FACTORS INFLUENCING ON COST ESTIMATION FOR SOFTWARE DEVELOPMENT

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Abstract:-*Software Project Management is a main issue in software organizations while Cost estimation is the key part of projects management. Business demands for shorter time-to-market while maintaining high product quality force software organizations to look for new strategies to increase development productivity. This paper gives an overview that a high level of uncertainty increases cost estimation errors while higher level of estimation development, estimation management as well as estimator experience and repetitive estimation decreases the cost estimation errors. We conclude with specific recommendations for reducing the extent of estimation errors.*

Keywords:-*cost estimation, Software, influencing factors, Software Project Management, Estimation error*

I.INTRODUCTION

Cost estimation is one of the most challenging tasks in project management, because on the basis of this estimated cost organization can plan the project development activities as well as decide the project schedule to complete the project within time and budget and recourses. All the important management decisions related to project are based on prediction of cost for the project by the estimators. The success and failure of these management decisions are totally based on accurate prediction of software development costs. But accurate cost estimation is very critical issue because major part of the failure can be due to a lack of understanding of the software development process and the effect of that method used in the project plan, schedule and cost estimates. Organizations and individuals have studied a number of projects that have both succeeded and failed and some common factors emerge. Major projects by nature are usually more complex and contain more risk elements than other projects. Careful attention must be provided when preparing cost estimates for major projects. Costs should be determined for uncertainties within an estimate. All elements of the project must be reduced to a cost that can be accounted and budgeted. There should be a disciplined and comprehensive method of assessing and reassessing project risk and uncertainty. Most importantly, however all estimates have uncertainty [1].

Accurate cost estimation plays main role to complete the project within time and budget. There are five important critical dimensions of cost estimation for software development like Effort hours, Time, Resource requirements, and Risk involved. There are various factors affecting on Cost estimation for software development. Accuracy of cost estimation depends on these factors. While estimating cost of software, these factors must be considered by the estimator because wrong cost estimation may lead to optimistic over promising on software development and the inevitable overruns and performance compromises as a consequence.

Estimation error is the difference between the estimates obtained during planning and the actual cost, time or effort required to complete the task. There are two types of estimation errors: overestimation – when the actual results exceed the planned values, and underestimation – when the actual results fall below the planned values. Both types are harmful and can damage the organization's reputation and management support [3].

Following are five important critical dimensions of cost estimation for software development,

1. *Effort estimation*
2. *Time estimation*
3. *Size estimation*
4. *Resource requirements*
5. *Risk involved*

II. MAIN FACTORS INFLUENCING ON DIMENSIONS OF COST ESTIMATION

The proper selection and application of estimation techniques is another main factor affecting estimation accuracy.

1. *Effort estimation*

Effort estimation means to predict the requirement of manpower to complete the project under consideration. Effort estimates are determined during the planning stage of the project and provide the basis for subsequent planning, control, and decision making. Following are the estimation techniques generally used for effort estimation

a) *Estimation by analogy:*

Efforts to complete a certain task are estimated by comparison to similar tasks done before. But the previous project and the project under consideration are usually not similar. For accurate effort estimation a skilled and experienced expert is required to fill this gap.

b) *Expert estimation*

Here effort estimation is done by experts. Expert estimation can be influenced by the estimator's experience, biasness and his involvement in the development. Finally, the estimator's experience is considered one of the most important factors affecting estimation accuracy. Estimator experience was measured in terms of years of experience and number of projects with similar technologies and systems the estimator was involved with.

2. *Time estimation*

Time estimation means to estimate the project duration. Overestimating time due to a presumed lack of resources or because the projected completion is too late, can convince management not to approve projects that may otherwise contribute to the organization. On the other hand, underestimation may result in approval of projects that will fail to deliver the expected product within the time and budget available. [3]

It is impossible to accurately estimate the project duration at the very start and that accuracy is improved by an iterative process throughout the life-cycle of the project. Their accuracy is affected by the extent of uncertainty regarding the task to be estimated. The estimation techniques generally used for time estimation are same as effort estimation i.e. Estimation by analogy and Expert estimation

3. *Size estimation:*

An accurate estimate of software size is an essential element in the cost estimation. Initial size estimates are typically based on the known system requirements. In general, you present size estimates as lines of code (KSLOC or SLOC) or as function points. The following are the techniques for estimating software size.

a) *Developer Opinion:*

Developer opinion is otherwise known as guessing. If you are an experienced developer, you can likely make good estimates due to familiarity with the type of software being developed.

b) *Previous Project Experience:*

Looking at previous project experience serves as a more educated guess. By using the data stored in the metrics database for similar projects, you can more accurately predict the size of the new project.

c) *Function Point Analysis:*

Function points allow the measurement of software size in standard units, independent of the underlying language in which the software is developed. Instead of counting the lines of code that make up a system, count the number of externals (inputs, outputs, inquiries, and interfaces) that make up the system.

Following are the factors affecting on software size

1. Data communications
2. Distributed functions
3. Performance
4. Heavily used operational configuration
5. Transaction rate
6. On-line data entry
7. Design for end user efficiency
8. On-line update of logical internal files
9. Complex processing
10. Reusability of system code
11. Installation ease
12. Operational ease
13. Multiple sites
14. Ease of change

4. *Resource requirements:*

Required resource estimation means to predict the requirement of resources like software, hardware, machines to complete the project under consideration. But to predict about the resources required is difficult at the primary stage of project. Requirement of resources may change during actual development of software.

5. *Risk involved:*

Risk in itself is not bad; risk is essential to progress, and failure is often a key part of learning. But we must learn to balance the possible negative consequences of risk against the potential benefits of its associated opportunity. [9] Risk management is a series of steps whose objectives are to identify, address, and eliminate software risk items before they become either threats to successful software operation or a major source of expensive rework. [10]

Risk management means to identify and analyze threats to success i.e. risks, action can be taken to reduce the chance of failure of a project. One problem in this task is that no validated lists are available to help the project manager understand the nature and types of risks typically faced in a software project. [7]

Risk management is a two stage process: assessing the risk and taking action to control it. The first stage, risk assessment, consists of three steps:

1) Identification of risk factors
2) Estimation of the likelihood for each risk factor to occur, along with potential damage from the risk
3) An evaluation of total risk exposure

There are several methods for identifying risk factors such as scenarios, examination of past or analogous situations, brainstorming, or other creative methods. But most of these methods are time consuming and too costly to use on a regular basis. [7]

There are some specific factors to consider when examining project, product, and business risks. Some examples of these factors are listed here, although this list is meant to stimulate your thinking rather than to be an all-inclusive list.

• ***People risks*** are associated with the availability, skill level, and retention of the people on the development team.

• ***Size risks*** are associated with the magnitude of the product and the product team. Larger products are generally more complex with more interactions. Larger teams are harder to coordinate.

• ***Process risks*** are related to whether the team uses a defined, appropriate software development process and to whether the team members actually follow the process.

• ***Technology risks*** are derived from the software or hardware technologies that are being used as part of the system being developed. Using new or emerging or complex technology increases the overall risk.

• ***Tools risks,*** similar to technology risks, relate to the use, availability, and reliability of support software used by the development team, such as

development environments and other Computer-Aided Software Engineering (CASE) tools.

• ***Organizational and managerial risks*** are derived from the environment where the software is being developed. Some examples are the financial stability of the company and threats of company reorganization and the potential of the resultant loss

of support by management due to a change in focus or a change in people.

• ***Customer risks*** are derived from changes to the customer requirements, customers' lack of understanding of the impact of these changes, the process of managing these requirements changes, and the ability of the customer to communicate effectively with the team and to accurately convey the attributes of the desired product.

• ***Estimation risks*** are derived from inaccuracies in estimating the resources and the time required to build the product properly.

• ***Sales and support risks*** involve the chances that the team builds a product that the sales force does not understand how to sell or that is difficult to correct, adapt, or enhance. [8]

III. GENERAL FACTORS INFLUENCING ON UNCERTAINTY IN COST ESTIMATION

1. MANAGEMENT

Top management commitment is the factor that determines the tipping point between potential success and failure when developing and implementing business continuity management projects and systems.

2. PROJECT DESIGN

The design provides an account of the project in its entirely, while the plan is largely limited to the operational perspective so it may create an uncertainty in estimated cost.

3. *COMMUNICATION*

The communication problems are a major factor in the delay and failure of software projects. Software projects suffer serious breakdowns in co-ordination and communication throughout their development life cycle.

4. STAFF EXPERIENCE

Staff weaknesses had to do with qualifications of staff, the experience of expatriate personnel, lack of commitment, turn-over of qualified staff.

5. FUNDING PROBLEMS

Financial-related delays are mainly due to poor cash flow management, followed by late payment, insufficient financial resources, and financial market instability.

6. PRICE CHANGES

Pricing must take into account broader organizational, economic, political and business considerations, such as Market opportunity, Financial Health, Requirements etc.

7. TECHNICAL FACTORS

Under most circumstances regulatory cost estimates ignore the possibility of technological progress. Technical factors plays main role in cost estimation, but these factors are not stable they are changing. [1]

IV.CONCLUSION

This paper gives the numbers of Uncertainty factors which are involved in the software cost estimation. Where we see various Main factors influencing on dimensions of cost estimation, as well as general factors influencing on uncertainty in cost estimation, by managing these factors influencing on cost estimation for software development it is possible for the estimator to increase the accuracy of estimated cost. It can reduce the gap between estimated cost and actual cost of project under consideration which may increase the percentage of project success.

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