A STUDY OF TOOLS, METHODS AND TECHNIQUES OF SOFTWARE COST ESTIMATION

Khin Sein Hlaing, Moh Moh, Yin Myo Kay Khine Thaw

Lecturer, Faculty of Information Science, University of Computer Studies, Mandalay, Mandalay, Myanmar
Lecturer, Faculty of Information Science, University of Computer Studies (Mandalay), Mandalay, Myanmar
Lecturer, Information Technology Supporting and Maintenance Department, University of Computer Studies (Mandalay), Mandalay, Myanmar

ABSTRACT

Software cost estimation is the process of predicting the effort required to develop a software system. Software Cost Estimation is becoming critical for both developers and customers to making the decision. An accurate Software Cost Estimation is becoming serious for both developers and customers to making the decision. There are several aspect needs to be concern that might influence the cost estimation. This paper gives an insight into the various models and techniques used in estimating cost of the software cost estimation.

Keywords: *Software Engineering: Software Cost Estimation*

1. INTRODUCTION

Cost estimation includes the process or methods that help us in predicting the actual and total cost that will be needed for our software and is considered as one of the complex and challenging activity for the software companies. Their goal is to develop software which is cheap and at the same time deliver good quality. Software cost estimation [1] is used basically by system analysts to get an approximation of the essential resources needed by a particular software project and their schedules.

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. Furthermore, the implementation Software Cost Estimation will be affect to the schedules, team skills, team cohesion, productivity advantage, complexity, reliability, quality, and many other features of the project [1]. Within the implementation, the process of estimation need to be done in a full time process and must be carried out in every phase of Software Development Life Cycle (SDLC). It is intended to keep in tract with a change during the development process.

Software cost estimation [5] is used basically by system analysts to get an approximation of the essential resources needed by a particular software project and their schedules. Important parameters in estimating cost are size, time, effort etc.

This study is focusing on the Software Cost Estimation especially for tools, methods, and techniques used for cost estimation purpose and software cost estimation is a cost estimation of software project development. In other definition, software cost estimation can be described as the process of predicting the required effort to develop a software system [2][3].

2.SOFTWARE COST ESTIMATION TOOLS

Here, the four tools to estimate cost ends. Using some of these tools and techniques when you're planning your project can help with your project budgeting.

Analogous Estimation

- It is the fastest technique to estimate cost but least accurate.
- This technique can be applied with limited information available about the project.

Parametric Estimation

- This technique uses the statistical relationship between historical data and variables; e.g., cost of painting a wall per square foot.
- It is more accurate than the analogous estimation.

Three-point Estimation

This technique uses three estimates to calculate the average estimate. The three estimates are the most likely cost, the pessimistic cost, and the optimistic cost.

- It reduces bias, risk, and uncertainty from the estimation.
- It is more accurate than the analogous and parametric estimating techniques.
- Bottom-up Estimation
- This is the most accurate technique of all the methods presented.
- This technique can only be used when every detail about the project is available.
- This is a time-consuming and costly technique but gives the most reliable and accurate result.

It is important to note that the more accurate a method, the costlier and time consuming it becomes. Based on this reason, it is not always advisable to use **bottom-up estimating** when you are short on time or resources, even though it might be the most accurate. [11]

3.SOFTWARE COST ESTIMATION METHODS

According to [6] and [7], the Software Cost Estimation Methods method are the combination of the following method: 1. Estimates made by an expert 2. Estimates based on reasoning by analogy 3. Estimates based on Price-to-Win. 4. Estimates based on available capacity. 5. Estimates based on the use of parametric models. Cost estimation method into several categories the estimation method into six approach which are Regression-based estimation approaches, Analogy-based estimation models, Expert judgment-based estimation models, the function point-based estimation approaches, Theory-based estimation approaches, and the diversity of estimation approaches. In this research, they are providing the information regarding to the distribution used.

In [8] categorize the estimation technique into two categories which are Qualitative cost estimation methods and Quantitative cost estimation methods. Qualitative cost estimation methods are based on the comparison analysis of new product with the previous product that has been manufactured by identify the similarities from both of the product. The implementation of qualitative technique may help the estimator to rough estimates the product during the conception process. These qualitative methods are further categorize into Intuitive cost estimation and Analogical cost estimation. In the other hand, quantitative methods are cost estimation methods based in the detailed analysis of product including the design, features, and manufacturing processes instead of simply relying on the past data or estimator knowledge. This quantitative method is further categorize in to Parametric cost estimation and Analytical cost estimation.

In [9] are grouped the estimation methods into three main categories which are expert judgment-based methods, model-based methods and the software estimation techniques into six categories. Those are Model-based techniques, Expertise-based techniques, Learning-oriented techniques, Dynamics-based techniques, Regression-based techniques, and Composite techniques. In addition, [10] are divide software cost estimation into two categories which are Algorithmic method and Non-Algorithmic method.

4. SOFTWARE COST ESTIMATION TECHNIQUES

In the actual cost estimation process, there are other inputs and constraints that needed to be considered besides the cost drivers. One of the primary constraints of the software cost estimate is the financial constraint, which are the amount of the money that can be budgeted or allocated to the project. There are other constraints such as manpower constraints, and date constraints. [4]

In the Expert judgement, several experts on the proposed software development techniques and the application domain are consulted. They each estimate the project cost. Expert judgment techniques involve

consulting with software cost estimation expert or a group of the experts to use their experience and understanding of the proposed project to arrive at an estimate of its cost. These estimates are compared and discussed. The estimation process iterates until an agreed estimate is reached. This technique captures the experience and the knowledge of the estimator who provides the estimate based on their experience from a similar project to which they have participated. [4]

In the Pricing to win, the software cost is estimated to be whatever the customer has available to spent on the project. The estimated effort depends on the customer's budget and not on the software functionality. In other words, the cost estimate is the price that is necessary to win the contract or the project. [4]

In the Estimation by analogy, this technique is applicable when other projects in the same application domain have been completed. The cost of new project is estimated by analogy with these completed projects and comparing the proposed project to previous completed similar project in the same application domain. It has been estimated that estimating by analogy is superior technique to estimation via algorithmic model in at least some circumstances. It is a more intuitive method so it is easier to understand the reasoning behind a particular prediction. The actual data from the completed projects are extrapolated. Can be used either at system or component level. [4]

In the Bottom up, cost of each software component is estimated and then combine the results to arrive the total cost for the project. The goal is to construct the estimate of the system from the knowledge accumulated about the small software components and their interactions. [4]

In the top down, this technique is also called Macro Model, which utilize the global view of the product and then partitioned into various low level components and start at the system level and assess the overall system functionality and how this is delivered through sub systems. [4] Using top-down estimating method, an overall cost estimation for the project is derived from the global properties of the software project, and then the project is partitioned into various low-level components. The leading method using this approach is Putnam model. This method is more applicable to early cost estimation when only global properties are known.

In the Algorithmic cost modelling, use of mathematical equations to predict cost estimations and equations are based on theory or historical data. An algorithmic cost model can be built by analyzing the costs and attributes of completed projects and finding the closest fit formula to actual experience. [4] Various techniques are used in software cost estimation and we can broadly classify these techniques into two categories namely Algorithmic and Non Algorithmic techniques. Algorithmic techniques rely on mathematical equations to estimate software cost. Constructive Cost Model (COCOMO) is a popular and widely used Algorithmic set of models. [5] Algorithmic methods have many advantages but at the same time these methods are hard to learn and too much data is needed about the current project state in these methods. Conversely Non-Algorithmic techniques are easy to learn but we need to have complete information about one of the very similar previous projects as compared to our current software project, as estimation in these are made on the basis of historical data. [5]

5.CONCLUSION

The software cost estimation is an acute issue to make the good management decisions and accurately determining how much effort and time a project required for both project managers as well as system analysts and developers. Software cost estimation if done before the initiation of a project can help in determining the features which can be included within the limited resources of the project. There are many methods of estimating cost but as it is clear that we cannot consider any single technique to be the best one as each of the techniques have their own advantages and disadvantages. To understand their strengths and weaknesses is very important when you want to estimate your projects**.**

REFERENCES

[1]. F. S. Gharehchopogh, I. Maleki, and A. Talebi, "Using hybrid model of Artificial Bee Colony and Genetic Algorithms in Software Cost Estimation," in 2015 9th International Conference on Application of Information and Communication Technologies (AICT), 2015, pp. 102–106.
[2]. H. LEUNG and Z. FAN, "SOFTWARE COST ESTIMATION," in Information and Software Technology, vol. 34, no. 10, 2002, pp. 307–324

[3]. N. Kushwaha and Suryakant, "Software cost estimation using the improved fuzzy logic framework," in 2014 Conference on IT in Business, Industry and Government (CSIBIG), 2014, vol. 35, no. 1, pp. 1–5.

[4]. https://www.slideshare.net/KudzaiRerayi/software-cost-estimation-techniques-presentation.

[5]. Shivangi Shekhar, Umesh Kumar," Review of Various Software Cost Estimation Techniques". International Journal of Computer Applications (0975 – 8887) Volume 141 – No.11, May 2016.

[6]. F. J. Heemstra and R. J. Kusters, "Function point analysis: evaluation of a software cost estimation model," Eur. J. Inf. Syst., vol. 1, no. 4, pp. 229–237, Dec. 1991.

[7] .F. J. Heemstra, "Software cost estimation," Inf. Softw. Technol., vol. 34, no. 10, pp. 627–639, Oct. 1992

[8]. A. Niazi, J. S. Dai, S. Balabani, and L. Seneviratne, "Product Cost Estimation: Technique Classification and Methodology Review," J. Manuf. Sci. Eng., vol. 128, no. 2, p. 563, 2006.

[9]. K. Molokken and M. Jorgensen, "A review of software surveys on software effort estimation," in 2003 International Symposium on Empirical Software Engineering, 2003. ISESE 2003. Proceedings., 2003, no. 1325, pp. 223–230

[10]. L. V Patil, R. M. Waghmode, S. D. Joshi, and V. Khanna, "Generic model of software cost estimation: A hybrid approach," in 2014 IEEE International Advance Computing Conference (IACC), 2014, pp. 1379–1384

[11].https://pmstudycircle.com/2012/06/4-tools-to-estimate-costs-in-the-project-management/comment-page-1/