SOFTWARE COST ESTIMATION

FINALLY BECOMING A REAL PROFESSION !

IT Confidence 2019
Beijing, 7 August 2019

Harold van Heeringen

INTRODUCING ME

Drs. Harold van Heeringen, (Groningen, the Netherlands)

- >20 years experience in IT, >**15 years in software measurement and metrics**
- **ISBSG** – Immediate Past President
- **METRI** – Senior Consultant ADM Benchmarking
- **NESMA** – board member International cooperation and partnerships
- **COSMIC** - Dutch representative in the International Advisory Council (IAC)
- **ICEAA** trainer of CEBoK chapter 12: Software Cost Estimation
- **sCEBoK** initiator and module developer

haroldvanheeringen

@haroldveendam

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ISBSG: www.isbsg.org
Nesma: www.nesma.org
METRI: www.metrigroup.com

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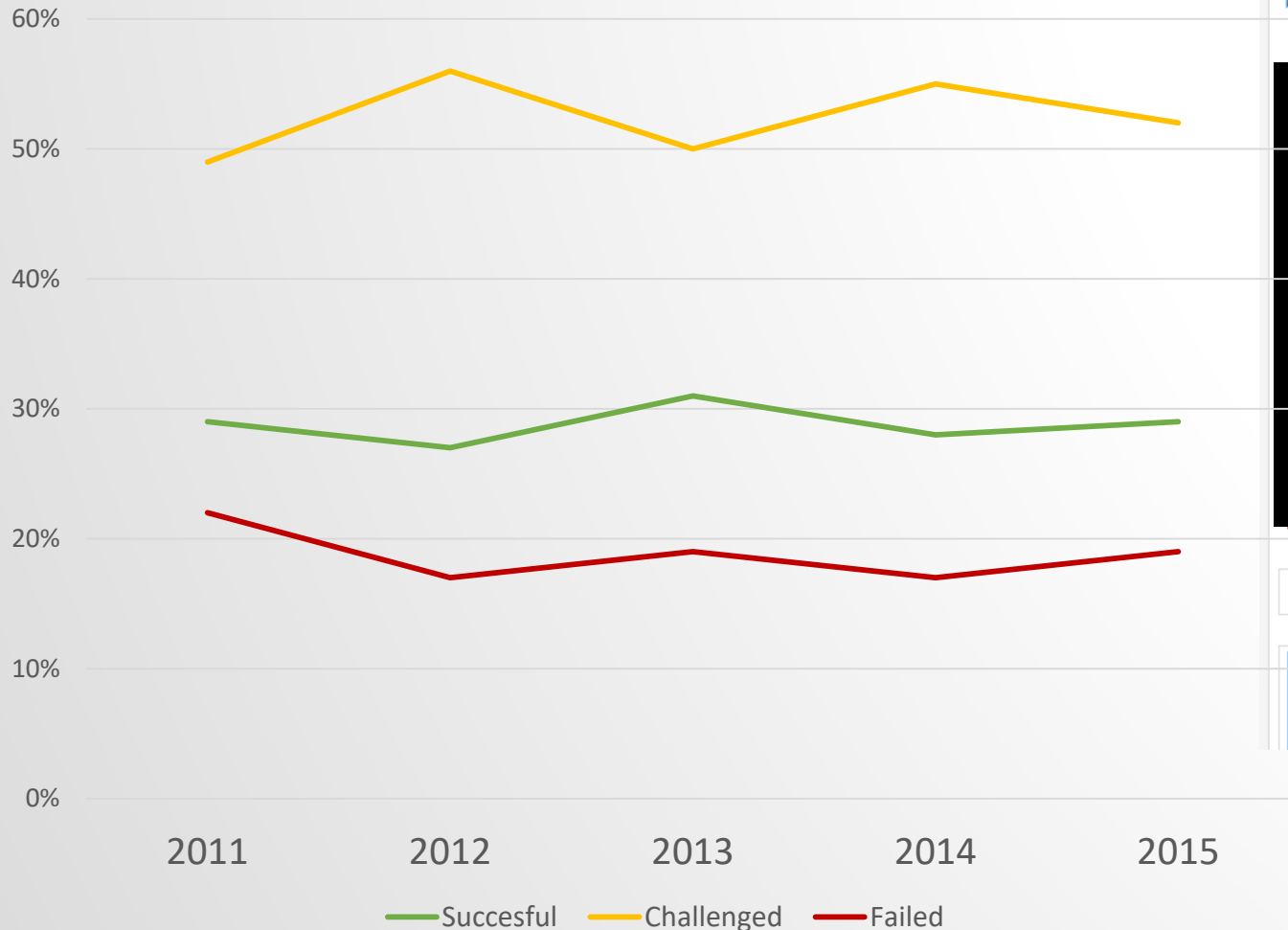
SOME FUN

The first 90 percent of the code accounts for the first 90 percent of the development time. The remaining 10 percent of the code accounts for the other 90 percent of the development time. — *Tom Cargill, Bell Labs*

Hofstadter's Law: It always takes longer than you expect, even when you take into account Hofstadter's Law.
— *Douglas Hofstadter, Gödel, Escher, Bach: An Eternal Golden Braid*

What one programmer can do in one month, two programmers can do in two months.
— *Fred Brooks*

NOT SO MUCH FUN!

Project Success Rate

60%

50%

40%

30%

20%

10%

0%

2011   2012   2013   2014   2015

— Succesful   — Challenged   — Failed

Failing IT projects cost the Dutch government 7 billion USD per year

Projects > 10 million USD only 7% succeeds.

In total, only 30% of IT projects are successful.

These are tax dollars and one of the reasons the whole country was in recession for years.

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NEW SOFTWARE HORROR STORIES EVERY DAY!

Nieuw ict-...
tientallen ...

Michaël Niewold · 14...
@michaelniewold

Opnieuw een ict-project...
van de dienst die de veil...
miljoen euro duurder uit...
dan gepland.

Hoe de overh...
uitgaf aan dri...
mislukkingen...

Het landelijk persoonsregiste...
Nederlanders, moest moder...
jaar later is er 100 miljoen ui...

✎ Liza van Lonkhuyzen & Derk Stokmans...
⏱ Leestijd 17 minuten

Opnieuw relevant (16 april 2019)
Het vernieuwen van de ICT-systemen bij...
tot zoveel problemen en kostenoverschr...
niet de eerste stukgelopen digitale verni...

In de kleine kantine van het beschaafd...
het najaar van 2007 een koude oorlog...
de ene hoek. De ict'ers, die ze hebben...
bouwen, zitten in een andere hoek. Tu...

De ambtenaren, van de Rijksdienst voor Identiteitsgegevens, zijn de poortbewakers van de
persoonsgegevens van alle mensen in Nederland. De ict'ers zijn er om een nieuw systeem te
bouwen voor al die gegevens. Het project staat op het punt te mislukken.

Binnenland

Nieuwe ict-flater in de maak: overheidsproject miljoenen duurder en vertraagd

Michaël Niewold · 07 december 2018 06:17
@michaelniewold

Minister Cora van Nieuwenhuizen van Infrastructuur en Waterstaat. Beeld © Archieffoto ANP

**Er dreigt een nieuw fiasco voor de overheid bij het bouwen van een ict-systeem.
Een project, bedoeld om het inhuren van externen door overheidsdiensten te
regelen, is 'in gevaar'. Er moet daarom snel iets veranderen, waarschuwt
Bureau ICT-toetsing (BIT).**

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PERFORMANCE MEASUREMENT
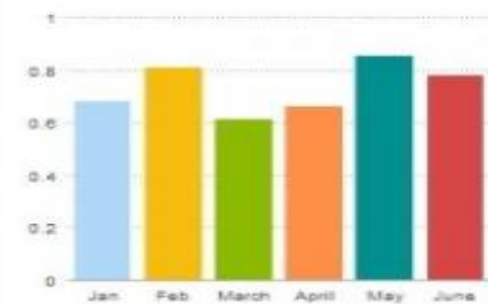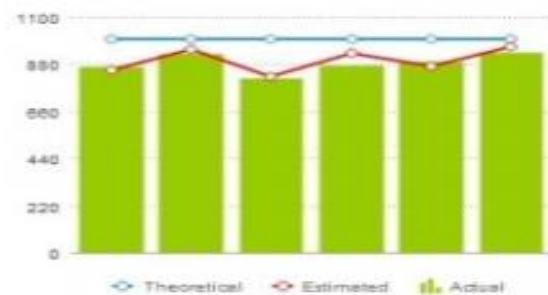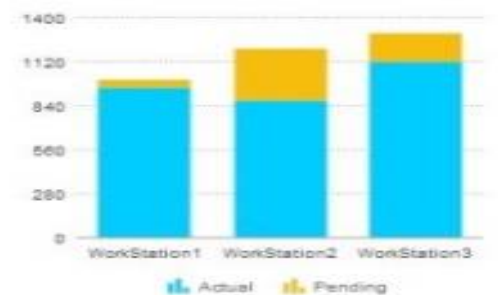
KEY METRICS FOR ANY (AGILE) TEAM

- **Productivity**

$$\frac{\text{Effort Hours}}{\textbf{\textcolor{red}{Size}} \text{ of the delivered Software Product}}$$

- **Cost Efficiency**

$$\frac{\text{Cost}}{\textbf{\textcolor{red}{Size}} \text{ of the delivered Software Product}}$$

- **Velocity**

$$\frac{\text{Duration (months)}}{\textbf{\textcolor{red}{Size}} \text{ of the delivered Software Product}}$$

- **Product Quality**

$$\frac{\text{Defects Delivered}}{\textbf{\textcolor{red}{Size}} \text{ of the delivered Software Product}}$$

- **Code Quality Metrics**

  Maintainability
  Reliability
  Performance
  Security
  Technical Debt

nesma

DEFINITIONS AND COUNTING GUIDELINES FOR THE APPLICATION OF FUNCTION POINT ANALYSIS

Version 2.3

Conformant to
INTERNATIONAL STANDARD
ISO/IEC 24570 : 2018
Software Engineering
Nesma functional size measurement

nesma.org

CISQ
Consortium for IT Software Quality

FOUNDED BY:
Software Engineering Institute
Carnegie Mellon
OMG
OBJECT MANAGEMENT GROUP®
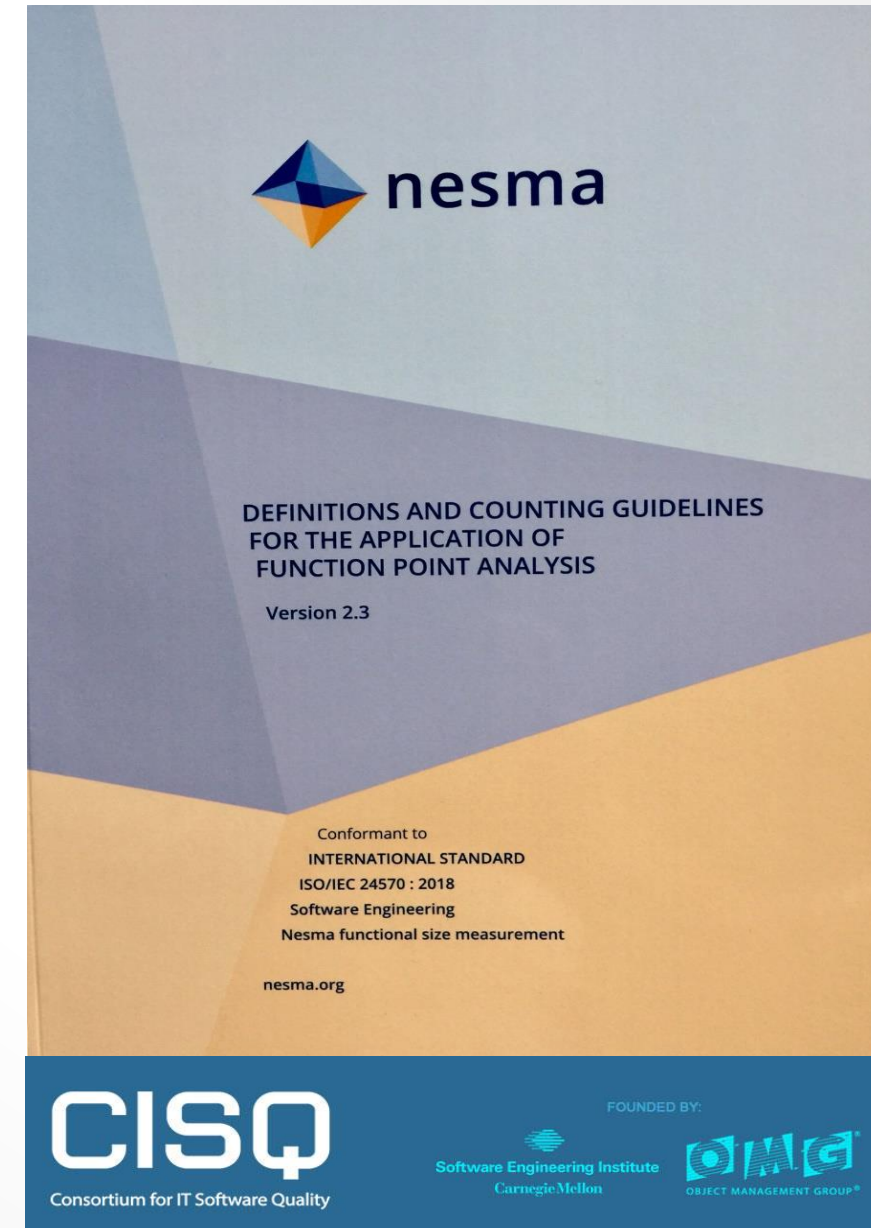
ESTIMATION MATURITY MODEL
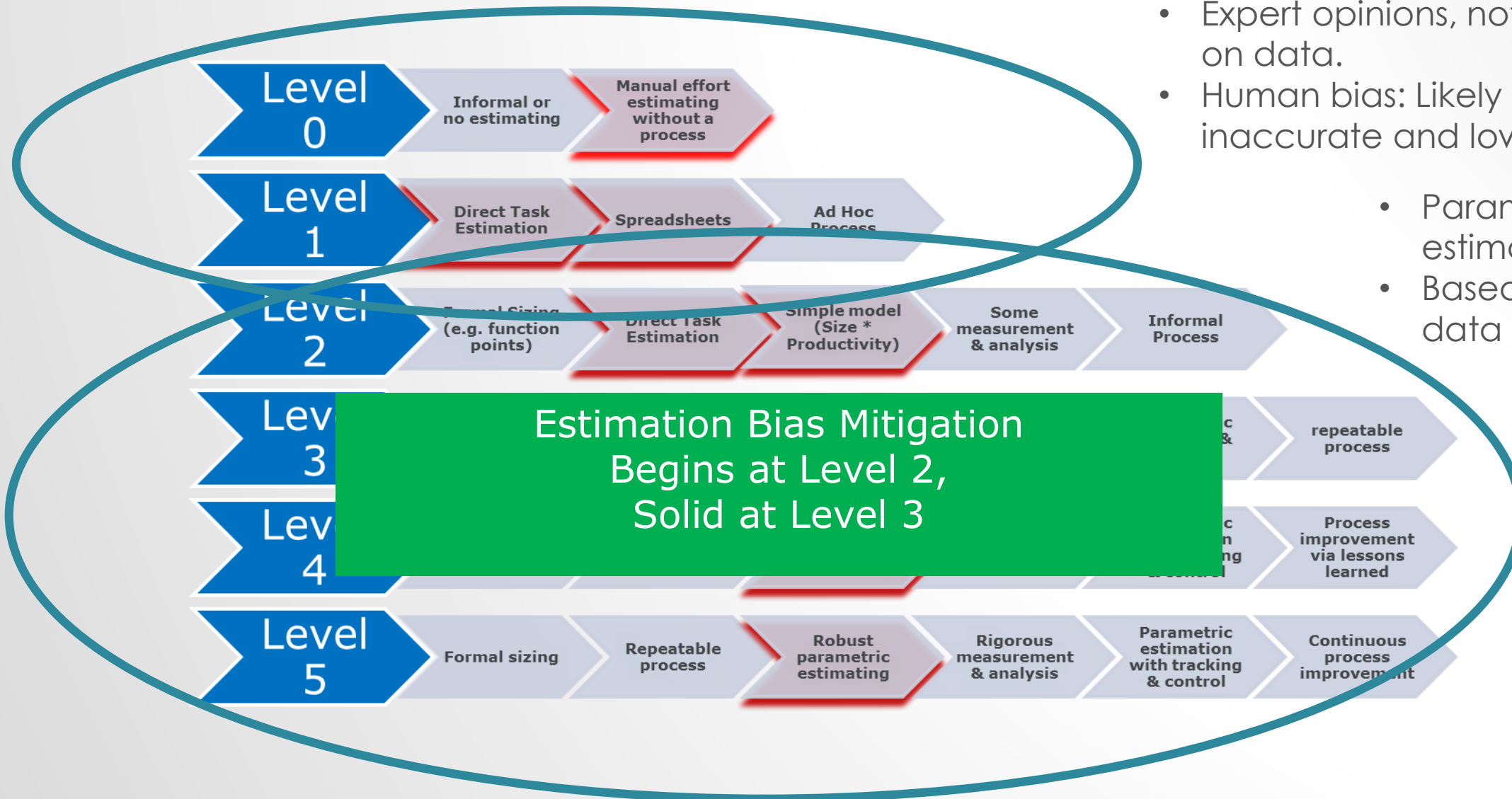
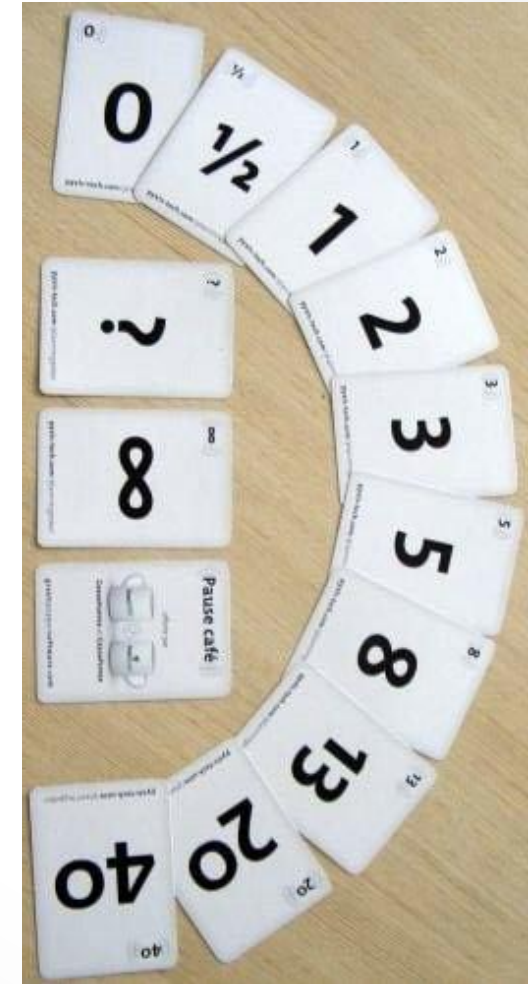- Expert opinions, not based on data.
- Human bias: Likely to be inaccurate and low
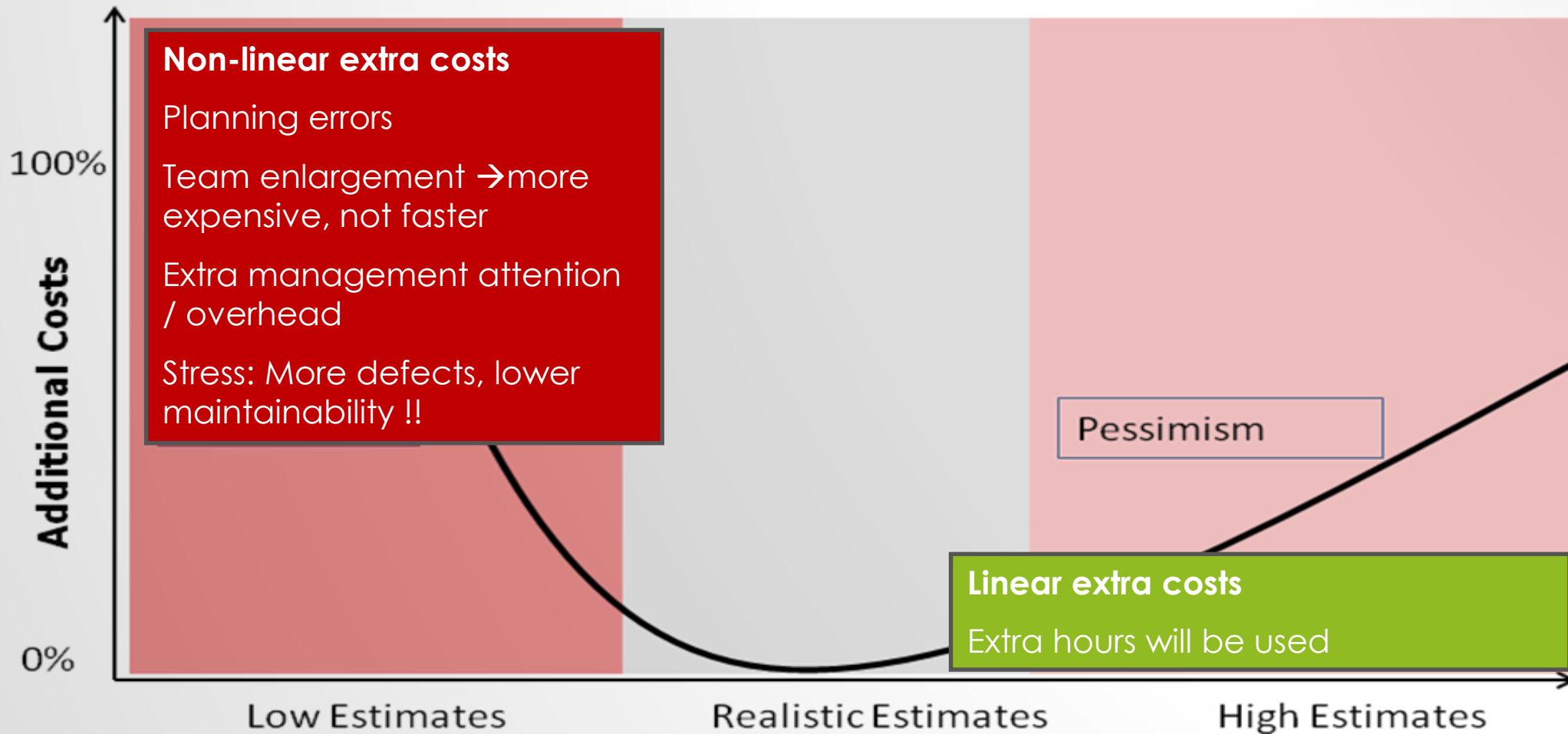
- Parametric estimates
- Based on size, data and models

Level 0 — Informal or no estimating · Manual effort estimating without a process

Level 1 — Direct Task Estimation · Spreadsheets · Ad Hoc Process

Level 2 — Formal Sizing (e.g. function points) · Direct Task Estimation · Simple model (Size * Productivity) · Some measurement & analysis · Informal Process

Level 3 — repeatable process

Level 4 — Process improvement via lessons learned

Level 5 — Formal sizing · Repeatable process · Robust parametric estimating · Rigorous measurement & analysis · Parametric estimation with tracking & control · Continuous process improvement

Estimation Bias Mitigation Begins at Level 2, Solid at Level 3

Source: Dan Galorath

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THE INDUSTRY PRACTICE

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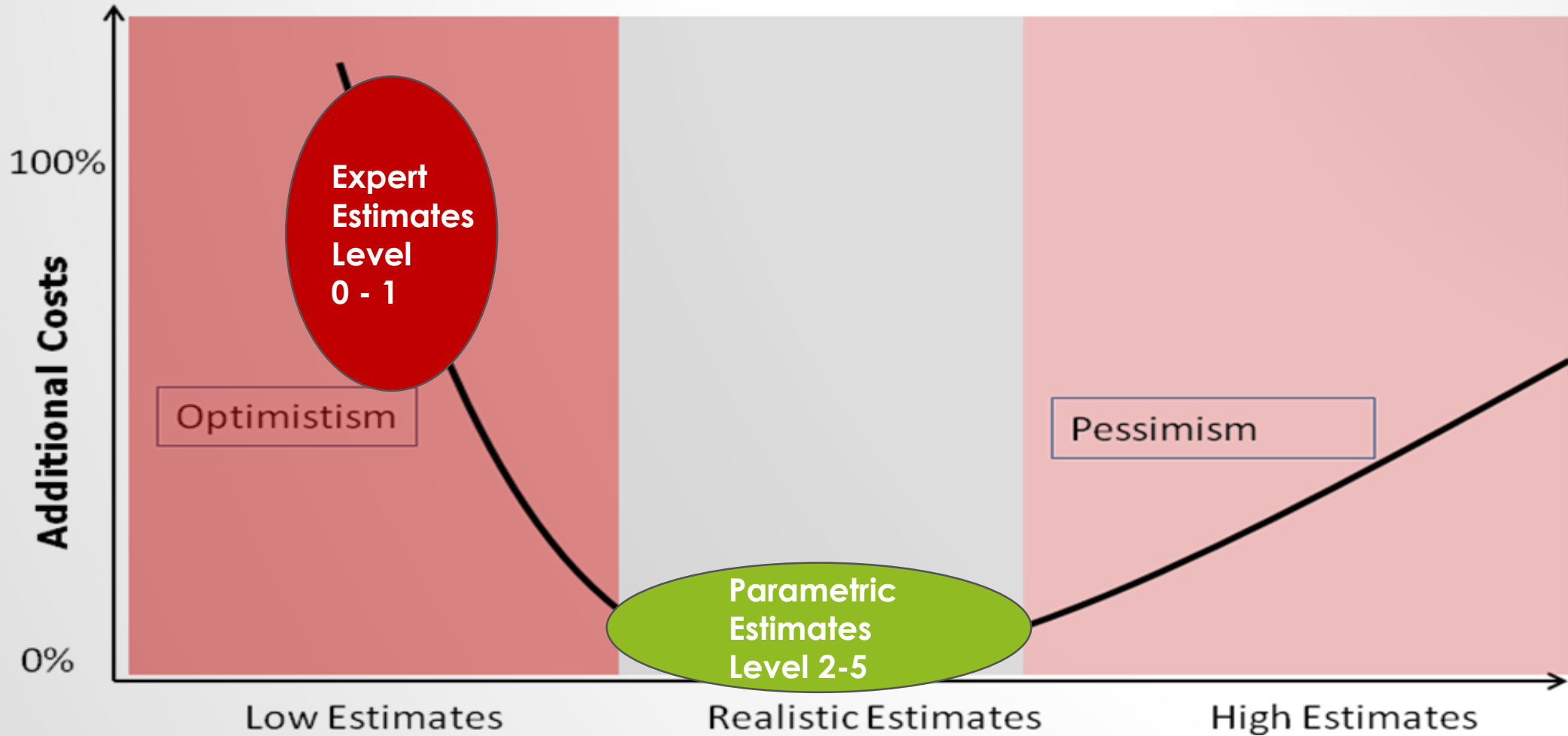of data and analysis for the IT industry

HUMAN 'EXPERT' ESTIMATION

OPTIMISM VS PESSIMISM

LOW MATURITY RESULTS IN DISASTERS

COST ESTIMATORS DO EXIST!

Overview

Cost estimators use standard estimating techniques to calculate the cost of a construction or manufacturing project. They help contractors, owners, and project planners determine how much a project or product will cost to decide if it is economically viable. There are approximately 216,270 cost estimators employed in the United States.

Quick Facts	
Alternate Title(s)	None
Duties	Plan and troubleshoot projects with owners, architects, engineers, and contractors; identify all cost items (e.g., site preparation; labor, materials); gather information and measurements; prepare estimates using job notes, blueprints, and supporting documentation; calculate estimates using software programs
Salary Range	$25,000 to $100,000+
Work Environment	Indoors/Outdoors
Best Geographical Location(s)	Nationwide, with particular focus on government and large commercial areas
Minimum Education Level	• Bachelor's Degree
School Subjects	• Business • Economics • Mathematics
Experience	Internship or co-op
Personality Traits	• Organized • Realistic • Technical

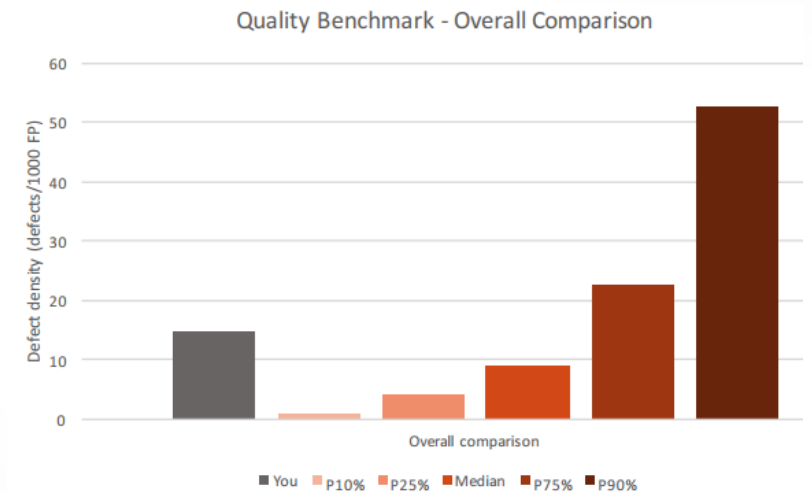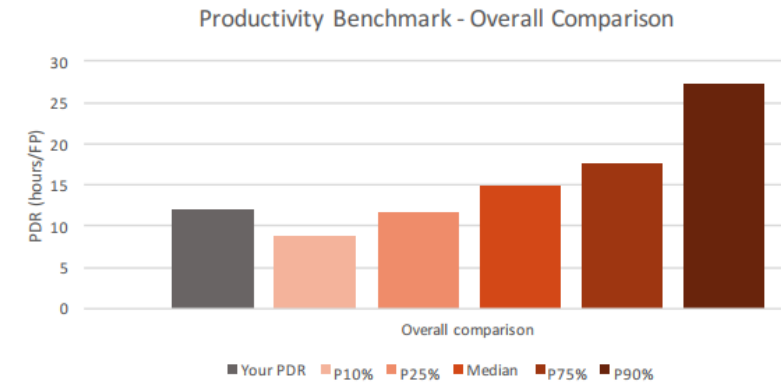# SOFTWARE COST ESTIMATOR

Software

Overview

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Software

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INTERNATIONAL SOFTWARE BENCHMARKING STANDARDS GROUP (ISBSG)

- **Independent** and **not-for-profit** organization based in Australia
- Full Members are non-profit organizations, like **China SPI**, AMMS, Nesma, IFPUG, FiSMA, GUFPI-ISMA, JFPUG and commercial organizations Galorath, Kexin Science, Leda-MC
- Bronze member: COSMIC

- Grows and exploits two repositories of software data:
  - New development projects and enhancements **(> 9150 projects, releases and sprints)**
  - Maintenance and support **(> 1100 applications)**

- Everybody can **submit** project data
  - Questionnaires on the site, online or Excel data files
  - Anonymous
  - **Free benchmark report in return**

Productivity Benchmark - Overall Comparison

Quality Benchmark - Overall Comparison

ISBSG
Delivering IT Confidence

The global and independent source of data and analysis for the IT industry

ISBSG MISSION

- Mission: "**To improve the management of IT resources** by both business and government, through the provision and exploitation **of public repositories of software engineering knowledge** that are <u>standardized, verified, recent</u> and <u>representative of current technologies</u>"

- All ISBSG data is
  - validated and rated in accordance with its quality guidelines
  - representative of the industry
  - independent and trusted
  - captured from a range of organization sizes and industries

ISBSG DATA

ISBSG Project ID	Data Quality Rating	UFP rating	Year of Project	Industry Sector	Organisation Type	Application Group	Application Type	Development Type	Development Platform	Language Type	Primary Programming Language	Count Approach	Functional Size	Normalised Work Effort Level 1	Normalised Level 1 PDR (ufp)	Normalised PDR (ufp)
10007	B	B	2016	Communication	Telecommunications;	Business Application	Customer relationship management;	Enhancement			Java	IFPUG 4+	51	314	6,2	6,2
10046	B	B	2015	Communication	Telecommunications;	Business Application	Customer relationship management;	Enhancement	Multi	3GL	Java	IFPUG 4+	63	888	14,1	14,1
10109	B	B	2015	Insurance	Insurance;	Business Application	Workflow support & management;	New Development	PC	4GL	.Net	NESMA	317	3735	11,8	11,8
10169	B	B	2015	Insurance	Insurance;	Business Application	Workflow support & management;	Enhancement	PC	4GL	Oracle	NESMA	168	137	0,8	0,8
10293	B	B	2016	Utilities	General;	Business Application		Enhancement		4GL	.Net	NESMA	32	1318	41,2	41,2
10305	B	B	2015	Communication	Telecommunications;	Business Application	Customer relationship management;	Enhancement	Multi	3GL	Java	IFPUG 4+	110	1037	9,4	9,4
10313	B	B	2015	Insurance	Insurance;	Business Application	Workflow support & management;	Enhancement	PC	3GL	COBOL	NESMA	402	1073	2,7	2,7
10317	B	B	2015	Government	Government;	Business Application	Business Application;	Enhancement		4GL	.Net	NESMA	8	816	102	102
10392	B	B	2016	Communication	Telecommunications;	Business Application	Customer relationship management;	Enhancement			Java	IFPUG 4+	132	1037	7,9	7,9
10421	B	B	2016	Communication	Telecommunications;	Business Application	Other;	Enhancement		4GL	.Net	IFPUG 4+	74	1229	16,6	16,6
10469	B	B	2015	Communication	Telecommunications;	Business Application	Stock control & order processing;	Enhancement	Multi	3GL	Java	IFPUG 4+	85	357	4,2	4,2
10473	B	B	2015	Insurance	Insurance;	Business Application	Workflow support & management;	Enhancement	PC	3GL	COBOL	NESMA	56	295	5,3	5,3
10521	B	B	2014	Communication	Telecommunications;	Business Application	Stock control & order processing;	Enhancement	Multi	3GL	Java	IFPUG 4+	135	2424	18	18
10546	B	B	2016	Communication	Telecommunications;	Business Application	Customer relationship management;	Enhancement			Java	IFPUG 4+	86	523	6,1	6,1
10565	B	B	2016	Insurance	Insurance;	Business Application		Enhancement		3GL	PL/SQL	IFPUG 4+	87	251	2,9	2,9
10572	B	B	2014	Government	Government;	Business Application	Business Application;	Enhancement		4GL	Oracle	NESMA	85	774	9,1	9,1
10600	B	B	2015	Government	Government;	Onshore		Enhancement		4GL	Oracle	NESMA	54	608	11,3	11,3
10655	A	B	2014	Government	Government;	Onshore		Enhancement		4GL	.Net	NESMA	16	706	44,1	44,1
10658	B	B	2014	Insurance	Insurance;	Business Application	Unknown;	Enhancement		3GL	PL/SQL	IFPUG 4+	71	117	1,6	1,6
10665	B	B	2015	Communication	Telecommunications;	Business Application	Stock control & order processing;	Enhancement	Multi	3GL	Java	IFPUG 4+	96	1599	16,7	16,7
10707	B	B	23,2	Communication	Telecommunications;	Business Application	Stock control & order processing;	Enhancement	Multi	3GL	Java	IFPUG 4+	56	1298	23,2	23,2
10762	B	B	2015	Communication	Telecommunications;	Business Application	Customer relationship management;	Enhancement	Multi	3GL	Java	IFPUG 4+	231	224	1	1
10776	A	B	2015	Government	Other;	Business Application		Enhancement		3GL	Java	NESMA	706	8276	11,7	11,7
10834	A		2016	Government	General;	Business Application		Migration		3GL	Java	NESMA	167	2643	15,8	15,8
10909	C	C	2015					New Development		3GL	Java	Gartner FFP	209	1438	6,9	6,9
10940	B	B	2015	Insurance	Insurance;	Business Application	Workflow support & management;	Enhancement	PC	3GL	Java	NESMA	246	5147	20,9	20,9
11014	B	B	2016	Communication	Telecommunications;	Business Application	Customer relationship management;	Enhancement		3GL	Java	IFPUG 4+	66	967	14,7	14,7
11118	B	B	2015	Communication	Telecommunications;	Business Application	Logistic or supply planning & control;	Enhancement	Multi	3GL	Java	IFPUG 4+	96	920	9,6	9,6
11182	B	B	2014	Insurance	Insurance;	Business Application	Unknown;	Enhancement		4GL	Oracle	IFPUG 4+	58	55	0,9	0,9
11195	B	B	2014	Manufacturing				New Development		3GL	Java	IFPUG 4+	51	818	16	16

D&E Corporate Release April 2019 — 9178 rows

EXAMPLE

	PDR (hours/FP)
Number of projects	166
Minimum	4,2
Percentile 10%	5,3
Percentile 25%	6,8
Median	7,8
Percentile 75%	9,4
Percentile 90%	10,2
Maximum	15,3
Average	7,9

Selection:

Data Quality: A or B

Year of Project > 2012

Project Type: Enhancement

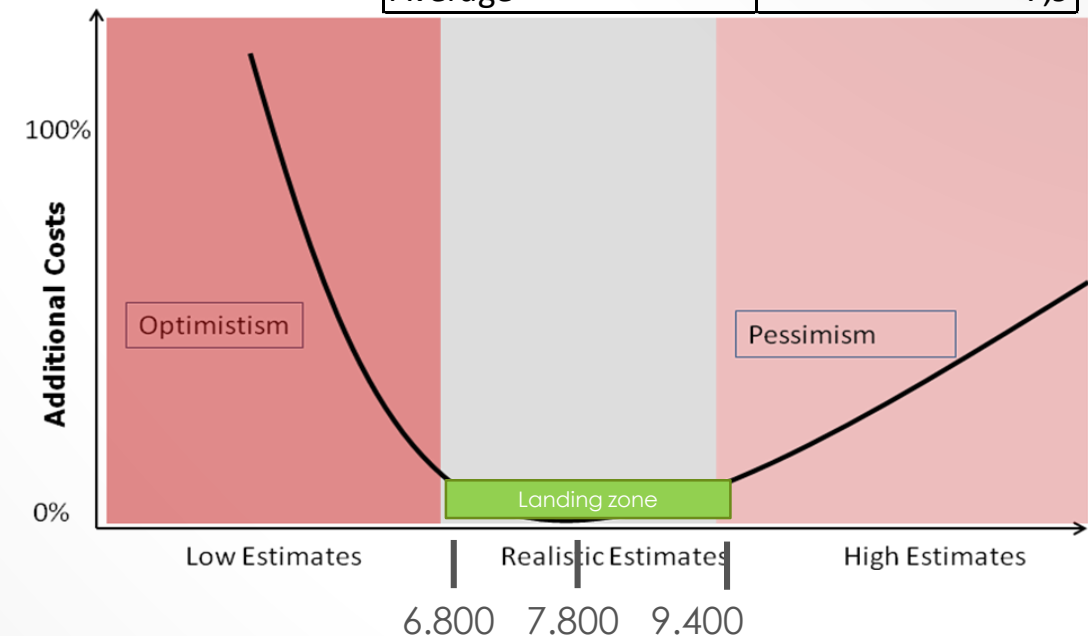Primary Programming language: Java

Count approach: Nesma or IFPUG

…

Example: 1000 FP

Min: 6,8 * 1000 = 6.800 hours

Likely: 7,8 * 1000 = 7.800 hours

Max: 9,4 * 1000 = 9.400 hours

6.800   7.800   9.400

ICEAA AND NESMA

SOFTWARE COST ESTIMATION BODY OF KNOWLEDGE (SCEBOK)

	Topic Area	No. of Ques.	(sCEBoK) Training Module Title	Track No.	CEBoK Title (Module No.)
Topics considered essential and worthy of examination	Software Engineering	6-10	Introduction - Software Engineering	SWT15	Software Cost Estimating (12)
		6-10	Estimation in the Software Lifecycle	SWT01	
	Cost Estimation Basics	6-10	Estimation Principles	SWT02	Cost Estimating Basics (1)
	Cost Estimation Processes	6-10	Solution-Based Estimation	SWT03	
	Estimation Methods & Techniques	6-10	Software Cost Estimation Methods	SWT08	Costing Techniques (2)
			Basis of Estimate (BOE)	SWT04	
	Sizing (FP's, Cosmic, Story Points, Proxies)	6-10	Estimation Methods – Size-Based Methods	SWT09	
	Data Collection and Basic Data Analysis	6-10	Basis of Measurement (BOM)	SWT05	Data Collection (4) Data Analysis (6)
		6-10	Metrics Collection and Basic Analysis	SWT10	
	Parametrics	6-10			Parametrics (3)
	Budget and Pricing	6-10	Budget and Pricing	SWT06	Contract Pricing (14)
	Cost Drivers	6-10	Cost Drivers	SWT07	Regression (8)
	Statistics	6-10	Statistics to Support Basic Metric Analysis	SWT11	Prob. & Stats. (10)
	Benchmarking	6-10	Benchmarking	SWT12	
	Scheduling	6-10	Scheduling	SWT16	
	Monitoring and Control	6-10			Cost Mgmt. (16)
	Risk Management	6-10			Cost Risk (9)
	Validation	6-10	Estimation Maturity	SWT14	
	Application Maintenance	6-10	Introduction – Application Maintenance	SWT13	
	Total	100-150			

Haarlem 7-9 October 2019

WHERE ACADEMIC IDEAS MEET INDUSTRY PRACTICE ON MEASURING, CONTROLLING AND PREDICTING DIGITIZATION

VENUE DETAILS

https://www.iwsm-mensura.org/

The future of IT Cost Estimation

Trends for the new Decade

On October 7-9, 2019 the IWSM Mensura conference will be held in Haarlem, the Netherlands. In this last conference before we enter a new decade, we want to look forward to discover the trends for the next decade. Register NOW.
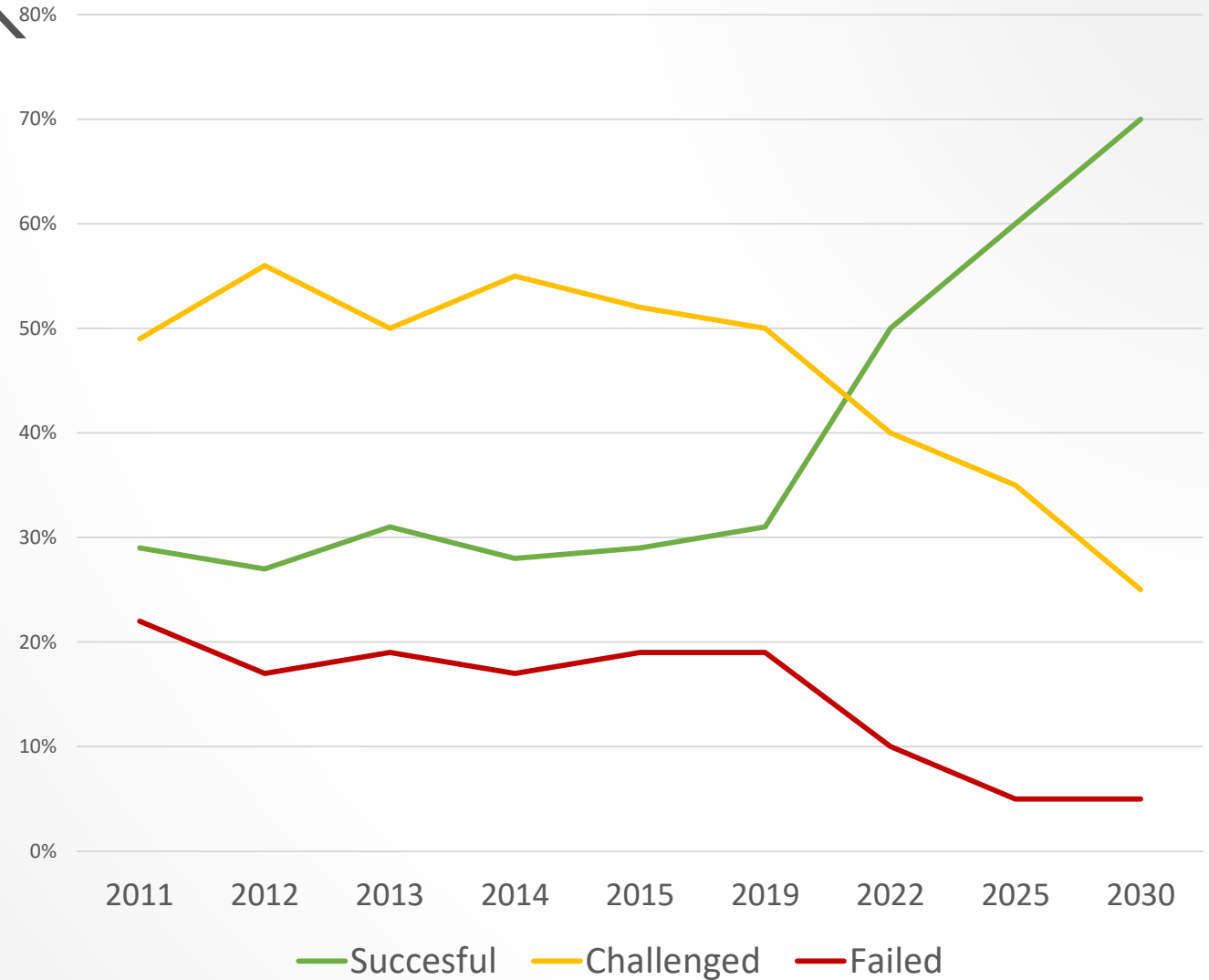
2030 LOOKING BACK

Overview

Software

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Project Success Rate

Legend: Succesful — Challenged — Failed
X-axis: 2011, 2012, 2013, 2014, 2015, 2019, 2022, 2025, 2030
Y-axis: 0% to 80%

THANK YOU!

haroldvanheeringen

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