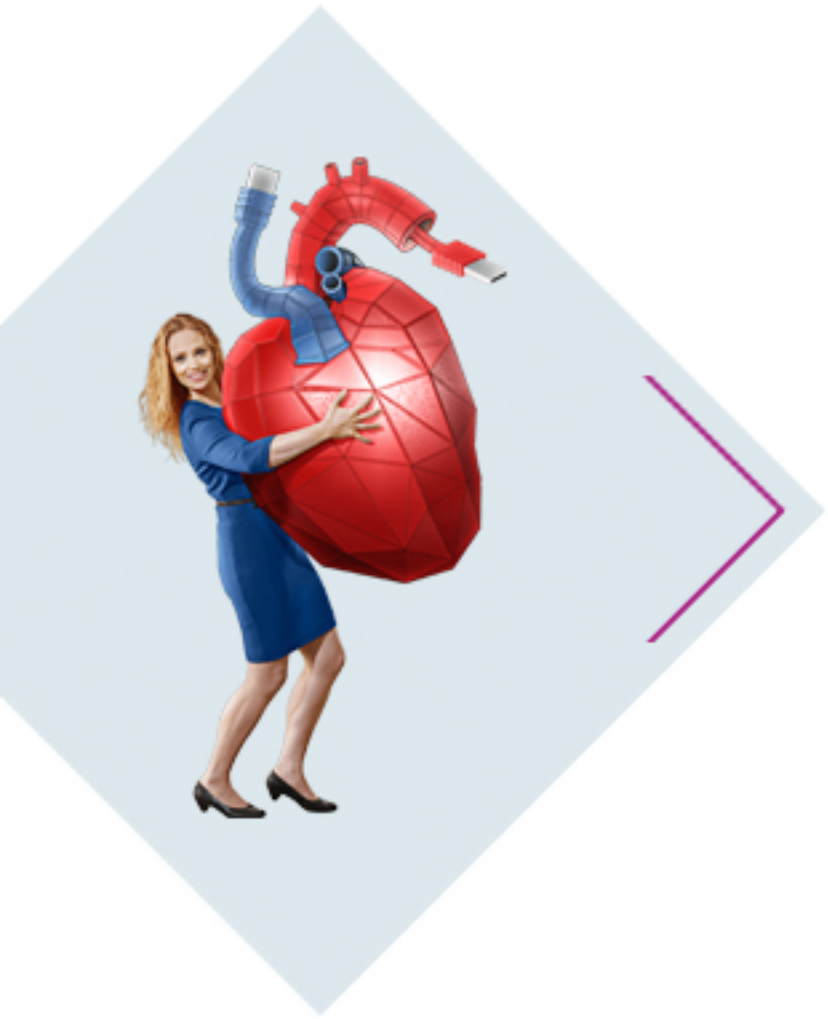
- A blend of *multiple* (independent!) estimators & multiple approaches tends to cover the full spectrum of uncertainty
  => average/median values give a fairly good idea
- *Iterative* approach with multiple rounds (& group discussions) helps to reduce the initial (substantial) spread between high/low estimates
  => reasonable bandwidth

© Smals – Cannot be copied & distributed outside of the 2021 Software Estimation Challenge organized by COSMIC & NESMA
Smals ICT for society

Availability Ad hoc team

- On average: 1 (à 2) days per team member
- Spread over multiple meetings & multiple estimate preparation (cf supra - slide Timeline)
- Need to focus on essentials (sizing first !)
- Time constraint (deadline 8/11/2021) + limited availability + uncertainty in case study =>
  - Delphi: convergence rather than consensus
  - Remaining spread/uncertainty: use Monte Carlo (P50, P80, P90...)

© Smals – Cannot be copied & distributed outside of the 2021 Software Estimation Challenge organized by COSMIC & NESMA



Agenda

- Background
- Hypotheses
- **Approach**
  - **Sizing > Effort > Cost**
  - **Conversion factors**
  - **Productivity**
- Estimates

Approach Adhoc team

Size

- Delphi (R1/R2/R3)
- Cosmic CFP ("Hard facts")
- Approximate sizing
  - Use case points
  - Early Cosmic
  - Iceberg theory
  - Scaling factors

Effort

- Cocomo ("Soft facts")
- ISBSG (hours/CFP)
- Reuse ?
- Monte Carlo
  - Sizing
  - Reserves
  - Soft facts

Cost

- Smals standards (Europe)
- Google search (America)
- Monte Carlo

© Smals – Cannot be copied & distributed outside of the 2021 Software Estimation Challenge organized by COSMIC & NESMA

Smals ICT for society

Conversion UCP->CFP

5. AVERAGE OF USE CASES.

Origin and approximation mechanism.

The average Use Case approximation was first introduced in the 'Advanced and Related Topics' document in version 3.0 of the COSMIC method [15].

The principle of the approximation is similar to the average functional process approximation from chapter 2, but on a higher level of documentation, namely the Use Case.

Local calibration might determine that a (locally-defined) Use Case comprises, on average, 3.5 functional processes, each of average size 8 CFP (as in the example in Chapter 2). Hence the average size of a Use Case according to this local definition, is 3.5 x 8 = 28 CFP per Use Case.

source: Early-Sizing-Experts-Guide-May-2020.pdf

- 1 average use case = 10 UCP (Use Case Points)
- **1 use case point = 2,8 CFP**

© Smals – Cannot be copied & distributed outside of the 2021 Software Estimation Challenge organized by COSMIC & NESMA

Smals ICT for society

Productivity

- Hours / CFP -> ISBSG check:

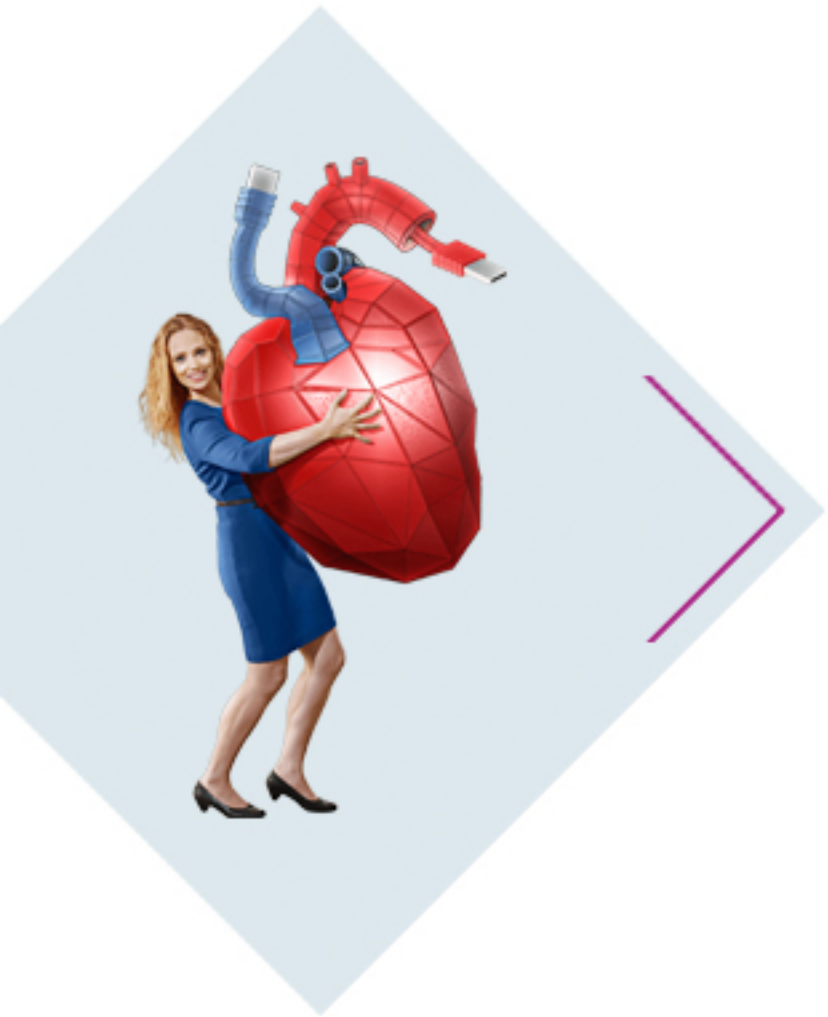
Filters applied (=> 33 out of 9592 records selected):
* Data quality rating = A or B
* UFP rating = A or B
* Year of project >= 2015
* Primary programming language = Java
* Count approach = COSMIC
* Relative Size = M1 or M2 or L

- Results:
  - average: 10,5 hours / CFP
  - **median: 8,6 hours / CFP**

- Cross-check Smals
  - Year of project >=2015
  - Language = Java
  - Count approach = UCP
  - Relative size = M1/M2/L

- Results:
  - average/median: 24,5 hours / UCP
  - **conversion to CFP: 24,5/2,8 = 8,75 hours/CFP**

© Smals – Cannot be copied & distributed outside of the 2021 Software Estimation Challenge organized by COSMIC & NESMA
Smals ICT for society



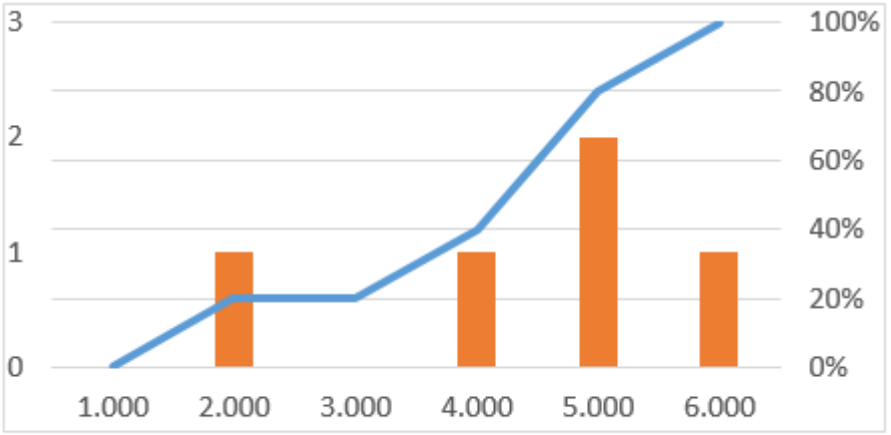
Agenda

- Background
- Hypotheses
- Approach
- **Estimates**
  - **Size FUR**
  - **Size NFR**
  - **Effort FUR+NFR**
  - **Cost**

Size FUR

	CFP	Method
Est 1	5.451	UCP->CFP
Est 2	4.191	UCP->CFP
Est 3	4.731	Early CFP
Est 4	3.740	UCP->CFP
Est 5	1.608	CFP

Median	**4.191**
Avg	**3.944**



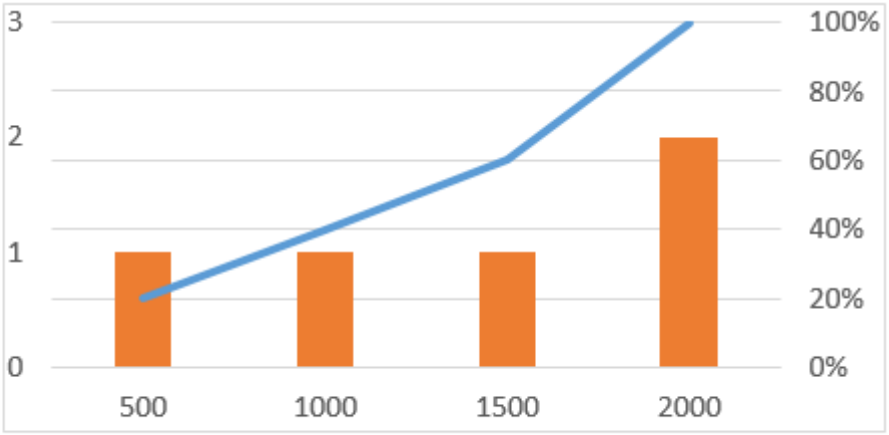
© Smals – Cannot be copied & distributed outside of the 2021 Software Estimation Challenge organized by COSMIC & NESMA

Smals ICT for society

Size NFR

	CFP	Method
Est 1	1.635	UCP->CFP
Est 2	1.056	UCP->CFP
Est 3	1.933	Early CFP
Est 4	924	UCP->CFP
Est 5	366	CFP

Median	**1.056**
Average	**1.183**



© Smals – Cannot be copied & distributed outside of the 2021 Software Estimation Challenge organized by COSMIC & NESMA

Smals ICT for society

Effort (FUR + NFR)

- Linear approach based on hard facts only:
  Effort (hours) = (4.191 + 1.056) x 8,6 = 45.124 hours
- "Cocomo" approach, based on hard + soft facts

		Type	*Explanation*
Size CFP	5.247	Hard facts	FUR + NFR
Req stab	1,00	Reserve	No buffer for change requested
Risk buffer	1,10	Reserve	10% risk contingency (default)
Tasks intensity	0,85	Soft facts	Agile mode => dedicated team => high intensity
PERS Cfonc	0,88	Soft facts	Team already supporting 2nd generation => high functional competences
PERS Ctech	1,00	Soft facts	No information about technology => nominal setting
PERS Continuity	1,00	Soft facts	No information about team continuity => nominal setting
PROD Complexity	1,00	Soft facts	All complexity reflected by Size CFP => nominal setting
PROD Reliability	1,10	Soft facts	High reliability needed, failure might cause high financial losses

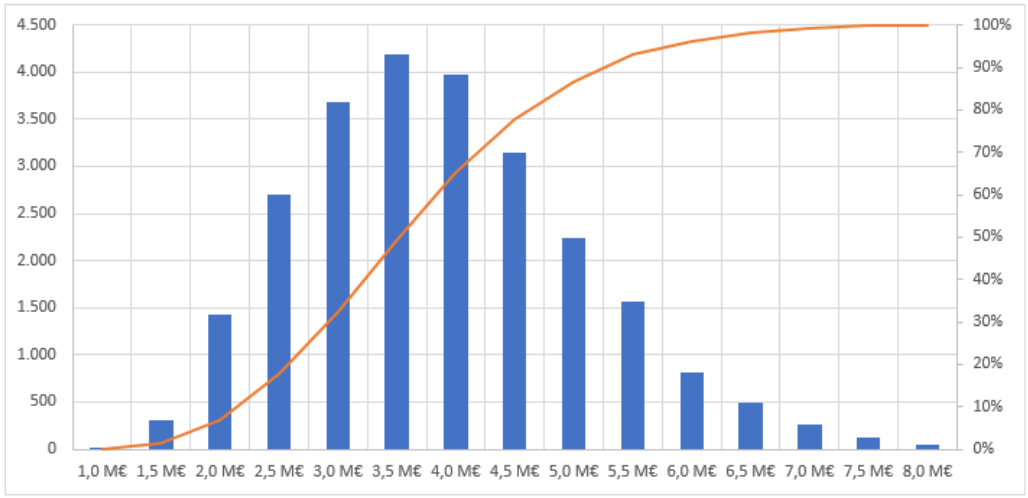
Effort	**40.197**

- **Conclusion (P50): rather 40.000 than 45.000 hours**

© Smals – Cannot be copied & distributed outside of the 2021 Software Estimation Challenge organized by COSMIC & NESMA
Smals ICT for society

Cost (FUR + NFR)

Monte Carlo simulation (25.000 runs)



1,0 M€	7	0%
1,5 M€	312	1%
2,0 M€	1.420	7%
2,5 M€	2.697	18%
3,0 M€	3.678	33%
3,5 M€	4.182	49%
4,0 M€	3.971	65%
4,5 M€	3.140	78%
5,0 M€	2.234	87%
5,5 M€	1.563	93%
6,0 M€	814	96%
6,5 M€	489	98%
7,0 M€	265	99%
7,5 M€	130	100%
8,0 M€	51	100%

Size CFP		Req stab	Risk	Intensity	Cfonc	Ctech	Continuity	Reliability	Rate
Low	1.974	1,00	1,00	0,70	0,81	0,84	0,81	1,00	57 €
ML	5.247	1,00	1,10	0,85	0,88	1,00	1,00	1,10	86 €
High	7.086	1,10	1,20	1,00	1,00	1,20	1,29	1,20	128 €

Conclusion:

- **P50 cost estimate: 3.500.000€**
- P95: 6.000.000€

© Smals – Cannot be copied & distributed outside of the 2021 Software Estimation Challenge organized by COSMIC & NESMA

Smals ICT for society

Annex: Lessons learned

- Uncertainty levels:
  - Sizing (FUR + NFR): high/low factor 46 (R1) -> 3,6 (R3)
    cf experiment 2017 (slide 9): 20 -> 1,5
  - Size (CFP) -> Effort (ISBSG): sample size issue ?
  - Effort -> Cost: many unknowns (international setting)
- Approximate sizing:
  - Use cases continue to be useful
  - Other approaches further to be examined & used
- Last but not least:
  - Challenges like these are great learning opportunities => thank you !!! :-))

© Smals – Cannot be copied & distributed outside of the 2021 Software Estimation Challenge organized by COSMIC & NESMA