

IMPROVE ESTIMATION MATURITY

using Functional Size Measurement and Industry Data

INTRODUCING ME

Drs. Harold van Heeringen, Senior Consultant ADM Benchmarking at **METRI**.

- **International Software Benchmarking Standards Group (ISBSG)** – President
- **Netherlands Software Metrics Association (NESMA)** – board member and chairman of the working groups 'Benchmarking' and 'FPA in contract(ing)'
- **Common Software Measurement International Consortium (COSMIC)** - Dutch representative in the International Advisory Council (IAC)
- **Dutch Association for Cost Engineers (DACE)** – working group parametric analysis
- **ICEAA trainer of CEBoK chapter 12: Software Cost Estimation**
- Speaker at many conferences on software measurement, estimation and benchmarking



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OVERVIEW

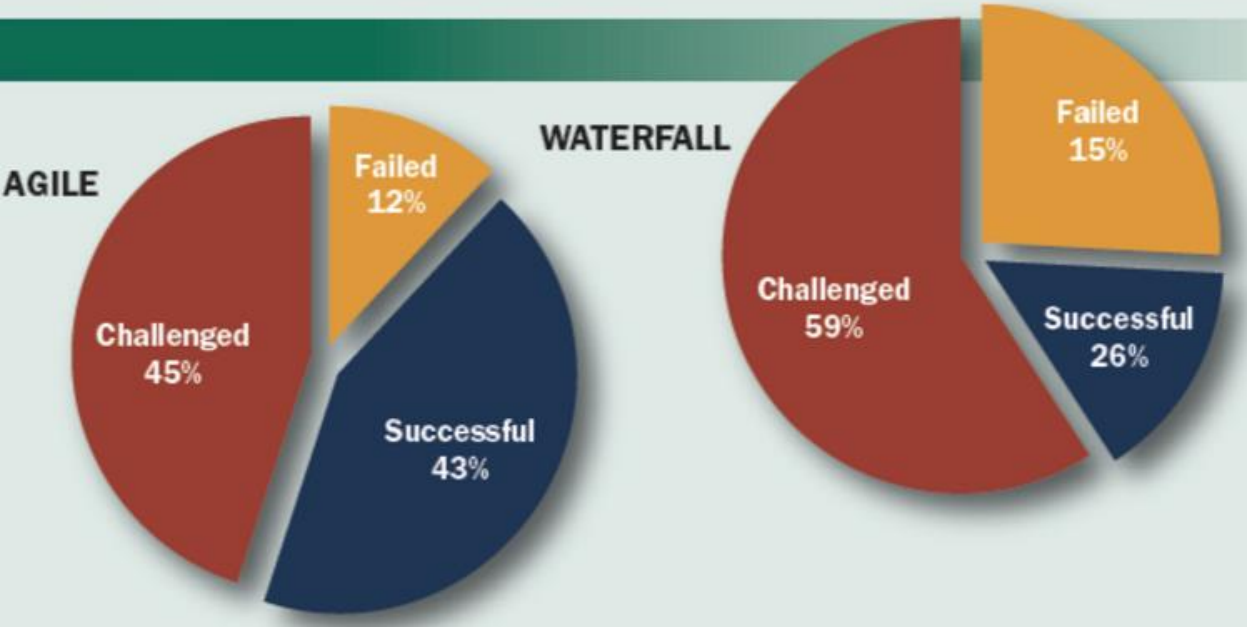
- Industry estimation maturity
- Effect of low maturity
- Maturity levels
- Function Point Analysis (FPA)
- Estimate with FPA
- Historical data
- Use in the industry

SOFTWARE PROJECT RESULTS

MODERN RESOLUTION FOR ALL PROJECTS

	2011	2012	2013	2014	2015
SUCCESSFUL	29%	27%	31%	28%	29%
CHALLENGED	49%	56%	50%	55%	52%
FAILED	22%	17%	19%	17%	19%

The Modern Resolution (OnTime, OnBudget, with a satisfactory result) of all software projects from FY2011-2015 within the new CHAOS database. Please note that for the rest of this report CHAOS Resolution will refer to the Modern Resolution definition not the Traditional Resolution definition.



US SOFTWARE PROJECTS CA. 2016

As can be seen schedule delays and cancelled projects are distressingly common among all forms of software in 2016. This explains why software is viewed by most CEO's as the **least competent and least professional form of engineering** of the current business world.

Table 1: Outcomes of U.S. Software Projects Circa 2016				
	Application Types	On-time	Late	Canceled
1	Scientific	68.00%	20.00%	12.00%
2	Smart phones	67.00%	19.00%	14.00%
3	Open source	63.00%	36.00%	7.00%
4	U.S. outsource	60.00%	30.00%	10.00%
5	Cloud	59.00%	29.00%	12.00%
6	Web applications	55.00%	30.00%	15.00%
7	Games and entertainment	54.00%	36.00%	10.00%
8	Offshore outsource	48.00%	37.00%	15.00%
9	Embedded software	47.00%	33.00%	20.00%
10	Systems and middleware	45.00%	45.00%	10.00%
11	Information technology (IT)	45.00%	40.00%	15.00%
12	Commercial	44.00%	41.00%	15.00%
13	Military and defense	40.00%	45.00%	15.00%
14	Legacy renovation	30.00%	55.00%	15.00%
15	Civilian government	27.00%	63.00%	10.00%
	Total Applications	50.13%	37.27%	13.00%

Source: Capers Jones

IMPACT

- Deliver too late: losing business.
- Fail/stop: loss of time, money, business and still no solution for the problem that needed to be solved.
- Waste of resources that could have been deployed successfully otherwise.

'Falende ICT kost overheid miljarden'

25-04-2014 11:42 | Door [Pim van der Beek](#) | Er zijn [41 reacties](#) op dit artikel | [Permalink](#)



'De Nederlandse overheid raakt elk jaar vier tot vijf miljard euro kwijt aan ict-projecten die mislukken. Vooral met de grote technologieprojecten gaat het mis. Van die projecten - vanaf een budget van 7,5 miljoen euro - slaagt maar 7

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.

Volgens gebruik v overschr projecten

Het gaat Rekenka trajecten

'Kleine

Volgens top-tien z technolo zijn betro

'De proje commiss

misloopt. Bij grote projecten moet de overheid vaak doormodderen', zei hij volgens persbureau ANP.



[bekijk reacties \(41\)](#) [print](#) [stuur door](#)

Dé cloud bestaat niet.

Dé cloud bestaat niet.

Sogeti geniet het vertrouwen van top 500 organisaties, waaronder PostNL. Sogeti helpt ook u graag met concrete cloudoplossingen. Van een stapsgewijze aanpak tot de meest vergaande cloud-only strategie. Ontdek dat dé cloud niet bestaat. [Bezoek de Sogeti Cloud Cases.](#)

Advertorial

LOW INDUSTRY MATURITY IN PERFORMANCE MEASUREMENT

- **Software industry: low maturity in performance measurement**
 - Performance Measurement processes are not targeted to software development and/or maintenance. Mostly financial metrics are used to measure performance.
 - Organizations don't know the size of their applications and of their software portfolio.
 - Organizations don't know how if the cost spent on AD and AM is in line with industry averages.
 - Organizations don't know their productivity.
 - Organizations don't know their time-to-market.
 - Organizations don't know their cost efficiency.
 - Organizations don't know the quality of their software products.
- Result: Organizations don't know their **capability** compared to industry peers when it comes to productivity, time-to-market, cost efficiency and quality. They are not able to understand where they need to improve and not able to control process improvement.
- But Application Development is becoming more and more important for organizations as delivering new software functionality fast becomes more and more a driver for business.
Increasing performance is sometimes crucial for survival!

SOFTWARE ESTIMATION MATURITY

- **Software industry: low maturity**

- Low estimation maturity
- No or little formal estimation processes → 'expert estimates'
- No or little use of historical data → 'experience'
- Customers chose suppliers based on price, not reality
 - Immature project estimation techniques results in low estimates
 - Unrealistic optimism results often in complete failure!

- **Lots of schedule and cost overruns**

- Standish Chaos reports: Many projects fail or are at least unsuccessful
- No learning of mistaken, failing over and over again

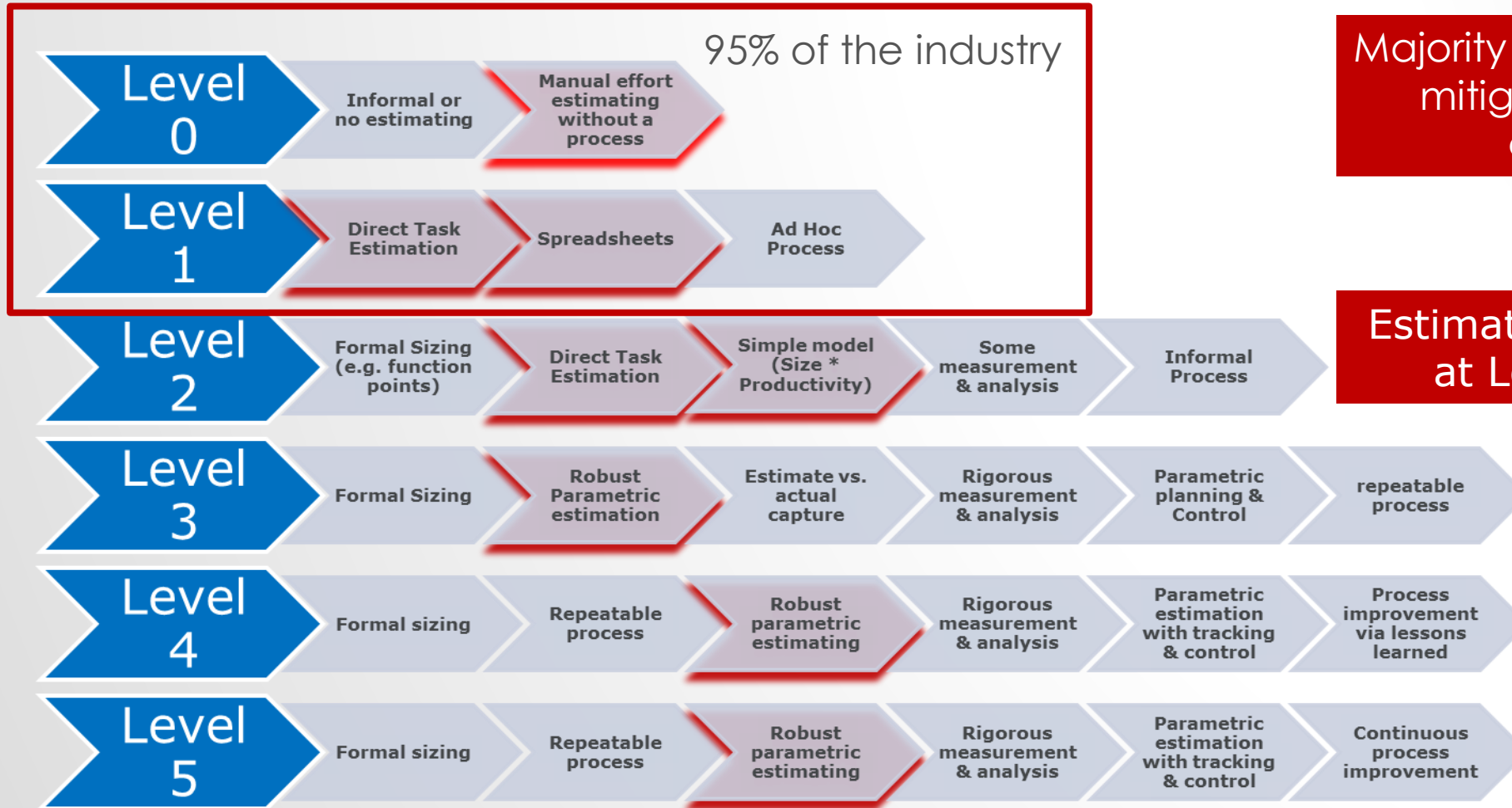
- **Low customer satisfaction rates**

- In Europe: only slightly higher than the financial sector

RESULTS OF LOW ESTIMATION MATURITY

- **Many projects are not estimated in a professional way**
 - Only expert estimates, no use of estimation models / historical data
- **Underestimation results in bad planning**
 - Development team too small
 - Duration too short
 - Unrealistic milestones
 - Project management with no grip on the project
 - Extra management attention, more meetings
 - Stress in the team → bad quality → more effort
 - Bad software, low maintainability, hard and costly to adapt to the changing world.

ESTIMATION MATURITY MODEL*



Majority of software projects are not mitigated for bias, resulting in optimistic estimates.

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

REALISTIC ESTIMATES

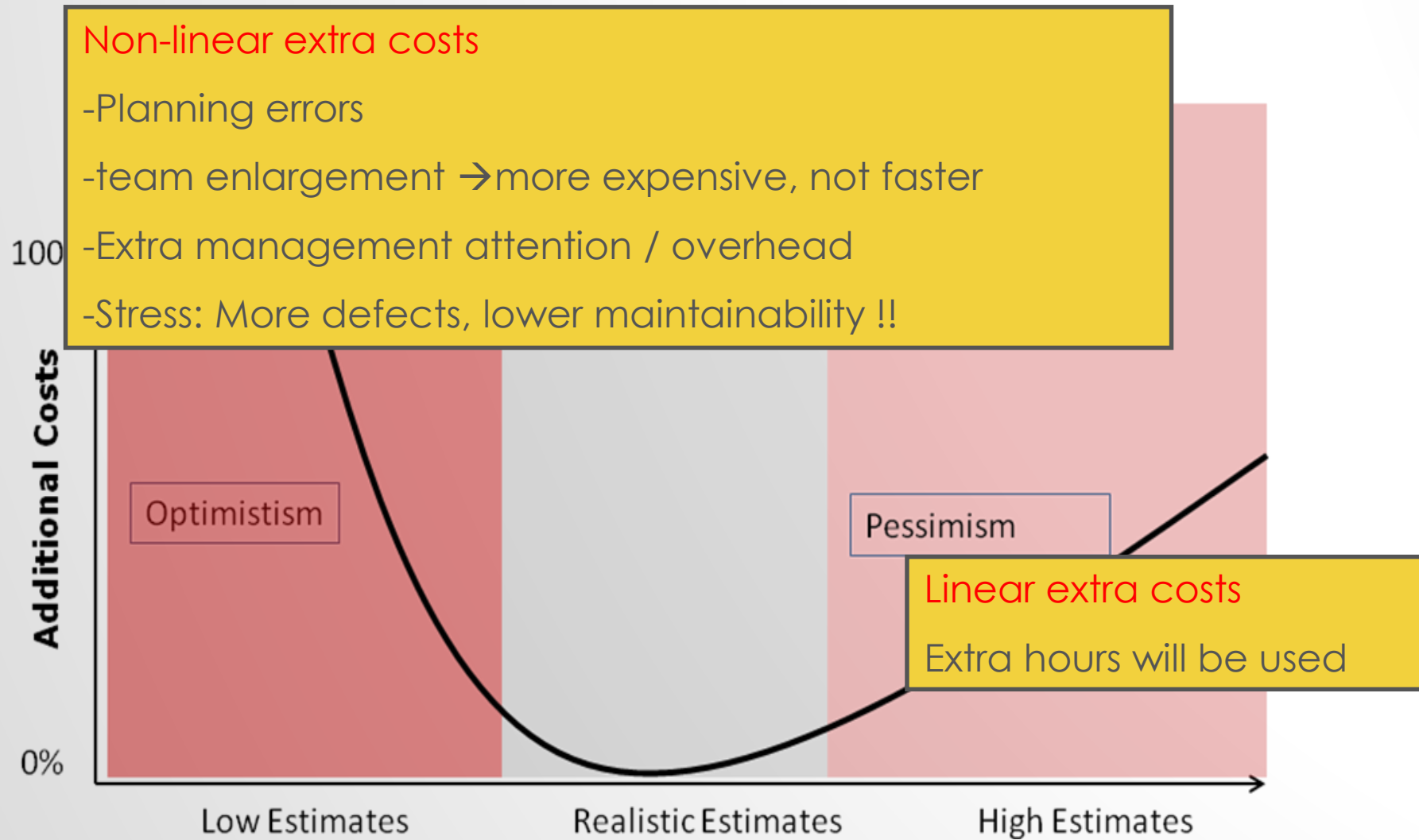
A realistic estimate is one of the most important **conditions** for a successful project.

The estimate is the basis for:

- Business case;
- Planning;
- Proposal (outsourcing: fixed price / date);
- Financial result of the project... and the organization;
- Claiming and releasing of resources;
- Alignment between IT and business / customer;
- Progress reports / dashboards;
- The feeling of the team and the stakeholder.

Without a realistic estimate, the project is **likely to fail!**

LOW/HIGH ESTIMATES



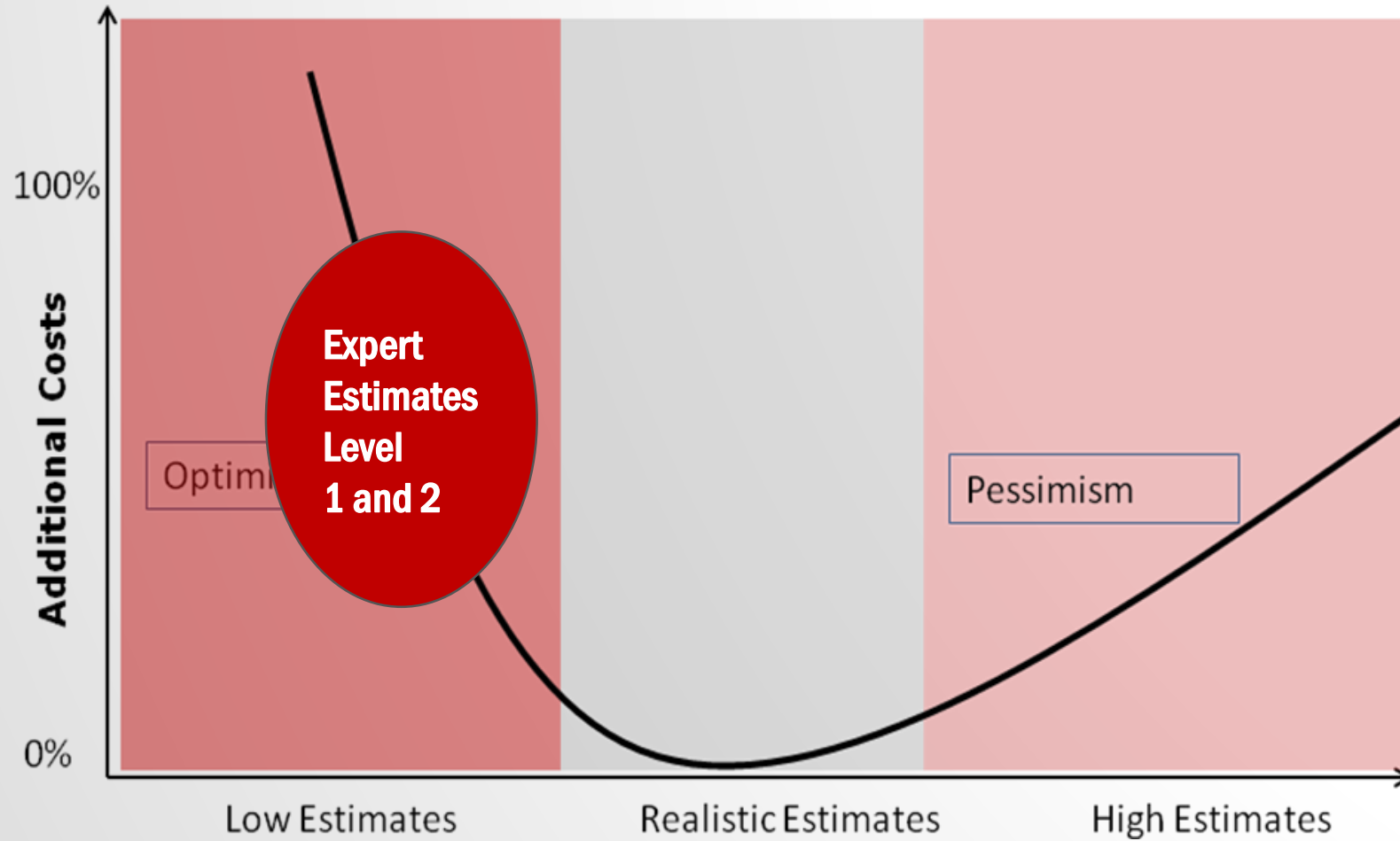
LEVEL 1 AND 2 ESTIMATES: HUMAN (EXPERT) ESTIMATES

- Bottom-up , assign effort hours to work items, based on expert knowledge and experience
- Humans are optimistic! Always! Even when they know they are!

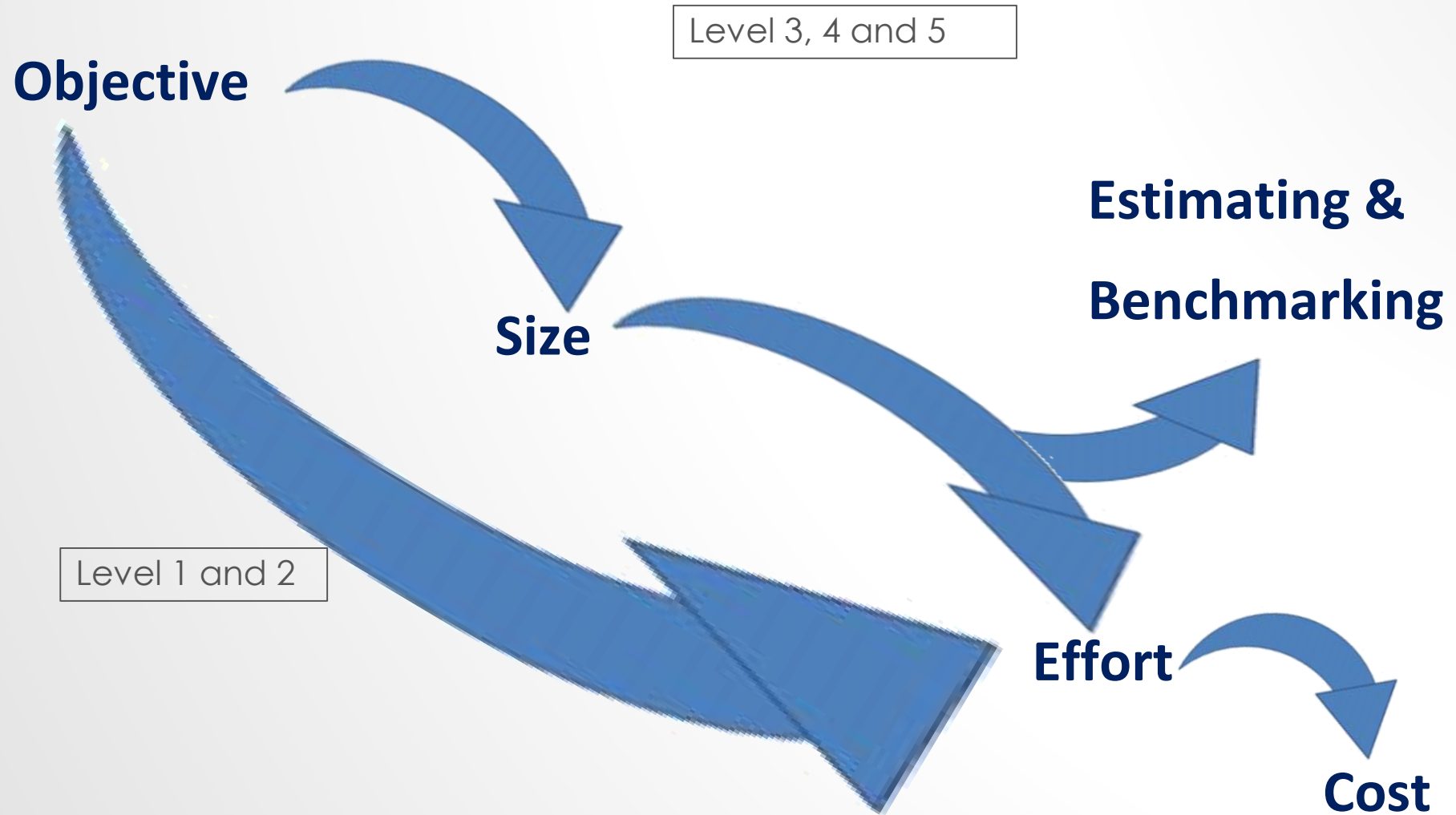
**Result: expert estimates are optimistic, on average
30% underestimation.**

- **Disadvantages:**
 - Forgotten activities (e.g. testscript reviews. ...);
 - No good foundation of the estimate, very subjective, not based on data;
 - 'Easy' to push back: 'That's too expensive. Can't you do it faster?'
 - The expert is not going to do all the work (who will ?);
 - How expert is the expert? (projects are unique);
 - Experts don't take into account duration, team size, etc.;
 - Experts don't assess the reality value, no real use of history.

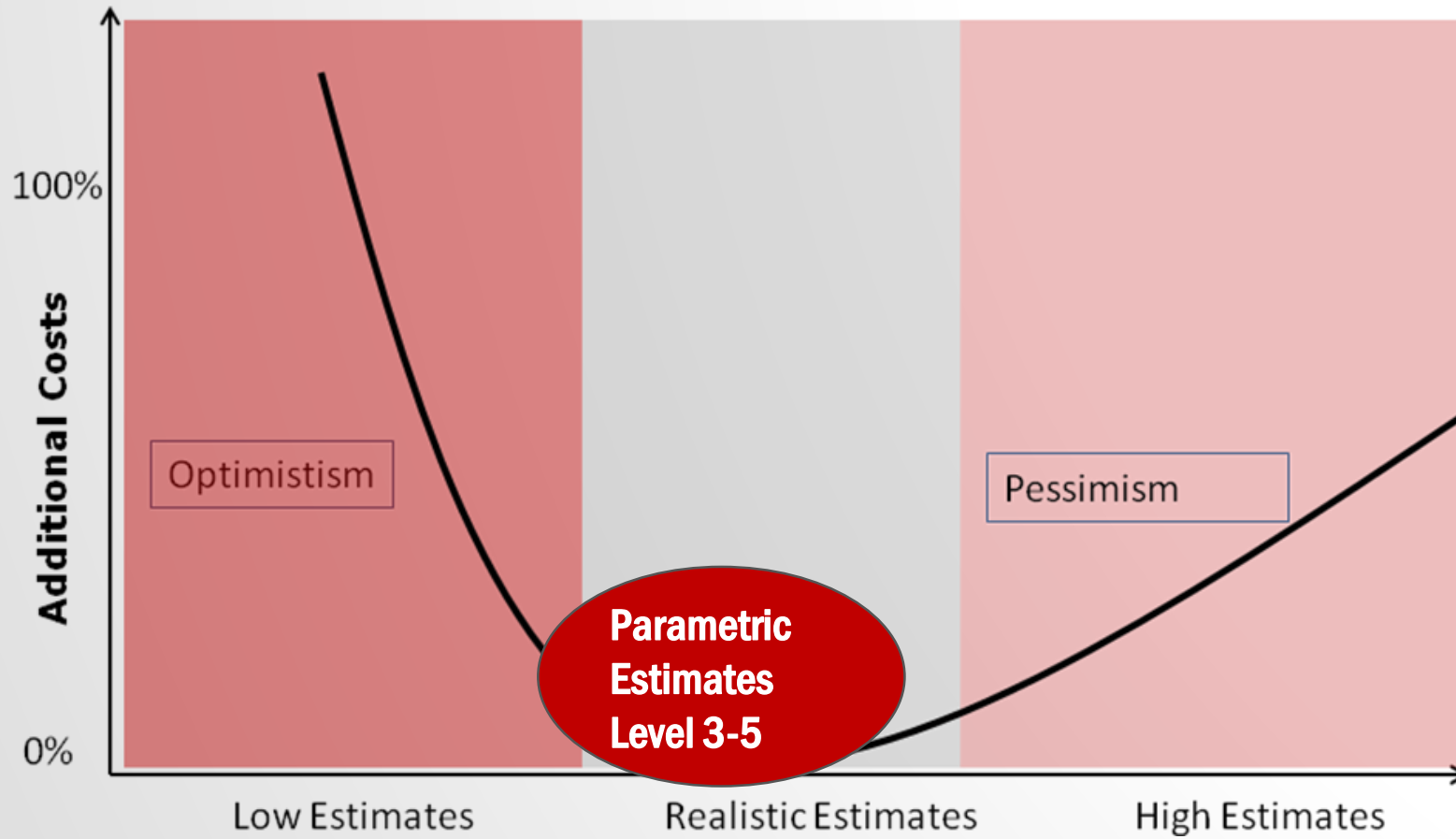
OVERVIEW



TWO WAYS TO ESTIMATE



OVERVIEW



FUNCTIONAL SIZE

- What the software should be able to do (functionality) expressed in a number based on an objectively described method
- ISO/IEC 14143
- Something intangible like functionality becomes a physical **number** that can be used for calculation

Functional
Size
Measurement

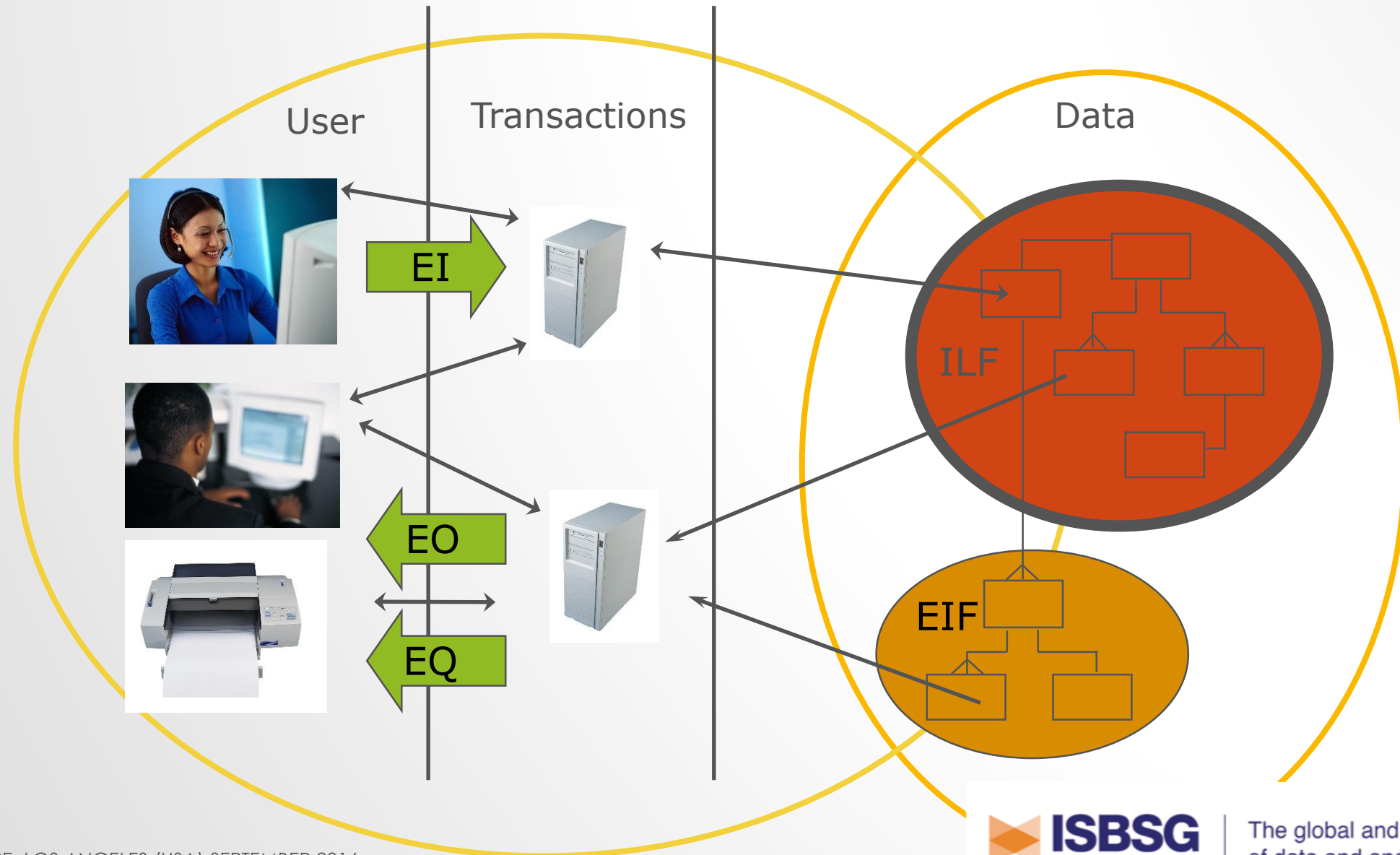


ISO/IEC 24570:2005



ISO/IEC 20926:2009

FPA PRINCIPLES

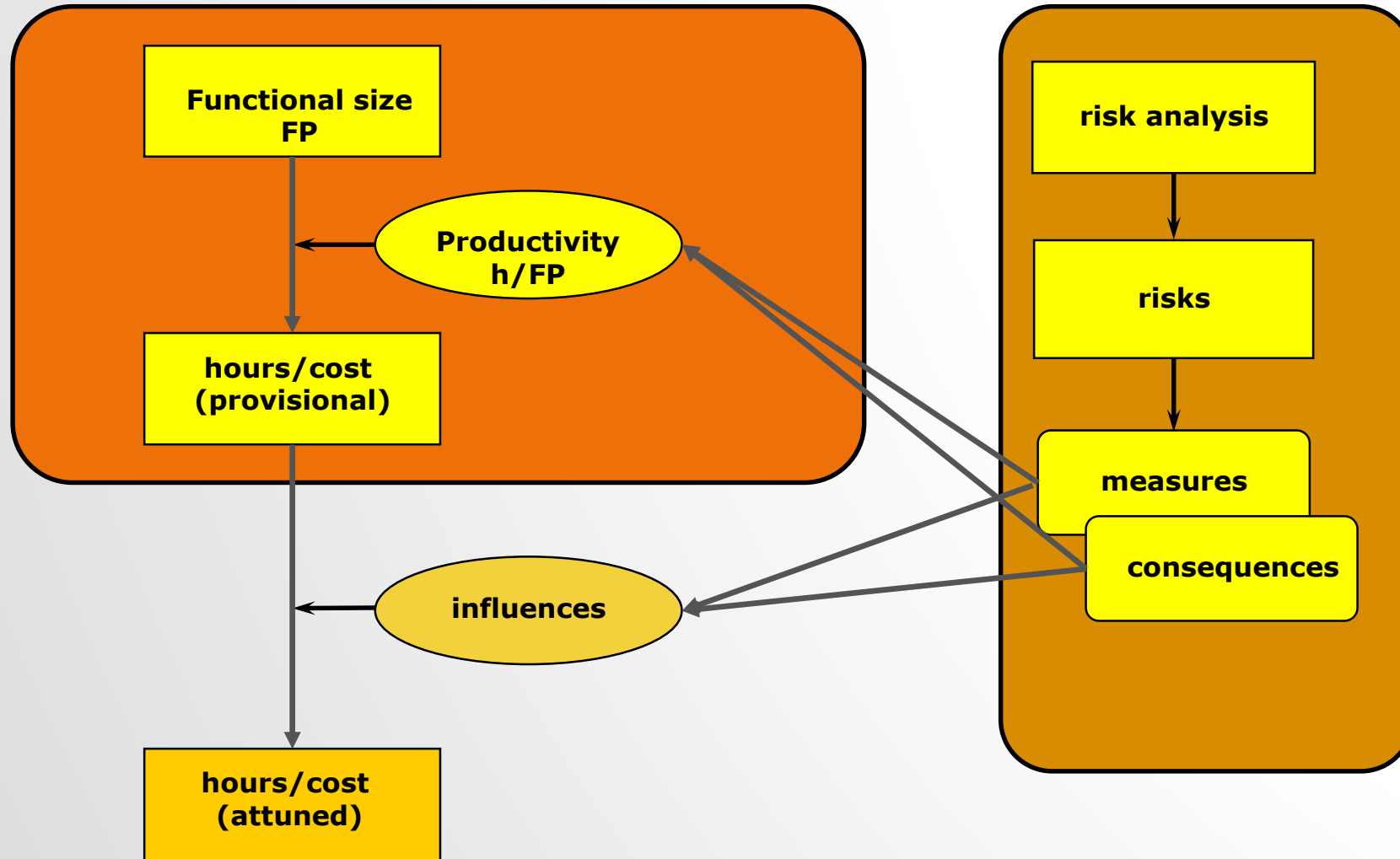


FUNCTION POINT ANALYSIS (FPA)

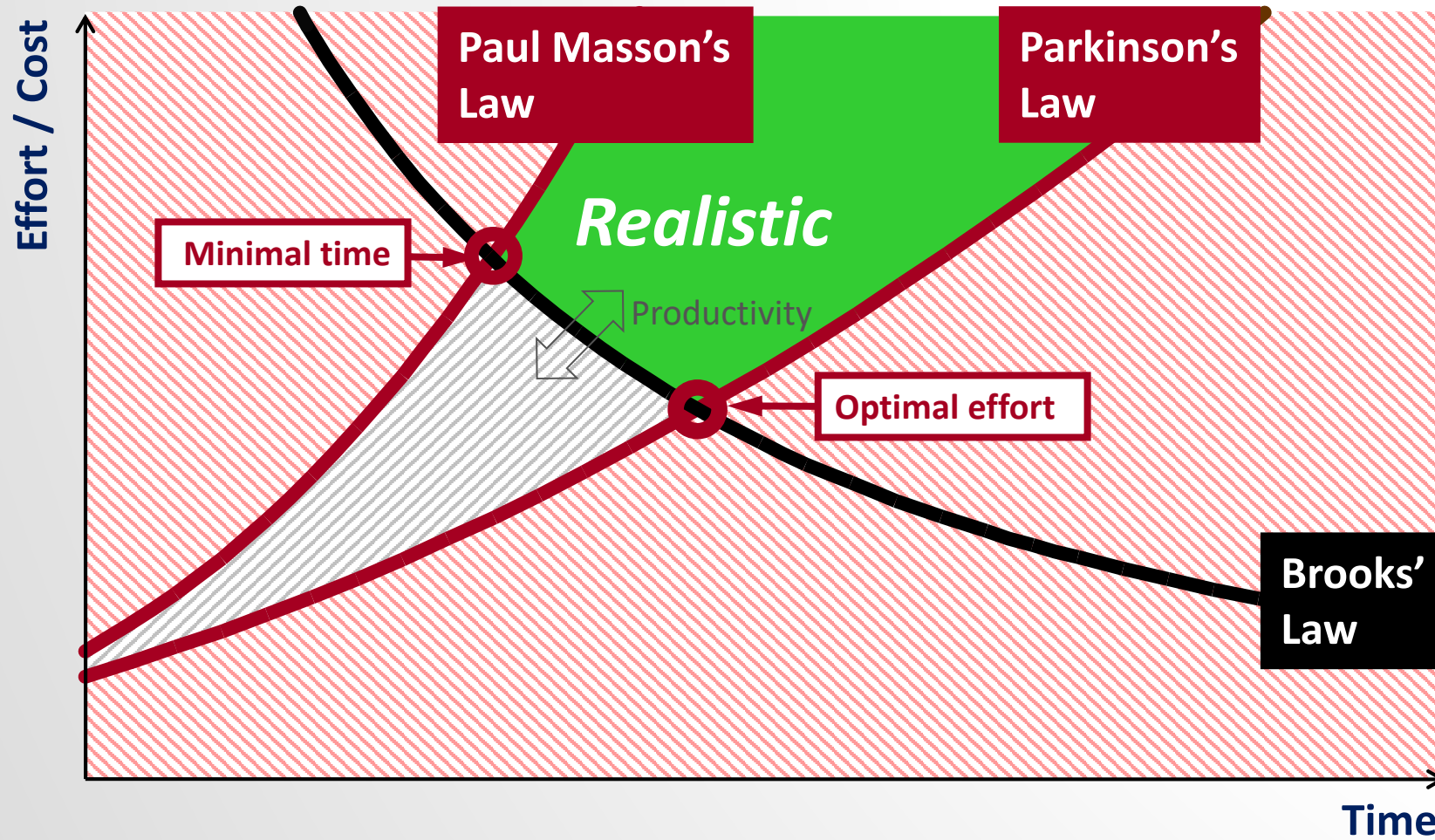
- Can be used early in the project, when functional requirements are known
- Independent of technical implementation. 500 FP Mobile app = 500 FP Legacy Cobol system
 - Just as a 20 m² glass wall = 20 m² brick wall
 - Effort to realize the software depends on **productivity**
 - Cost depends on **productivity** and **labor rates**.
- Independent of the systems requirements
- **Objective, verifiable, repeatable, defensible measurement !!**
- More function points means more functionality: value!
- Functional size is the basis for **objective software metrics**:
 - Productivity (Hours spend per FP)
 - Cost Efficiency (Money spend per FP)
 - Time to Market (FP per calendar month)
 - Quality (Defects per 1000 FP)



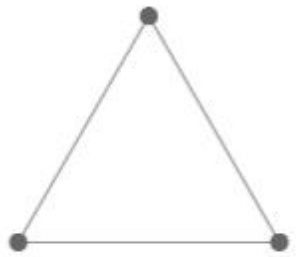
BASIC ESTIMATION MODEL



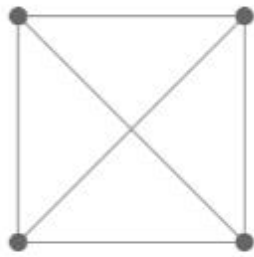
TIME VS COST



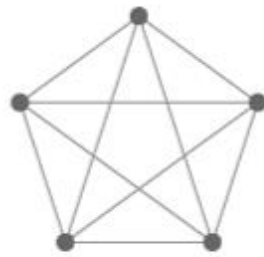
TEAM SIZE: IMPACT ON PRODUCTIVITY



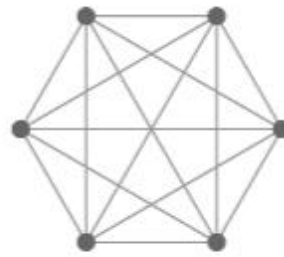
3 people, 3 lines



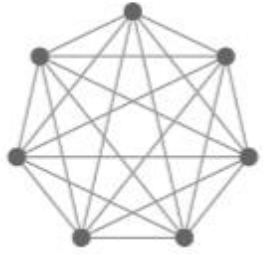
4 people, 6 lines



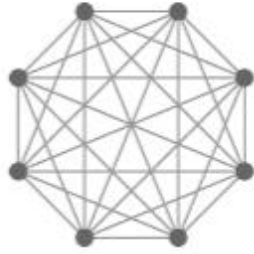
5 people, 10 lines



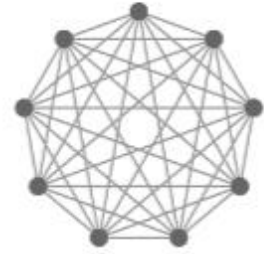
6 people, 15 lines



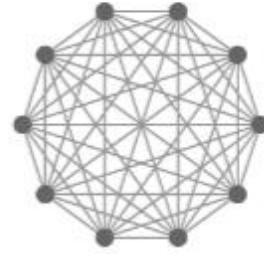
7 people, 21 lines



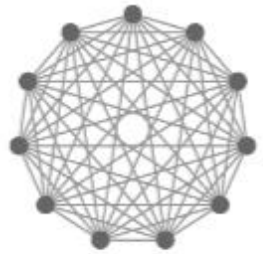
8 people, 28 lines



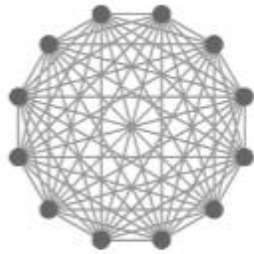
9 people, 36 lines



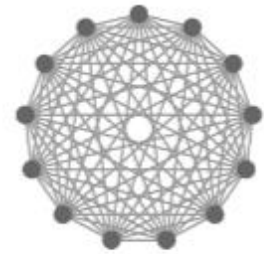
10 people, 45 lines



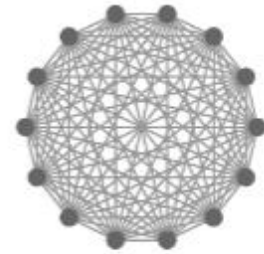
11 people, 55 lines



12 people, 66 lines



13 people, 78 lines

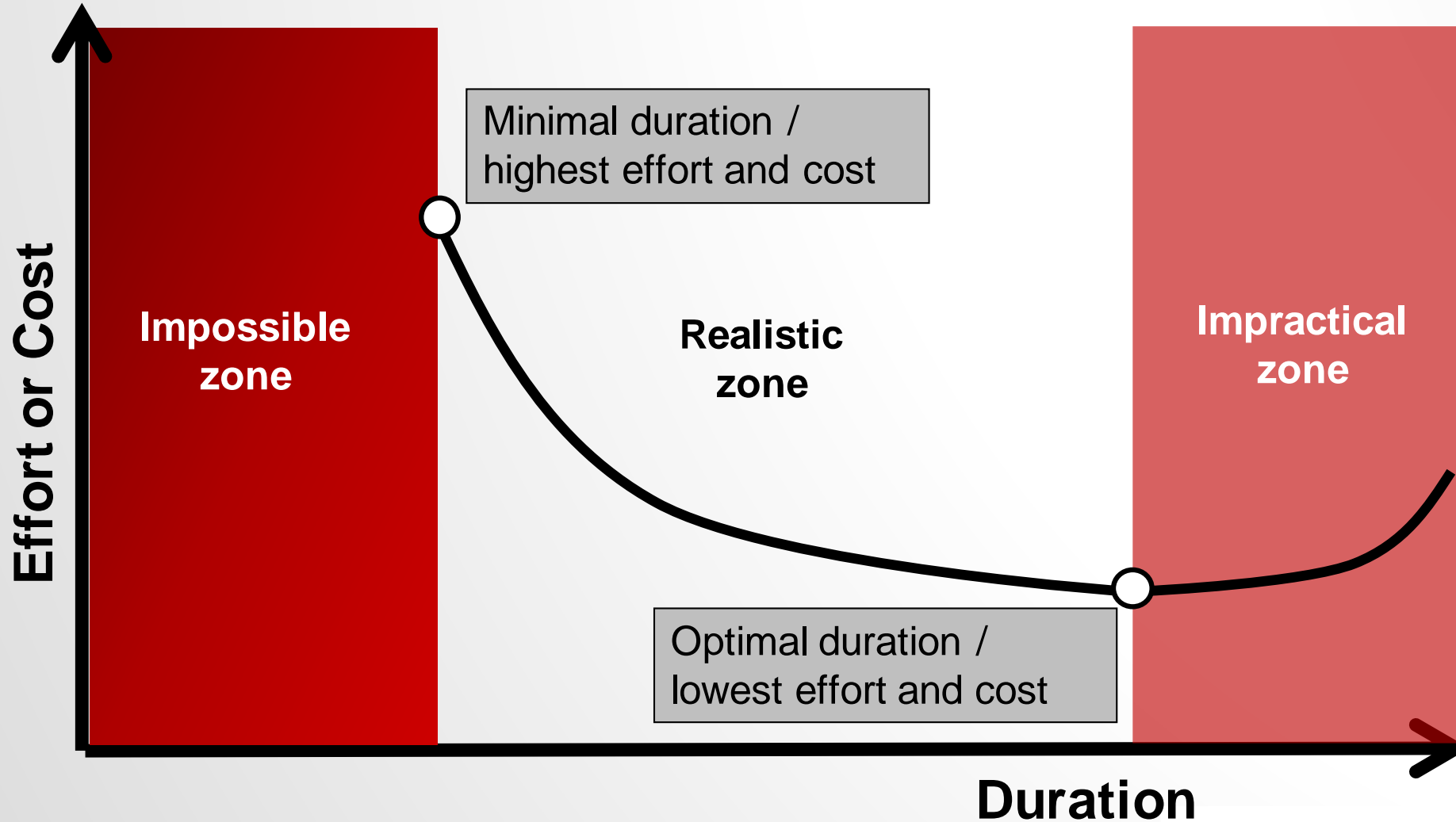


14 people, 91 lines

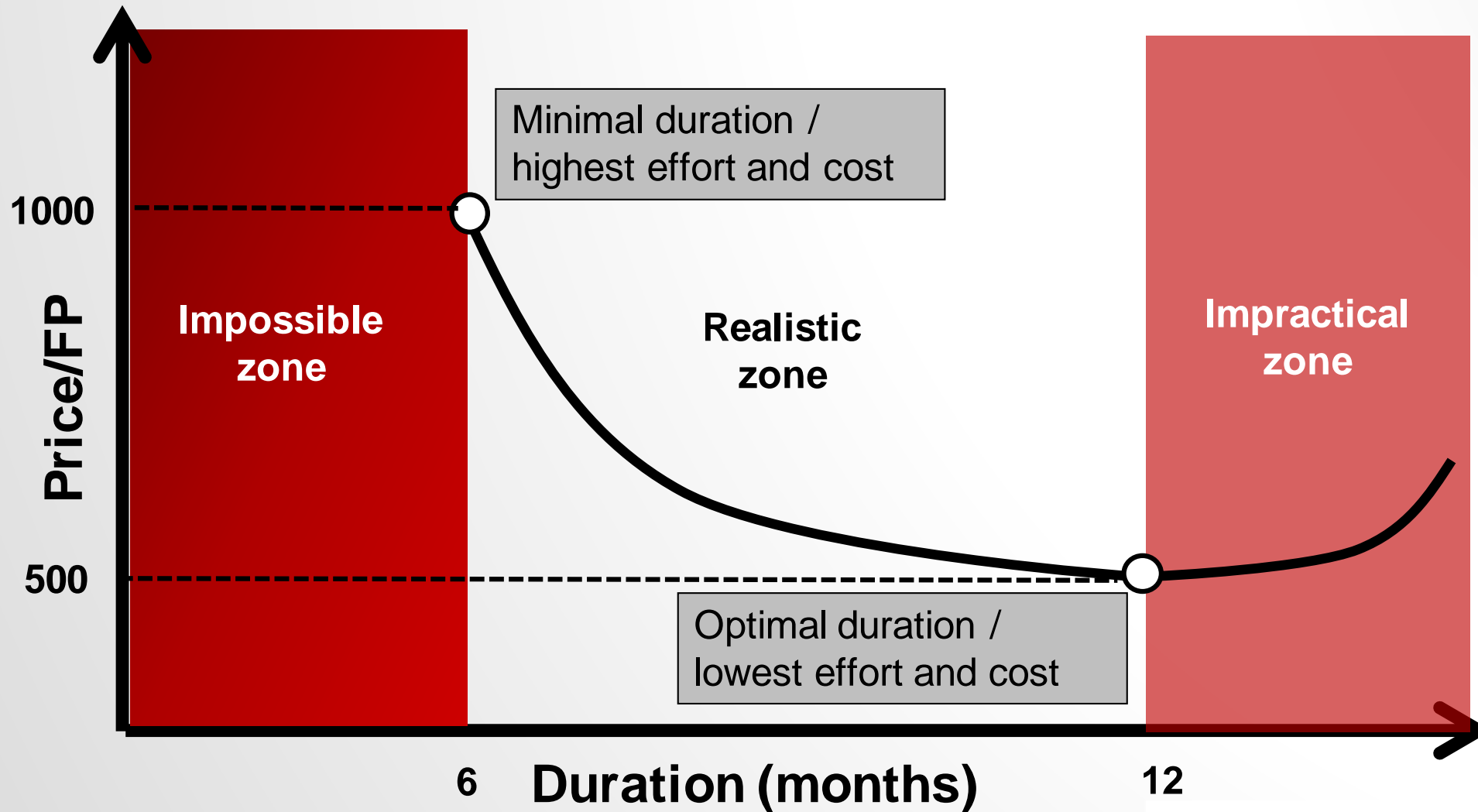
Larger team size means lower overall productivity.

Adding people to a late project only makes the project later.

OVERVIEW



OVERVIEW



HISTORICAL DATA

- Parametric estimation models need historical data to estimate
- Preferred for estimation: data of the company itself
- For new types of projects or no data available: Industry data can be used
- Sources of industry data:
 - Data delivered with the parametric models, e.g.
 - SEER-SEM: knowledge bases
 - QSM SLIM: trendlines based on slocs or FP
 - Data provided by Benchmarking suppliers (METRI, Gartner, DCG, etc.)
 - Independent data (International Software Benchmarking Standards Group)


INTERNATIONAL SOFTWARE BENCHMARKING STANDARDS GROUP

- **Independent and not-for-profit;**
- Full Members are non-profit organizations, like NESMA, IFPUG, Beijing Kexin Science and Technology Ltd, JFPUG, GUFPI-ISMA, FiSMA, QESP, DASSMA, China SPI and Swiss-ICT.
- Grows and exploits two open repositories of software data (.xls):
 - New development projects and enhancements (**> 7500 projects**);
 - Maintenance and support (**> 1200 applications**).
- Everybody can submit project data
 - Questionnaire on the site / on request (.xls) / online
 - Anonymous
 - Free benchmark report in return

OVERVIEW

>7500 rows in Excel, Easy to analyze.

>250 data fields per project

												
D&E Release April 2016		7518 rows										
	Rating	Rating	Software Age	Major Grouping	Major Grouping	Major Grouping	Major Grouping	Major Grouping	Major Grouping	Major Grouping	Major Grouping	Major Grouping
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
10046	B	B	2015	Communication	Telecommunications	Business Application	Customer relationsh	Enhancement	Multi	3GL	Java	IFPUG 4+
10109	B	B	2015	Insurance	Insurance;	Business Application	Workflow support &	New Developmen	PC	4GL	.Net	NESMA
10169	B	B	2015	Insurance	Insurance;	Business Application	Workflow support &	Enhancement	PC	4GL	Oracle	NESMA
10305	B	B	2015	Communication	Telecommunications	Business Application	Customer relationsh	Enhancement	Multi	3GL	Java	IFPUG 4+
10317	B	B	2015	Government	Government;	Business Application	Business Applicatio	Enhancement		4GL	.Net	NESMA
10469	B	B	2015	Communication	Telecommunications	Business Application	Stock control & orde	Enhancement	Multi	3GL	Java	IFPUG 4+
10665	B	B	2015	Communication	Telecommunications	Business Application	Stock control & orde	Enhancement	Multi	3GL	Java	IFPUG 4+
10762	B	B	2015	Communication	Telecommunications	Business Application	Customer relationsh	Enhancement	Multi	3GL	Java	IFPUG 4+
10940	B	B	2015	Insurance	Insurance;	Business Application	Workflow support &	Enhancement	PC	3GL	Java	NESMA
11118	B	B	2015	Communication	Telecommunications	Business Application	Logistic or supply pl	Enhancement	Multi	3GL	Java	IFPUG 4+
11230	B	B	2015	Insurance	Insurance;	Business Application	Electronic Data Inte	Enhancement	PC	3GL	Java	NESMA
11318	B	B	2015	Communication	Telecommunications	Business Application	GEO Information M	Enhancement	Multi	3GL	Java	IFPUG 4+
11737	B	B	2015	Communication	Telecommunications	Business Application	Workflow support &	Enhancement	Multi	3GL	Java	IFPUG 4+
11990	B	B	2015	Insurance	Insurance;	Business Application	Electronic Data Inte	New Developmen	PC	3GL	Java	NESMA
12928	B	B	2015	Insurance	Insurance;	Business Application	Workflow support &	Enhancement	PC	4GL	.Net	NESMA
13120	B		2015	Service Industry	Art , Events , Ticket	Business Application	Document manager	Re-development	PC	3GL	Java	COSMIC
13137	B	B	2015	Communication	Telecommunications	Business Application	Workflow support &	Enhancement	Multi	3GL	Java	IFPUG 4+
13372	B	B	2015	Insurance	Insurance;	Business Application	Web-based Applica	New Developmen	PC	4GL	.Net	NESMA
14138	B	B	2015	Insurance	Insurance;	Business Application	Workflow support &	Enhancement	PC	3GL	Java	NESMA

<http://isbsg.org/project-data/>

EXAMPLE

- Data Quality: A or B
- Year of Project > 2012
- Project Type: Enhancement
- Primary Programming language: Java
- Count approach: Nesma or IFPUG
- Further refinement, for instance:
 - Size category
 - Methodology
 - Industry
 - Application type
 - Team size
 - Time pressure (duration)
 - ...

	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

Example: 500 FP Java project ROM Estimate

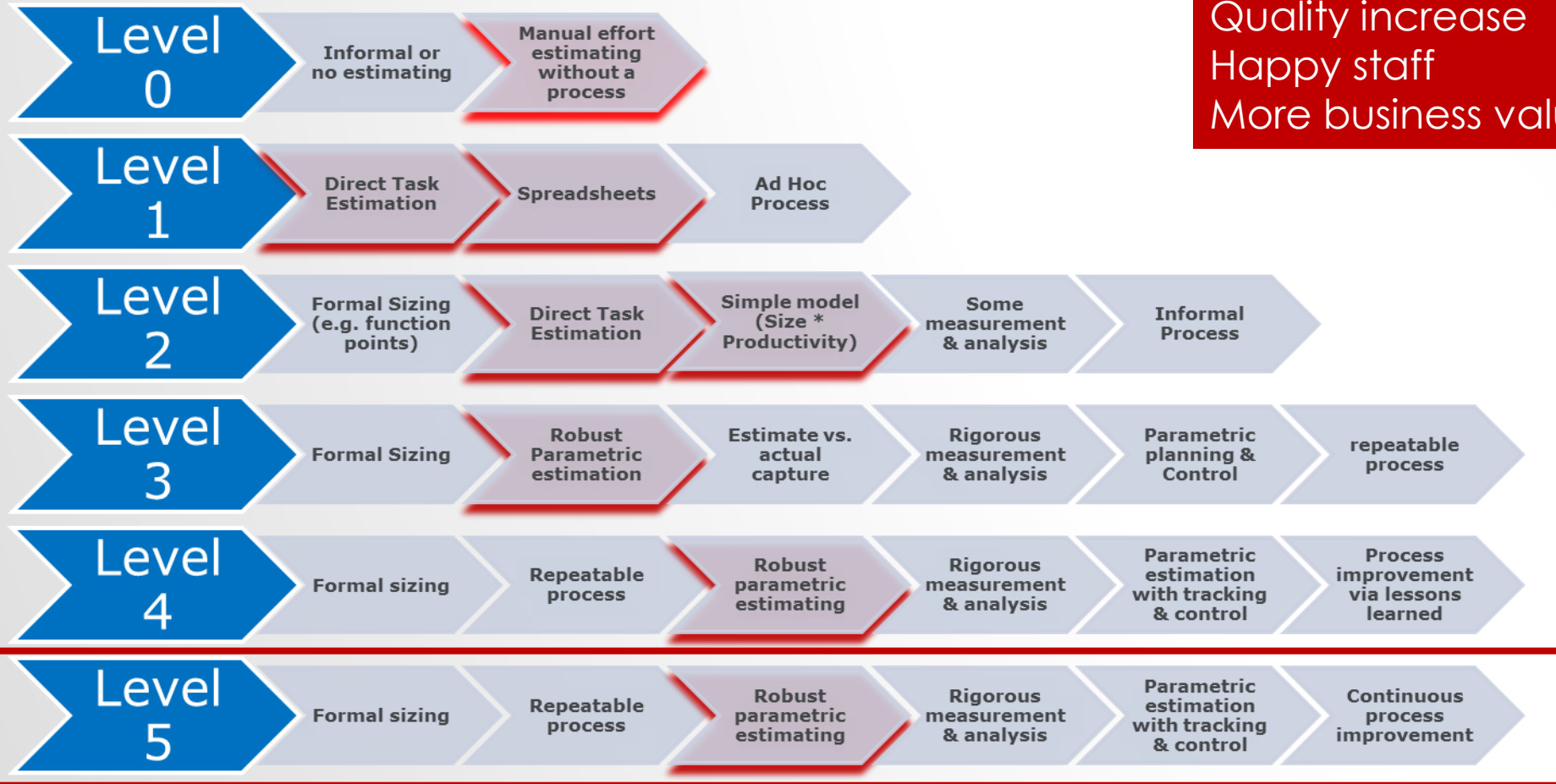
Reality Zone:

Low (P25): $500 * 6,8 = 3400$ hours
Likely(Median): $500 * 7,8 = 3900$ hours
High (P75): $500 * 9,4 = 4700$ hours

PARAMETRIC ESTIMATION IN PRACTICE

- Parametric Estimation is carried out by a number of 'more mature' organizations:
 - Global software service providers, e.g. HP, IBM, Capgemini, Sogeti, HCL, TechM, et cetera. They need to understand their capabilities and to be able to estimate fixed **price/fixed duration projects** accurately.
 - 'More mature' companies and governments that have implemented an '**Estimate and Performance Measurement**' or '**Supplier Performance Measurement**' process in order to understand their (and their suppliers') capabilities in order to improve, e.g. many banks, governments, insurance companies, telecom providers.
- Agile project estimation is still needed! Measure the functional size of the backlog and estimate which functionality will be ready at which point in time.
- Next to estimating, performance measurement and benchmarking of completed projects is another main advantage of measuring functional size.
- Use Price/FP in contracting reduces the risk of failures significantly:
 - The supplier takes the risk for the price and gets an incentive if he improves productivity (higher margin)
 - The customer takes the risk for the scope of the project.

ESTIMATION MATURITY MODEL*



Project Success rate >80%
<3% cancelled projects
Productivity increase
Cost decrease
Quality increase
Happy staff
More business value! Corporate success!!

THANK YOU!



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