Improved Software Cost Estimation Scenario using WBS with COCOMO II – A Review

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***Abstract*— The effort and cost estimation of software projects is very crucial activity. If we don't have the proper ability to estimate the cost of product development it will lead us to major economical lose and bad market reputation. With the universal acceptance of researcher's different variants of COCOMO stands out as the best technique among all the cost and effort estimation techniques and this research we have tried to develop a more accurate cost estimation scenario using work breakdown structure and COCOMO II. Here a tool is developed which takes some numerical information of software project wireframe and system requirement specifications (SRS) as input and using WBS dividing the whole project into small tasks and then applies related cost drivers from COCOMO II effort and cost estimation model by this methodology it ensures an effective and faster approach for estimating software project development cost and effort.**

Keywords: Software Engineering, Cost Estimation, Effort Estimation, Work Breakdown Structure (WBS), COCOMO II.

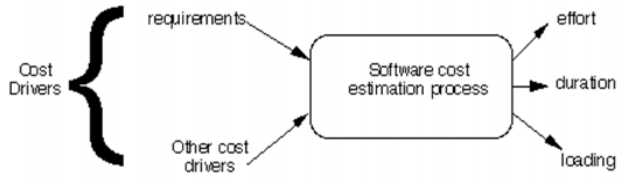
I. Introduction

Stability of market place in any business relies on the cost of product. The seller or producer can decide the selling price by the raw material and the effort used in production. Similarly in software project development while estimating the cost its complexity and efforts are taken in consideration. Software cost estimation plays a vital role in profit and growth of any IT industry if the software cost estimation is wrong that may cause a huge lose. According to a study in 2012 the worldwide cost of IT failure was about 3 trillion dollars [12] and in 2007 well reputed companies like TATA consultancy caused 62% of organizations experienced IT projects that failed to meet their schedules, 49% suffered from budget overruns, 47% had higher-than-expected maintenance costs, 41% failed to deliver the expected business value and ROI, 33% fail to perform against expectations [3]. In spite of this importance of cost estimation in software engineering very few have awareness of proper methodology of cost estimation like survey taken of 44 companies only 2 companies that clarified the meaning of their estimates and had a proper method for adding these estimates. So the improvement and awareness in the area of cost estimation scenario in software engineering stretch the attention of researchers. Since the development of COCOMO in 1981 to last variant was published in 2000 [6][7]. It has been accepted as a standard cost estimation methodology. But there is a scope of improvement in COCOMO II because using its all 16 cost drivers and 5 scale drivers in each and every scenario will consume more time in estimation as well as degrade the quality of estimation so there is a scope of improvement in that we've tried to overcome this problem using WBS with COCOMO II. The tool developed by this methodology will be faster and more reliable because of the processing inside that will be depend on classification and Parallelization.

II. BACKGROUND THEORY & RELATED WORK

COCOMO stands for constructive cost model. This cost model was presented in 1981 by an American software engineer named "Dr. Barry W. Boehm". It is also known as COCOMO 81. COCOMO applies to three classes of software projects: organic, semi-detached and embedded projects [6]. The COCOMO II is the uppermost extension of the original COCOMO 81. It has some sub-models like application composition, early design and post architecture models. COCOMO II can be used for decision situations like making investments, setting project budgets, making software cost and schedule risk etc. COCOMO II consist of 16 cost drivers and 5 scale drivers and this cost drivers depend on the rating of values corresponding to real numbers known as the Effort Multipliers(EM). This rating values ranges from very low, low, nominal, high, very high and extra high [7]. Work Breakdown

Structure can be defined as "It is a process of dividing complex projects to make it manageable". In WBS, the larger tasks are broken down in the small task of chunks which are easy to manage and estimate. Reasons for creating WBS project: accurate and readable project format, proper assignment of role to project team, milestones and check points can be established, define scope of project [8]. Software cost estimation can be defined as rough perspicacity cost for software project. It can never be measured accuracy because there are multiple variables which are involved in the calculation such as human, technical, environmental, political etc. It is usually measured in terms of effort. The most common metric used for these is person months or years. Basic cost estimation process is as follows:



Techniques of cost estimation are: Algorithmic model, expert judgment model, top-down, bottom-up, estimation by analogy etc [9]. Software effort estimation denotes the measurement of workforce and can be defined as the total time taken by the development team members to complete a given assignment. It is expressed in terms of man-day, man-month, man-year etc. Effort can vary from time-to-time. The reasons behind that are project approve, project management, understanding of project task [11].

III. LITERATURE SURVEY

After reviewing the papers and internet web sites

The effort estimation of any development project is necessary it helps to reduce the project failure. Smith et Al [10] provided task assignment factors and functional size of module but was not clearly mentioned how to calculate this values so in this paper "Applying Software Effort Estimation Model based on Work Breakdown Structure" by authors Wen-Tin Lee, Kuo-Hsun Hsu, ′Jonathan Lee and Jong Yih Kuo [1] shown a good way which combines task assignment factors and work breakdown structure to break project into main tasks. Then by using Unadjusted function point (UFP) and computing related experience (EXP) is used to obtain the functional size of that software module. These values are input to the effort estimation model with co-efficient values obtained by historical projects and shown improvements by using MRE and RMSE statistical equations for comparison.

In paper "GENERIC MODEL OF SOFTWARE COST ESTIMATION:A HYBRID APPROACH" the authors Lalit V. Patil , Rina M. Waghmode ,S. D. Joshi and V. Khanna have combined the algorithmic and non-algorithmic approach for the cost estimation of any software development project. In their research size, cost factors and scale factors are used as input to the principle component analysis. Now PCA will pre-process all these values and these values are given to the ANN and are further processed as the input to the COCOMO II model. Which will give the final results [2].

According to author Jorgensen, M. of paper "Fallacies and Biases when Adding Effort Estimates" when adding effort estimates there are many ways to estimate effort other then the COCOMO. From the survey of forty-four software companies according to author 73% of companies uses single point estimates, 14% company uses three-point estimates, 11% use formal estimates like COCOMO. The use of effort estimation methodology of all this companies are not wrong but while project has been developed in different modules or with WBS then after estimating the individual cost the summation of whole estimation is under-estimated so they have introduced a new technique called PERT method for summation of estimation and got improved and total effort estimation became unbiased [3].

The authors A. Sharon and D. Dori in "A project-product model-based approach to planning work breakdown structure of complex projects" that WBS method suffers some problems stemming the lack of explicit and directory representation of product facet in project plan by surveying object process methodology and work breakdown structure they have suggested some source which derives project development tools including WBS augmented with product related information. This review is suggesting more reliable product but still a practical approach needed to be developed [4].

The authors Ratnesh Litoriya, Narendra Sharma and DR.Abhay Kothari, in "Incorporating Cost driver substitution to improve the Effort using Agile COCOMO II" have developed a tool using by analyzing behavior of different COCOMO drivers that participates in accurately predicting the cost of any project and substitute it with its near value to show the effective decrease in the required effort using a web based tool Agile COCOMO II [5].

Comparison Table:

Paper Title	**Authors**	**Publication**	**Method Use**
Applying Software Effort Estimation Model based on Work Breakdown Structure	Wen-Tin Lee, Kuo-Hsun Hsu, Jonathan Lee and Jong Yih Kuo	IEEE 2012 Sixth International Conference on Genetic and Evolutionary Computing	Task assignment factors,WBS, UFP and EXP

GENERIC MODEL OF SOFTWARE COST ESTIMATION: A HYBRID APPROACH	Lalit V. Patil, Rina M. Waghmode, S. D. Joshi and V. Khanna	2014 IEEE International Advance Computing Conference (IACC).	PCA, ANN COCOMO II
Fallacies and biases when adding effort estimates	Magne Jørgensen	2014 40th Euromicro Conference on Software Engineering and Advanced Applications	PERT method and WBS
Incorporating Cost driver substitution to improve the Effort using Agile COCOMO II	Ratnesh Litoriya, Narendra Sharma and Dr. Abhay Kothari	IEEE 2012 CSI Sixth International Conference on Software Engineering (CONSEG) - Indore, Madhay Pradesh, India	Agile COCOMO II, Used WEKA tool
A Project–Product Model–Based Approach to Planning Work Breakdown Structures of Complex System Projects	A. Sharon and D. Dori	2015 IEEE Systems Journal, volume: 9, issue: 2.	PPLM

Table 1: Literature Survey Summarization.

IV. Research Gap and Conclusion

After surveying different methodology we observed that various tools and techniques are available for cost and effort estimation. But they are having some overhead due to no classification in applying cost factors or drivers while estimating the effort and cost.

Still there is a scope of improvement by classification of task by Work-Breakdown Structure (WBS) and applying only appropriate cost driver to specific task for overall cost estimation. This will result into a better software cost estimation tool development.

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