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A Comparative study of COCOMO II and Putnam models of Software Cost Estimation

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Abstract - Project planning is one of the most important activities in software projects. Poor planning often leads to project faults and dramatic outcomes for the project team. If cost and effort are determined pessimistic in software projects, suitable occasions can be missed; whereas optimistic predictions can be caused to some resource losing. Nowadays software project managers should be aware of the increasing of project failures. The main reason for this problem is imprecision of the estimation. The accurate prediction of software development costs may have a large economic impact. As a consequence, considerable research attention is now directed to understand better the software development process. The objective of this paper is to provide an example base study of two software cost estimating models (COCOMO II and PUTNAM). By the case study, it is observed that Putnam model is very sensitive to the development time: decreasing the development time can greatly increase the person-months needed for development whereas COCOMO II is more realistic because it is based on functions points and object points of the project.

Index Terms – Cost Estimation, COCOMO II, Effort estimation Putnam Model, scale factors, effort multipliers, cost parameters

1 INTRODUCTION

Software cost estimation is a prediction of the cost of the resources that will be required to complete all of the work of the software project.

Software has a bad reputation about cost estimation. Large software projects have tended to have a very high frequency of schedule overruns, cost overruns, quality problems, and outright cancellations. Instead of it bad reputation, it is important to note that some large software projects are finished on time, stay within their budgets, and operate successfully when deployed.

A widely respected survey (CHAOS Reports) of software projects in industry and government, estimated that, only 29% of software projects in large enterprises succeeded, 53% were challenged and 18% failed to deliver in proper cost and budget. The projects that are in trouble have an average budget overrun of 56%. This represents a serious and chronic risk control problem.

Software cost estimation is a complex activity that requires knowledge of a number of key attributes about the project for which the estimate is being constructed. Creating accurate software cost estimates requires knowledge of lots of parameters.

The overall process of developing a cost estimate for software is not different from the process for estimating any other element of cost. There are, however, aspects of the process that are peculiar to software estimating. Some of the unique aspects of software estimating are driven by the nature of software as a product. Other problems are created by the nature of the estimating methodologies. Software cost estimation is a continuing activity which starts at the proposal stage and continues through the lift time of a project. Continual cost estimation is to ensure that the spending is in line with the budget.

Cost estimation is one of the most challenging tasks in project management. It is to accurately estimate needed resources and required schedules for software development projects. The software estimation process includes estimating the size of the software product to be produced, estimating the effort required, developing preliminary project schedules, and finally, estimating overall cost of the project.

After years of research, there are many software cost estimation methods available including algorithmic methods, estimating by analogy, expert judgment method, price to win method, top-down method, and bottom-up method. No one method is necessarily better or worse than the other, in fact, their strengths and weaknesses are often complimentary to each other. To understand their strengths and weaknesses is very important when you want to estimate your projects. Two of the well known software cost estimation methods are discussed below:

PUTNAM MODEL

The form of this model is:

Technical constant C= size * $B^{1/3}$ * $T^{4/3}$

Total Person Months B=$1/T^4$ *$(size/C)^3$

T= Required Development Time in years

Size is estimated in LOC

Where: C is a parameter dependent on the development environment and It is determined on the basis of historical data of the past projects.

Rating: C=2,000 (poor), C=8000 (good) C=12,000 (excellent).

The Putnam model is very sensitive to the development time: decreasing the development time can greatly increase the person-months needed for development.

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One significant problem with the PUTNAM model is that it is based on knowing, or being able to estimate accurately, the size (in lines of code) of the software to be developed. There is often great uncertainty in the software size. It may result in the inaccuracy of cost estimation.

COCOMO II

Both the Post-Architecture and Early Design models use the same functional from to estimate the amount of effort and calendar time it will take to develop a software project. The amount of effort in person-months, PM, is estimated by the formula:

$$PM = A \times Size^{E} \times \prod_{i=1}^{n} EM$$

$$\text{where } E = B + 0.01 \times \sum_{j=1}^{5} SF_j$$

The amount of calendar time, TDEV, it will take to develop the product is estimated by

$$TDEVNS = C \times (PMNS)^{F}$$

$$\text{where } F = D + 0.2 \times 0.01 \times \sum_{j=1}^{5} SFj$$

$$= D + 0.2 \times (E - B)$$

In COCOMO-II effort is expressed as person month(PM). COCOMO II treats the number of person-hours per month, PH/PM, as an adjustable factor with a nominal value of 152 hours/PM.

- The value of n is 16 for the Post-Architecture model effort multipliers, Emi, and 6 for the Early Design model, the number of SFi stands for exponential scale factors.

The values of A, B, C, D, SF1 …, and SF5 for the Early Design model are the same as those for the Post-Architecture model.

CASE STUDY

CALL MANAGER IN ANDROID

As a case study we have taken a project in consideration which was developed for an very US based client. The project takes care calls and SMS details for a client.

After completion of project we calculated the efforts (Person-Month) using COCOMO II and got the actual time taken to develop the project. Total line of code of Android is 2122 i.e. 2.1 KLOC.

COCOMO II

For all the scale factors and effort multipliers we have taken average for all the parameters. By calculating the final values which we got are

$$\sum_{j=1}^{5} SF_j = 18.97$$

$$E = B + 0.01 \times \sum_{j=1}^{5} SF_j = 1.097$$

$$\prod_{i=1}^{n} EM = 0.184295$$

$$PM = A \times Size^{E} \times \prod_{i=1}^{n} EM$$

$$\text{where } E = B + 0.01 \times \sum_{j=1}^{5} SF_j$$

Applying the values on formula :
Here we have

A = 2.94
Size = 2.1
E = 1.097
B = 0.91
$\prod EM$ = 0.184295

PM = 1.225196

Actual time taken for this project is 1.5 Months

PUTNAM MODEL

Table for Putnam parameters

				Remarks
T =	0.17	T^4 =	0.000759333	Assuming we need project in 2 months so .17 year.
Size	2122			Size in LOC

B (Person Month)	$1/t^4$	Size/C	C
24.57728047	1316.945031	0.26525	8000
		$(size/C)^3$	
		0.018662343	
Formula = $1/T^4$ *$(size/C)^3$			Assuming development env. average

CONCLUSION

By the results we can see that time is very dominating factor in Putnam model. Putnam model is basically based on only two variables which is time and size. It is not considering all other aspects of software development life cycle. Whereas in COCOMO II we are getting more nearer results because it is considering almost all aspects of SDLC.

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