



**The Amplification of the Cocomo II Model
regarding Offshore Software Projects**

First International Workshop on Offshoring of Software Development - Methods and Tools for
Risk Management

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Agenda



- Motivation
- COCOMO
- Amplification
 - Identification
 - Categorization
 - Value Assignment
- Résumé & Future prospects



Motivation

- Focusing on the cost reduction solely causes problems
- The offshore Software Development comprises additional sources of costs and effort
- A more realistic cost estimation requires its scruting

COCOMO – the Constructive Cost Model



- Definition: “[...] a model which can estimate costs of Software projects [...]”
- The model is used for estimating the number of person-months it will take to develop a software product
- Widely accepted public cost model
 - Calibrated with 161 actual project data
- Objective impact analysis for the factors
 - If There is no data available for the parameter
- Can be calibrated from the organization’s historical data

COCOMO II



- Post-architecture Model
 - Widely used in praxis
 - Detailed information about the effort drivers
- Quantification of the Effort:

$$PM = A * Size^E * \prod_{i=1}^{17} EM_i$$

- PM: Person Month
- A: Constant (2.94 for COCOMOII.2000)
- Size: KSLOC (Estimation, Function Points)
- E: Scale Factors
- EM: Effort Multipliers

Amplification



Regarded Factors for the offshore Software Development



Effort Multipliers	Scale Factors
Product attributes: DOCU	PREC, TEAM, PMAT
Personal attributes: ACAP, PCAP, PCON, APEX, PLEX, LITEX	
Project attributes: TOOL, SITE, SCED	

Amplification



$$PM = A * Size^E * \prod_{i=1}^{17} EM_i * \prod_{n=1}^{11} EMO_n$$

- EMO: Efforts Multiplier Offshoring

1. Identification



Offshoring Factors	Buyers Offshoring Maturity	Providers Offshoring Maturity	Coordination Factors
CULT	BOXP	OOXP	OFIT
LANG	BUPM	OFPM	PMGM
TMZN	CDES	-	TESP

2. Categorization



- Example:
 - CULT

Categories	Categorization criteria
Very Low	Both companies are from the same country and the same geographical region
Low	Both companies are from the same country but from different geographical regions
Nominal	Both companies are from the same [HOFS80]-group, but belong to different countries
High	The companies belong to different [HOFS80-]-groups

3. Value assignment



- Example:
 - CULT

Categories	Value	Categorization criteria
Very Low	1,00	Both companies are from the same country and the same geographical region
Low	1,08	Both companies are from the same country but from different geographical regions
Nominal	1,15	Both companies are from the same [HOFS80]-group, but belong to different countries
High	1,22	The companies belong to different [HOFS80-]-groups

3. Value assignment



- Example:

- BUPM

Categories	Very Low	Low	Nominal	High	Very High
Driver					
# Projects	0	1-3	4-10	11-30	>30
Foreign deployment	0	1	2-5	5-10	>10
Foreign education	0%	0%-1%	1%-15%	15%-30%	>30%

2. Categorization



- Example:

- BUPM

Categories	Value
Very Low	1,25
Low	1,20
Nominal	1,15
High	1,10
Very High	1,05

Example



COCOMO II in house	COCOMO II distributed	Amplification best case	Amplification worst case
39	110,66	165,76	944,37

Résumé & Future prospects



- The model helps to come up with customer's expectations about project costs and duration
- The model provides estimation of the diapason or range, not the precise figure
- The number of collaborative companies (2) should be extended
- Calibration on the basis of more expert opinions and data basis has to be made

Example



Cultural Clusters [HOFS80]

Cluster Länder

Anglo Australien, Kanada, Irland, Neu Seeland,
Süd Afrika, Die Vereinigten Staaten von Amerika

Germanic Österreich, Deutschland, Israel, Schweiz

Nordic Dänemark, Finnland, Holland, Norwegen, Schweden

Latin European Argentinien, Belgien, Brasilien,
Frankreich, Italien, Spanien

Latin American Chile, Kolumbien, Mexiko,
Peru, Portugal, Venezuela,

Near Easter Griechenland, Iran, Türkei, Jugoslawien

Far Eastern Hong Kong, Indien, Pakistan, Philippinen

Singapur, Taiwan, Thailand

Arab Abu-Dhabi, Bahrain, Kuwait,

Oman, Saudi Arabien, U.A.E.

Japanese Japan

Other Clusters Other European, Other Asian, African,

Other Latin American, Other Middle Eastern,

Caribbean Basin

COCOMO



- **COCOMO II** is a model that allows one to estimate the cost, effort, and schedule when planning a new software development activity. It consists of three submodels, each one offering increased fidelity the further along one is in the project planning and design process. Listed in increasing fidelity, these submodels are called the Applications Composition, Early Design, and Post-architecture models. Until recently, only the last and most detailed submodel, Post-architecture, had been implemented in a calibrated software tool. As such, unless otherwise explicitly indicated, all further references on these web pages to "COCOMO II" or "USC COCOMO II" can be assumed to be in regard to the Post-architecture model.
- The implemented tool provides a range on its cost, effort, and schedule estimates, from best case to most likely to worst case outcomes. It also allows a planner to easily perform "what if" scenario exploration, by quickly demonstrating the effect adjusting requirements, resources, and staffing might have on predicted costs and schedules (e.g., for risk management or job bidding purposes).
- The **original COCOMO** model was first published by [Dr. Barry Boehm](#) in 1981, and reflected the software development practices of the day. In the ensuing decade and a half, software development techniques changed dramatically. These changes included a move away from mainframe overnight batch processing to desktop-based real-time turnaround; a greatly increased emphasis on reusing existing software and building new systems using off-the-shelf software components; and spending as much effort to design and manage the software development process as was once spent creating the software product.
- These changes and others began to make applying the original COCOMO model problematic. The solution to the problem was to reinvent the model for the 1990s. After several years and the combined efforts of USC-CSE, [IRUS at UC Irvine](#), and the [COCOMO II Project Affiliate Organizations](#), the result is COCOMO II, a revised cost estimation model reflecting the changes in professional software development practice that have come about since the 1970s. This new, improved COCOMO is now ready to assist professional software cost estimators for many years to come.