



**COBRIX**  
COBRIX

**Release 2.6**

**User Manual**

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## Table of Contents

<b>A</b>	<b>The Installation</b>	<b>1</b>
A.1	JAVA Runtime Environment Installation	1
A.2	COBRIX Installation	1
<b>B</b>	<b>Usage of COBRIX</b>	<b>2</b>
B.1	Starting COBRIX (CoBRA Project Selection Dialog)	2
B.2	Import CoBRA Project	3
B.3	Initialization of a New CoBRA Project	4
B.4	CoBRA Process Overview	5
B.5	Export CoBRA Project	6
B.6	Import Cost Factors	7
B.7	Synthesize Organization-Relevant Cost Factors	8
B.8	Export Cost Factors	9
B.9	Expert Management	9
B.10	Cost Factor Ranking by Experts	10
B.11	Choose Most Important Cost Factors	12
B.12	Build Causal Model	14
B.13	Collect Multiplier Data	22
B.14	Synthesize Multiplier Data	25
B.15	Choose Past Project Data Type	26
B.16	Elicitation of Past Project	26
B.17	Validation of the CoBRA Model	28
B.18	Enter New Project Data	33
B.19	Project Simulation	35
B.20	Estimate Project Cost	36
B.21	Analyze Project Cost Risk	37
B.22	Benchmark Projects	38
<b>C</b>	<b>Configuration File</b>	<b>40</b>
C.1	Causal Model Visualization	40
C.2	Predefined Scale Types	40
C.3	Predefined Cost Factor Categories	41
C.4	Change DB Server Settings	41
C.5	Debug Settings	42
C.6	Productivity Model	42
C.7	Project Simulation	43
C.8	Other Properties	43



## A The Installation

The following installation description assumes that you are using a Microsoft Windows PC. If you are using another operating system, the procedure may be slightly different. The installation of the CoBRA™ Tool CoBRIX is very simple, but to execute **CoBRIX**, you **must have installed the newest version of the Java Runtime Environment** (or at least version 6 or higher), which is available from the website [www.java.com](http://www.java.com).

### A.1 JAVA Runtime Environment Installation

If you have not installed Java in version 6 or higher or if you are not sure which version of Java is installed on your computer, please go to [www.java.com](http://www.java.com) and follow the installation instructions you find there.

### A.2 COBRIX Installation

The installation of the CoBRA™ Tool itself is very simple.

Just unzip the folder 'CoBRIX\_R2.5.2' in the CoBRIX\_R2.5.2.zip file to a directory on your hard disk, e.g., 'C:\Program Files\CoBRIX'.

## Usage of COBRIX

### Starting COBRIX (CoBRA Project Selection Dialog)

## B Usage of COBRIX

In this section, we provide a short introduction on how the CoBRA Tool can be used to collect data, build and validate an estimation model, and how to use it for cost estimation, risk analysis, and benchmarking. We start by explaining how a new CoBRA project can be created and how an old one can be reloaded.

### B.1 Starting COBRIX (CoBRA Project Selection Dialog)

To run the application, double click on the file '**COBRIX.exe**', which can be found on your hard disk in the 'COBRIX\_R2.5.2' folder.

When you start the CoBRA Tool, a dialog similar to the one below appears:



You can choose to start a new CoBRA project (i.e., create a new model) by pressing the 'New' button or continue working with an existing one by choosing the appropriate project and pressing 'Open', or you can import an XML file containing a CoBRA model/project ('Import').

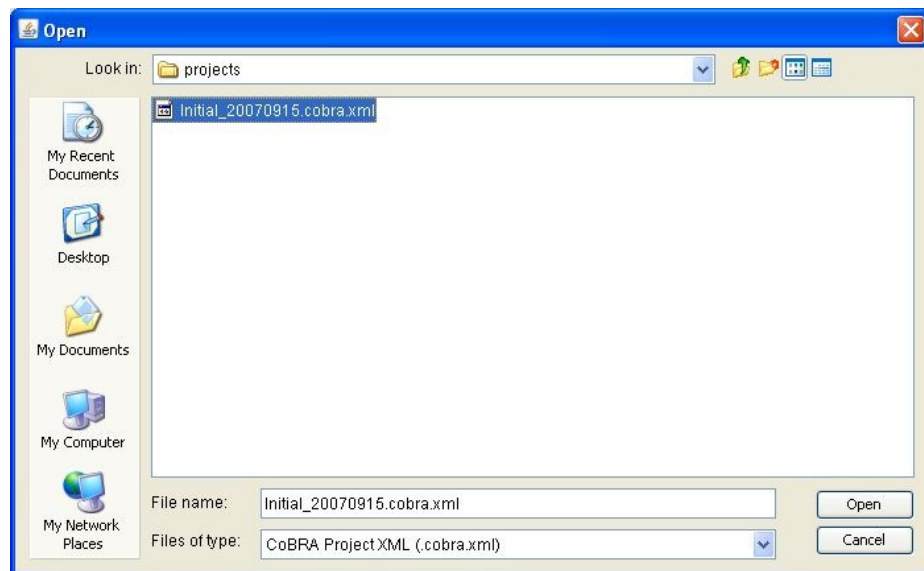
- If you chose to work with an *existing project*, the project overview dialog appears, showing the actual state of the CoBRA project (see CoBRA Process Overview).



- If you chose to create a *new CoBRA project*, the first step is the project initialization (see Initialization of a New CoBRA Project).
- If you chose to *import an XML file* containing a CoBRA model, you can select the XML in a file dialog (see Import CoBRA Project) and then return to the project selection dialog.

## B.2 Import CoBRA Project

By pressing the 'Import' button, you get to the following dialog:



In this dialog, you can import an XML file ('.cobra.xml') with an existing CoBRA project/model. After choosing a file and pressing the 'Open' button, you can choose a name for the imported CoBRA project/model. After a valid name has been chosen, you return to the CoBRA Project Selection Dialog.

### B.3 Initialization of a New CoBRA Project

The screenshot shows a dialog box titled "Initialization of your CoBRA Project". It contains the following fields and values:

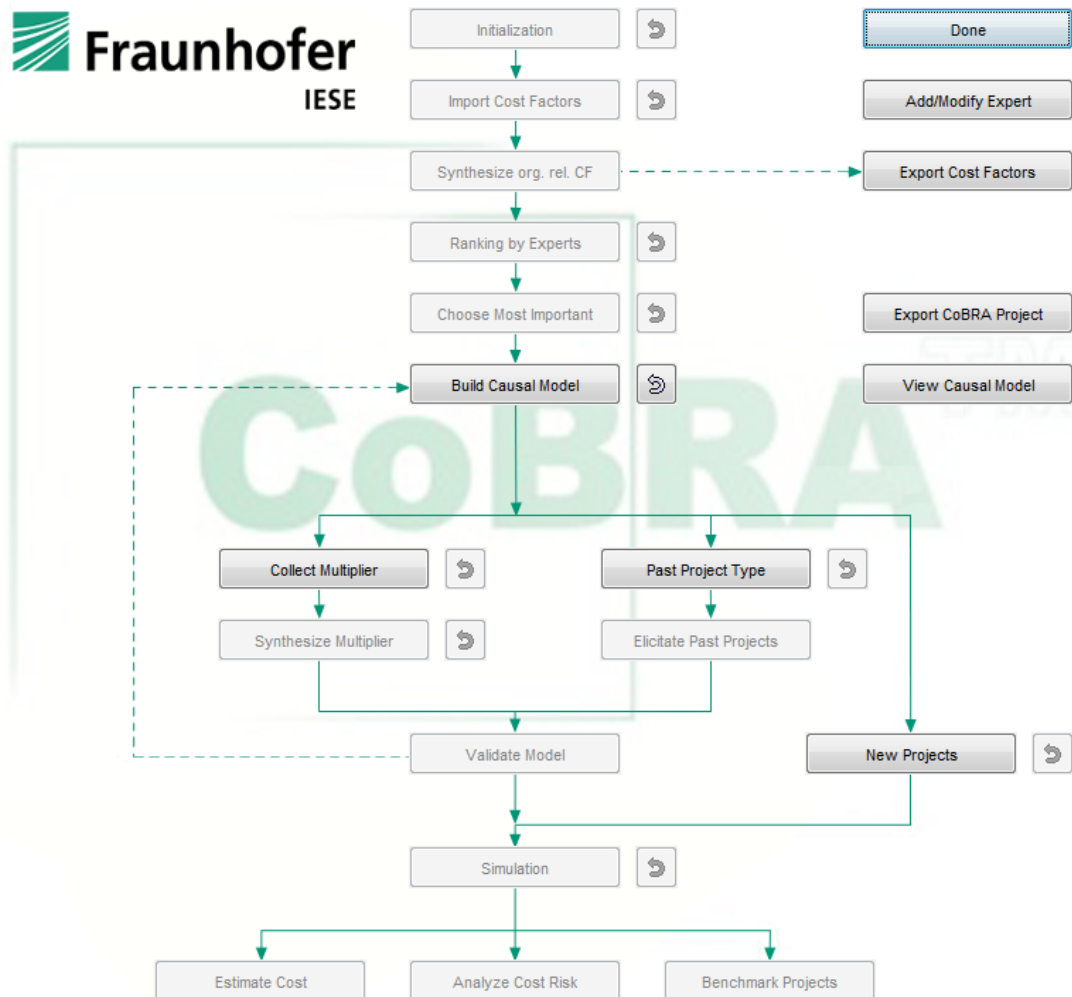
- CoBRA Project**
  - Name: My CoBRA Project
  - Context: automotive industry, embedded, C++, maintenance
- Project size metric**
  - Unit: kLoC
  - Definition: kilo lines of code, without comments
- Project cost metric**
  - Unit: PH
  - Definition: person hours
- Expert experience metric**
  - Unit: #projects
  - Definition: number projects in this context

Buttons: Ok, Cancel

First, you have to enter the project name. Then you can enter the context (scope) of the CoBRA project. In addition, you should decide on the size, cost, and experience metric you want to use.

The 'Ok' button brings us to the Process Overview Dialog.

B.4 CoBRA Process Overview



The process overview dialog guides us through the CoBRA process. All process steps you can do next are shown as enabled buttons:



Process steps that cannot be executed yet are disabled:



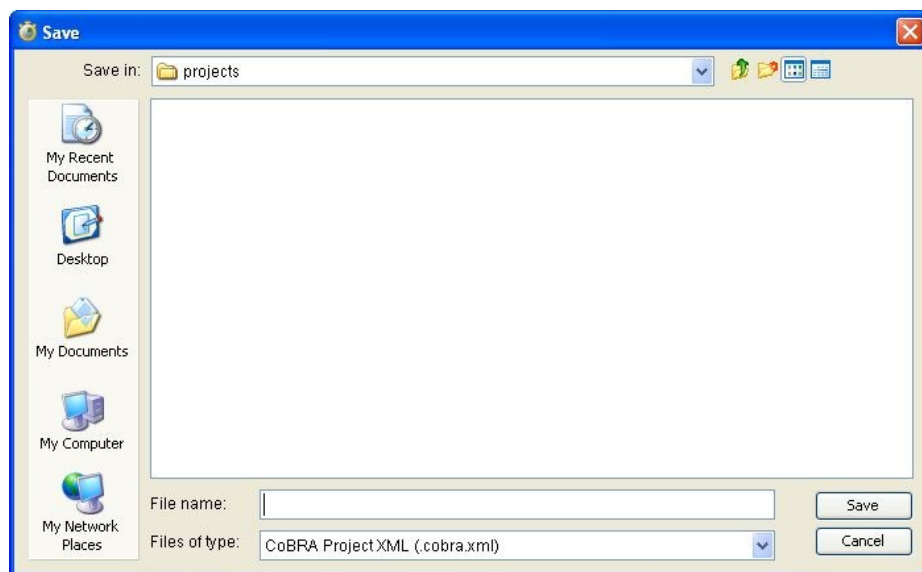
If you want do undo a previous process step, you can use the undo button:



The 'Done' button closes COBRIX. The current project state is safe in the database and you can continue working by choosing the project in the starting dialog ('CoBRA Project Selection').

## B.5 Export CoBRA Project

The CoBRA project, i.e., the model developed, can be stored in an XML file at any point in time. This is especially useful after the validation of the model is completed successfully. To export the current CoBRA project/model, press the 'Export CoBRA Project' button. The following dialog appears:

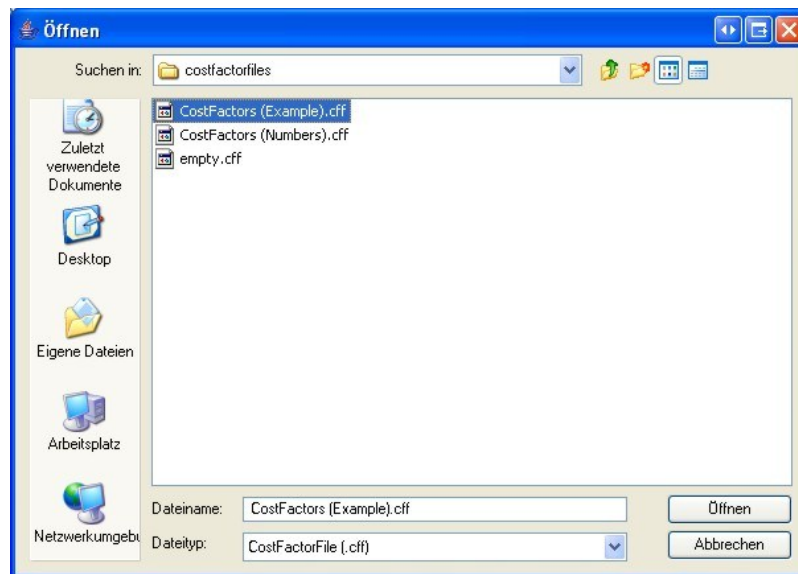


In this dialog, you can export our model as a CoBRA Project XML file (\*.cobra.xml).

*Remark:* Modifications made during the different steps of model development are stored directly in the current model. Modifications also remain if you leave the actual CoBRA project (i.e., you do not need to store the changes in the model explicitly). However, if you want to store a certain state of the CoBRA project/model or exchange a project/model with other persons, you can export the current state of the project/model as an XML file. You can also use the export function to migrate our models to a newer CoBRIX version.

## B.6 Import Cost Factors

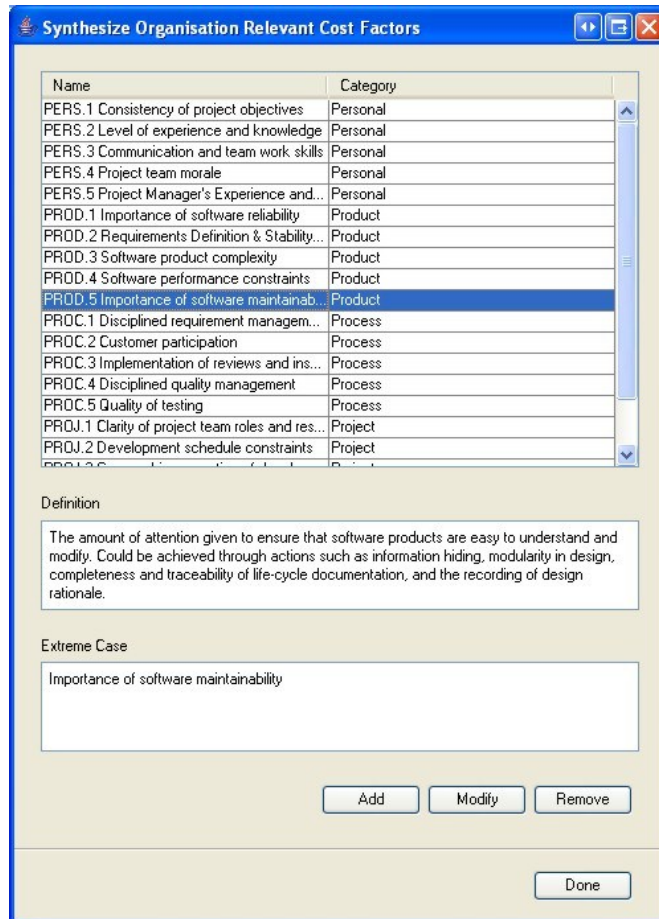
By pressing the 'Import Cost Factor' button, you get to the following dialog:



In this process step, you can import a proposal list of predefined cost factors. If you want to start without using such a list, you can load 'empty.cff', which contains no cost factors.

## B.7 Synthesize Organization-Relevant Cost Factors

By pressing the 'Synthesize org. rel. CF' button, you get to the following dialog:



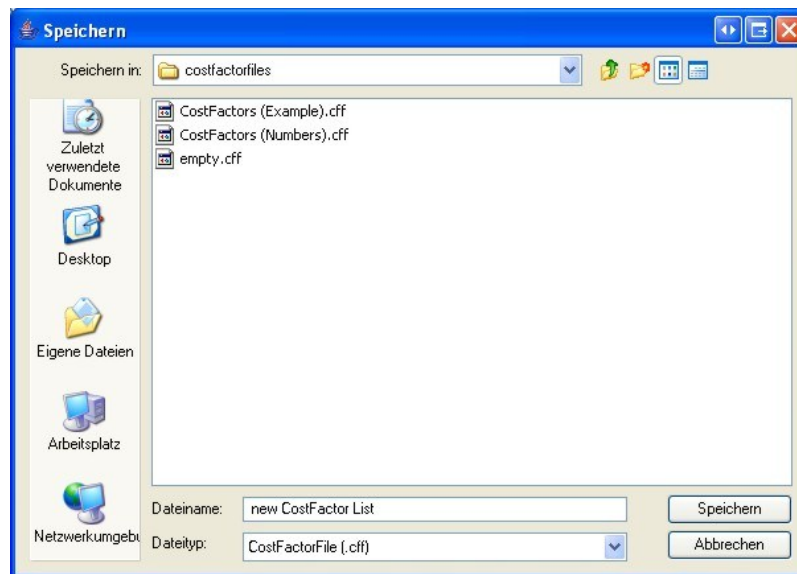
This dialog shows all cost factors that are mentioned as relevant in the scope of the CoBRA project and should therefore be ranked by the experts.

When selecting a cost factor, its definition and its extreme case (worst case) are shown.

You can remove cost factors that are not relevant in our context. In addition, existing cost factors can be modified and new cost factors can be created.

## B.8 Export Cost Factors

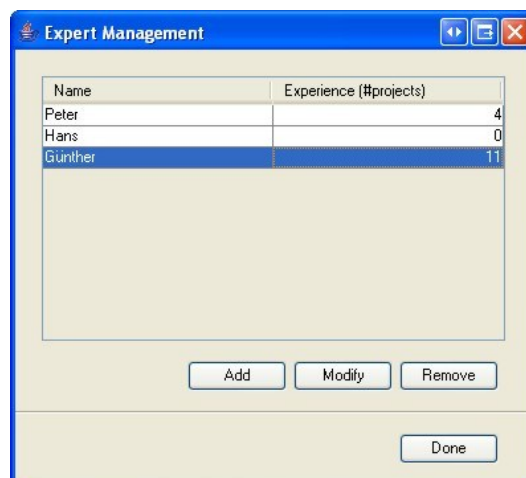
By pressing the 'Export Cost Factors' button, you get to the following dialog:



In this dialog, you can export our modified list of cost factors as a cost factor file (\*.cff) in XML format. You can reuse this modified list of cost factors, for example, in later CoBRA projects.

## B.9 Expert Management

By pressing the 'Add/Modify Expert' button, you get to the following dialog:



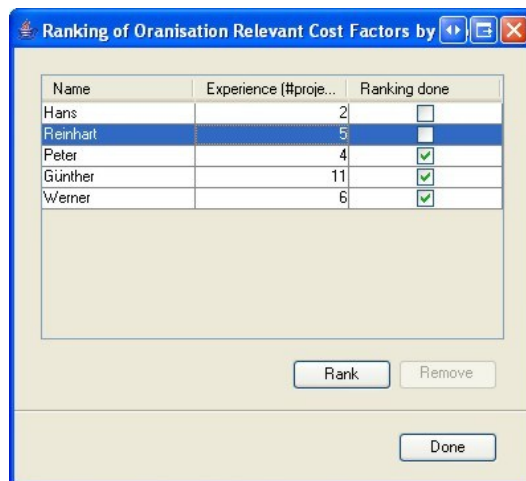
This dialog allows managing the participating experts in our CoBRA project.

You can add new experts (with their experience level) to the CoBRA project, you can modify existing experts, and you can remove them from the CoBRA project.

*Remark:* You can only remove an expert from the project if the expert does not participate in any CoBRA estimation activity, like the ranking of cost factors or multiplier estimation.

## B.10 Cost Factor Ranking by Experts

By pressing the 'Ranking by Experts' button, you get to the following dialog:



*Remark:* If you have no expert in our project, you find an empty table. You can add required experts in the Expert Management dialog.

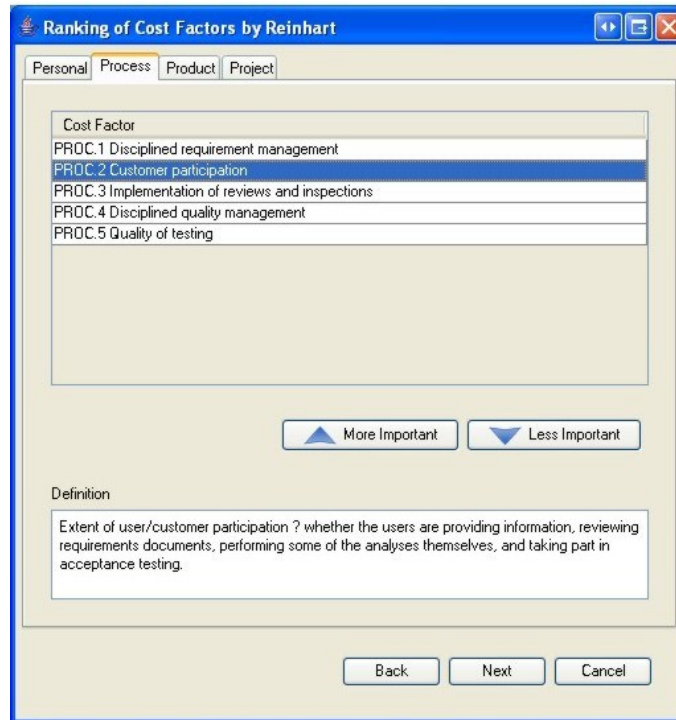
In this process step, the experts can rank the organization-relevant cost factors. If an expert has completed his ranking, this is automatically marked by a check:

Günther	11	<input checked="" type="checkbox"/>
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The rankings can be modified or removed.

For experts who have not ranked the cost factors, you can start the ranking process by pressing the 'Rank' button.





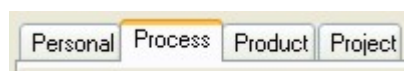
In this dialog, the experts can rank the cost factors for each category.

To do this, they use the 'More Important' and 'Less Important' buttons,



which move the selected cost factor in the list one position up (more important) or down (less important). To support the ranking process, the definition of the selected cost factor is shown.

To navigate through the individual categories,

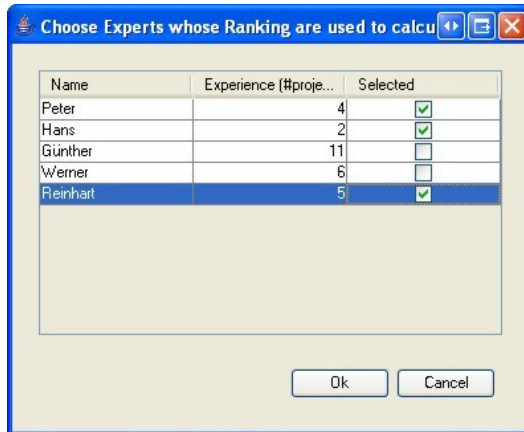


the 'Back' and 'Next' buttons can be used.

After the cost factors of all categories have been ranked, you can close the dialog and store the rankings with the 'Finish' button.

### B.11 Choose Most Important Cost Factors

By pressing the 'Choose most important' button, you get to the following dialog:



There, you can mark the experts whose cost factor rankings should be used to create the statistics.

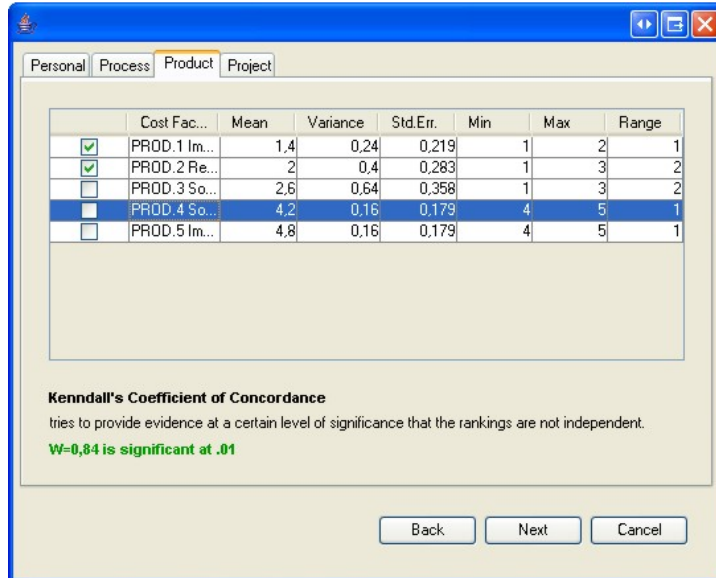
Ranking is used (click on check to remove mark):



Ranking is not used (click on check to mark):



By pressing the 'Ok' button, the statistics for the cost factors are created:



For each category, cost factors are sorted by their importance, with the most important one on top. Ranking statistics are presented. They contain the mean, the variance, the standard error, the minimum, the maximum, and the range of the rankings provided by the previous selected experts.

In addition, the coefficient of concordance (Kendall) is computed, which allows checking whether the statistics are meaningful. Significance at .01 and .05 is shown:

**W=0,84 is significant at .01**

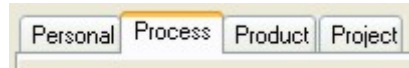
It is also shown if there is no significance:

**W=0,65 is NOT significant**

You can select the most important cost factors that you want to use in our CoBRA model:

<input checked="" type="checkbox"/>	PROD.2 Re...	2	0,4	0,283	1	3	2
-------------------------------------	--------------	---	-----	-------	---	---	---

To navigate through the individual categories,



the 'Back' and 'Next' buttons can be used.

When the most imported cost factors have been marked for all categories, you can store our selection and close the dialog with the 'Finish' button.

## B.12 Build Causal Model

By pressing the 'Build Causal Model' button, you start the CoBRIX Editor. It allows us to create a graph representing the causal model you use for the cost estimation. The vertexes of a graph are (cost) factors or variables and the edges are so-called influence relationships, which model the dependencies between factors/variables.

### B.12.1 Create New or Open Existing Causal Model

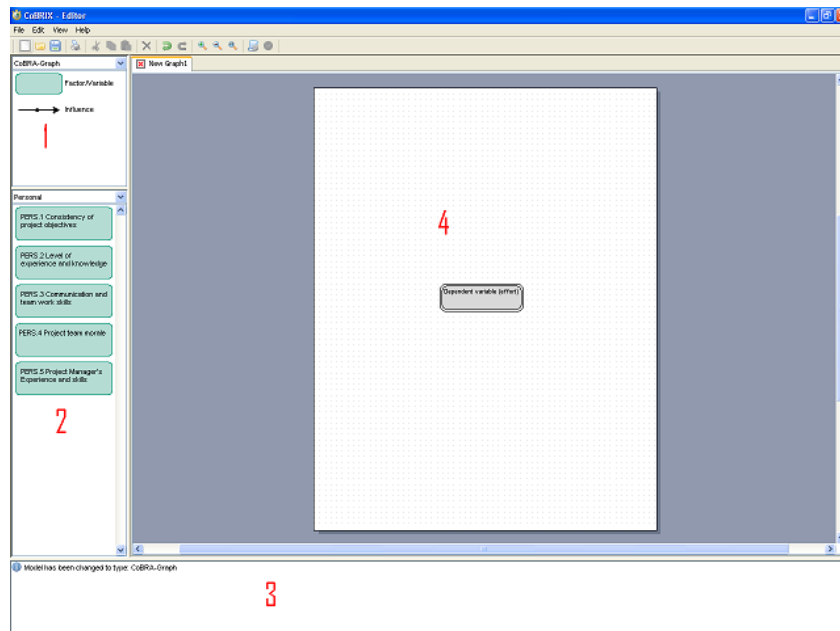
When starting the CoBRIX Editor, you have the option of either creating a new graph or loading an existing graph. It is possible to open or create up to 10 different graphs. Each of them is stored in its individual tab.

The corresponding icons are located on the tool bar:



### B.12.2 Causal Model Editing

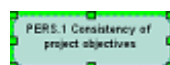
After creating or opening a graph, you can see the following sections:



## 1: Tool Box Section

In this section, you have the elements 'Factor/Variable' and 'Influence'.

There are two options to add a new factor or variable to the graphical section **4**: One can either select the box 'Factor/Variable' in section **1** and click on any point of section **4**, or one can drag and drop the box 'Factor/Variable' to section **4**.

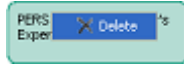


As soon as at least two cost factors are in section **4**, you can connect them with an influence or an edge. For this, you need to select the "Edge" or "Influence" button in section **1** and move the mouse cursor to the center of the cost factor so that it is surrounded by green border lines. Press the left mouse button and pull the line to the connecting factor. As soon as the cost factor is also surrounded by a green border, you can release the left mouse button. Now the two factors are connected by an influence relationship.

## 2: Cost Factor Section

This section presents the cost factors that were defined and ranked in the previous stages of the CoBRIX tool. Each cost factor can be dragged and dropped from section **2** to section **4**.




At the top of section **2** in the combo box, you can select a specific category.



To remove a cost factor from the factor list, right-click on the cost factor and select 'Delete'. Some cost factors cannot be removed because they have been defined as important in the previous stages of the CoBRIX tool. In those cases, you will get a warning in section 3.

### 3: Message Box Section






In the message box section, you can see all relevant information, warnings, and exceptions of the current graph:

- Simple activity information is preceded by the icon .
- Warnings are not critical but provide information if data is missing or activities are not possible. Warnings are preceded by the icon .
- Exceptions are critical and indicated by the icon .















### 4: Graphical Section

In the graphical section, you can design the graph. As mentioned above, you can drag and drop important or new cost factors to the graph section. Influences between the factors can be drawn by selecting the 'Influence' element in section 1.

#### Functions on the tool bar or/and menu bar

-  'New' creates a new graphical environment in a new tab. It is possible to have up to 10 different tabs/graphs at one time.
-  'Open' loads a graph in a new tab and its graphical environment. In contrast to the 'New' function, the 'Open' function loads a graph from a file, which contains factors and influences.
-  'Check': By pressing this button, the system verifies the designed graph and informs you in sections 3 and 4 whether the graph is consistent with syntactic modeling rules. In case of inconsistency, the warning icon(s)  appear(s). For more information about rules, see the chapter 'Validation' below.
-  'Accept': The accept button is enabled only if you pressed the check button before and the graph does not violate any modeling rules. This means

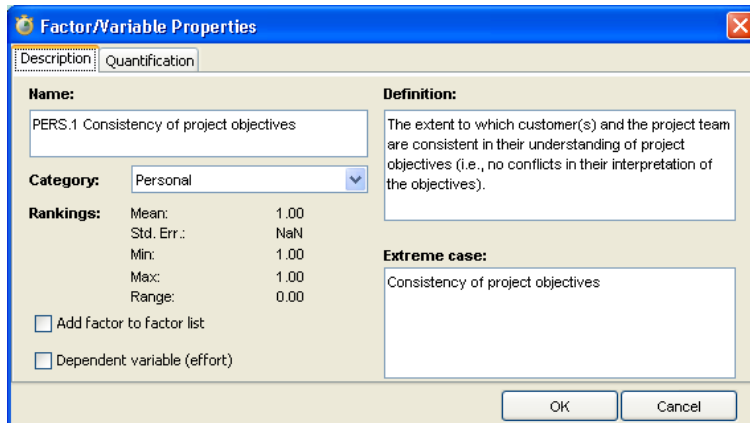
that the graph is a valid CoBRA causal model that can be stored in the database. By pressing the 'Accept' button, the necessary data regarding cost factors, variables, and influences will be stored in the database, and the CoBRIX Editor will be closed. In the CoBRIX tool, the step 'Build Causal Model' will be marked as completed.

-  'Save': As soon as the graph has been modified, you can save the current graph to a file. If the graph was not saved before, the function 'Save As' will be used automatically.
-  'Save As' is similar to the 'Save' function but allows you to provide a file name for the saved graph.
-  'Page Setup' allows choosing the page size and orientation as well as the printing settings.
-  'Print' sends a print job to print the current graph.
-  'Exit' closes the CoBRIX Editor. Modifications will not be stored in the database.
-  'Cut' cuts the selected cost factors or influences from the graph and stores them on the clipboard.
-  'Copy' copies the selected cost factors or influences and stores them on the clipboard.
-  'Paste' inserts all cost factors and influences stored on the clipboard into the currently selected tab and its graphical environment.
-  'Delete' deletes the selected cost factors and influences.
-  'Undo' undoes the last activity/activities.
-  'Redo' restores the last undone activity/activities.
- 'Select All' selects all factors and influences of the current tab and its graphical environment.
- 'Select None' deselects all factors and influences.
-  'Zoom In' zooms into the graphical environment by 120%.
-  'Zoom Out' zooms out of the graphical environment by 120%.
-  'Fit to Size' resets the page to its visible and graphical page size.



### B.12.3 Modify Factors or Variables in the Causal Model

A dialog containing the properties of a factor/variable appears when you select and right-click the factor/variable (or double-click the left mouse button) on a cost factor.



Rankings:	
Mean:	1.00
Std. Err.:	NaN
Min:	1.00
Max:	1.00
Range:	0.00

The 'Description' tab contains all information relevant for a cost factor:

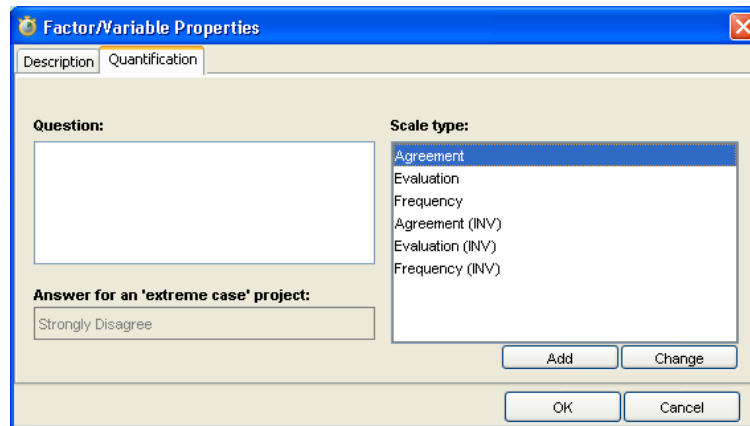
- The 'Name' of the factor/variable must be unique in the graph.
- A cost factor belongs to one 'Category', which is defined in the category field. If the vertex is a variable, then the category field must not be defined.
- 'Rankings' provide statistical data based on the results of the previous step 'Expert Ranking' in the CoBRIX tool. The information cannot be edited. Newly created cost factors/variables do not contain ranking data.
- In the graph, we differentiate between cost factors, variables, and the dependent variable (i.e., the project effort/cost). Each graph needs exactly one dependent variable.
- 'Definition' and 'Extreme case' store detail information about the factor/variable, but they do not have an influence on the representation of the factor in the graph.

### B.12.4 Quantify Factors or Variables in the Causal Model

A dialog containing the properties of the selected 'Factor/Variable' appears when you right-click the factor/variable (or double-click it with the left mouse button).

The tab 'Quantification' contains all information relevant for variables:



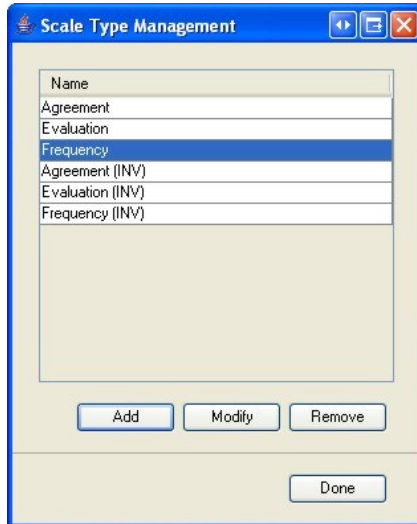


- The 'Question' provided here will be answered in a subsequent step for each historical and new project in order to characterize the project with respect to the variable.
- 'Scale Type' is used to provide predefined answer possibilities for the stated question. According to the selected scale type, the predefined answer for an extreme case is shown.
- The 'Add' and 'Change' buttons can be used to define new scale types or modify existing ones. More details are provided in the next subsection.

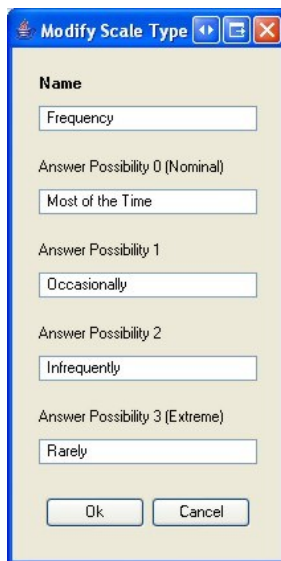
### B.12.5 Add/Modify Scale Types

If you need a scale type that is not available yet, you can add it by pressing 'Add' or 'Change' at the bottom of the dialog. The dialog that appears allows choosing to add a new scale type or modifying/removing an existing one:



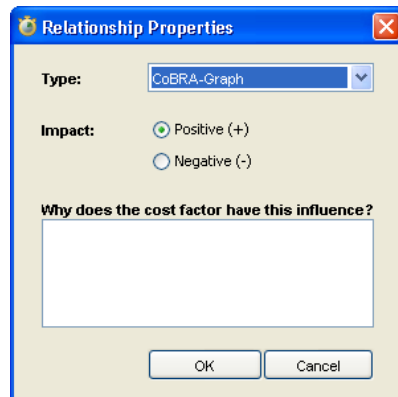


For a scale type, its name and the four answer possibilities (from nominal case to extreme case) have to be provided:






### B.12.6 Modify Causal Relationships

A dialog containing the properties of an 'Influence' appears when you right-click the influence (or double-click it with the left mouse button).



- In general, factors must have either a positive or a negative influence. Variables that connect to their factors do not need an influence.
- The field 'Why does the cost factor have this influence?' can provide additional information for the model user.

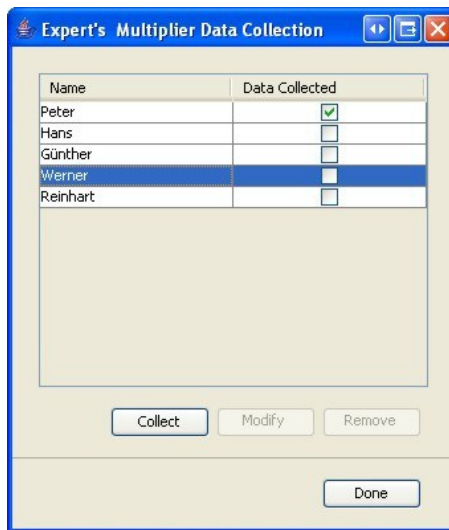
### B.12.7 Causal Model Validation

The graph has to fulfill a set of criteria/rules in order to be compliant. The 'Check'  function validates the graph. As soon as the graph is validated and no warnings  appear, the 'Accept'  button is enabled in the tool bar.

- The graph contains at least one loop.
- The graph contains two factors/variables with identical names.
- The graph does not contain exactly one dependent variable (Effort).
- The dependent variable (Effort) has one or more outgoing influences.
- The dependent variable (Effort) has no incoming influences.
- A factor is not connected to the dependent variable or to an influence that targets the dependent variable.
- A variable does not have exactly one outgoing influence.
- A variable contains one or more sub-variables.
- A variable has an indirect influence.
- A variable has no scale type selected.
- An influence contains more than one indirect influence.

### B.13 Collect Multiplier Data

By pressing the 'Collect Multiplier Data' button, you get to the following dialog:



The dialog shows all experts and whether the experts already have estimated the influence of the cost factor variables (as multipliers):

Peter	<input checked="" type="checkbox"/>
Hans	<input type="checkbox"/>

The multiplier estimations of each expert can be modified and removed. To collect the multiplier estimations for an expert or to modify them, the following dialog is used:

Variable Name	Low	Most Likely	High
PERS.2.1 Applicati...	15	40	100
PERS.2.2 Platform ...	10	30	100
PERS.5 Project Ma...	10	30	100
PROC.1 Disciplined...	10	50	100
PROC.2 Customer ...	5	30	150
PROD.2.1 Difficult...	30	65	125
PROD.1 Importanc...	0	30	100
PROD.3 Implement...	0	20	100
PROD.4 Software ...	0	30	150
PROD2.2 Require...	18	60	125
PROJ.1 Clarity of ...	0	50	100
PROJ.2 Developm...	10	30	100

The dialog shows all cost factor variables that have to be estimated by the selected expert. For each variable, the low, most likely, and high value that were provided by the selected expert are presented. You can modify the values by double clicking on the corresponding line:

**Variable Name**  
PERS.5 Project Manager's Experience and skills

**Question**  
Project Manager's Experience and skills?

**Answer (Extreme)**  
Inferior

**Multiplier Data (in full %) for this Variable**

Low

Most Likely

High

The dialog shows the name of the cost factor variable and the associated question with the answer for the extreme case (worst case). The experts have to estimate the cost overhead produced through the extreme case of the variable (e.g., inferior skills and experience of the project manager). The estimation is provided with a low value (lowest possible influence on project cost), a most likely value (the cost overhead occurs most likely), and a high value (the highest possible influence on project cost). The estimates are given in percent of cost overhead.

*Example:* If an expert expects that the inferior skills and experience of the project manager lead to a minimum 0% increase in project costs, most likely leads to a 30% increase in project costs, and maximal to additional project costs of 100%, he provides:

Multiplier Data (in full %) for this Variable	
Low	<input type="text" value="0"/>
Most Likely	<input type="text" value="30"/>
High	<input type="text" value="100"/>

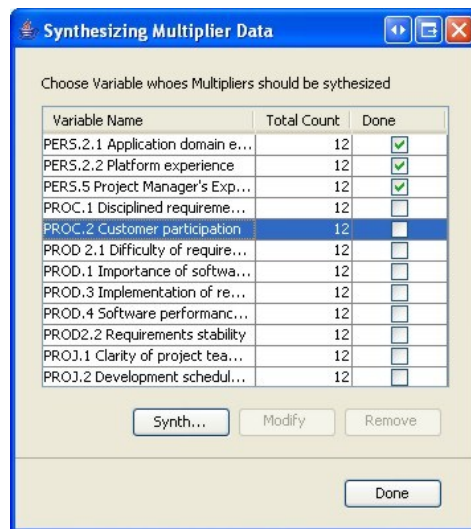
Moreover, if an influencing cost factor exists, its extreme case is presented and the expert must estimate the influenced cost factor variable for both cases:

- the influencing cost factor is nominal (optimal) and
- the influencing cost factor is extreme (worst case)

Extreme Case of Influencing Cost Factor		
<input type="text" value="Disciplined requirement management"/>		
Multiplier Data (in full %) for this Variable		
if the Influencing Cost Factor is:	<input type="text" value="Nominal"/>	<input type="text" value="Extreme"/>
Low	<input type="text" value="5"/>	<input type="text" value="30"/>
Most Likely	<input type="text" value="20"/>	<input type="text" value="100"/>
High	<input type="text" value="50"/>	<input type="text" value="200"/>

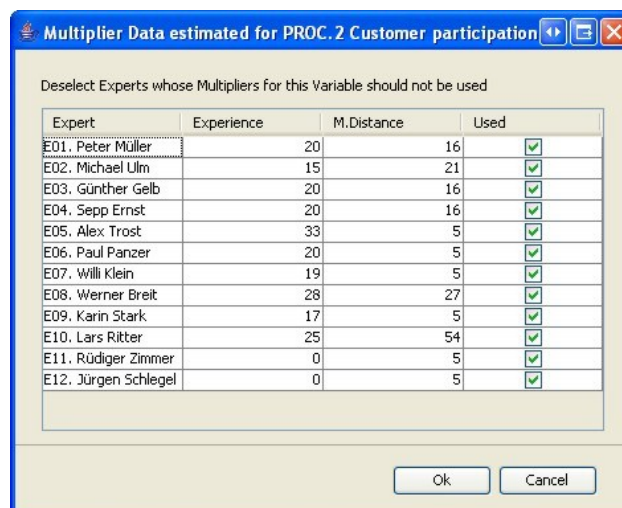
## B.14 Synthesize Multiplier Data

By pressing the 'Synthesize Multiplier' button, you get to the following dialog:



In this step, you can decide which expert's estimations should be used to simulate the influence of each cost factor. This allows us to remove individual outliers before the calculation. For this purpose, the first dialog shows a list with all cost factor variables and allows choosing a variable.

Pressing the 'Synthesize' or 'Modify' button opens the following dialog:



The dialog shows all experts who have provided estimations for the chosen cost factor variable. Moreover, it shows the experience of the experts and the divergence of their estimation from the estimations of the other experts.

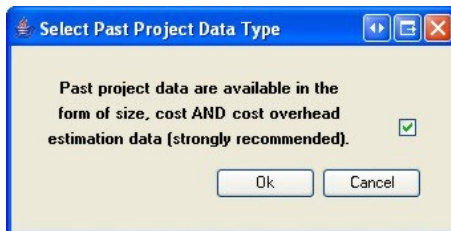
**Usage of COBRIX**  
Choose Past Project Data Type

In the last column, you can remove the check to avoid the use of the outlier estimation in the cost overhead calculation:

E10. Lars Ritter	25	54	<input type="checkbox"/>
------------------	----	----	--------------------------

**B.15 Choose Past Project Data Type**

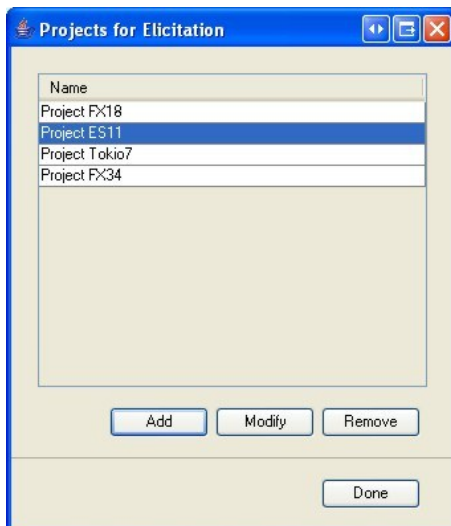
By pressing the 'Past Project Data Type' button, you get to the following dialog:



With the check, you can choose to use or not to use cost overhead estimation data of past projects. Not using cost overhead data usually results in strong overestimation of project costs. Therefore, we strongly recommend keeping the checkmark.

**B.16 Elicitation of Past Project**

By pressing the 'Elicitate Past Project' button, you get to the following dialog:





In this dialog, you can manage our past project database. You can add additional past projects, modify existing ones, or remove them from the database.

For each past project, you have to enter the project name, project size, and project cost. In addition, you have to answer the questions obtained from the causal model quantification to determine the difficulty of the project:

**Add new Project Elicitation**

Project Name: Project FX18

Project Size (kLoC): 300

Project Cost (PH): 4200

PROD.2.1 Difficulty of requirements definition: It is difficult to define the requirements.

Strongly Disagree

Disagree

Agree

Strongly Agree

PROD.2.2 Stability of Requirements:

Rarely

Infrequently

Occasionally

Most of the Time

PROJ.2 Development schedule constraints: In the project exists a disciplined requirement management?

Strongly Agree

Agree

Disagree

Strongly Disagree

OK Cancel

**Remark:** In the actual version of CoBRIX, for each question, you can also find a button named 'Details'. The button allows us not only to select one of the four answer possibilities, but also to provide probabilities for each answer possibility. For example, if you are not sure whether answer possibility 1 or 2 is correct for our project, you can press the 'Details' button and provide a '50' percentage probability for both answer possibilities.

### B.17 Validation of the CoBRA Model

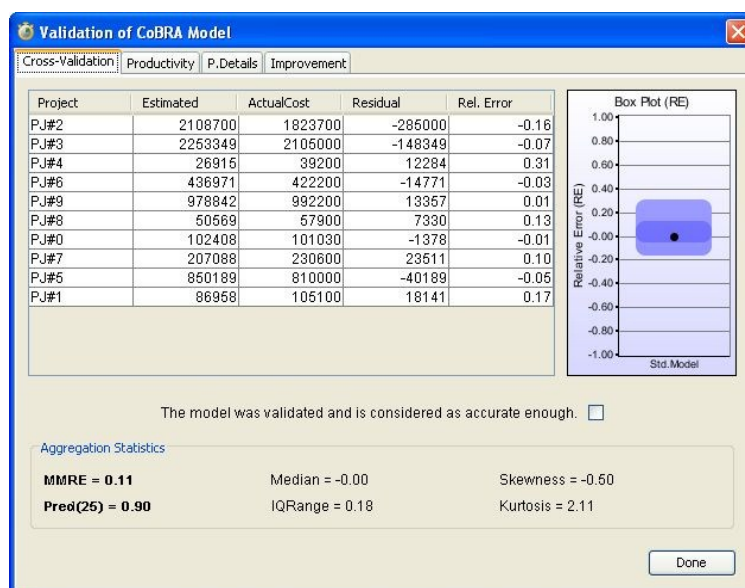
By pressing the 'Validate Model' button, you get to a dialog with several tabs. 'Regression' is optional and shown only if a regression model is used to determine productivity (see productivity models in configuration file section for details):



The first tab 'Cross-Validation' shows the results of a cross-validation performed with the past project data, i.e., each past project is estimated based on an estimation model built with the remaining past projects. The results of cross-validation are presented in a table and aggregated in a box plot of their relative estimation errors. In the table column 'Estimated', the estimates for the project cost can be found; the column 'Actual' presents the actual project costs; the column 'Residual' contains the difference between estimated and actual project costs; and the column 'Rel. Error' shows the resulting relative error (RE) of the estimate. The box plot is based on these relative error values.

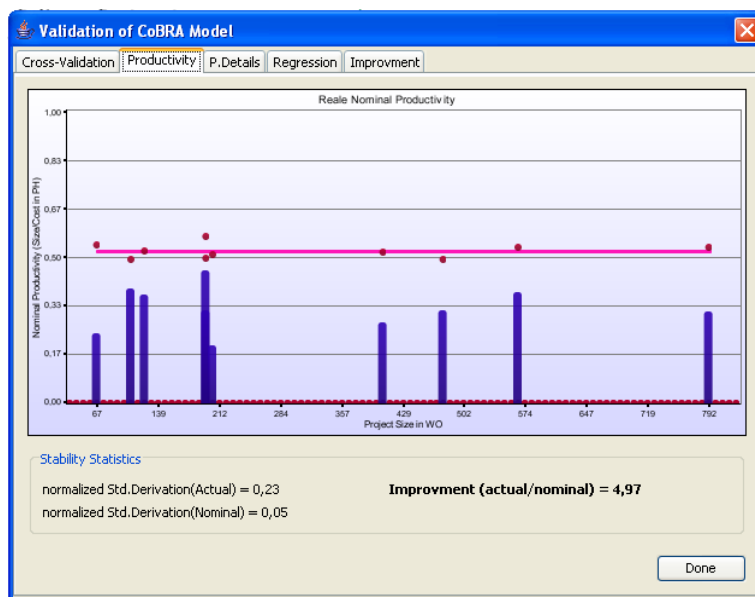
In this tab, you can also decide whether the model is accurate enough for productive use, i.e., only if you checkmark 'The model was validated and is considered as accurate enough', the model can be used to simulate new projects for the purpose of cost estimation, risk analysis, and benchmarking.

On the other hand, as long as the checkmark is set, you cannot modify the model. To modify the model, you must remove the checkmark again.



The second tab 'Productivity' shows the productivity estimation improvement in figures as well as in a diagram. Here, improvement is understood as the reduction of the derivation of calculated nominal productivity.

The dark blue bars in the diagram are the actual productivity values of the historic projects based on their cost and size. The dark red dots are the corresponding calculated nominal productivity values. The magenta line is the estimated (overall) nominal productivity based on the project data of all historic projects.

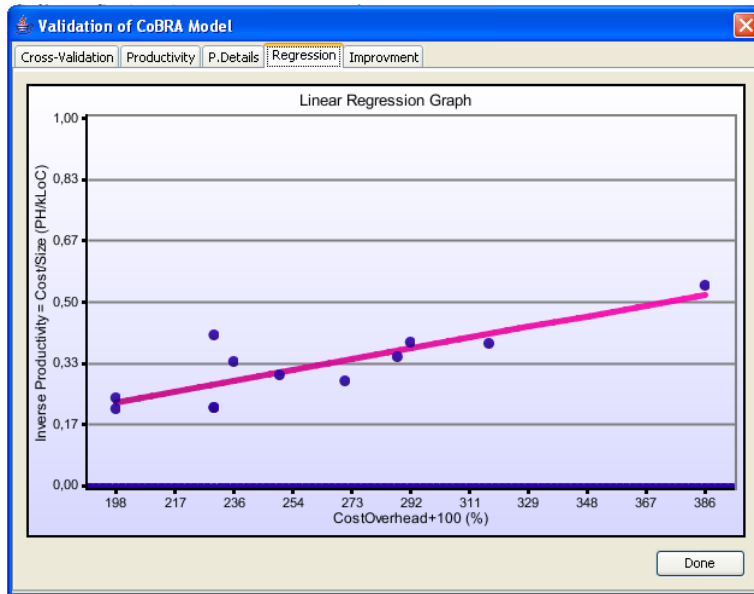


The third tab 'P.Details' contains a table of the relevant size, cost and productivity data for each project; the table can be easily copied to Excel for further analysis. Size is provided in the defined size unit, actual cost in the defined cost unit, cost overhead in percentage, and actual and nominal productivity in the cost unit / size unit.

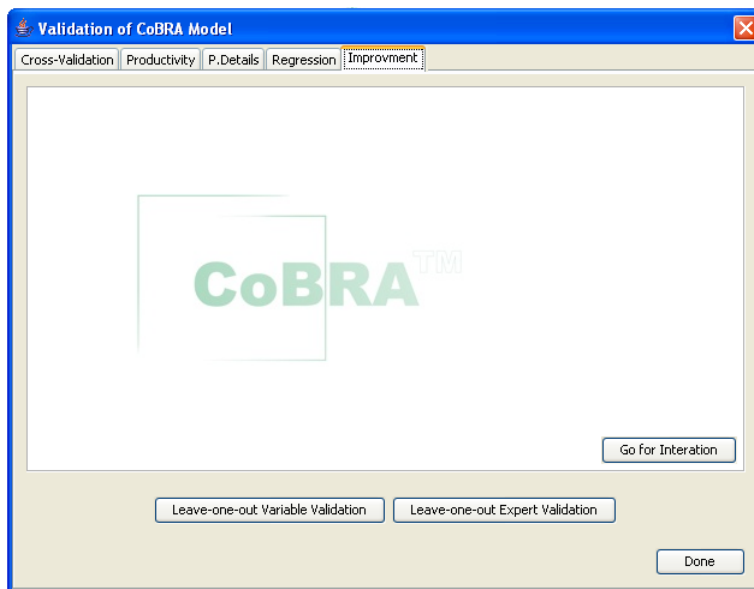
Project	Size	Actual Cost	Cost Overhead	Actual Producti...	Nominal Produc...
CoBRA 01 (2062)	404	1450	293	0,279	1,451
CoBRA 02 (2150)	199	623	229	0,319	1,458
CoBRA 03 (2185)	130	336	239	0,387	1,805
CoBRA 04 (2192)	107	266	266	0,402	1,985
CoBRA 05 (2246)	124	455	134	0,273	0,986
CoBRA 06 (2292)	199	437	158	0,455	1,757
CoBRA 07 (2298)	520	1590	153	0,327	1,246
CoBRA 08 (23079)	568	1482	157	0,383	1,475
CoBRA 09 (2314)	67	278	292	0,241	1,254
CoBRA 10 (2322)	203	1002	405	0,203	1,282
CoBRA 11 (2359)	798	2500	263	0,319	1,565
CoBRA 12 (2373)	135	299	214	0,452	1,992

**Usage of COBRIX**  
Validation of the CoBRA Model

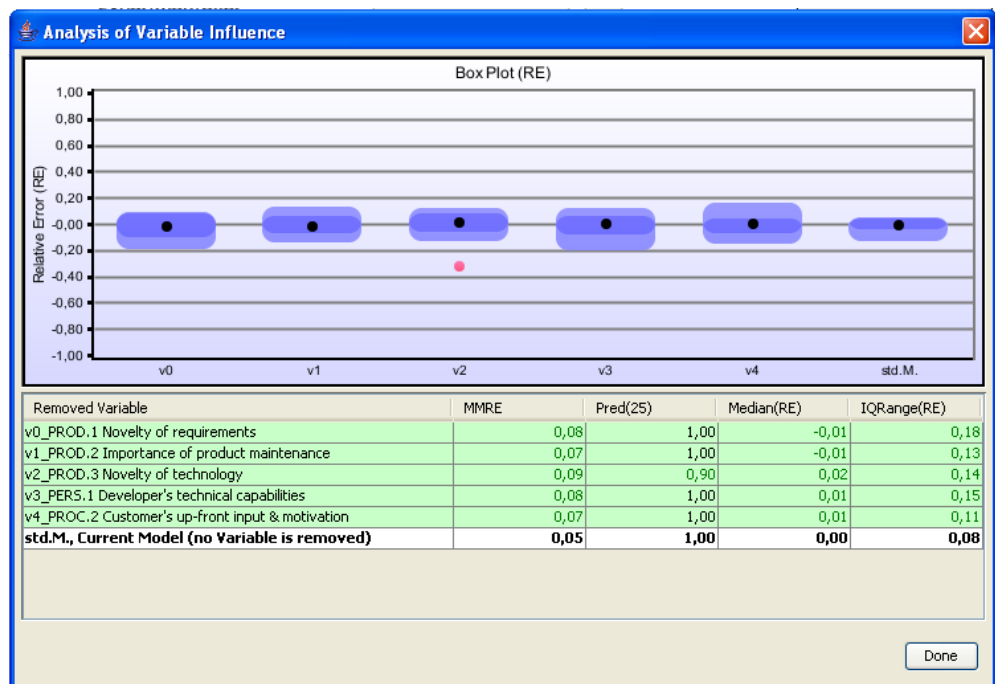
If the productivity model is built with the help of linear regression, the following (optional) tab 'Regression' contains a diagram with the data points (historical projects) and the resulting regression line.



The last tab 'Improvement' allows conducting advanced analysis as well as starting an iteration to improve the existing model.



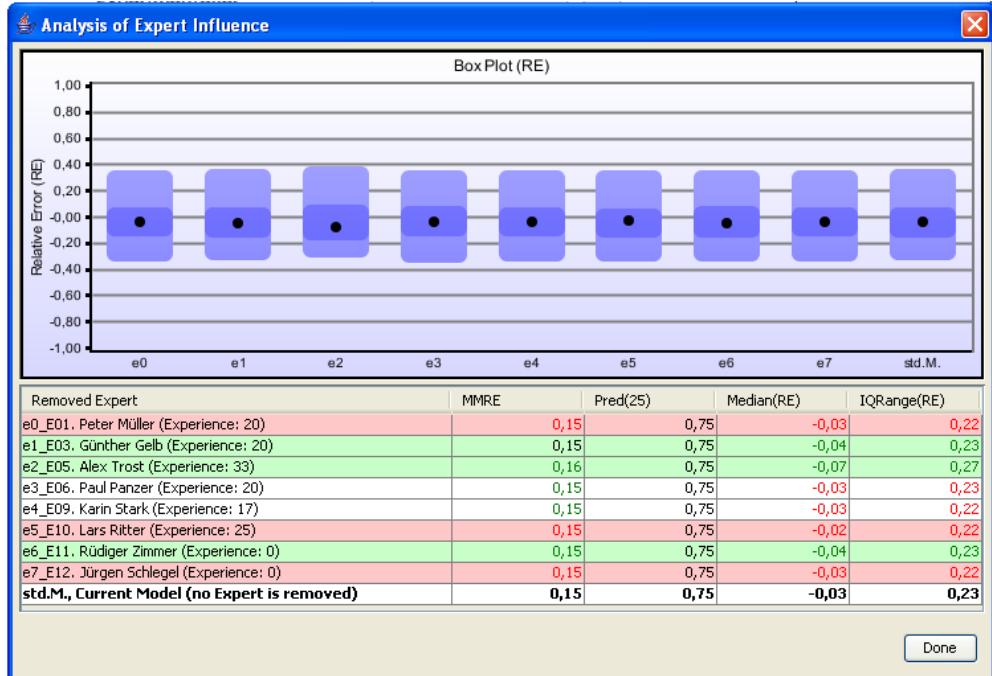
Pressing the 'Leave-one-out Variable Validation' allows comparing the influence of each single variable on the estimation results. The results of removing a certain variable from the model are presented by a box plot as well as in figures. The figures show whether the removal of a certain variable decreases or increases model prediction accuracy.



Variables with a green table background improve model prediction accuracy, whereas variables with a red table background decrease the accuracy of the model prediction. The row with the results of the current model serves as a reference to quantify the improvement potential by each variable.

Pressing the 'Leave-one-out Expert Validation' allows comparing the influence of the estimations of each single expert on model prediction accuracy. The results of removing all estimations of a certain expert from the model are presented by a box plot as well as in figures. The figures show whether the removal of all estimations provided by a certain expert decreases or increases model prediction accuracy.

**Usage of COBRIX**  
Validation of the CoBRA Model

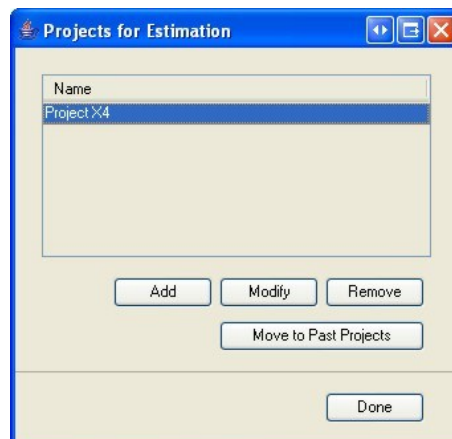


Variables with a green table background improve model prediction accuracy, whereas variables with a red table background decrease the accuracy of the model prediction. The line with the results of the current model serves as a reference to quantify the improvement potentials by the estimations of each expert.

Pressing the 'Go for Iteration' allows jumping back to the causal model-building step, so you can modify and enhance the causal model and its quantification to improve prediction accuracy. The modifications should consider the results of the advanced analysis performed (Leave-one-out Variable/Expert Validation).

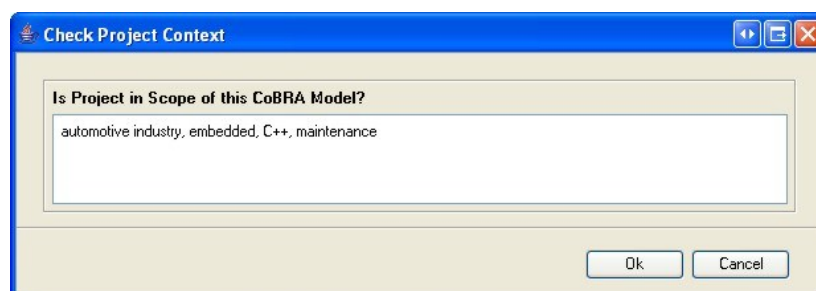
## B.18 Enter New Project Data

By pressing the 'New Project Data' button, you get to the following dialog:



This dialog shows all projects that can be estimated with the help of our validated CoBRA model. You can move finished projects to the past projects to extend the base for future estimations (and hopefully improve the model) by pressing the 'Move to Past Projects' button. You can also add new projects to the list, modify existing ones, or remove them.

To add a new project, you have to press the 'Add' button:



Before you enter data of a new project, you are asked to check whether the project is or will be conducted in the previously defined context (scope) of the CoBRA project.

After pressing 'Ok', you can enter the name of the project and its estimated size. Additionally, you have to answer the questions derived from the quantification of the causal model:

**Add new Project to Estimate**

Project Name: Project X4

Project Size (kLoC): 150

Project Cost (PH): 0

PROJ.2 Development schedule constraints: In the project exists a disciplined requirement management?

Strongly Agree

Agree

Disagree

Strongly Disagree

PROD.2.1 Difficulty of requirements definition: It is difficult to define the requirements.

Strongly Disagree

Disagree

Agree

Strongly Agree

PROD.2.2 Stability of Requirements:

Rarely

Infrequently

Occasionally

Most of the Time

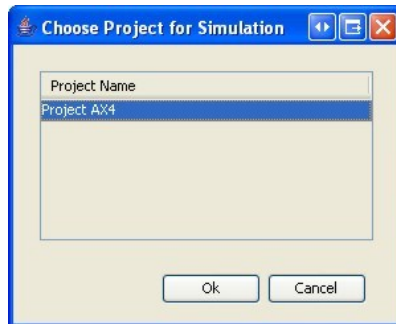
Ok Cancel

*Remark:* In the actual version of CoBRIX, for each question, you can also find a button named 'Details'. This button allows us not only to select one of the four answer possibilities, but also to provide probabilities for each answer possibility. For example, if you are not sure whether answer possibility 1 or 2 is correct for the actual project, you can press the 'Details' button and provide a '50' percentage probability for both answer possibilities.



## B.19 Project Simulation

By pressing the 'Simulation' button, you get to the following dialog:

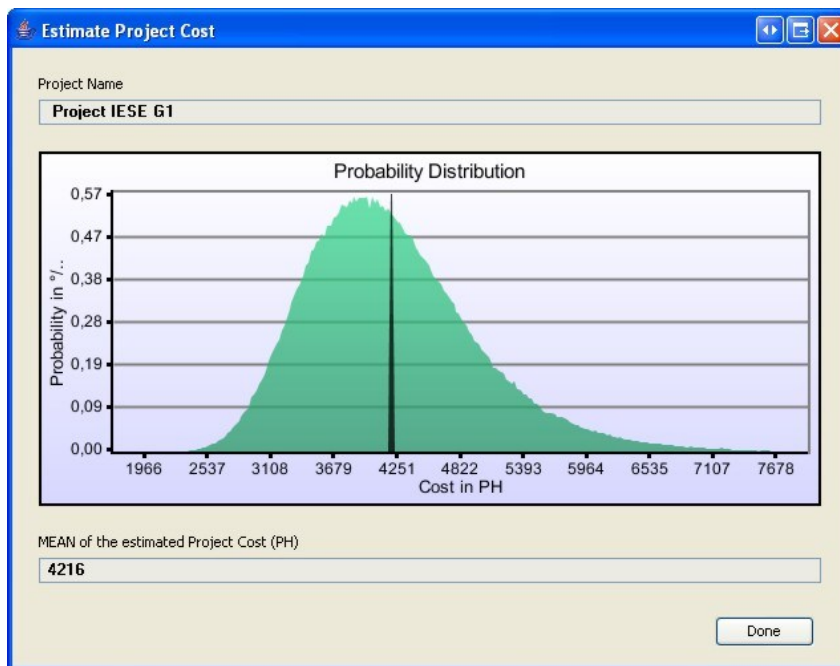


You can choose the project that you want to simulate. The simulation creates a cost overhead distribution based on the CoBRA model and the information provided for the selected project. The distribution is required to estimate project cost, analyze cost risk, and benchmark the project. If you start simulation, the following dialog, which shows the progress, appears:



## B.20 Estimate Project Cost

By pressing the 'Estimate Cost' button, you get to the following dialog:

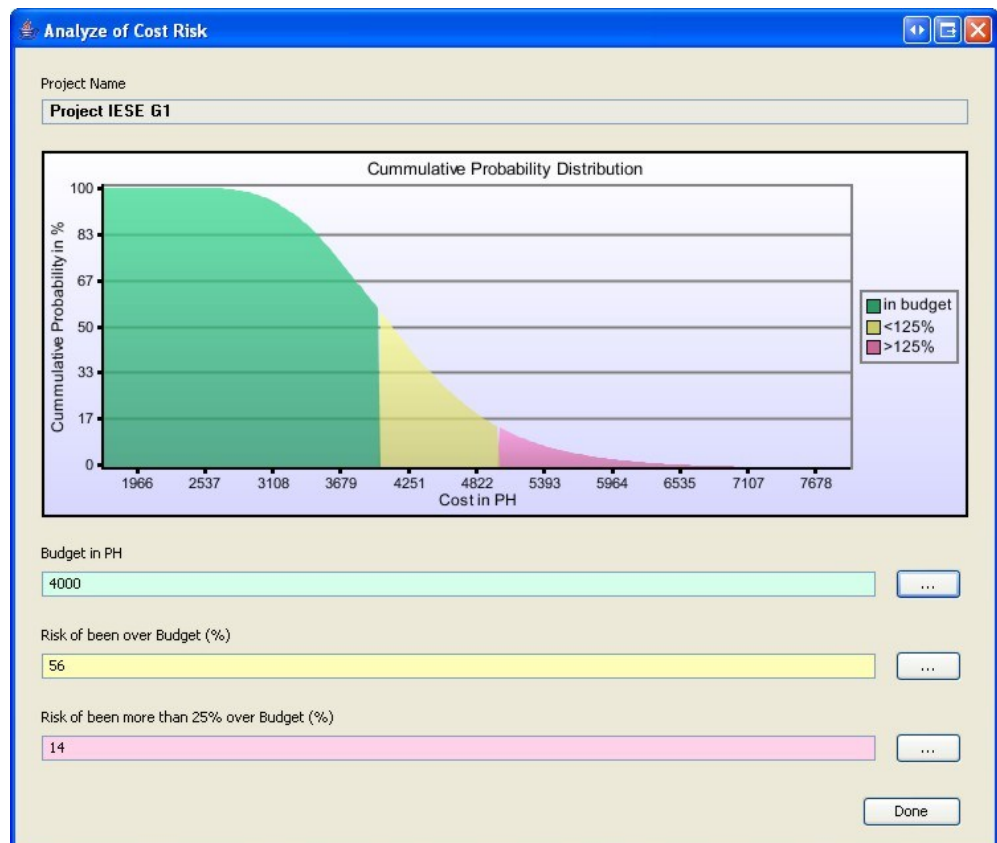


The dialog shows the probability density distribution of the project's costs in the given project cost unit. The mean (i.e., average) project cost is presented as well:

MEAN of the estimated Project Cost (PH)  
4216

## B.21 Analyze Project Cost Risk

By pressing the 'Analyze Cost Risk' button, you get to the following dialog:



You can calculate the risk of being over budget or even of being 25% over budget for every given budget by entering the budget and pressing the button on the right:

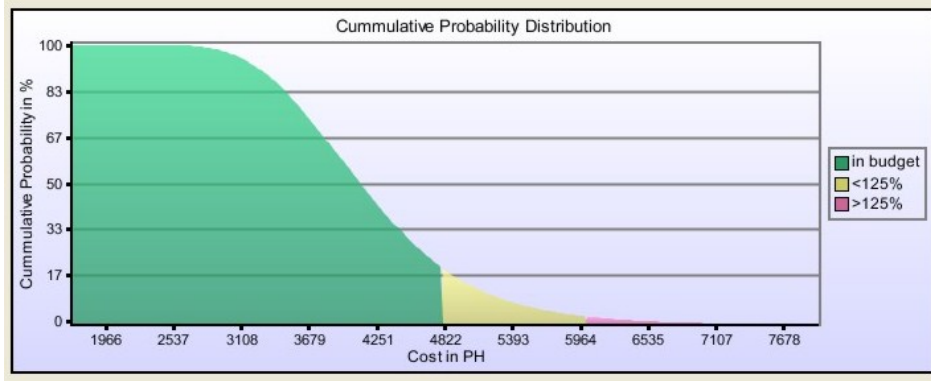
Budget in PH

You can also calculate how high the budget has to be so that it is not exceeded by a given probability. To do this, you enter the probability and press the button on the right:

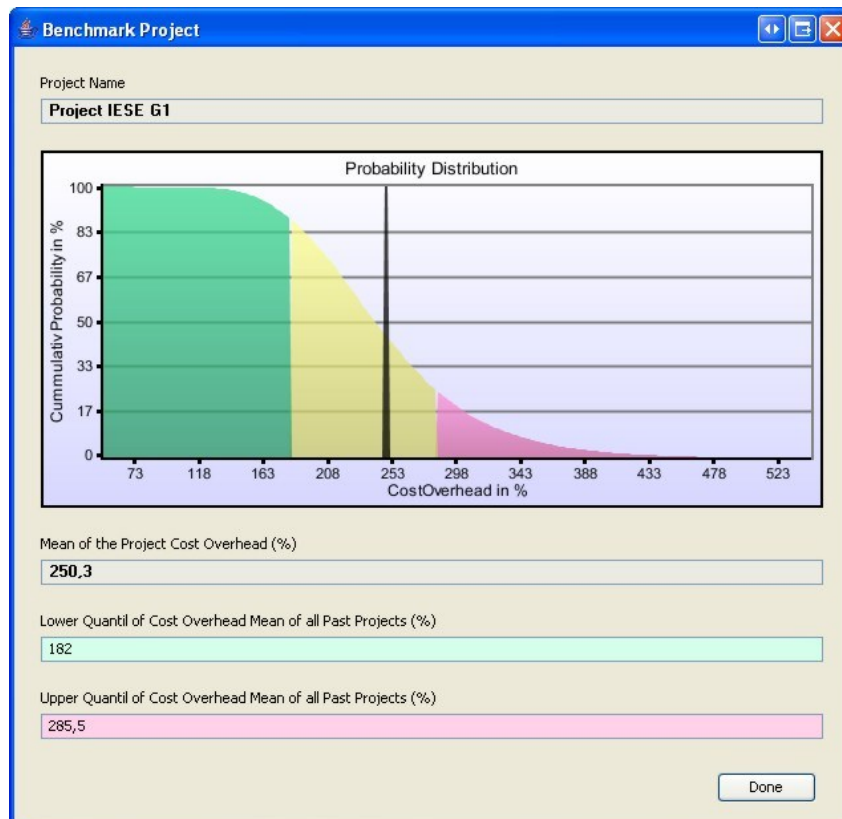
Risk of been over Budget (%)

The diagram in the dialog gives a graphical interpretation of the results:



## B.22 Benchmark Projects

By pressing the 'Benchmark Projects' button, you get to the following dialog:



This dialog shows us how difficult in terms of cost overhead our new project is. It is compared to the earlier projects (past projects) and can be significantly easier than the average, if it is in the green area (left area), or significantly harder, if it is in the red area (right area). It may also be of average difficulty if it is located between the upper and lower quantile boundaries (yellow area).



## C Configuration File

This chapter explains how to use the '**config.xml**' file to customize the tool behavior for one's own special needs. The configuration file can be found in the installation directory of the CoBRA Tool (e.g. 'C:\Program Files\COBRIX'). Generally, the settings provided by the default configuration cover most application scenarios. Therefore, only experienced users should change the configuration file.

### C.1 Causal Model Visualization

The property allows choosing the type of visualization for the presentation of the causal model. A value of '0' chooses the standard visualization. [*Remark*: The visualization of the causal model has not been officially released yet].

```
<entry key="PRODUCTIVITY_MODEL">0</entry>
```

### C.2 Predefined Scale Types

The answer possibilities on the question sheets that are needed for the elicitation of past and new projects are defined by the scale type of the respective question. The predefined scale types for new CoBRA projects are defined by the following properties in the configuration file. [*Remark*: Scale types can be added, modified, and removed in each CoBRA project independently.]

For example:

```
<entry key='SCALE_TYPE3'>Frequency</entry>  
<entry key='SCALE_TYPE3_AP0'>Most of the Time</entry>  
<entry key='SCALE_TYPE3_AP1'>Occasionally</entry>  
<entry key='SCALE_TYPE3_AP2'>Infrequently</entry>  
<entry key='SCALE_TYPE3_AP3'>Rarely</entry>
```

### C.3 Predefined Cost Factor Categories

The cost factors can be categorized by default into 'Personal', 'Product', 'Process', and 'Project'. With the help of the property below, you can add additional categories or modify existing ones.

For example, to add an additional category, insert:

```
<entry key="CF_CATEGORY5">Customer</entry>
```

*Warning:* The change of categories has an effect on *all* CoBRA projects.

### C.4 Change DB Server Settings

The properties below allow you to access a DB Server on another computer or with another username and password. This can be helpful if you want to use an existing DB Server on a dedicated server machine. However, we recommend using the integrated Derby DB provided.

This property names a database that is available on the server:

```
<entry key="DBMS_UNIDB"> DERBY_JDBC</entry>
```

This property names the database driver:

```
<entry key="DBMS_DRIVER">  
org.apache.derby.jdbc.EmbeddedDriver</entry>
```

This property locates the database server:

```
<entry key="DBMS_URL">jdbc:derby:</entry>
```

This property names a database user with root rights:

```
<entry key="DBMS_USER">empty</entry>
```

This property provides the password for the named user:

```
<entry key="DBMS_PWD"></entry>
```



## C.5 Debug Settings

These properties are for developers who modify or debug CoBRiX. They allow printing exceptions and SQL statements on the console.

If this property is set to 'true', all exceptions are shown:

```
<entry key="PRINT_EXCEPTION">true</entry>
```

If this property is set to 'true', all SQL 'inserts', 'update' and 'delete' statements are shown:

```
<entry key="PRINT_SQL">true</entry>
```

If this property is set to 'true', all SQL 'select' statements are shown:

```
<entry key="PRINT_SQL_SELECT">true</entry>
```

## C.6 Productivity Model

The tool allows choosing the productivity model that is applied to transform calculated cost overhead into project cost. A value of '0' chooses the standard model:

```
<entry key="PRODUCTIVITY_MODEL">0</entry>
```

If this property is set to '1', the productivity model presented in the first CoBRA paper (Lionel et al., 1998) is used, i.e.,  $cost = 1 / (b1 \cdot co + b0) \cdot size$ .

If this property is set to '2', the productivity model developed together with the Tool is used, i.e.,  $cost = (b1 \cdot (co+100) + b0) \cdot size$ .

If this property is set to '3', the productivity model developed for Web CoBRA is used, i.e.,  $cost = b1 \cdot (co+100) \cdot size$ .

If this property is set to '4', the previous productivity model is used, i.e.,  $cost = b1 \cdot (co+100) \cdot size$ , but  $b1$  is calculated as the median of inverse productivity to increase robustness.

If this property is set to '5', the productivity model does not consider the influence of cost factors, i.e.,  $cost = b1 \cdot size$ .



If this property is set to '7', a productivity model with a definable fix cost value is used, i.e.,  $cost = b1 \cdot (co+100) \cdot size + fix\_cost$ , where the fix costs can be defined by an additional property:

```
<entry key="FIX_COST">0</entry>
```

## C.7 Project Simulation

These settings influence the project simulation in the 'Simulate Project' step, which is responsible for sampling the cost overhead distribution.

This property allows choosing the simulation algorithm. The three available algorithms are 'StdMonteCarlo', which is a standard Monte Carlo approach; 'LatinHypercube', an improved simulation approach, which, however, needs more runtime per iteration; 'LatinHypercubePO', a runtime optimized version of the Latin Hypercube algorithm, which is faster but needs more memory and can be used only until 640000 iterations.

```
<entry key="SIMULATION_METHOD">StdMonteCarlo</entry>
```

The number of project simulation iterations performed by 'Simulate Project':

```
<entry key="SIMULATION_ITERATIONS">1000000</entry>
```

The property allows using an advanced simulation mode, where probabilities of different answer possibilities are used to simulate uncertainty regarding a certain project property:

```
<entry key="PROBABILITY4ANSWERS">>true</entry>
```

## C.8 Other Properties

The first property allows viewing UTF-8 chars in the application by overriding system dependent font selection with Unicode fonts. This is helpful if using, for example, Japanese characters.

```
<entry key="UTF-8">>true</entry>
```

The second property allows choosing the language used in the CoBRiX dialogs. The possible values are 'System', 'English', 'German', and 'Japanese', with



'System' being the default value that automatically chooses the language of the operation system as the language for the CoBRIX dialogs.

```
<entry key="LANGUAGE">System</entry>
```

The third property defines the maximum number of CoBRA projects that can be stored in the database. A high number of projects can reduce application start performance.

```
<entry key="MAX_PROJECTS">20</entry>
```