# COCOMO II TOOL Components Questionnaire

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|---|---|
| Project Title: | Project ID No: |
| Date Prepared: | Originator: |

This questionnaire attempts to collect data related to the extended three-dimensional tool rating scales such as *Completeness of Activity Coverage* (TCOV), *Degree of Tool Integration* (TINT), and *Tool Maturity*/*User Support* (TMAT) from the COCOMO II one-dimensional TOOL rating scale. Those rating scales were developed to assess more accurate impact of CASE (Computer Aided Software Engineering) tools on software development efforts.

The COCOMO II TOOL rating in Post-Architecture Model can be determined by the weighted sum of the extended three-dimensional TOOL rating scales as the following:

$$\mathrm{PM} = \mathrm{A} \cdot \mathrm{Size}^{\mathrm{B}+0.01\times\sum_{j=1}^{5}\mathrm{SF}_j} \times \sum_{\substack{i=1 \\ i\neq 1}}^{17} EM_i \times TOOL$$

$$TOOL = b_1 \cdot TCOV + b_2 \cdot TINT + b_3 \cdot TMAT$$

$$\sum_{i=1}^{3} b_i = 1$$

Constant A and Exponent B are the same as in the COCOMO II Post Architecture model. A=2.94 and B=0.91 for the COCOMO II.2000 calibration to 161 projects

In the above research model, the initial calibrated weighted values for the three-dimensional TOOL rating scales were determined by using Bayesian approach with 15 actual project data as follows:

$$TOOL = 0.207 \cdot TINT + 0.349 \cdot TMAT + 0.444 \cdot TCOV$$

This indicates that differences in tool coverage are the most important determinant of tool productivity gains, with a relative weight of 44%. Next most important is relative tool maturity, with a relative weight of 35%. Tool integration has a smaller effect, but still significant at a 21% relative weight.

In order to compare the prediction accuracy of the research model, an evaluation criterion, the percentage of predictions that fall within X% of actual project efforts denoted as PRED(X), is used. The research model is evaluated at PRED(.10), which is done by counting the number of MRE (Magnitude of Relative Errors)s that are less than or equal to 0.10 and dividing by the number of the projects. The MRE for each project shown below is defined as the absolute value of difference between the estimated project effort, E(Y), and actual project effort, Y, relative to the magnitude of the actual effort.

$$MRE_i = \left| \frac{E(Y)_i - Y_i}{Y_i} \right|$$

The COCOMO II and the research model use the same Bayesian approach to calibrate the coefficients of predictor variables except that the research model use the three-dimensional TOOL rating scales rather than the one-dimensional COCOMO II TOOL rating scale. Table shown below summarizes the prediction accuracies of the two models. By extending the COCOMO II TOOL rating to the three-dimensional TOOL rating scales (TCOV, TINT, and TMAT), the prediction accuracy for the estimates of 15 project data is increased from 67% to 87%. That is, the research model produced two estimates that had MRE > 0.1, while the COCOMO II produced five estimates out of 15 actual project data.

| | **COCOMO II (TOOL)** | **Research model (TCOV,TINT, and TMAT)** |
|---|---|---|
| PRED(.10) | 67% | 87% |

This questionnaire should be submitted with COCOMO II data collection form. Your contribution will help us calibrate the model to find out the best-fit weighted value set of the three tool rating scales. For the detailed information and initial result of the model calibration, refer to the CSE Tech report "**The Effects of CASE Tools on Software Development Effort"**. It is available from the following URL:

http://sunset.usc.edu/TechRpts/electronicopy.html/usccse99-528/usccse99-528.pdf

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## Completeness of Activity Coverage (TCOV)

| | Rating Scale | Your Rating |
|---|---|---|
| Very Low | Text-Based Editor, Basic 3GL Compiler, Basic library Aids, Basic Text-based Debugger, Basic Linker | |
| Low | Graphical Interactive Editor, Simple Design Language, Simple Programming Support Library,<br>Simple Metrics/ Analysis Tool | |
| Nominal | Local Syntax Checking Editor, Standard Template Support Document Generator, Simple Design Tools, Simple Stand-alone Configuration Management Tool, Standard Data Transformation Tool, Standard Support Metrics Aids with Repository, Simple Repository, Basic Test Case Analyzer | |
| High | Local Semantics Checking Editor, Automatic Document Generator, Requirement Specification Aids and Analyzer, Extended Design Tools, Automatic Code Generator from Detailed Design, Centralized Configuration Management Tool, Process Management Aids, Partially Associative Repository (Simple Data Model Support), Test Case Analyzer with Spec. Verification Aids, Basic Reengineering & Reverse Engineering Tool | |
| Very High | Global Semantics Checking Editor, Tailorable Automatic Document Generator, Requirement Specification Aids and Analyzer with Tracking Capability, Extended Design Tools with Model Verifier, Code Generator with Basic Round-Trip Capability, Extended Static Analysis Tool, Basic Associative, Active Repository (Complex Data Model Support), Heterogeneous N/W Support Distributed Configuration Management Tool, Test Case Analyzer with Testing Process Manager, Oracle Support, Extended Reengineering & Reverse Engineering Tools | |
| Extra High | GroupWare systems, Distributed Asynchronous Requirement Negotiation and Trade-off tools, Code Generator with Extended Round-Trip Capability, Extended Associative, Active Repository, Spec-based Static and Dynamic Analyzers, Pro-active Project decision Assistance | |
| Don't Know | | |

## Degree of Tool Integration (TINT)

| | Rating Scale | Your Rating |
|---|---|---|
| Very Low | Individual File Formats for Tools (No Conversion Aid), No Activation Control for Other Tools, Different User Interface for each Tools, Fundamental Incompatibilities among Process Assumptions and Object Semantics | |
| Low | Various File Formats for Each Tools (File Conversion Aids), Message Broadcasting to Tools, Some Standardized User Interfaces among Tools, difficult Incompatibilities among Process Assumptions and Object Semantics | |
| Nominal | Shared-Standard Data Structure, Message Broadcasting through Message Server, Standard User Interface Use among Tools, Reasonably Workable Incompatibilities among Process Assumptions and Object Semantics | |
| High | Shared Repository, Point-to-Point Message Passing, Customizable User Interface Support, Largely Workable Incompatibilities among Process Assumptions and Object Semantics | |
| Very High | Highly Associative Repository, Point-to-Point Message Passing Using reference for Parameters, Some level of Different User Interface, Largely Consistent among Process Assumptions and Object Semantics | |
| Extra High | Distributed-Associative Repository, Extended Point-to-Point Message Passing for Tool Activation, Complete Set of User Interface for different level of Users, Fully Consistent among Process Assumptions and Object Semantics | |
| Don't Know | | |

## Tool Maturity and User Support (TMAT)

| | Rating Scale | Your Rating |
|---|---|---|
| Very Low | Version in pre-release beta-test, Simple documentation and help | |
| Low | Version on market/available less than 6 month, Up-dated documentation, help available | |
| Nominal | Version on market/available between 6 months and 1 year, On-line help, tutorial available | |
| High | Version on market/available between 1 and 2 years, On-line User Support Group | |
| Very High | Version on market/available between 2 and 3 years, On-Site Technical User Support Group | |
| Extra High | Version on market/available more than 3 years | |
| Don't Know | | |