

**1^oInternational Conference on
IT Data collection, Analysis and Benchmarking**
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Estimation - The Next Level



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Common Software Measurement International Consortium (COSMIC)

COSMIC Functional Size Measurement Method

International Advisory Committee

Dutch Association of Cost Engineers (DACE)

WG Parametric Estimation

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Estimation (concepts)



Cost Estimating



- The process of collecting and analyzing historical data and applying quantitative models, techniques, tools, and databases to predict the future cost of an item, product, program, or task

Purpose of cost estimating:

- Translate system/functional requirements associated with programs, projects, proposals, or processes into budget requirements
- Determine and communicate a realistic view of the likely cost (effort, schedule) outcome, which can form the basis of the plan for executing the work

A Bridge to the Future



Historical
data



Time
now

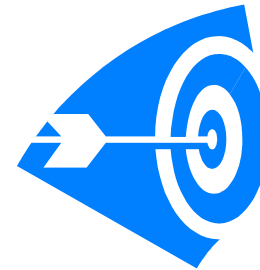


Estimate

Source: ICEAA training
<http://www.iceaaonline.org>

Estimation Techniques

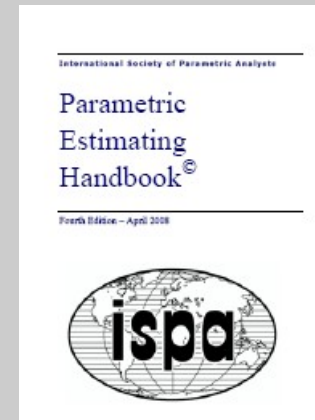
- Most Common
 - Extrapolation from Actuals
 - Expert Opinion
- The three essential cost estimating techniques (or methodologies) are:
 - Analogy
 - **Parametric**
 - Build-Up



Parametric Estimating - Process

- Collect Data
Relevant, Reliable
- Normalise Data
Cost level, activity level
- Determine correlations
- Validate correlations
 $R^2 > 0.8$ is useable
- Adjust Data Set when necessary
- Define CER/EER*
- Estimate the new object

https://www.iceaaonline.org/documentation/files/ISPA_PEH_4th_ed_Final.pdf



2012
ISPA & SCEA
are merged into
ICEAA

**Cost Estimation Relationship / Effort Estimation Relationship*

About



Association for the Advancement of Cost Engineering

not-for-profit organization

internationally oriented

Recommended Practices a.o.

17R-97: Cost Estimate Classification System

34R-05: Basis of Estimate

40R-08: Contingency Estimating: General Principles

42R-08: Risk Analysis and Contingency Determination Using Parametric Estimating



Certification a.o.

Certified Cost Consultant™ (CCC™)

Certified Cost Engineer™ (CCE™)

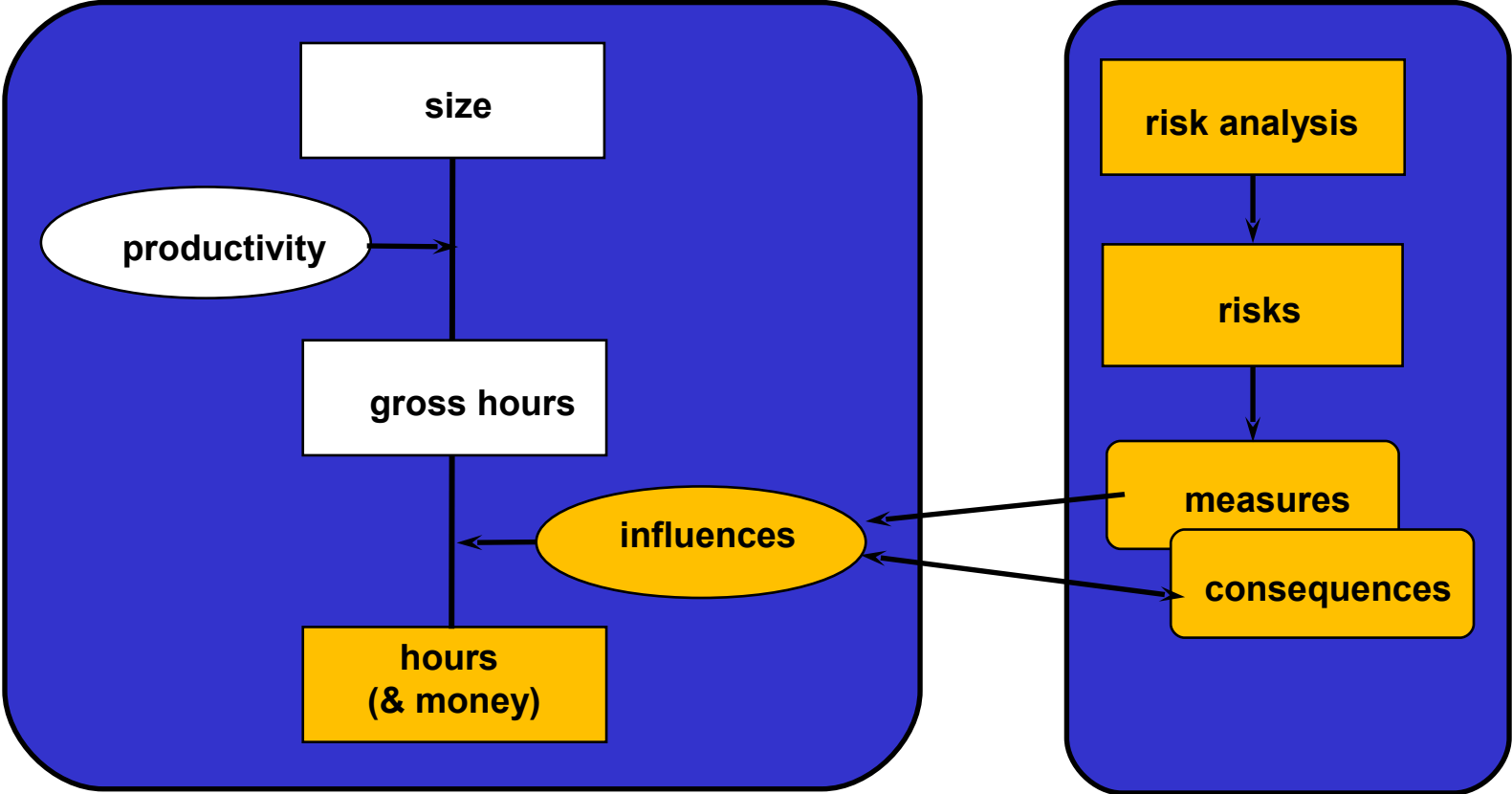
Certified Estimating Professional™ (CEP™)



IT Confidence 2013 - October 3, 2013

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Simplified Estimation Model



Size

- Basis of Estimate (**BOE**)

- **Quantity Metrics:** excavation and backfill quantities, concrete volumes, piping quantities, ...

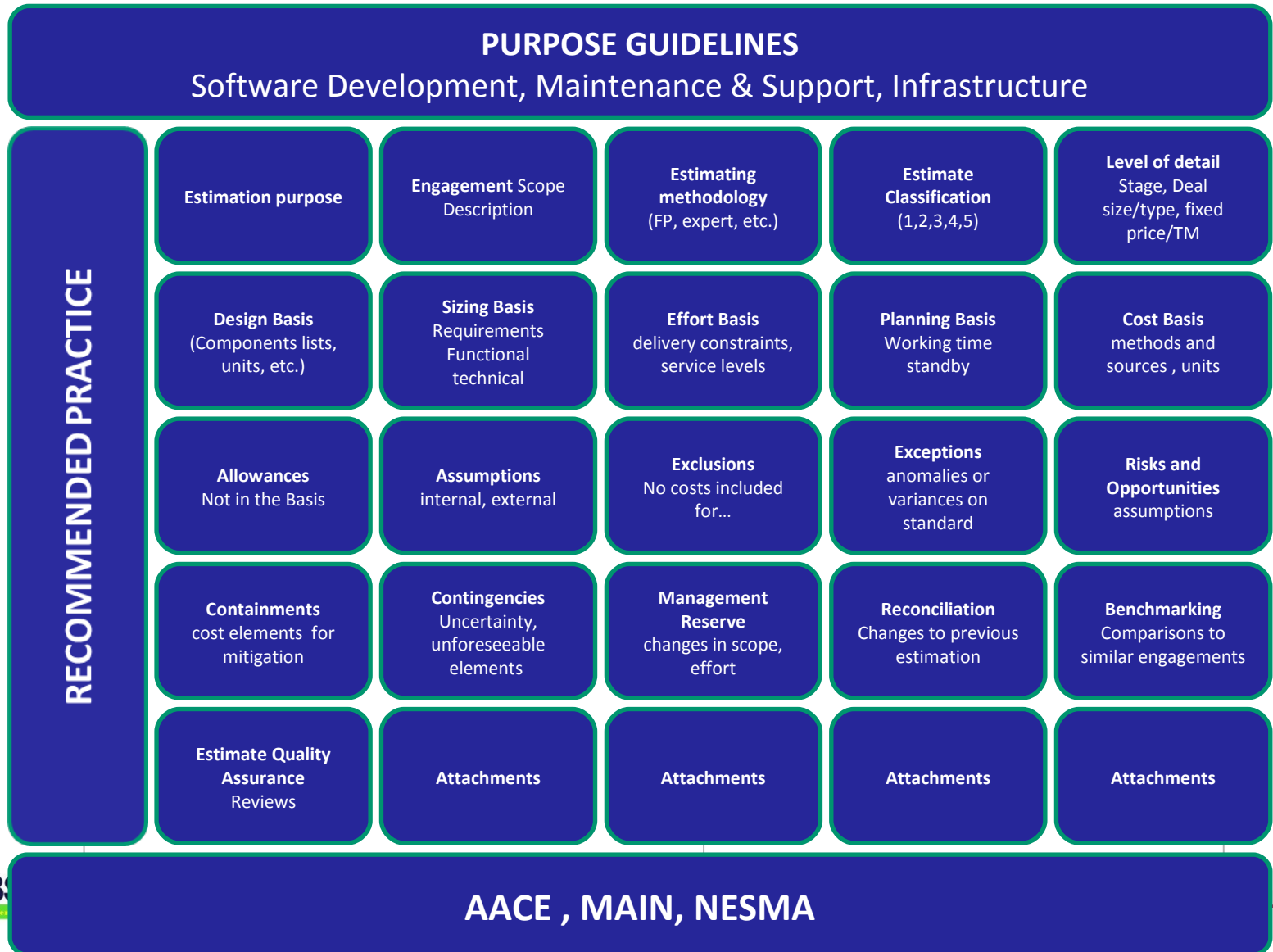
These may be organized by facilities, process train or manufacturing unit.

- Basis of Estimate – Software Services

- **Requirements:** # use cases, # backlog items, ...
- **Functional size:** Function points
Measurement methods: IFPUG, NESMA, COSMIC, FiSMA, ...
- **Non Functional size:** SNAP (Measurement method)
- **Technical size:** (source) lines of code, # interfaces, modules, ...
- **Service size:** # incidents, tickets, users, locations, ...

These may include expected error range, level of accuracy and method of 'measuring' (e.g. "Backfired", detailed)

Basis of Estimate – Software Services



The Tax System Case Study



Customer Challenge

- **Tender** requested by Dutch Tax Office for a New Full Tax Information System including Registration, Levying, Controlling & Reporting
- Functional size provided in the request for tender (Most likely based on an internal sizing exercise)
- Initial work
 - Base Application 5000 Function Points
 - Time Frame 2 Years
- Extended work
 - Enhancements 3000 Function Points
 - Time Frame 3 Years
- Support
 - 5 Years

Supplier Challenge

The proposal should address:

- An all-in price per Function Point
- Approach (Development, Test, Quality Assurance)
- Technology
- Organizational Structure

This requires:

- Functional “excellence”
- Transparent estimates / right expectations
- Functional Size Measurement knowledge / experience
- Historical data

Proposal (Template)

Gegevens gegadigde:

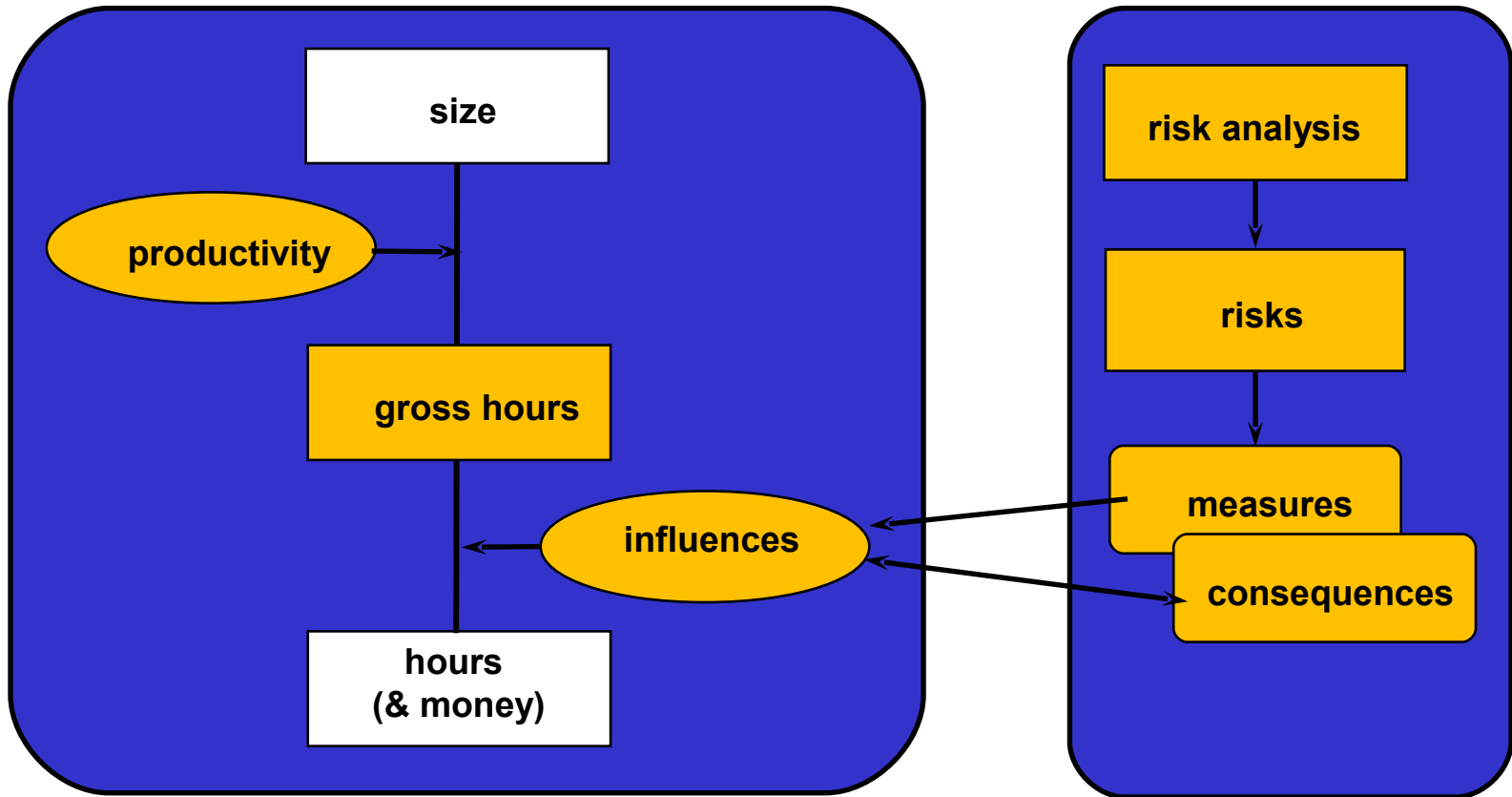
Naam = invoerveld
 Code offerte

Optie A
 Standaard pakket + maatwerk

Optie B
 Volledig maatwerk

Samenvatting OFFERTE	OPDRACHT			
Assignment Standard Package Additional development Maintenance & Support Realisation services Non functional Development, Realisation, Assembly & Acceptation Maintenance & Support	Standaard pakket	\$	483.333,33	
	Volledig ontwikkeling	\$	8.000.000,00	
	Beheer en Onderhoud	fixed fee	\$	8.483.333,33
			\$	6.786.666,67
				\$ 15.270.000,00
	RTBRENGINGSERVICES			
	functionele	\$	347.222,22	
	A	\$	500.000,00	
	Beheer en Onderhoud	\$	847.222,22	
		\$	100.000,00	
		\$	947.222,22	
	Totaal	\$	16.217.222,22	
	Omzetbelating	\$	-	
	GUNNIGSWAARDE	\$	16.217.222,22	

Simplified Estimation Model



Validating Size of Core Application

Sizing sheet results

Size	4636 FP
• Logical Files	138
<i>Validation:</i>	<i>33.59 FP / Logical File</i>
<i>Reference NESMA</i>	<i>35.00 FP / Logical File</i>
• Technical Tables	240 (Data Base Tables)
<i>Validation:</i>	<i>19.32 FP / Technical File</i>
<i>Reference NESMA</i>	<i>25.00 FP / Technical File</i>

Note: System is considered closed, all files are internal (maintained)

Estimating the indicated size

Organization	Inspectie der Belastingen	Inspectie der Belastingen	Eilandsontvanger/Landsontvanger
Tables in the database	40	32	240

Core Application 4636 FP

- Application 1
32 tables, 5 taxes
 $32 * 19.32 * 5$

3095 FP

- Application 2
40 tables, 1 tax
 $40 * 19.32 * 1$

773 FP

- TOTAL current system

8504 FP

- New System
Assumption 60% of
the current system

5102 FP

Assumption:
All functionality
unique
(maybe similar but
not equal)

Limited Historical Data

Analyze Historical Data

- Validate the current system
- Validate the expert estimate of the new system
- Validate the application developed with new Framework

Determine activities included in base performance

- Mix waterfall (base design) / iterative (prototype)
- Proposal requirements (template)

Finding reference material

- ISBSG
- Parametric Estimation (SEER for Software)

Data Analysis

Validation of the current system

- Approx. 8,000 FP
Developed equivalents 10,000 FP over time
- Team size 6 – 14 FTE
Effort 75,000 – 85,000 hours
- Performance 7.5 - 9 hours / FP

Validation of a similar system (Framework developed)

- Sized 600 FP (based on 30 technical files)
- Effort 5,200 hours
includes training / learning curve
- Performance 8 - 9 hours / FP

Validation of the Expert estimate

- Assumed 5000 FP
- Expert estimates 'performance' to be 3 – 4 hours / FP
(Expected effort / 5000)

CONCLUSION:

Expert estimate is likely too optimistic

External Validation

Create/Modify WBS Element

[Guide me using Project Assistant](#)

SEER For Software

Create/Modify WBS
This dialog box lets you describe a new project or WBS element.

Switch to Wizard
Use the SEER Project Assistant to create a new project or work element.

Description
Enter text to uniquely identify the item

Notes
Enter work element notes.

Analyst
The analyst who is estimating this project.

Volume Inputs
(Project only) Select one or more sizing metrics

FBS Method
(Project only) For Function Based Sizing, select a

Description: New Development Notes...

Analyst: TD

Element Type

Rollup Program Component COTS Unit

Indenture

Level 2

Knowledge Base Selections

Platform: Business Mission Critical

Application: MIS

Acquisition Method: Concept Reuse

Development Method: Waterfall

Development Standard: IS Formal

Class:

Sizing Methods: Lines, Functions; none

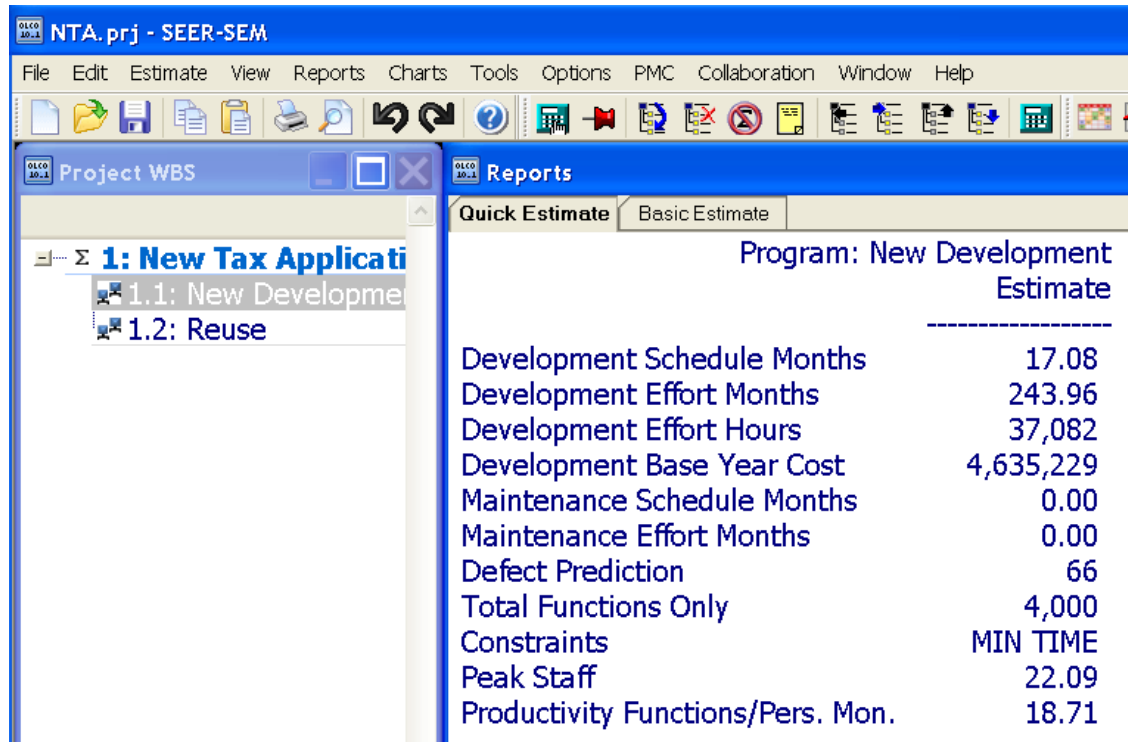
Start Date: 9/08/2010

Create and Insert Next Element OK Cancel

Created 9/08/2010 17:18:02 Modified 9/08/2010 19:06:45

External Validation (II)

Assumed 4000 FP new development



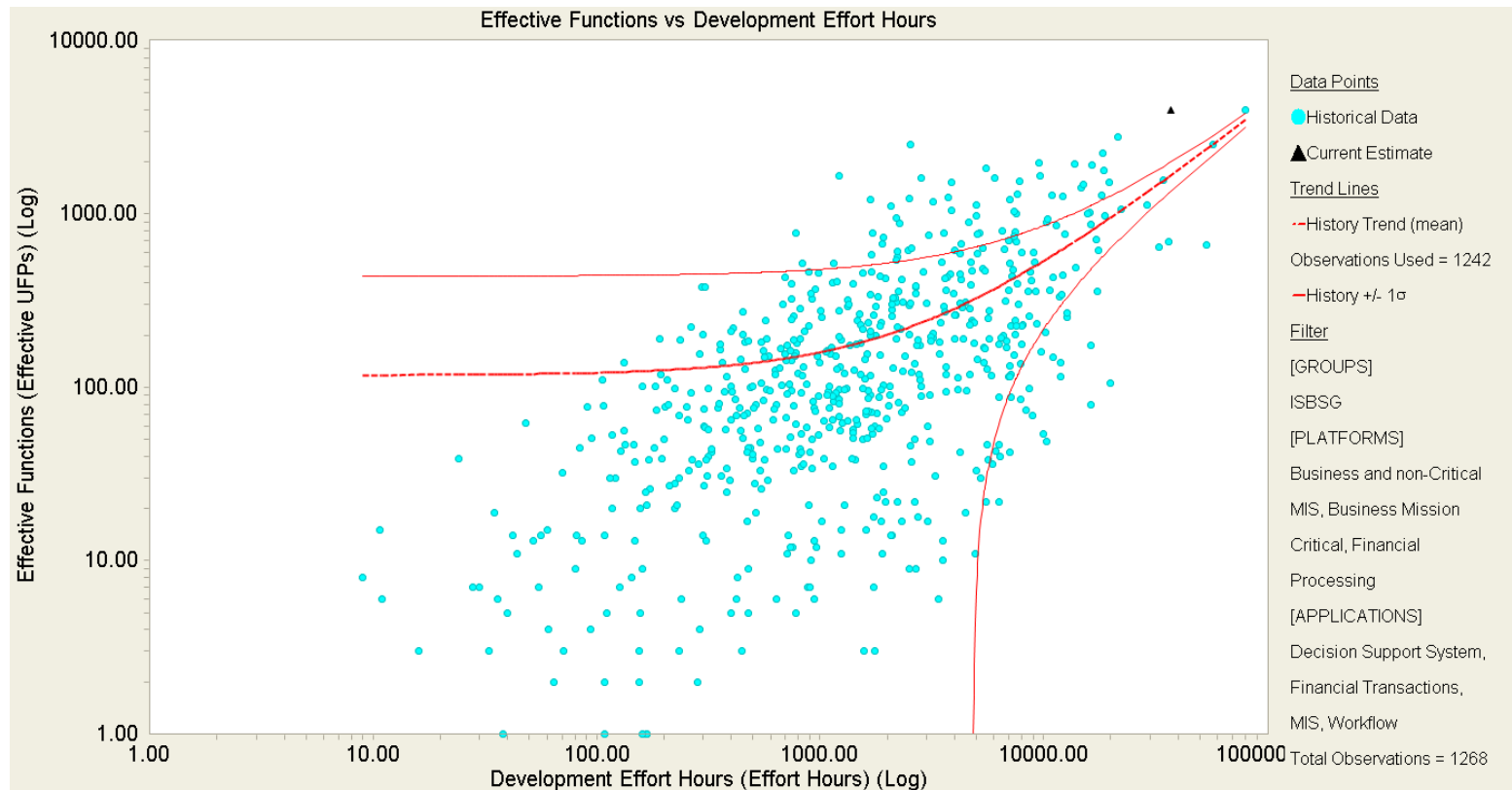
The screenshot shows the OLCO 30.1 software interface. The main window is titled "NTA.prj - SEER-SEM" and has a menu bar with options: File, Edit, Estimate, View, Reports, Charts, Tools, Options, PMC, Collaboration, Window, Help. Below the menu bar is a toolbar with various icons. The interface is split into two panes. The left pane, titled "Project WBS", shows a hierarchical tree structure with the following items: "1: New Tax Applicati", "1.1: New Developme", and "1.2: Reuse". The right pane, titled "Reports", shows a "Quick Estimate" report for "Program: New Development Estimate". The report contains the following data:

Program: New Development Estimate	
Development Schedule Months	17.08
Development Effort Months	243.96
Development Effort Hours	37,082
Development Base Year Cost	4,635,229
Maintenance Schedule Months	0.00
Maintenance Effort Months	0.00
Defect Prediction	66
Total Functions Only	4,000
Constraints	MIN TIME
Peak Staff	22.09
Productivity Functions/Pers. Mon.	18.71

Performance 8.12 hours / FP (= 152 / 18.71)

External Validation (III)

Benchmark estimate with ISBSG



Conclusion [April 2010]

(**After winning the tender**)

Parametric based estimates provides

- Less risk of underestimating
- Transparent and defensible proposals
- Objective approach
- Realistic expectations on
 - Cost
 - Effort
 - Capacity required

Actual Situation [Sept 2012]

Delivered release 2.2

- Size agreed 3700 FP [75% of indication]
Size customer 3705 FP
Size supplier 3690 FP
- Agile Development using **Be Informed**
a generic business process platform, based on Forrester's dynamic case management principles
- Performance
 - Supplier Effort New, Change, Rework
Cost
 - Customer Size Management
Change Management

Conclusion [September 2012]

(After delivery 2.2)

Parametric based estimates provide

- Less risk of underestimating
- Transparent and defensible proposals
- Objective approach
- Realistic expectations on
 - Cost **Knowing the right personnel mix**
 - Effort **Limited experience with Be Informed**
 - Capacity required
- Rework and Conversion are challenges
 - Requires separate approach / performance conditions

Basis of Estimate – Software Services

PURPOSE GUIDELINES					
Software Development, Maintenance & Support, Infrastructure					
RECOMMENDED PRACTICE	Estimation purpose	Engagement Scope Description	Estimating methodology (FP, expert, etc.)	Estimate Classification (1,2,3,4,5)	Level of detail Stage, Deal size/type, fixed price/TM
	Design Basis (Components lists, units, etc.)	Sizing Basis Requirements Functional technical	Effort Basis delivery constraints, service levels	Planning Basis Working time standby	Cost Basis methods and sources , units
	Allowances Not in the Basis	Assumptions internal, external	Exclusions No costs included for...	Exceptions anomalies or variances on standard	Risks and Opportunities assumptions
	Containments cost elements for mitigation	Contingencies Uncertainty, unforeseeable elements	Management Reserve changes in scope, effort	Reconciliation Changes to previous estimation	Benchmarking Comparisons to similar engagements
	Estimate Quality Assurance Reviews	Attachments	Attachments	Attachments	Attachments
AACE , MAIN, NESMA					

Good

- H
- A
- L
- na
- L
- A
- H

Poor

Conclusions (General)

- Estimation (validation)
Consistent structure (e.g. Basis of Estimate)
Embedded process
- Benchmarking
Validation Estimate / Proposal
Historical data (Internal/External)
- Metrification
Consistent approach
Auditable calculations (e.g. tool-based)
- Management & Control
Metrification (direct data collection)
Re-estimation (reflecting direct data)
Risk Control

Q & A

