



CORADMO: A Software Cost Estimation Model for RAD Projects

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ISPA/SCEA 2001 Presentation



Introduction

RAD (Rapid Application Development)

- an application of any of a number of techniques or strategies to reduce software development cycle time

CORADMO

- COCOMO II model extension
- Focuses on software development costs using RAD techniques



Constructive Rapid Application Development Model

- Calculates/predicts
 - schedule (months, M)
 - personnel (P)
 - adjusted effort (person-months, PM)
- Based on
 - Effort and schedule distribution to the various phases
 - Selected schedule driver ratings impacts on the M, P, and PM of each phase.



Six Classes of Strategies for RAD

- Reuse, Very High-level Languages (RVHL)
- Development Process Reengineering (DPRS)
- Collaboration Support (CLAB)
- Architecture, Risk Resolution (RESL)
- Prepositioning Assets (PPOS)
- RAD Capability of Personnel (RCAP)



Background

COCOMO II Schedule shortfalls:

- Reflects a large project model (Effort > 120 PM)
- Duration calculation unreasonable for small projects
- Model does not address RAD strategies

COCOMO II.2000 Duration Calculation

Cube Root Law: Months ~ 3.67 (Person-Months)^f

where $0.28 \leq f \leq 0.34$

CORADMO differs from COCOMO:

- A square root instead in computing the number of months needed to complete a small project
- Square root law (i.e. $f = 0.5$)



COPSEMO

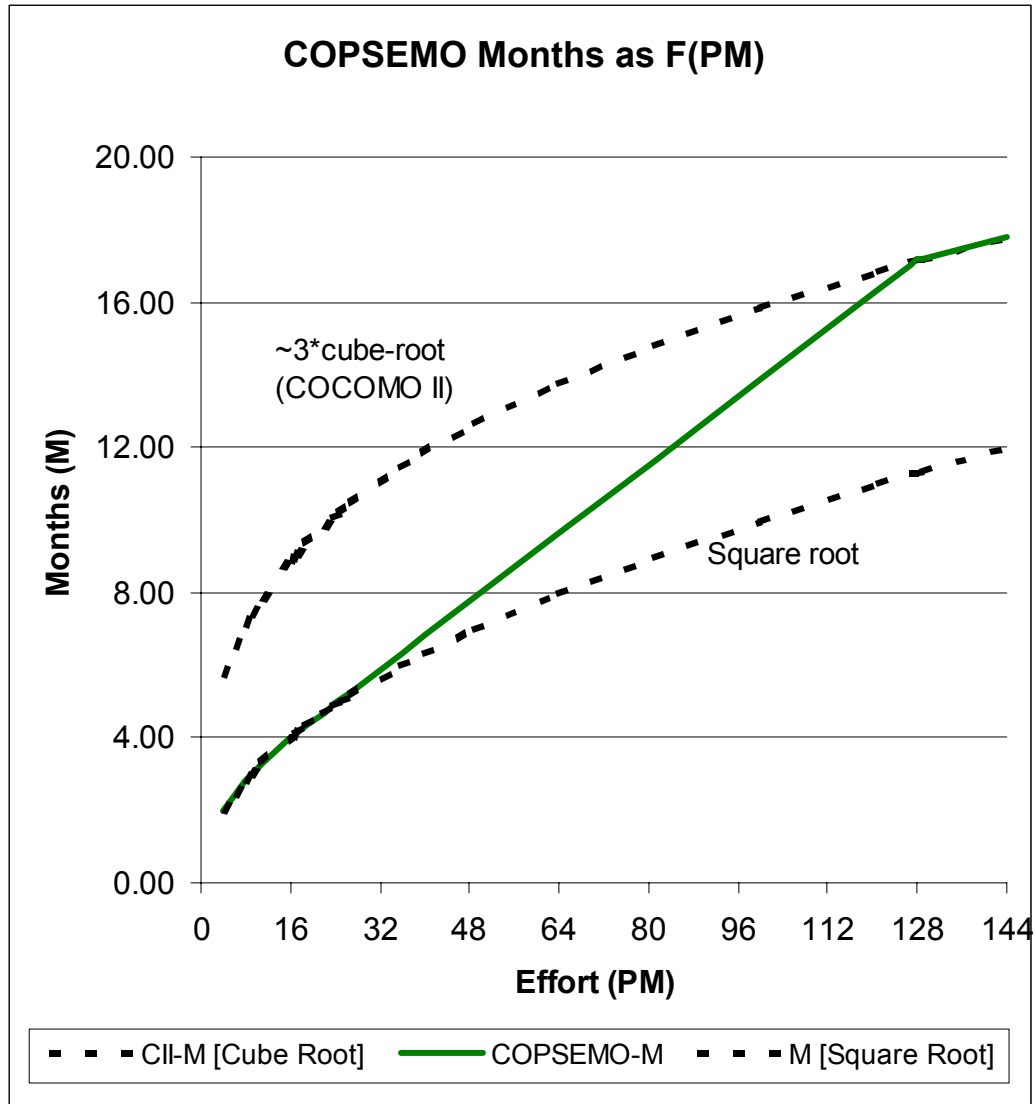
Constructive Phased Schedule and Effort Model

Inputs: the baseline effort and schedule from
COCOMO II

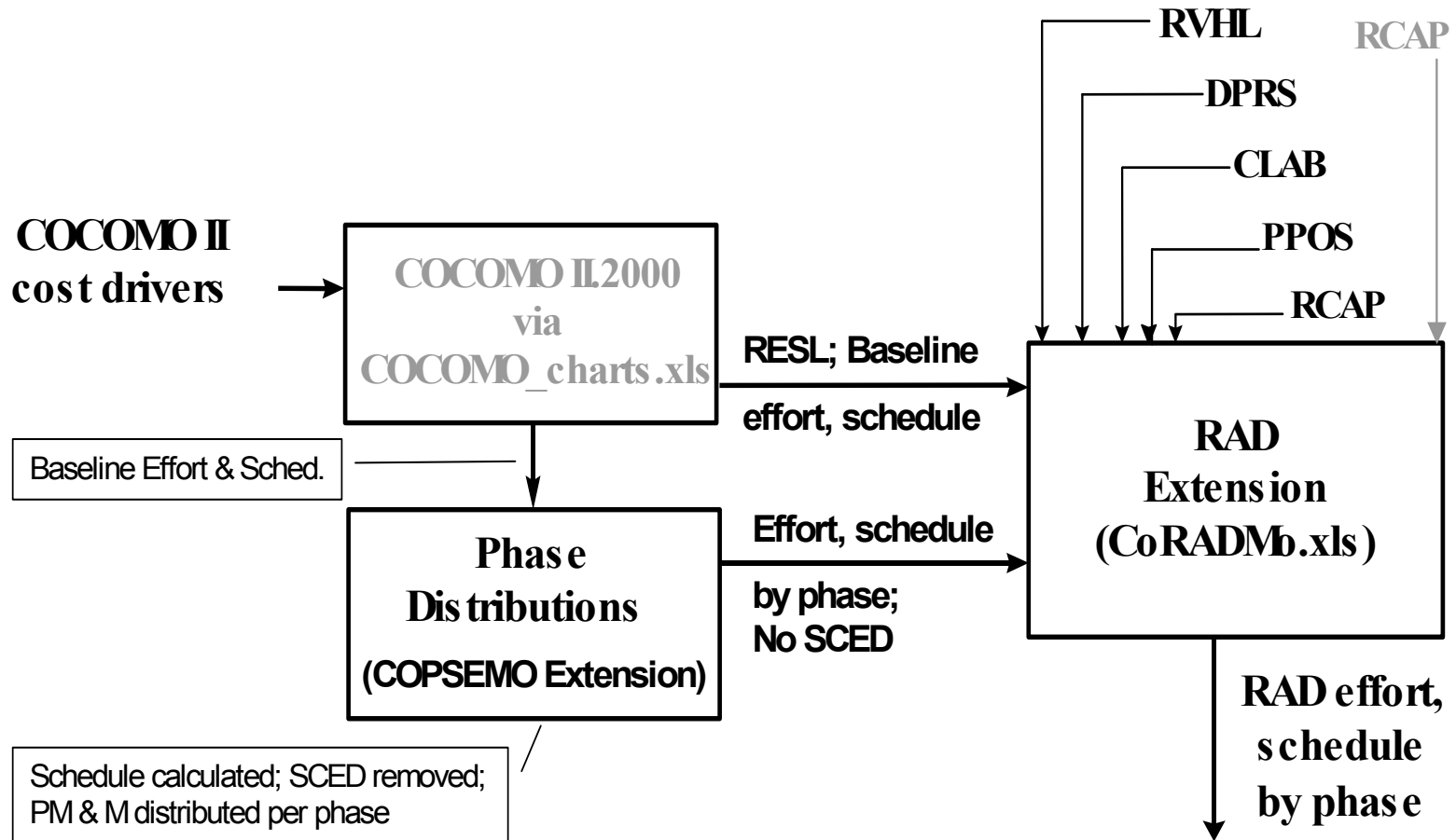
Outputs: the effort and schedule by phase
needed for CORADMO.

Phases: Inception, Elaboration, Construction,
and Transition

Source: MBASE/RUP (Model-Based
Architecting & Software Engineering/Rational
Unified Process) life-cycle model



Physical Model



Results

- Delphi Exercise Forms distributed
- Experts from Academia, Industry and Government
 - Affiliates, Professors, and Researchers
- EMR (Effort Multiplier Range)
 - Highest divided by Lowest across the rating scale for effort
- SMR (Schedule Multiplier Range)
 - Highest divided by Lowest across the rating scale.

% Effort per phase

	Mean	Standard Deviation
Inception – I	10.4	6.61
Elaboration – E	23.8	6.36
Construction – C	70.6	13.19
Total I, E, & C	104.8	4.80

% Schedule per phase

	Mean	Standard Deviation
Inception – I	16.6	7.06
Elaboration – E	31.7	7.10
Construction – C	62.7	11.46
Total I, E, & C	110.9	8.12

Reuse, Very High-level Languages

Degree to which re-use of artifacts other than code and/or very high-level languages are utilized

RVHL	EMR		SMR	
	Mean	Standard Deviation	Mean	Standard Deviation
Inception	1.23	0.11	1.19	0.19
Elaboration	1.26	0.08	1.23	0.19
Construction	1.14	0.18	1.11	0.16

Development Process Reengineering

Measures the degree to which the project and organization allow and encourage streamlined or reengineered development processes

DPRS	EMR		SMR	
	Mean	Standard Deviation	Mean	Standard Deviation
Inception	1.32	0.12	1.26	0.22
Elaboration	1.24	0.06	1.19	0.14
Construction	1.29	0.12	1.21	0.21

Collaboration Support

Accounts for Multisite tool support plus special collaboration tools, yields a reduced effect on schedule and effort

CLAB	EMR		SMR	
	Mean	Standard Deviation	Mean	Standard Deviation
Inception	1.29	0.13	1.19	0.10
Elaboration	1.18	0.08	1.19	0.08
Construction	1.20	0.13	1.18	0.11

Architecture, Risk Resolution

Same as COCOMO II RESL

RESL	EMR		SMR	
	Mean	Standard Deviation	Mean	Standard Deviation
Inception	1.11	0.17	1.08	0.10
Elaboration	1.11	0.13	1.06	0.11
Construction	1.14	0.12	1.20	0.20

Prepositioning Assets

Degree to which assets are pre-tailored to a project and furnished to the project for use on demand

PPOS	EMR		SMR	
	Mean	Standard Deviation	Mean	Standard Deviation
Inception	1.14	0.09	1.23	0.06
Elaboration	1.14	0.11	1.23	0.09
Construction	1.17	0.14	1.26	0.16

RAD Capability of Personnel

Personnel effects associated with the degree to which the personnel is familiar with RAD

RCAP	EMR		SMR	
	Mean	Standard Deviation	Mean	Standard Deviation
Inception	1.50	0.26	2.51	1.01
Elaboration	1.48	0.13	2.42	0.98
Construction	1.50	0.14	2.42	0.97

Example

With RCAP = Nominal \Rightarrow PM=25, M=5, P=5

Result: The square root law: 5 people for 5 months: 25 PM

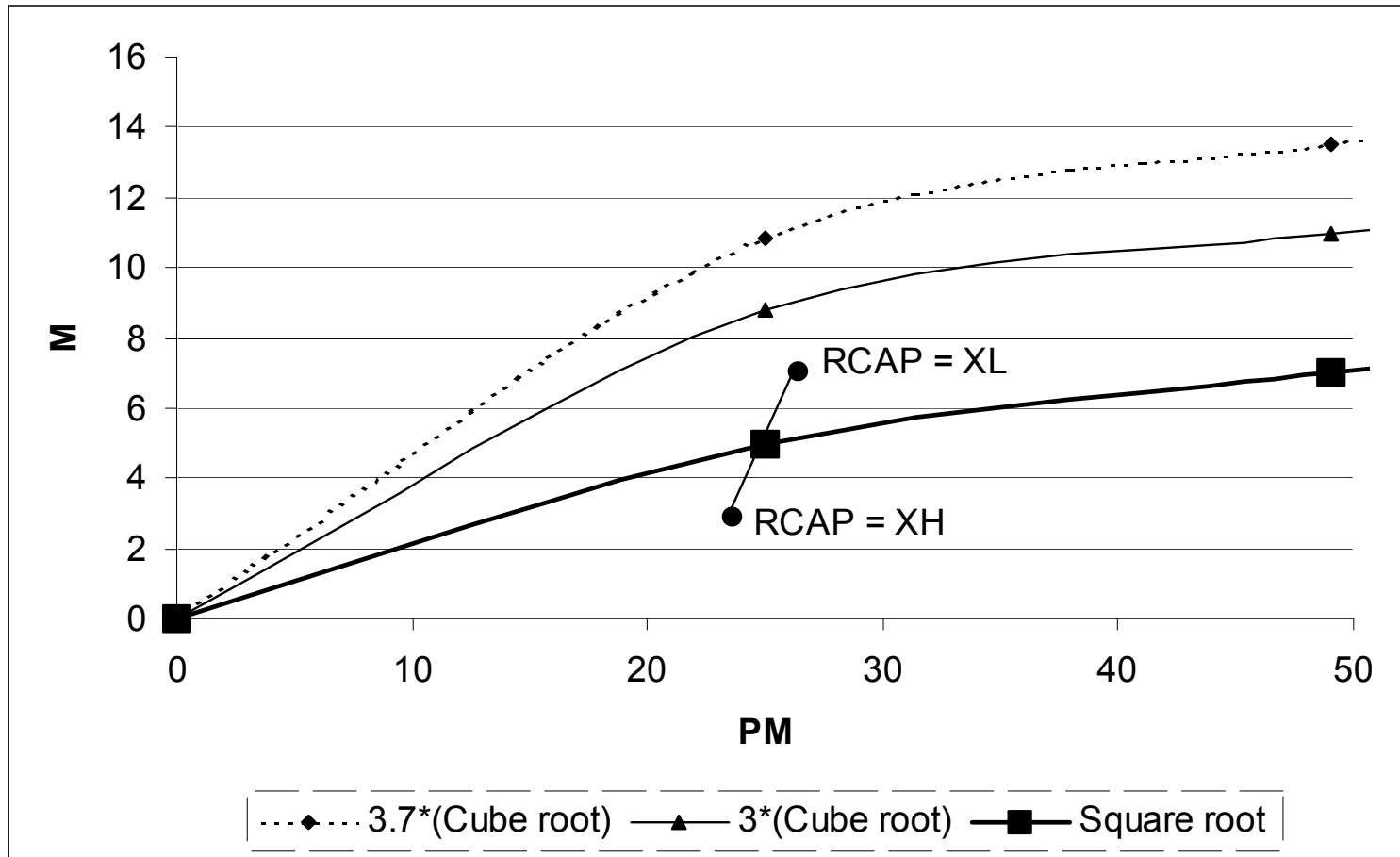
With RCAP=XH (Extra High) \Rightarrow PM=20, M=2.8, P=7.1

Result: A super team can put on 7 people and finish in 2.8 months: 20 PM

With RCAP = XL (Extra Low) \Rightarrow PM=30, M=7, P=4

Result: Trying to do RAD with an unqualified team makes them less efficient (30 PM)

RCAP Effort/Schedule Effect



Next Steps

- Possible removal of drivers
 - e.g., RVHL and RESL drivers
- Complete another Delphi Round
- Analyze Data from RAD projects
- Bayesian Analysis
- Calibrate Model

How you can help

- Leave me your contact information
 - E-mail address
 - Phone number
 - Business card
- Take my business card
- Send e-mail to fakharza@usc.edu
- Seeking:
 - RAD Experts for Delphi
 - RAD Data