Software size measures and their usefulness for software project estimation

SOGETI

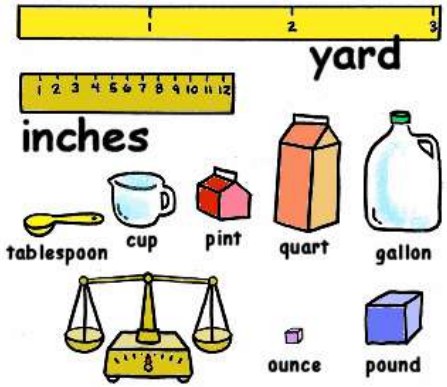
Software Size Measures and their usefulness for software project estimation

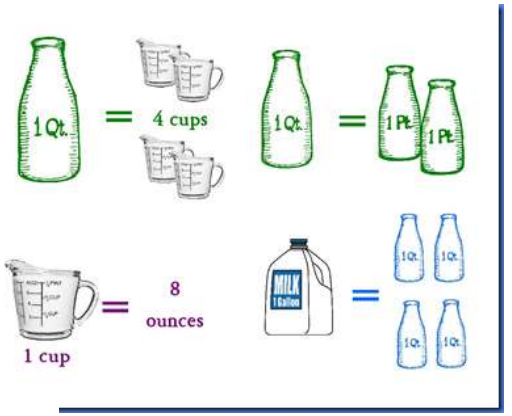
Harold van Heeringen
Sogeti Nederland B.V., Senior Software Cost Engineer

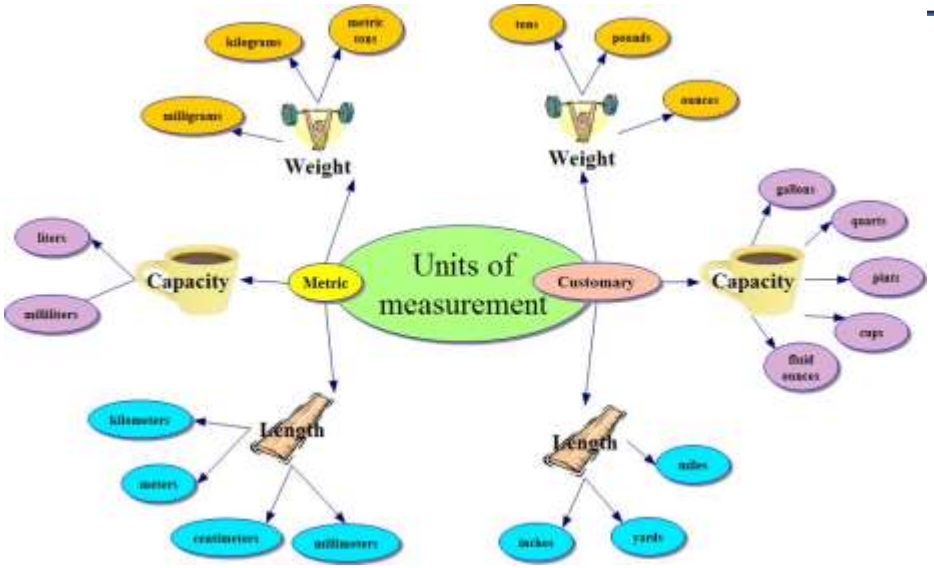
San Diego (CA, USA) June 2015

SOGETI

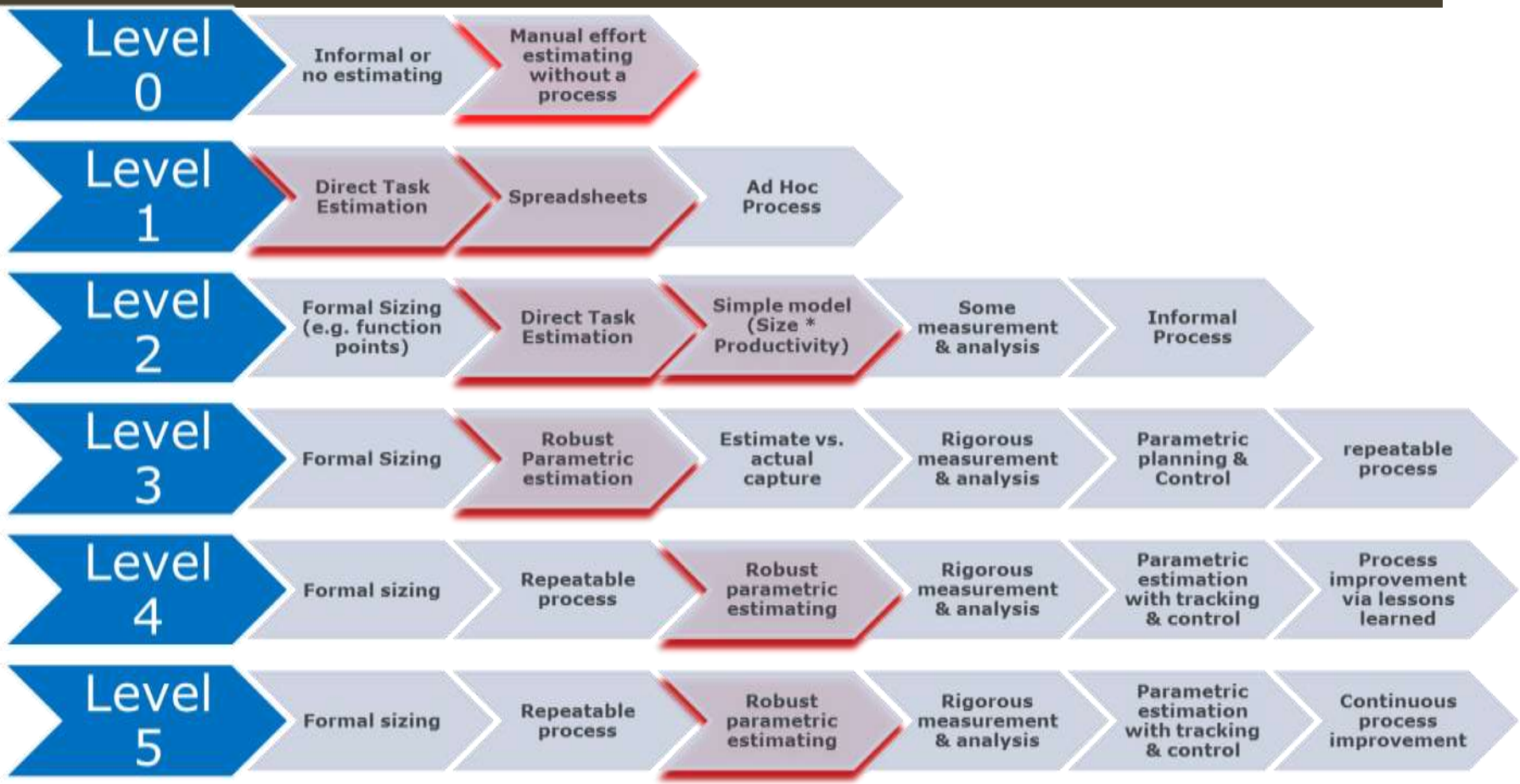
Why this presentation?







Estimating maturity model*



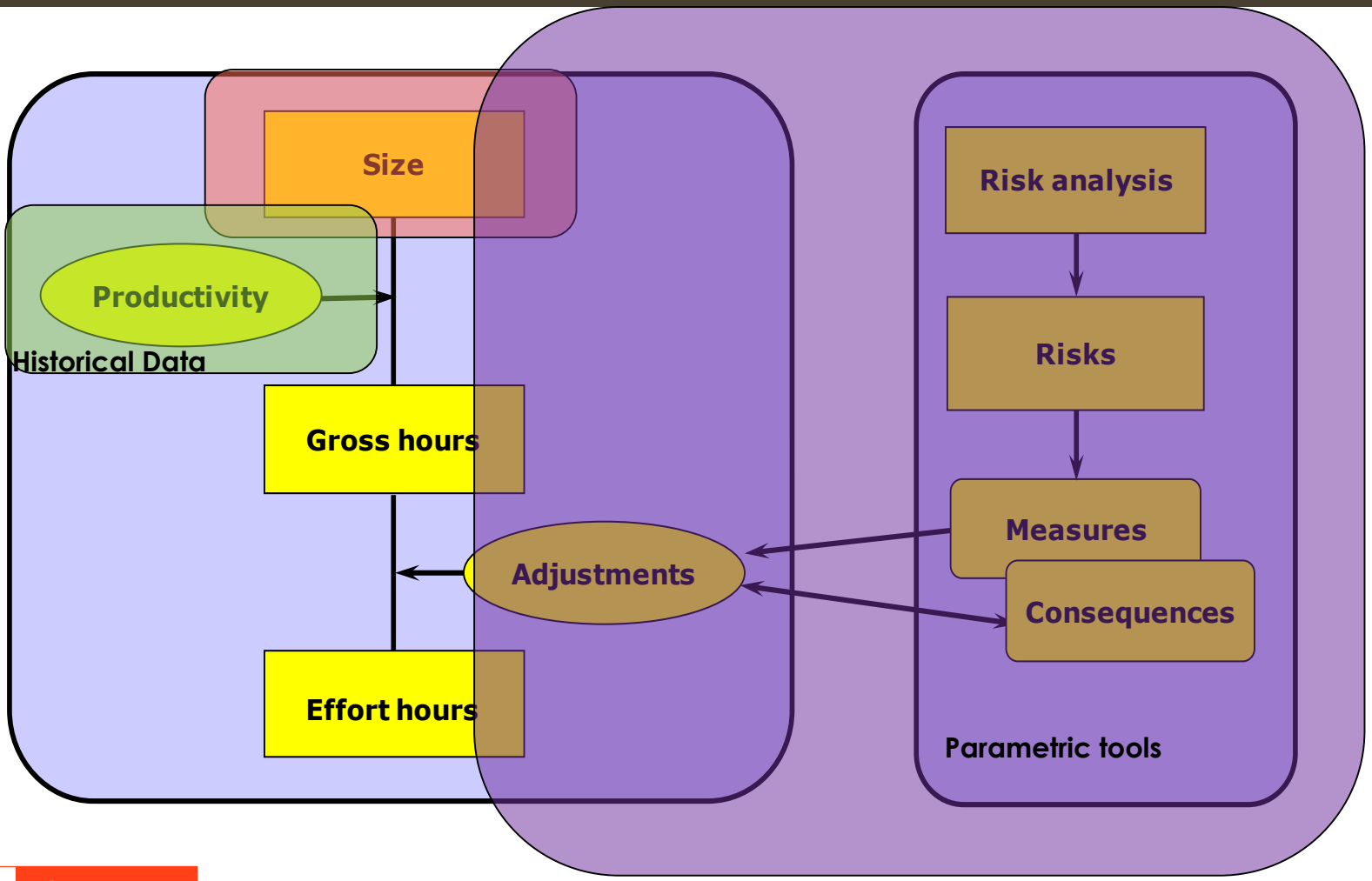
Estimation Bias Mitigation
Begins at Level 2,
Solid at Level 3

* Developed by Dan Galorath, www.galorath.com

Software project estimation

- Size is main input parameter for many cost estimation models;
- Size should be **measured**, not guessed;
- Many sizing techniques available in the industry
  - IFPUG Function Points;
  - Nesma Function Points;
  - COSMIC Function Points;
  - Source Lines of code (Slocs);
  - Story points;
  - SNAP points.
  - …
- How **useful** are these methods for **project estimation?**

Software project estimation (simplified)



Software size and project estimation

- Size is one of the main **input parameters** for a software project estimate;
- Size is not enough, historical data and parametric tools are necessary in order to create accurate estimates;
  - Measuring the size in a method of which no historical data is available **does not make sense;**
  - Measuring the size in a method that is not supported by parametric tools and/or models **does not make sense.**
- The chosen combination of size measurement method, historical data and parametric tool drives the accuracy **(usefulness)** of the estimate.

What is software size?

- Size (surface) of a wall: **square feet**;
- Size (volume) of a bottle: **liters**;
- Size (weight) of a man: **pounds**.

International Standards

- **Software size ??**
  - **Number of screens?**
  - **Number of modules?**
  - **Number of objects?**
  - **Number of source lines of code?**

Not International Standards

- What is the square feet metric in software?
- We need **standards** to express the size of software.

Classification

- **Functional size measurement methods**
  - Measure the functionality the software offers to its users;
  - Independent of technology / implementation;
  - "What can the users do with the software".
- **Non-functional size measurement methods**
  - Measure technical and/or quality attributes of the software;
- **Hybrid methods**
  - Measure both functionality and technical characteristics of the software.

Size measurement methods covered

Software size measure	Measurement scope	Size	
Source lines of code (slocs)	'Physical' software object	Technical size in slocs	NF
IFPUG Function Points	Functional user requirements	Functional size in FP	F
NESMA Function Points	Functional user requirements	Functional size in FP	
COSMIC Function Points	Functional user requirements	Functional size in CFP	
SNAP Points	Part of the non-functional user requirements	Non-functional size in SNAP points	NF
Usecase Points	Usecases, technical project characteristics, environmental project characteristics	'Effort/Size combination' in Usecase points	H
Fast Function Points	Functional user requirements and Configuration size	Gartner FFP	
Story Points	Backlog items, functional and non-functional	Story points	

Functional size measurement

- Independent of technical environment and implementation method
  - 200 FP Java project = 200 FP COTS package implementation.
- ISO/IEC standard for functional size measurement
  - Nesma, IFPUG, COSMIC, FiSMA, MK II.
- **Objective, repeatable, verifiable measurement**
  - **Defendable!**
  - Used in software estimation, project control, benchmarking, output based pricing contracts.
- **Square meters of software.**
  - Functionality = value

Historical data

- International Software Benchmarking Standards Group (ISBSG). R13 (February 2015)[1]. Total: >6.700 projects.
  - IFPUG: 5244 projects;
  - Nesma: 187 projects (treated equal to IFPUG);
  - COSMIC: 488 projects;
  - FiSMA: 580 projects;
  - MK II: 37 projects;
  - SNAP: 0 projects;
  - LOC: 180 projects;
  - Usecase points: 0 projects.
- Other databases.

Parametric tools

- Most parametric tools and models support functional size measures as well as technical size methods:
  - QSM SLIM;
  - Galorath SEER-SEM;
  - Price True planning;
  - Cocomo II;
  - Others.

- ISO/IEC standard Functional size measurement methods + historical data + parametric tools should result in accurate project estimates.

Slocs

NF

- **How many lines is this?**

```
for (i = 0; i < 100; i++) printf("hello"); /* How many lines of code is this? */
```

- Same functionality

```
/* Now how many lines of code is this? */
for (i = 0; i < 100; i++)
{
    printf("hello");
}
```

- Different code counters, different results;
- Code counters often count 1 programming language.

Source Lines of Code (slocs)

NF

- Technical size measure;
- Not standardized
  - Different code counters result in different slocs;
  - Eslocs / Slocs / Locs / Physical locs / etc;
- **Measurement** only possible to measure **after completion**;
  - More slocs is not better… or more value;
  - Use in project estimation → very risky;
  - Large error range in main input parameter;
  - Project estimates are probably **not very accurate**.

- Why is it used? Easy / Fast / Automatic / No expertise.

IFPUG/Nesma/COSMIC Function points

F

- **Advantages**
  - ISO/IEC standards;
  - Used in many countries worldwide;
  - Many **certified analysts** available;
  - Lots of **historical data** available;
  - Supported by most **parametric tools** and models;
  - Powerful static test of requirements;
  - **Very useful** for software project estimation.

- **Disadvantages**
  - Documentation requirements;
  - Available expertise/skills, Usually takes a few days.

Nesma derived methods

F

- **Global Nesma**
  - Applicable earlier in the software project lifecycle;
  - Less effort while not losing accuracy (-8 / +15%);
  - Less strict documentation requirements;
  - Faster to carry out.

- **Indicative Nesma**
  - Only data model is needed;
  - Even faster to carry out;
  - Enough accuracy for ROM estimate (-30% / +50%)

- **Nesma is very useful for software project estimation**

COSMIC

F

- Open standard, material for free;
- Possible to measure more than business software:
  - Realtime software;
  - Infrastructure software;
  - Mobile software.
- Possible to measure the size per 'layer' and 'peer component'.
- No size limit per functional process, possibly more accurate sizing than other methods.
- Early methods available, but accuracy may be low.

- **COSMIC is very useful for software project estimation**

SNAP points

NF

- **Software Non-Functional Assessment Process**
  - Should be complementary to IFPUG;
  - Connected to ISO 9126 and ISO 25010;
  - Not a standard;
  - Often no information on SNAP categories available;
  - Not all non-functional requirements are measured;
  - Relationship between classes is questionable, e.g.
    - UI Complexity – Nr. of properties added or configured;
    - Batch processes: 4*, 6* or 10* nr. of data attributes.

SNAP categories

NF

- **1. Data operations**

1.1. Data Entry Validations
1.2. Logical and Mathematical Operations
1.3. Data Formatting
1.4. Internal Data Movements
1.5. Delivering Added Value to Users by Data Configuration

Often also Functional

- **2. Interface Design**

2.1. User Interfaces
2.2. Help Methods
2.3. Multiple Input Methods
2.4. Multiple Output Formats

SNAP Categories

- **3. Technical Environment**

```
3.1. Multiple Platform
3.2. Database Technology
3.3. Batch Processes
```

- **4. Architecture**

```
4.1. Component Based Software
4.2. Multiple Input / Output interfaces
```

- **Performance / Security / Maintainability ??**

SNAP points

NF

- **Other issues**
  - Published proof is reported statistically invalid;
  - There is no historical data available that can be used publicly;
  - Not supported by parametric tools.
  - Project documentation usually does not explicitly state the NFR's measured by SNAP → Not clear what to do….

- The idea may be good, but SNAP is **not yet useful** for project estimation

Usecase Points

- Developed by Gustav Karner
  - UML/RUP projects.
- Measure the size per Usecase, e.g. nr of transactions;
- Measure the number and complexity of actors;
- Determine '*Technical Complexity Factor*' and '*Environmental Factor*'
  - Highly **subjective** activities;
  - Multiplier effect result in **huge differences** between people.

- UCP = (UUCW + UAW) * TCF * EF

TCF and EF

TCF = 0.6 + (TF/100)

Factor	Description	Weight
T1	Distributed system	2.0
T2	Response time/performance objectives	1.0
T3	End-user efficiency	1.0
T4	Internal processing complexity	1.0
T5	Code reusability	1.0
T6	Easy to install	0.5
T7	Easy to use	0.5
T8	Portability to other platforms	2.0
T9	System maintenance	1.0
T10	Concurrent/parallel processing	1.0
T11	Security features	1.0
T12	Access for third parties	1.0
T13	End user training	1.0

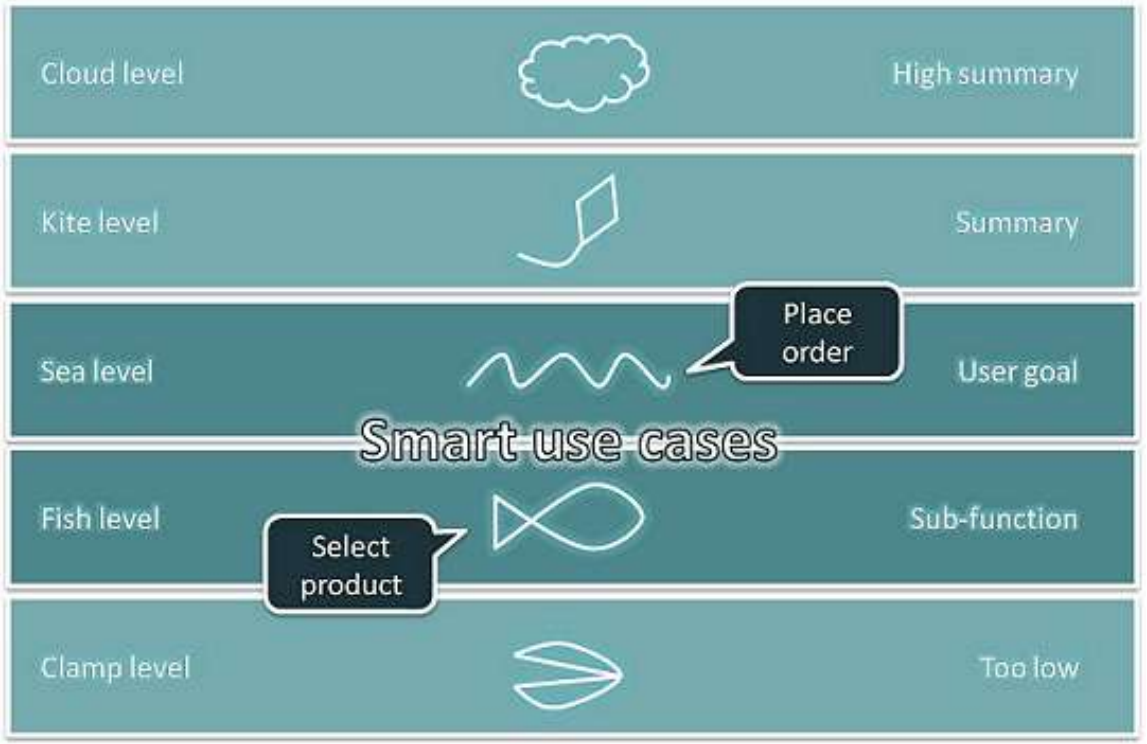
ECF = 1.4 + (-0.03 x EF)

Factor	Description	Weight
E1	Familiarity with development process used	1.5
E2	Application experience	0.5
E3	Object-oriented experience of team	1.0
E4	Lead analyst capability	0.5
E5	Motivation of the team	1.0
E6	Stability of requirements	2.0
E7	Part-time staff	-1.0
E8	Difficult programming language	-1.0

Assign value 0 to 5 depending on relevance

Usecase levels

- No standard for Usecase documentation;



Usecase Points

- No standard for Usecase documentation;
- No historical data available;
- Not supported by most parametric tools.
  - Some organizations convert UCP to FP… **theoretically impossible!**

- UCP is **not useful** for project estimation, unless…
  - There are strict definitions on how to model usecases implemented;
  - The process of assessing the TCF and EF is formalized somehow.

Fast Function Points

H

- Gartner method, part FPA, part Configuration;
- 'Function Points' is misleading statement;
- Pushed on management level, no specialist support;
- Many **unsupported (and false)** claims, like
  - Faster counting than Nesma / IFPUG;
  - Faster training than Nesma / IFPUG;
  - Accuracy higher than Nesma / IFPUG;

- Vendor lock-in;
- No historical data available outside Gartner;
- No support from parametric tools;
- Fast Function Points is **not suitable** for effort estimation.

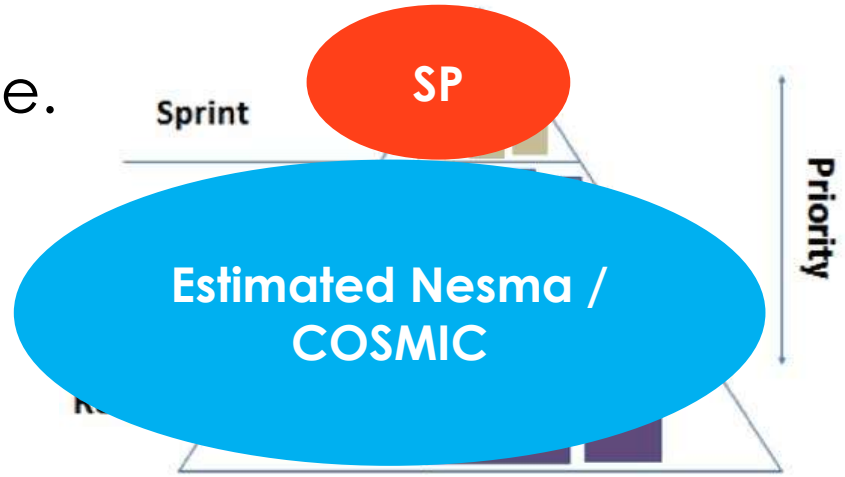
Story Points

- Often used in agile projects;
- Planning Poker → assign SP to backlog items;
- SP is not a size measure, but an effort measure;
  - Very Subjective;
  - No standard;
  - Only valid in 1 team;
- No historical data available outside team (useless);
- No support from parametric tools.

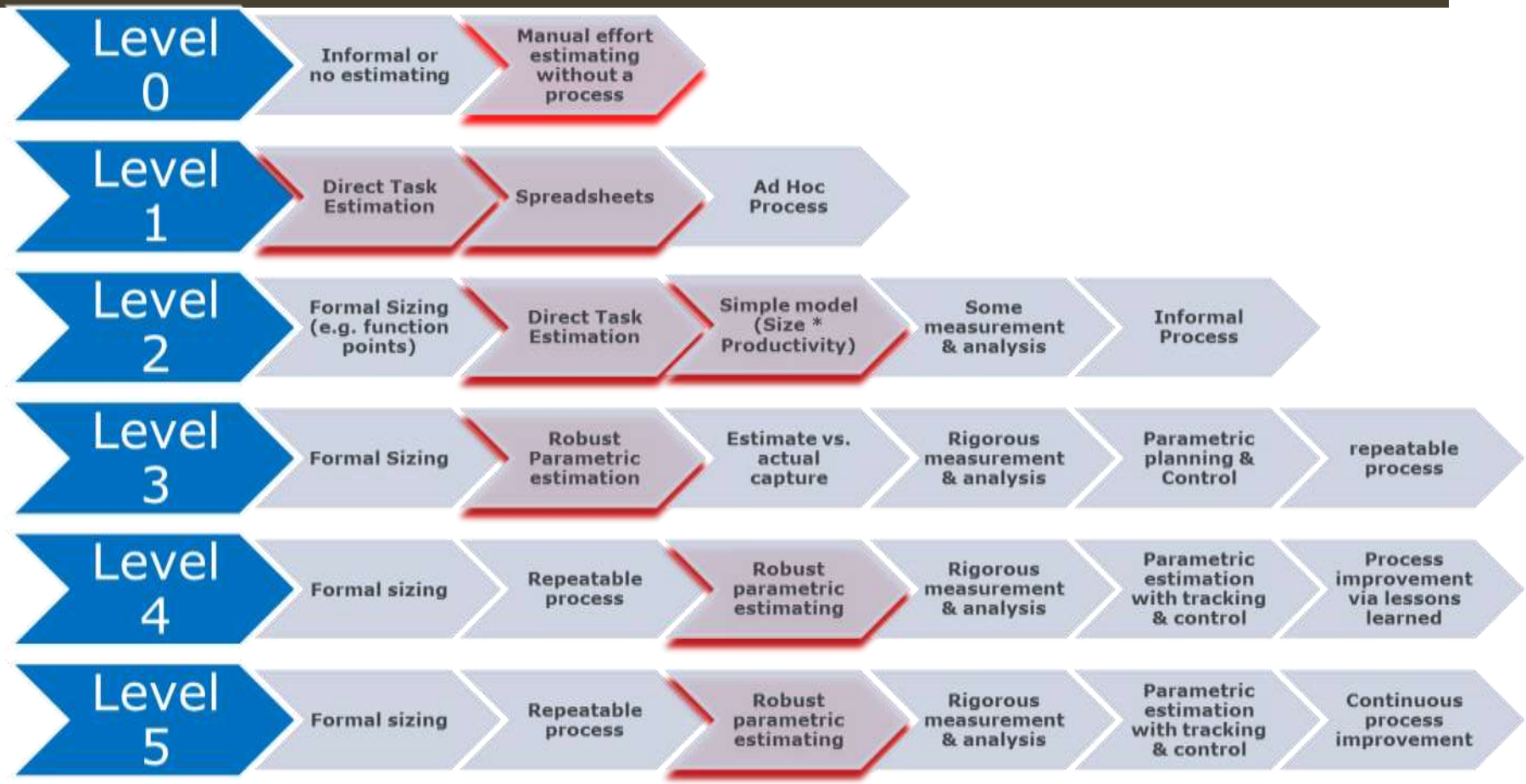
- Story Points are very useful for **sprint planning**, but **not useful** for project estimation.

Story Points

- SP are useful to plan the product backlog items that can be realized per sprint;
- Hard to do on Product Backlog that is not yet detailed;
- Early Project Lifecycle methods are better suitable.



Estimating maturity model*



SOGETI

* Developed by Dan Galorath, www.galorath.com

Conclusions

- There are many sizing techniques available, but few are useful for software project estimation;
- Project Estimation based on Slocs, Usecase points, Story points or Fast function points may work in certain situations, but is **not recommended** in a mature 'Estimating & Performance Measurement' process.
- Best Practice: select one of the functional size measurement methods (IFPUG, Nesma or COSMIC) and implement this method in the E&PM process.

Thanks for your attention!