Colaboradores:
Software cost estimation

finally a real profession!
Introducing myself

Drs. Harold van Heeringen,

- 20 years experience in IT, 15 years in software measurement and metrics
- ISBSG – 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
- Dutch Association for Cost Engineers (DACE) – working group parametric analysis
- Speaker at many conferences on software measurement, estimation and benchmarking

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

- Industry Maturity
- Software Estimation – the current practice
- Software Cost Estimation basics
- Introducing the Software Cost Estimation Body of Knowledge
- ISBSG
- Next steps
- Conclusions.
Cost Estimation

- A **cost estimate** is the approximation of the cost of a program, project, or operation. The cost estimate is the product of the cost estimating process. The cost estimate has a single total value and may have identifiable component values.

- A problem with **a cost overrun** can be avoided with a credible, reliable, and accurate cost estimate.

- A cost estimator is **the professional who prepares cost estimates**. There are different types of cost estimators, whose title may be preceded by a modifier, such as building estimator, or electrical estimator, or chief estimator. Other professionals such as quantity surveyors and cost engineers may also prepare cost estimates or contribute to cost estimates.

- In the US, according to the Bureau of Labor Statistics, there were **185400 cost estimators** in 2010.[1] There are around 75000 professional quantity surveyors working in the UK.

- Cost Estimator is **not a recognized profession** in the Software industry!

- Software Cost Estimates are created by project leaders, architects, developers, testers and other team members. Estimations are called ‘Expert estimates’

- Cost Estimates are typically based on Work Breakdown Structures, filled in with estimated hours based on ‘experience’ and ‘gut feeling’. These are human ‘expert’ estimates.
Estimating maturity model*

- Expert opinions, not based on data.
- Human bias: Likely to be inaccurate and low

- Parametric estimates
- Based on size, data and models

* Developed by Dan Galorath, www.galorath.com
Maturity in the software industry

- Software industry: **low maturity** in performance measurement and estimation
- Estimation and 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** if the **cost** spent on software development and maintenance 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.
Reasons for low maturity

- But Software Development is becoming more and more important for organizations as delivering new software functionality fast becomes more and more a **driver for business success**.
- **Increasing performance is sometimes crucial for survival!**
- **Productivity** is the most important metric in most performance measurement processes as it is independent of locations (e.g. hour rates).
- In general the notion that it is relevant, even crucial, to measure productivity is evident in almost all industries, except for the software industry. Why?
  - Productivity is universally defined by **output / input**.
  - **Input** is usually easily measured in: The number of effort hours spent per project or application.
  - But how do we measure **output**? What is the **size** of the software developed or maintained?
Output measurement: FSM

- Can be used early in the project, when functional requirements are known
- Independent of technical implementation. 500 CFP Mobile app = 500 CFP 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: more value!
- Functional size is the basis for objective software metrics:
  - Productivity (Hours spend per CFP)
  - Cost Efficiency (Money spend per CFP)
  - Time to Market (CFP per calendar month)
  - Quality (Defects per 1000 CFP)
- These metrics can be used for estimation, contracting, project control, benchmarking, supplier performance measurement, etc!
Realistic estimation is a KSF

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 stakeholders

Without a realistic estimate, the project is likely to fail!
In the IT industry, estimates are often low

**IT industry – estimates are too optimistic**
- Business/customer: pressure to lower price
- Business/customer: pressure shorter time-to-market
- Business/customer: incomplete requirements
- Business/customer: early fixed price/date quote
- IT Supplier: Unclear what customer wants
- IT Supplier: Immature estimation techniques (only expert estimates)
- IT Supplier: No idea about own performance and capabilities;
- IT Supplier: Not defendable \(\rightarrow\) easy to push back

**Optimistic estimates are more rule than exception**
Effect

Non-linear extra costs
- Planning errors
- Team enlargement → more expensive, not faster
- Extra management attention / overhead
- Stress: More defects, lower maintainability !!

Linear extra costs
Extra hours will be used
Two ways to estimate

Objective

Level 0, 1 and 2

Size

COSMIC

Effort

Estimating & Benchmarking

Level 3, 4 and 5

Cost
Level 0 and 1 estimates: optimistic and failure
Level 3, 4 & 5 estimates: realistic and success!
Welcome to ICEAA

The International Cost Estimating and Analysis Association is a nonprofit organization that strives to promote and to enhance the profession of cost estimating and analysis with the primary goal of fostering the professional growth of our members in cost estimating, cost analysis, and allied fields. ICEAA is represented locally by more than 20 chapters nationwide and International affiliates in Australia, Canada, Japan and the United Kingdom.

Member Benefits

Membership is open to all interested individuals from all levels of expertise from the government, private sector and academia. ICEAA members enjoy a valuable suite of member benefits, including:

- Discounted registration to the annual Professional Development & Training Workshop, an annual training event that brings together industry experts for a dynamic four-day informational environment
- Local and regional seminars designed to address specific topics of special interest and networking events to expand your circle of colleagues
- Subscription to ICEAA World, a magazine filled with important association news, book reviews, feature articles and chapter updates
- Subscription to the Journal of Cost Estimating & Analysis, ICEAA's scholarly journal dedicated to providing the most current and innovative research and analysis in the cost community
- Eligibility to submit articles and papers for publication in both ICEAA World and the Journal of Cost Estimating & Analysis

ECO Logistics Solutions Team Meeting
21-23 August 2018

ICEAA 2018
All-Member Virtual Meeting
September 20

Call for Papers!
Summaries Due
November 5, 2018

ICEAA 2018
June 12-15 ♦ Phoenix, Arizona
Nesma: Metrics and more

In a world that is becoming more and more agile, metrics are an indispensable base for managing the essentials of your software project: quality, cost, and time. Nesma provides you with valuable information about software metrics and measurements, and the way metrics support your road to successful and cost-effective software projects.

Your starting point for successful software projects

**Sizing and more**

Nesma has its origin in measuring the size of software. Today, size and other metrics form the base for many activities that play a role in successful and cost-effective software projects.

**SW Cost Estimating**

Estimating cost and managing budgets is very important in software projects. Together with IEEAA and with support of international organizations, Nesma is involved in establishing a Software Cost Estimating Body of Knowledge (SCEBoK).

**Publications**

Nesma offers a combination of both free and paid publications that are helpful for you as a metrics professional. Take a look at these publications and raise your level of knowledge.

In the spotlight
Software Cost Estimating is the profession for estimating the costs of a software solution based on the needs and a defined solution.

Software Cost estimation is the basis for a successful software project and needs to have the right level of detail and accuracy to be able to control the delivery with respect to scope, cost and schedule.

A certified software cost estimator creates estimates based upon relevant historical data and by means of estimation models. Except cost, these estimates result in a schedule to deliver the defined solution.

A certified cost estimator baselines his estimate in a Basis of Estimate document, documenting the scope, the assumptions, the data used and the models used per estimated item.
Currently there is no internationally accepted certification for the profession of Software Cost Estimator available in the market, like the certification for Cost Estimator and Analyst for system engineering that is provided by ICEAA.

To fill this gap, Nesma and ICEAA (International Cost Estimation and Analysis Association) are working together on the creation of a training curriculum and certification program to make ‘Software Cost Estimator’ a profession. Other metrics associations, like IFPUG, COSMIC and ISBSG support this.

Certified Software Cost Estimators will support organizations to bring their cost estimation process to a higher level and to make software projects more successful.

The following certifications are anticipated:
- Certified Software Cost Estimator Foundation
- Certified Software Cost Estimator Expert
Software Cost Estimation Body of Knowledge (sCEBoK)

- Software Cost Estimation Body of Knowledge (sCEBoK).
- This body of knowledge will contain relevant knowledge to fulfil the role of Software Cost Estimator and will be the basis for training and certification. Except knowledge, experience is an important criterion to pass this exam.

sCEBoK 2018 content

Currently the sCEBoK consist of the following modules, as presented during the ICEAA Conference in Phoenix in June 2018:

- Estimation principles
- Solution based estimation
- Basis of Estimate (BOE)
- Basis of Measurement (BOM)
- Budget process
- Data collection and basic data analysis
- Statistics to support basic metric analysis
- Estimation in the software lifecycle
- Estimation methods – Formal
- Estimation models – Size based methods
- Estimation maturity
- Cost drivers
- Benchmarking
- Application Maintenance

For the final sCEBoK, additional modules will be developed and current modules will be further improved with support of professionals of international software organizations. The new modules will focus on knowledge with respect to software cost estimation as well as on a further refinement of estimation models for modern lifecycles like Agile and DevOps. The sCEBoK will consist of training material including detailed notes. As a next step a wiki will be developed to share the knowledge.
ISBSG

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

- Grows and exploits two repositories of software data:
  - New development projects and enhancements (> 8250 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
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 standardized, verified, recent and representative of current technologies.”

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

- 8261 rows in Excel, Easy to analyze.
- 250 data fields (columns) per project

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<th>Rating</th>
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Example: Estimate Landing zone

- Selection:
  - Data Quality: A or B
  - Year of Project > 2012
  - Project Type: Enhancement
  - Primary Programming language: Java
  - Count approach: Nesma or IFPUG

- The landing zone may be in this case:
  - Low: 6.8 h/FP
  - Likely: 7.8 h/FP
  - Max: 9.4 h/FP

- Further refinement may be possible,
  - Size category
  - Development methodology
  - Industry
  - Application type
  - ...

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<td>Percentile 10%</td>
<td>5.3</td>
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<td>Percentile 25%</td>
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<td>Median</td>
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<td>Percentile 75%</td>
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<td>Percentile 90%</td>
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<td>Maximum</td>
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<td>Average</td>
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AMMS member benefits

- **AMMS members get a 20% discount** on data licenses, corporate subscription and other ISBSG products, such as special analysis reports.

**Development & Enhancement Data**
Purchase a 12 month licence for the ISBSG Development & Enhancement Repository. You will receive data for more than 8,000 projects from countries around the world, for 7 major industry types.

- Data can be used to test ideas, benchmark, and improve the planning and management of projects.
- Review what you can find in the repository.
- Download a free sample of Development & Enhancement data.
- Price $1,000 (Australian dollars) for a single user licence

**ISBSG Reports**
The ISBSG analyses the data it has accumulated to produce analysis reports that will be useful to people across a range of IT roles including CIOs, ARCEs, Project Managers, Inside Managers, Business Analysts, Costbusters, project managers and so on.

**NOTE:** All prices are shown in AUD

- **10 Take-Aways From the Reiter Agile Report**
  - **Format:** Downloadable file
  - **Updated:** 2012
  - **Price:** $1,350.91

- **A Quantitative Analysis of Agile Methods**
  - **Format:** Downloadable file
  - **Updated:** 2013
  - **Price:** $1,352.27

- **Agile Methodology Analysis Reports – Value Pack**
  - **Format:** Downloadable files
  - **Price:** $2,048.90

- **Agile Software Quality – A Quantitative Analysis**
  - **Format:** Downloadable file
  - **Updated:** 2013
  - **Price:** $1,352.27

- **Early Lifecycle Software Estimation**
  - **Format:** Downloadable file
  - **Updated:** 2005
  - **Price:** $873.51

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Conclusions

- Cost estimation is a profession in most industries, however **Software Cost Estimation is not a profession** yet as it is hard to measure software.
- This is the root cause for many failing projects, which were estimated using low maturity techniques and therefore estimated optimistically.
- There is loads of software estimation material, research and data available, but unknown to most of the industry.
- ICEAA and Nesma create the Software Cost Estimation Body Of Knowledge (sCEBoK) and a certification program for certified Software cost estimators.
- ISBSG is one of the contributing organizations, contributing effort and materials in order to improve estimation decision making in the industry.