

Review on Traditional and Agile Cost Estimation Success Factor in Software Development Project

Zulkefli Mansor¹, Saadiah Yahya², Noor Habibah Hj Arshad³

¹Faculty of Information Technology Industry

Universiti Selangor, Jalan Timur Tambahan, 45600 Bestari Jaya, Selangor, Malaysia

Tel: 6019-3937795 Fax: 0355238733

E-mail: kefflee@unisel.edu.my

²Computer Technology and Networking Studies, Faculty of Computer Science and Mathematics,

Universiti Teknologi MARA, 40450 Shah Alam, Selangor, Malaysia

Tel: 6055211150 Fax: 603-55435501

E-mail: saadiah@tmsk.uitm.edu.my

³System Science Studies, Faculty of Computer Science and Mathematics,

Universiti Teknologi MARA, 40450 Shah Alam, Selangor, Malaysia

Tel: 60355211241 Fax: 603-55435501

E-mail: habibah@tmsk.uitm.edu.my

ABSTRACT

Software development project is one of the important areas in software engineering. Many researches have been conducted and looked into issues in software development project such as methodology used, costing, challenges, type of project and many more. However, the most crucial issues in software development project are costing. Moreover, current trend in software development project is adopting agile as methodology. Therefore, this paper aimed to discuss success factors that influence in traditional and agile cost estimation process for software development project. Literature survey is carried out from the past researches. Then, this paper presents the success factors that bring to the successful of traditional and agile cost estimation in software development project. Realisation these factors will help software development communities contribute positively to the success of traditional or agile cost estimation process in software development project.

KEYWORDS

Traditional, Project Management, Costing, Software Engineering, Methodology

1. INTRODUCTION

The crucial question in software development project is how to complete a project in specific time, budget and resources. In order to measure these three attributes are achieved, person who involved in estimation process especially project manager need to measure all requirements are considered and well-defined [2], [3], [4] added project schedule overrun is one of the main contributors to project failure. Proper and complete resource identification is needed in order to start estimation process. With consideration of all the requirements, the cost estimation process becomes easier and will produce accurate result. In common practices, cost estimation process is crucial

at the early phases of software development. However, it can be in other phases for example in development and deployment process [5]. This is due to changes of needs and requirements from time to time. The accuracy of cost estimation is depending on how software development communities defined the resources needed and the quantity of the resource. Meaning that, they need to thoroughly analyze these two elements during the project planning phases. Zhang et al [6] has listed the important of cost estimation accuracy such as (i) it can help to classify and prioritize development projects with respect to an overall business plan, (ii) it can be used to determine what resources to commit to the project and how well these resources will be used, (iii) it can be used to assess the impact of changes and support re-planning, (iv) projects can be easier to manage and control when resources are better matched to real needs and (v) customers expect actual development costs to be in line with estimated costs.

A study conducted by Standish shows that only 16.2% with traditional methods were completed on-time and on-budget with all features and functions specified. However, 52.7% of the projects were completed over-budget, over the time estimate, and/or offering less features and functions; 31.1% of projects were canceled at some point during the development cycle (Standish Group, 1994). Figure 1 displays the result of the research. A more recent study by the same group (Standish Group, 2001) still showed only 28 percent of IT projects were completed on time, on budget and

with all the features and functions originally specified. Further, the study found that 23% of the projects failed and 49% of the projects were challenged.

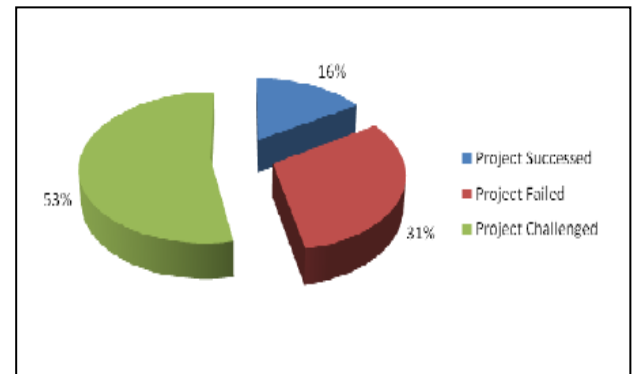


Figure 1: Result from Standish Report

This paper discusses on traditional and agile cost estimation success factors in software development project.

2. SOFTWARE COST ESTIMATION PROCESS

Software cost estimation process begins during the planning phases in Software Development Life Cycle (SDLC). The process starts with identifying the types of resources and the quantity needed. The resources include list of hardware and software, training session, testing activities, infrastructure and few more. When project manager is assigned to manage certain project, he or she needs to understand the entire project first in order to start planning the tasks. Then, he or she will start identify and investigate the types of resources and quantity needed. Then, the identified resources will be listed and estimated.

For example in developing a personal website, in order to develop the modules, project manager needs to list the type of hardware and software needed. Furthermore, the number of team member also needs to be considered. In this case, who need to be hired: the web developer or web designer or web programmer or others? If the web designer and web programmer are needed, the next thing the project manager needs to think is how many of them to be hired. This scenario is one of the examples on how resources identification is conducted. Then, project manager will start estimating the project cost from the list of resources needed. Wrong identification of resources at early planning stages could cause incorrect results in estimation process and may lead to over budget. Due to this scenario, project manager needs some kind of tool to help them in resources planning and cost estimation process.

Many techniques can be implemented in both processes (identifying the resources and estimating process) such as expert judgement, parametric model, top-down approach, bottom-up approach, price-to-win, analogy and few more. However until the date, researchers are still investigating the best technique to be applied in both processes. Based on the literature, many researchers try to combine few techniques which are called the hybrid model in estimation process in hoping to produce accurate results. But, this matter is still under investigation phase. However, [7] found expert judgment and COCOMO II are the best techniques that can be applied in web-based application. From the

literature, the most technique used to estimate the cost is by expert judgement [6], [8],[9],[10],[11] and COCOMO II [6],[7],[12]. Expert judgment is based on historical experience owned by the project manager may be or the person who are directly involved in estimation or budgeting cost. Normally, the estimation result is more accurate. However, some researchers felt that it can be bias since expert judgement is human [10].

3. SUCCESS FACTORS IN TRADITIONAL COST ESTIMATION

Standish CHOAS Report in 1994 reported that five most factors in influencing a successful project are user involvement, executive management support, clear statement of requirements, proper planning and realistic expectations. Previous research [13] and team member's technical skills are the top three factors that contributed to the successful of any software development project [5], [8]. Project manager also plays important roles and become important factor in the successful of any project [3], [8], [14], [15]. However, there are few more factors need to be considered such as entertainment, role of sponsors, changes of company policies, proper tool selection, suitable estimation technique and suitable software development methodology that contribute to the successful of cost estimation.

3.1 Entertainment

Overlook in entertainment cost is a serious matter in causing over budget in software development project. Entertainment cost is not only entertaining the client but includes having outside meeting with supplier or top management or other stakeholders. Some software development communities do not include entertainment cost in their estimation and budgeting process because they thought entertainment cost is not included in the expenses and they tend to use their own pocket money. However, if they look deeply into this matter, sometimes it causes them a big amount of money. As a result, they might claim these expenses under the project budget. Therefore, the actual cost is sometimes exceeded the allocation budget.

3.2 Changes of Company Policy

The changes of company policy can be one of the contributions for the success of cost estimation process in software development project. The changes include change of top management, change of technology, change of governs, change of environment and many more. All the changes are strongly affect to cost estimation process. In certain cases, an organization might have their own policy on resources, budget and duration of project. Therefore, software development communities need to consider the company policies in doing the estimation. Normally, the changes affect during the early stage, in progress or after the estimation process. However, the right

time to consider any changes is at the early stage of the estimation process.

3.3 Role of Sponsor

Sponsors are commonly seen as providing or contributing to the allocation of resources and budget of a project. The main role of sponsors is to ensure a project is managed within the budget. Even though the sponsor is not fully involved in the project but somehow the project manager needs to report frequently to the sponsor. In common practice, the sponsor will influence the decision made. Therefore, the involvement of sponsor is needed in order to make sure the identification of resources is done properly. Proper identifying of the resources will ensure the cost estimation process is properly done and perhaps will result an accurate estimation. Without the involvement of sponsors, team members will simply define the types and quantity needed for the project. Therefore, the possibility of cost increment and over estimation of budget is high for unnecessary resources.

3.4 Proper Tool Selection

Choosing the right proper tool is important in cost estimation process. The right proper tool produce an accurate results. Studied by Zulkefli et al [7] showed that most of the cost estimation process was done manually. The traditional common tool used in estimating the cost is spreadsheet or Microsoft excel and

Microsoft project. The biggest challenge in using the traditional method is the level of accuracy. Software development communities faced difficulty to achieve high accuracy in producing cost estimation result. Therefore, many studies have been done to develop automated tool for cost estimation process. However, no one claimed their proposed tool can produce accurate result.

Most of the researchers agreed that to produce accurate cost estimation is hard and crucial [12],[15],[16],[17]. From the literature, there is less accurate tool that can be used to estimate cost in any IS project. This is due to the different and various requirements and needs by the users or project developers [8],[18]. Even though, many researchers have tried to construct their own tool, until the date, nobody can claim their tool would produce good and accurate and widely acceptable estimation. Surprisingly, most of the process is done manually [12]. That shows, most of software development communities did not rely on automated tool.

Another reason is traditional tool does not provide a proper way in recording and tracking previous result of certain project. In some cases, the similarity from previous result can be applied for a new project. Therefore, a proper tool that provides good keeping and tracking system could help in order to estimate the cost for a new project. Common practice in using spreadsheet or Microsoft project is fragile. It might cause problem to track records that is missed place or the softcopy of the

file is corrupted. However, a proper tool will provide high level of result availability. Therefore, proper tool plays an important role in ensuring the accuracy and availability in cost estimation process.

3.5 Suitable Estimation Technique

In software cost estimation process, there are few techniques that can be applied to estimate the cost. For examples, the expert judgment, top-down approach, bottom-up approach, price-to-win, rules of thumb, parametric model, analogy, time boxes and many more. However, until the date, there is no research that can ensure which technique is the most suitable in cost estimation process. Therefore, many researches have been done investigating the most suitable technique that can be applied. Choosing the right cost estimation technique is important to ensure the result is accurate. Different approach applied in the cost estimation techniques might produce different accuracy of result. There are few researches have been carried out to integrate more than one technique which is called the hybrid technique. Yet, no one can claim which technique is the best. Therefore, there is no right and wrong approach in choosing cost estimation technique in a project. The most important matter is to choose the right technique which is suitable to the project. Sometimes, few techniques might be applied in a single project but it caused the increment of cost and time [19],[20] However, this does not mean the result is better.

3.6 Suitable Software Development Methodology

Software development methodology plays an important role in cost estimation process. However, some software development communities just ignore it in the estimation process. The examples of software development methodology are agile, spiral, waterfall, Rapid Application Development, prototyping and many more. Each software development methodology provide different step which contributes in cost estimation process. For example traditional method (example waterfall) provides different process compared to agile methodology. The simplest process can affect the way the software development communities do the estimation. Less step or process might decrease the cost involved. Therefore, to secure the cost estimation process, the most suitable and correct software of development methodology is needed.

4. SUCCESS FACTORS IN AGILE COST ESTIMATION

Since agile become more interesting to be adopted as new method in software development methodology, it is important to looked at how estimation process is done. Agile methodology provides simple process compare to traditional method. With agile, the development process becomes simpler and easier. Most of the researchers agreed that agile provides simple steps and much easier compared to the traditional method [21][22][23][24][25][26][27][28]. In general, agile provides more customer's

involvement, earlier testing, quick delivery and active requirements [21][22][23][24][25][26][27][28][29][30][31]. Agile helps software development community reduces their effort in development. Therefore, cost estimation process also effect from the different processes. Figure 2, shows the traditional software development process whereas; figure 3 shows the generic agile process.

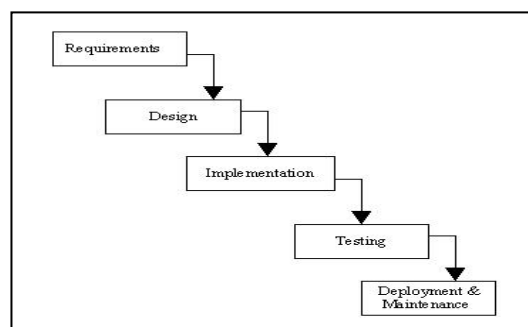


Figure 2: Traditional Methodology (Waterfall)

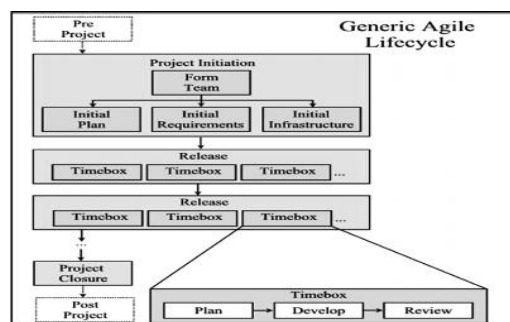


Figure 3: Generic Agile Methodology

Table 1 shows summarize the characteristics, strengths and weaknesses of Traditional and Agile Software Development Methods.

Table 1: Characteristics, strengths and weaknesses of Traditional and Agile Software Development Methods. (Jyun, 2010)

	TSDMs	ASDMS
Characteristics	<ul style="list-style-type: none"> • Extensive planning • Codified process • Rigorous reuse • Heavy documentation • Big design up front 	<ul style="list-style-type: none"> • Iterative and incremental • Customer collaboration • Frequent delivery • People centric • Light and fast development cycle
Strengths	<ul style="list-style-type: none"> • Straightforward, methodical, and structured nature • Predictability, stability, and high assurance 	<ul style="list-style-type: none"> • Short development cycle • High customer satisfaction • Low bug rate • Quick adaptation to rapidly changing business requirements
Weaknesses	<ul style="list-style-type: none"> • A slow adaptation to rapidly changing business requirements • A tendency to be over budget • A tendency to be behind schedule • Difficult to create a complete set of requirements up front 	<ul style="list-style-type: none"> • Significant document reduction and heavy dependent on tacit knowledge • Not sufficient test for mission/safety-critical projects • Not adequate for highly stable projects • Can be successful only with talented individuals who favor many degrees of freedom • Not appropriate for large-scale projects

Success factor in agile cost estimation are active customer involvement, strong communication, simplicity, fixed constraints and adopting of user stories.

4.1 Active Customer Involvement

Agile principle concerns with the customers' involvement in any software development project [21][22][23][24][25][26][27][28][30][32]. Less involvement from customers might cause misunderstanding of the process and output of the project. [33] added, active customer's involvement will ensure the project team has a clearer picture of the whole process and the expected output. It helps the project team to comprehend the scopes, the objectives and the requirements from the customers. An active customer's involvement also will verify the end product that is according to their needs [34]. When they customer completely identify the needs, it will help project team get the correct and complete requirements and indirectly it will reduce time and cost to review it again and again.

4.2 Strong Communication

Most of the researchers agreed that communication plays an important role in any software development project [34]. In general, communication is an activity of conveying information between people or groups of people. The purpose of communication is an approach to discuss something whether formal or informal [33]. It can be done at workstation or at any places as stated by [34]. They added, it reflects to whom, how and where to communicate. In software development, communication occurs between customers and project team. Active communication between them will lead to the success of software development [35][36]. Frequent meeting or discussion with customers and team will establish strong relationship and trust [33]. Furthermore, it avoids misunderstanding of scope or poor defined of requirements [33]. He added, an active or daily communication between customers and the project team will shorten and smoothen the development process. Therefore, strong communication help in project team to reduce their effort and definitely will reduce the cost involved.

4.3 Simplicity

Agile offers simplicity in a process. For example in Figure 1, the process is shorter compared to the traditional method. It helps the project team to complete the project in shorter duration because of the process is not that complex. [33] stated that there are three dimensions or faces to

simplicity which are; do less, do better, and do swarms. 'Do less' means do fewer activities, produce fewer documents, and reduce management reports. Whereas, 'do better' has a particular flavour particularly when applied to design and 'do swarms' value simplicity for the complexity it generates. The concept of swarm intelligence comes from complexity theory which is the right set of simple rules, applied within a group of highly interactive individuals, produces complex behaviours such as innovation and creativity [37]. The last face which is do swarms is often overlooked and underappreciated by a great number of people, both in and outside the agile community.

4.4 Fixed Constraints.

In agile software development, fixed constraint such as fixed-price, scope and schedule sometimes can help the team efficiency. It can help project team more focus on the budget, scope and schedule [39]. Adopting fixed price in agile ensure sharing great deal of risk among customers and developer [40]. [38] added, fixed budget and schedule is a nature of agile method and the scope still remain flexible It can be done through combination of industry experience and agile project team in planning and estimating project scope and effort accurately.

4.5 User Stories

A user story is other name for features in software development. The term is widely used in XP programming. It describes details user requirements in a story card

and written by a customer [41]. Then, the developer will estimate the user story implementation in terms of how long need to be completed. Therefore, adopting user stories as an input to software cost estimation can reduce effort in agile software development. For example, instinct of estimate the time needed, we can also use user stories to estimate the cost in software development. Therefore, it will reduce effort and shorten the estimation process.

5. RESULTS AND DISCUSSION

From the literature discussion, authors discuss different success factors between traditional and agile cost estimation in software development project. In general, success factors in traditional cost estimation can also contribute to agile cost estimation. However, in agile active customer involvement is the main focus besides team must have strong communication between them and the customer or other stakeholders. Since, agile provide less process compare to traditional method in software development, simplicity of the process also become important success factor in agile cost estimation. As discussed in previous section, the nature of agile method is implementing fixed price and schedule, it definitely reduce cost estimation effort. Major concern is when we use user stories as input in the cost estimation process. All these factors provide better solution to the software development community in estimating the cost in software development project.

6. CONCLUSION

In conclusion, research in cost estimation process has been carried out for decades with huge number of researches have to look into the various aspects in the estimation process. This study has looked at the success factors of traditional and agile cost estimation process in software development project. Therefore, by considering these factors, perhaps agile cost estimation process can produce more accurate result and can reduce effort, time and cost. In the next steps, the determine factors will be evaluated through hypothesis test and a questionnaires survey.

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