Estimation Tools – An Overview

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Dr. Buglione is a regular speaker at international Conferences on Software/Service Measurement, Process Improvement and Quality, and is actively part of several International (ISO WG10-25, IFPUG, COSMIC, ISBSG, MAIN) and National (AutomotiveSPIN Italy GUFPI-ISMA, AICQ, itSMF Italy) technical associations on such issues.

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Dr. Ebert serves on a number of advisory and industry bodies. An internationally renowned keynote speaker, he teaches at the University of Stuttgart and authored several books including his most recent book “Global Software and IT” published by Wiley.

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Agenda

- Introduction
- Estimation Principles
- Estimation Tools
- Case Study
- Summary and Conclusions
Estimation – Daily Life

- **How much time** does the blue car need to its final destination?

- It depends on several **parameters**:
  - distance to drive (quantitative: Km, absolute scale)
  - average speed (quantitative, ratio scale)
  - weather conditions (qualitative: ordinal scale)
  - traffic jams (unpredictable: risk to be evaluated)
  - ...

Estimation – Daily Life (At Least Ours)

- **How much effort** will the project need to complete

- It depends on several **parameters**, such as:
  - functional size (quantitative: absolute scale)
  - typical productivity (quantitative, ratio scale)
  - employee motivation (qualitative: ordinal scale)
  - supplier delays (unpredictable: risk to be evaluated)
  - ...
Agenda

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- Estimation Tools
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Cooperation: Goals, Estimates and Plans

**Goals**
- External
- Business needs
- Examples: requirements, target cost

**Estimates**
- Internal
- Constrained by dependencies, uncertainties
- Examples: effort, duration

**Plan**
- Break-down of a goal to activities and milestones in order to reach this goal
- Relates goals and estimates to best possibly reach the goals
- Approach: Win-win
- Needs clear commitments of all impacted stakeholders

Understand, adapt, commit
Constraints for Estimation: The Parameters

- Degree of reuse of models and programs
- Functionality, size, complexity
- Productivity
- Quality requirements
- Schedule pressure
- Qualification and skills
- Team size and distribution
- Engineering methodology and tools
- ...

<table>
<thead>
<tr>
<th>Impact factors</th>
<th>Effects</th>
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<th>Effort</th>
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<td>Schedule pressure</td>
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Feasibility Study and Risk Assessment

Project scenarios ① to ⑤

Correlation ("Putnam equation"): Effort \( \sim \frac{3^{\text{scope}}}{\text{productivity}^3 \times \text{time}^4} \)

Legend:
① Optimum solution (shortest distance to curve)
② Effort optimized to time target (here: target value not achieved)
③ Time optimized to cost target
④ Within time and budget (reduced scope)
⑤ Within time and budget (increased productivity)
Estimation Models

- **Expert Judgment (E)**
  - Based on brainstorming from experts
  - Example: Expert consensus mechanism such as the Delphi Technique

- **Analogy Estimating (A)**
  - Based on the comparison with previous, similar activities by using relevant project and product/service attributes
  - Example: Standard estimation template

- **Decomposition (D)**
  - Top-down estimation technique, to provide granular list of tasks and relationships
  - Combine granularity and risk management to avoid micro-management
  - Example: Work Breakdown Structure

- **Statistical (parametric) models (S)**
  - Set of related mathematical equations and benchmark data in which alternative scenarios are adjusted based on project, product and environment parameters
  - Example: Estimation tools

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## Estimation Tools - 1

<table>
<thead>
<tr>
<th>Software Estimation tools</th>
<th>Producer</th>
<th>LOC-FP Based</th>
<th>Single-Multi Count</th>
<th>Online-Web</th>
<th># Projects</th>
<th>Proprietary DB</th>
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<th>Complexity</th>
<th>Price per License</th>
<th>Notes</th>
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<tr>
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<td>n/d</td>
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<td>S=E</td>
<td>Low</td>
<td>- Web page for calculating project effort and duration - Results exportable on .txt files - Few languages for backfilling tables when working with FPA</td>
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<td>Comparative Estimating Tool (<a href="http://www.isbsg.org">www.isbsg.org</a>)</td>
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<tr>
<td>ISBSG r11 database, with 13 possible filters - Main results obtained: PDR (Project Delivery Rate), PWE (Project Work Effort), Speed of Delivery, Project Duration - Three-point estimations: Conservative, Likely, Optimistic</td>
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## Estimation Tools - 2

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### Estimation Tools - 4

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Agenda

- Introduction
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Case Study – 1

- With:
  - Product Life Cycle
  - How

- Product Feature Tree
- What
Case Study – 2

- With:
  - Work Breakdown Structure (WBS)

- Estimation Spreadsheet

- With these tools an estimation frame ("envelop") can be established

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Case Study – 3

From the what...

And the PLC...

The WBS has to be made: the estimation FRAME
Case Study – 4

- Estimation Worksheet
  - For each phase or increment: one spreadsheet
  - For each activity: one line

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Case Study – 5

- Estimation Rules
  - Always estimate without overhead
  - Always estimate without Reserve
  - Consider average (available) expertise
  - The estimation to do the job comes from the technical expert who will do the job.
Case Study – 6

- Estimations must be based on scenarios.
- Example:
  The project manager and the 5 team leads will meet weekly 2 hours for one year
  52*2*6 = 78 Person/Days

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Case Study – 7

- Other way of effort estimation is to rely on industrial benchmarks
- The ratio between "Productive" tasks and Mgmt and Admin is 65% to 35%, or 100% to 50%.
- Attention: these percentages are Project dimension-specific and must be measured first.
- Recommendation:
  Use the scenario strategy. Apply benchmark results. Evaluate different scenarios.
Case Study – 8

- Feasibility
  - Evaluate the feasibility of the estimate
  - Assess error probability and uncertainties in parameters

- Recommendation:
  Establish and periodically reevaluate your own thresholds, possibly on your own historical data

Case Study – 9

- Risk management
  - Estimates are often fuzzy and inaccurate
  - It is the right and duty of the project manager to include adequate risk mitigation

- Recommendation: Typical approach is prioritized increments combined with time buffer within the team.
Case Study – 10

- When the estimations are done, cost is calculated.
- This is where estimate, goal and plan will meet.
- Recommendation: First internally create feasible scenarios, then relate the scenarios to business needs, then look for buy-in, internally and externally

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Tage und Wochen

h/Tag: 8.2
h/Woche: 41

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Recommendations – Method

- **Estimations have business impacts**
  - Clearly distinguish goals, estimates and plans
  - Estimation is a cause-effect logic.
  - Estimation helps mitigating business risks
  - Target estimation accuracy in line with your business needs

- **Estimation needs process**
  - Immature processes will always cause ad-hoc behaviors with unpredictable results

- **Data is the resource, Information brings the value.**
  - Establish a robust process to report and store data
  - Verify and validate data before storing in historical databases
  - Use standard measurements (e.g. what is a LOC or a defect?)
  - Always analyze data to add information for the decision-making process

We achieved with many clients a preciseness of 10-20% within one year, which in most cases is sufficient.

Recommendations – Tools

- **A fool with a tool remains a fool**
  - Don’t use models you don’t know. Never use a tool to camouflage insufficient process ("the tools says so")
  - Garbage in, garage out. Tools do not provide value if the information is missing
  - Clarify the underlying data collection and estimation approach

- **Carefully introduce an estimation tool**
  - Evaluate different tools, considering needs and cost (there is even OSS)
  - Consider Total Cost of Ownership (TCO)
  - Budget and provide adequate training and coaching on estimation principles

- **Use estimation tools to grow**
  - Continuously improve. Don’t stay with the same parameters for longer than one year. Benchmark with the best to focus your improvements.
  - Challenge results and improve your efficiency each year

Do not rely on a tool, if there is no mature development process. This means management coaching and strong push for keeping commitments.
More Information

**Software Measurement**

Establish, Extract, Evaluate, Execute

by Christof Ebert and Reiner Dumke


The book to support this keynote with backup data, case studies and industry experiences – for better performance.

"Few organizations have really institutionalized measurement of their products and processes. This book is bang up-to-date in both fields and packed with practical advice. For every software engineer."

- Charles R. Symons

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**The IFPUG Guide to IT and Software Measurement**

A Comprehensive International Guide

Edited by IFPUG


The book proposes a worldwide perspective on software measurement, proposing 43 chapters by 52 authors from 13 different countries

"This book is an important contributor to the promotion and application of software measurement."

- Peter Hill (ISBSG)
Thank you for your attention.

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www.vector.com/consulting

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