A comparison of SLIM and COCOMO estimates
versus historical man-power and effort allocation

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I. Abstract

The development of a Planning and Cost Control System is proceeding within Olivetti, where one or more software cost estimation models will be integrated. Cocomo and SLIM have been evaluated using data related to two industrial projects, and one project of the National Research Council.

The results have been compared between themselves and with the distribution of man-power and effort results from the historical data.

The approach for each case study has been the following:

1. Get from the historical data the input parameters for both SLIM and Cocomo models.
2. This has meant collecting values for the number of source code instructions of the product, as well as investigating on the production environment characteristics.
3. For both models, use data to obtain effort and manpower distribution curves, as if an a-posteriori estimation was carried on.
4. Collect historical data to allow drawing of real effort and manpower curves on the same diagram used for the models.
5. In this phase, normalisation has been executed on the time basis to allow consistency for the values given by the two models.
6. Compare the curves and try a qualitative interpretation on the basis of the characteristics of the project.

The following project case studies have been analysed:

I. Software for a hard disc WDENI unit;
II. Software for a COBOL programming environment;
III. Software for a multi-micro architecture development environment.

Noting that the above case studies all deal with system software rather than application software.

It may be observed that for such systems (although developed by different organisations) a common behaviour can be observed, which differs somehow from that of application software systems.
A COMPARISON OF SLIM AND COCOMO ESTIMATES VERSUS HISTORICAL MAN POWER AND EFFORT ALLOCATION

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MOTIVATION

- planning and cost control system under development
- includes one or more models for software projects cost estimation
- SLIM and COCOMO under evaluation
FRAMEWORK

. get historical data and information to be used as models input parameters (DSI, development mode, effort up to first external release)

. feed models with these parameters, and get man-power and effort curves as if an a-priori estimate was carried on

. draw man-power and effort curves obtained using historical data

. compare the results
CASE STUDIES

- software for hard disc WREN1 unit
- software for COBOL programming environment
- software for multi-micro architectures developing environment
WREN1 DISC SOFTWARE

- I/O subsystem, diagnostics programs, initialisation and formatting programs, installation and copy utilities
- people: 17
- duration: 14.2 months
- DSI: 29736
- mainly PASCAL, Z8000 ASM is a minor part
SLIM APPLICATION

- \( Y(td) \): 52.99 man-months
- \( Ck \): 10239 (high)
- \( D \): 8.60 (low)
- \( \text{grad}(D) \): 7.27 (low)
- \( \text{PROD} \): 5877 DSI/man-year

COCOMO APPLICATION

- mode: organic (familiar)
DSI = 29376
mode = organic
Ck = 10239

Table 1.2
MODELS COMPARISON VS HISTORICAL DISTRIBUTIONS

- effort underestimated by models up to development time

- effort overestimated by models after the development time

- man-power overestimated by COCOMO

- man-power underestimated by SLIM in early phases, then overestimation takes place

- both models completely unreliable after the time of the first external release

- reason: the organisation anticipates activities. Activities taken into account by models are less important for this kind of software
COBOL PROGRAMMING ENVIRONMENT SOFTWARE

- compiler and interpreter, closely related
- people: 14
- duration: 21.0 months
- DSI: 26000
- mainly PLZ/sys, minor parts of PLZ/asm and LIMO (interpretive language)
SLIM APPLICATION

- Y(td): 134.818 man-months
- Ck: 3940 (low)
- D: 10.01 (low)
- grad(D): 5.72 (low)
- PROD: 2045 DSI/man-year

COCOMO APPLICATION

- mode: semidetached
Table 2.1
DSI = 26000
mode = semidetached
Ck = 3940

-- reality
-- smoothed COCOMO
-. SLIM
MODELS COMPARISON VS HISTORICAL DISTRIBUTIONS

- effort underestimated by models up to development time
- effort overestimated by models after the development time
- man-power underestimated by models in early phases, then overestimation takes place
- both models completely unreliable after the time of the first external release
- reason: the organisation anticipated through activation of beta-site in the middle phases of development
MULTI-MICRO PROGRAMMING SOFTWARE

- programming subsystem (compilers, interpreters, code generators)
- network related functionalities
- relational database and general utility programs

- people: 16
- duration: 38.0 months
- DSI: 55803
- PASCAL
SLIM APPLICATION

. Y(td): 125.00 man-months
. Ck: 3882 (low)
. D: 2.83 (very low)
. grad(D): 0.89 (very low)
. PROD: 4672 DSI/man-year

COCOMO APPLICATION

. mode: semidetached
Multi-Micro programming software

DSI=55083
mode=semidetached
Ck=3882

--- reality
-- smoothed COCOMO
-. SLIM

Table 3.1
MODELS COMPARISON VS HISTORICAL DISTRIBUTIONS

- effort slightly underestimated by SLIM up to development time. Amount of underestimation is small. After development time, overestimation take place

- effort always overestimated by COCOMO. Also the trend of the curve does not match with the real one

- man-power underestimated by SLIM in early and middle phases. Near development time, overestimation takes place

- man-power always overestimated by COCOMO

- both models completely unreliable after the time of the first external release

- reason: the organisation anticipates activities. The behaviour of COCOMO in this case deserves further analysis
CONCLUSIONS

- man-power and effort distribution laws as embedded in the models do not fit real distribution for the three case studies.
- behaviour for the three case studies is homogeneous.
- anticipation of some activities and less effort spent on others.
- compressed software life cycle.
- system software.
- flat region at the beginning.
- external constraints imposed on man-power allocation.