

A Survey on Cost Estimation Process in Malaysia Software Industry

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ABSTRACT

One of the issues that arise within the community of software developers is the process of estimating costs. Questions such as how and what is proper and correct process has always been a matter of much thought among them. Estimation of the exact things related to system development process taken into account and will produce accurate results. In the success of this research, a survey was conducted among those involved in this

process as a project manager and developer of the system. The study shows that method of estimation, experience and some serious matter related to software development process help to obtain accurate results. In conclusion, the consideration of important matters in the software development process helps to produce an accurate budgeting.

KEYWORDS

Software Development, Experience, Person, Accurate, Budget

1. INTRODUCTION

Cost estimation is a prediction process of defining the required cost in order to get the accurate cost of equipping facility, producing goods or providing services. It is important in managing a project especially for the project manager when proposing a budget for certain project.

The occurrence of common software failure was caused by the poor cost and schedule estimation [1]. That is why accurate cost estimation is needed for software development.

An accurate and efficient cost estimation methodology is very important for software development as it would assist the management team to estimate the cost. Furthermore, it will ensure the development of cost suits the planned budget and provides a fundamental motivation towards the software development.

The objective of this study is to investigate the current practice in software cost estimation process. The discussion of this paper begins with the introduction and followed by the discussion on the literature review. The third section will be the methodology and followed by the discussion on the results. The last section of this paper is the conclusion.

2. SOFTWARE COST ESTIMATION PROCESS

Cost estimation is a prediction process to get close result of required cost. It includes the process of considering the required cost, experiences, time constraints, risks, methods used, schedules, resources and other elements related to the development of a project. Hence, cost estimation is important in managing a project especially to the project manager when proposing budget for certain project. In software development a widely used term is “software project estimation” where its function is to calculate the estimation process. Cost estimation is the determination of quantity and predicting or forecasting within a defined scope of the costs required to construct and equip a facility to manufacture goods or to furnish a service. Included in these costs are assessments and an evaluation of risks and uncertainties.

A cost estimation process considers and determines utilized experience by an expert, calculating and forecasting the future cost of resources, methods and schedule for any project development. It provides input to original baselines and changes the baselines against cost comparisons throughout a project. It is performed at a certain point based on the available information at a certain time. Normally, it includes cost estimation details, a cost estimation summary, basis of estimation which describes the project details, estimation methodologies, type of cost estimation including risk, cost driven, cost adjustment and so on [2],[3].

Estimation is depicted as “black art” because it is a subjective process [4]. One person might take a day to do a task that might only require few hours of another’s

time. As a result when many people are asked to do the estimation process, they might give different answers and results. But if the work is actually performed, it takes only actual amount of the time and any estimation that did not come close to that actual time is considered inaccurate. To someone who has never involved in estimation process, estimations is just an attempt to predict the required cost and resources. It is important to assume that the project will come in on time in order to have good estimation practices and to improve the accuracy of estimation process. Hence, the project manager can help to create a successful estimation for any software project by applying good techniques and understanding what makes estimation more accurate.

Software project estimation is a form of problem solving and in most cases; the problem that needs to be solved is too complex to be considered in one piece [5]. To solve the problem, it can be decomposed and restructure to a smaller problem. There are software sizing, problem based estimation which is line of code estimation and function point based estimation, process-based estimation, used-case based estimation and reconciling estimations.

The main purpose of doing software estimation is to reduce the amount of the estimated actual cost in software process development. Software estimation is crucial and any cost estimation error can make a difference between profit and loss. Each factor must be well considered and well calculated. Over cost will cause a bad impact to the organization and the developer [6],[7].

In real life, cost estimation process is difficult because it requires the estimator to consider many factors or variables such as hardware costs, travel costs, training costs, man power, environmental, effort, expertise advices and government policies[8],[9],[10],[11]. Effort costs are generally the largest and least predictable development effort. Therefore, most cost estimations estimate the effort cost using man-month (MM) as cost unit. All these factors will affect the overall cost and effort involve in any project that one wants to develop. So, one needs something that can give better result in doing estimation in order to achieve the most accurate result.

3. METHODS

This part analyses result on survey done. A random survey was conducted in order to get an overview of current practice in cost estimation process among project managers and web developers. A set of questionnaire has been developed and distributed to 30 software companies in Klang Valley to get responses from information technology background which are identified as project manager and web developer who are closed to cost estimation process in web development project.

The purpose of this survey was to identify current practices of cost estimation process by the public specially the project managers and web developers. From 30 questionnaires distributed, only 13 questionnaires were returned to the researcher which is 8 project managers and 5 web developers.

3.1 Questionnaires Organization

The questionnaires are divided into two parts which is Part A and Part B. In part A, the questions are focus on background and the understanding of current practices of cost estimation process. There are nine questions to be asked in this part. The respondents has been asked about their position in the company, the cost estimation method that they familiar and normally used in cost estimation process. Basically, this part is concentrated on the current practices in cost estimation process. In this part, there are three metric tables design of which using five (question 2), four (question 3) and three (question 4) point-scales. The rest of questionnaire is closed-ended questions (question 1, 5,6,7,8 and 9).

The second part which is part B was concentrated on cost estimation process. There are 8 questions that have been asked in this part. The questions focused on how the cost estimation process was conducted. In part B, all questions are close-ended type.

Example of questionnaire is attached (labelled as Appendix A) in the appendices section of this dissertation. The survey results were discussed accordingly to the questions and answers by the respondents in the next section.

4. RESULTS AND DISCUSSION

4.1 Position in the company

There are 8 project managers and 5 web developers who have responded to this research. This is because most people who are involved in cost estimation process in

an organization are project manager and web developer.

4.2 Cost Estimation Method Used

Table 1: Score in average

| Method | PM | Web-Dev. |
|------------------|------|----------|
| Expert Judgment | 4.75 | 4.2 |
| Algorithmic | 3.87 | 3.0 |
| Analogy | 2.5 | 1.2 |
| Bottom-up | 2.62 | 1.2 |
| Top-Down | 2.62 | 1.2 |
| Parkinson-Ian | 2.7 | 1.2 |
| Machine Learning | 2.8 | 1.2 |
| Price-to-win | 4.37 | 3.6 |

Table 1 show that the Expert Judgment method is the most preferable method in cost estimation process. However, the raw score from the respondents of the web developer are lower than that of the project managers (i.e. 4.75 and 4.2 respectively). The second preferable method is Price to Win and the third is the Algorithmic Model. This could be done to people involved in cost estimation process usually make the estimation based on previous project (experiences). The rest of the scores from both charts indicated much lower scores which shows that the rest of the methods are less preferred by the respondents.

In order to analyse the result, the researcher has developed the indicator such in Table 2 below.

Table 2: Coding of level of understanding of cost estimation method.

4.3 The Accuracy of Cost Estimation Method

Both project managers and web developers agreed that Expert Judgment, Price-to-Win and Algorithmic Model methods produce most accurate result in cost estimation process. This result is incongruent to the method preferable used by the project manager and web developer. Table 3 show the accuracy of cost estimation method based on project manager and web-developer opinion when they used specific method.

Table 3: Accuracy of Cost Estimation Method

| Method | PM | Web-Dev. |
|------------------|-----|----------|
| Expert Judgment | 1.0 | 1.2 |
| Algorithmic | 1.2 | 1.6 |
| Analogy | 2.7 | 3 |
| Bottom-up | 2.6 | 3.2 |
| Top-Down | 2.6 | 3 |
| Parkinson-Ian | 2.7 | 3.2 |
| Machine Learning | 2.6 | 2.8 |
| Price-to-win | 1.2 | 1.4 |

Table 4: Coding of Accuracy Estimation

| Coding | Accuracy Estimation |
|--------|--------------------------------------|
| 1 | Deviation less than 15% |
| 2 | Deviation between 16% - 30% |
| 3 | Deviation between 31% - 50% |
| 4 | Deviation more than 50% (inaccurate) |

Table 4 shows the assigned scale used in the table matrix question 3 of part A as it is entered in the SPSS worksheet. The Expert Judgment method is the most accurate method selected by the respondents in cost estimation process

| Mean | Level |
|------|-------------------------------------|
| 1 | Unknown |
| 2 | Known by name |
| 3 | Theoretical Knowledge |
| 4 | Theoretical and practical knowledge |
| 5 | expert |

which achieve an average the score of 1.0 (within the deviation of less than or equal to 15%). The second most accurate are Price to Win and Algorithmic Model method.

4.4 Effort Necessary for Estimation

Table 4 shows the effort necessary in cost estimation process. The Expert Judgment and Algorithmic Model, Analogy, Bottom Up, Top Down and Machine Learning methods has shown had less effort in the process. Parkinson Ian and Price to Win need more effort to estimate.

The higher average shows the high effort whereas lower average shows the low effort in cost estimation process.

Table 5: Effort necessary in cost estimation process

| Method | Average |
|------------------|---------|
| Expert Judgment | 1.77 |
| Algorithmic | 1.85 |
| Analogy | 1.69 |
| Bottom-up | 1.77 |
| Top-Down | 1.77 |
| Parkinson-Ian | 2.00 |
| Machine Learning | 1.85 |
| Price-to-win | 2.85 |

Table 6: Coding of Effort Necessary Estimation

| Coding | Effort Necessary Estimation |
|--------|-----------------------------|
|--------|-----------------------------|

| | |
|---|----------------|
| 1 | Low effort |
| 2 | Average effort |
| 3 | High effort |

Table 6 shows the coding of effort necessary estimation. If the average between 1 until 1.99, it is considered as low effort. If the average between 2 until 2.99, it considers as average effort and if the average is 3 and above, it considers as high effort in cost estimation process.

4.5 Number of Method Applies in a Single Estimation

Survey's result shows that 5 respondents apply one method in a single estimation, 7 respondents apply double methods and one respondent applies triple methods in a single estimation.

4.6 Saving the Estimated Data for Recent Project.

The survey's result shows that 9 respondents have saved their estimated data for recent projects. Only 4 respondents have not done so.

4.7 Reuse the Estimated Data for New Project

The survey result shows that 9 respondents reuse the estimated data for new projects and 4 respondents have acted otherwise.

4.8 Point of Time in Binding Estimation

The survey result shows the point of time in binding estimation. 2 respondents agreed binding estimation must perform at 'the end of study' or 'end of analyses'. Most of the respondent agreed the binding

time is during analysis part. 3 of them were agreed to bind during project beginning

4.9 Method Done in Estimation

In this question, the respondents were asked how estimation process was done. 10 respondents were done manually. Only 3 respondents did the estimation by using particular tools. It shows there is no proper tool that produces accurate result in estimation process.

4.10 Type of Software Has Been Developed

The survey result shows normal type of software that has been developed by the respondents. 12 respondents have involved in web-based application and only 1 respondent involved in e-commerce application.

4.11 Size of Software Has Been Developed

The survey result shows that 10 respondents have developed small size of web-based application. Only 3 of the respondents have developed large web-based application.

4.12 Core Person Involved in Estimation Process

The survey result shows the core person involved in estimation process. 11 of the respondents agreed that project manager plays an important role in cost estimation process rather than other positions.

4.13 Experiences of the Person

The survey result shows an experience of the person involved in cost estimation process. 11 of the respondents stated that the person who involved in current project have experience in previous project.

4.14 Year Person Involved in Estimation Process

The survey result show the year person involved in estimation process. Most of the person involved has more than 5 years' experience. Only 6 respondents stated that the person has experience between two to five years. It can be considered that they are an expert person in estimation process.

4.15 Method Used By Particular Person

The survey result show method used by particular person. 12 respondents have chosen Expert Judgment as a method in estimation process. It is due to the number of year involved by the person in charged. Only 1 respondent have chosen Algorithmic Model as a method.

4.16 Size Measure

The survey result shows the size measure in cost estimation process. 9 of the respondents have chosen function point as their size measure. 3 of the respondents have chosen web object which is the latest measurement in web-based application specially when deal with multimedia elements. Only 1 respondent has chosen data point as measurement.

From the survey finding expert judgment is the preferred method to estimate the cost among the project managers and web developers. The finding also shows that both project manager and web developer agreed the accuracy of cost estimation method is by using expert judgment technique. Majority of the organizations relied on individual's expertise and experience to arrive at cost estimates. Estimators were expected to arrive at accurate estimates by relying on their knowledge of the software process used within the organization and recollections of their previous projects.

Besides, the estimation cannot be improved without a well-defined and well – controlled of parameters. Organizations without a defined and controlled software process cannot achieve consistency in their software development. Without consistency in software development, consistently accurate estimates are not possible.

Based on the survey, the most preferred size measurement is by using function point rather than web object and data point. This is because the developers frequently dealing with coding. Lastly is an algorithmic cost estimation model are rarely used as the primary cost estimation technique. Generally, algorithmic models were not used as a primary means of cost estimation in most organization. That is why this research is proposed and considered algorithmic models as one of the important method besides expert judgment in order to perform cost estimation for web-based application project. This is due in the literature review that algorithmic model such as COCOMO

It provides accurate result in cost estimation process.

5. CONCLUSION

In conclusion, in order to get accurate estimation result, we must carry good cost estimation process. Proper selection cost estimation technique, correct size measure, person experiences, familiarity of software developed can contributed to the producing accurate cost estimation result.

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