ASSESSMENT OF HEALTHCARE WITH USE CASE POINT

Alka Gulati
Research Scholar
Barkatullah University, Bhopal, India

Kanak Saxena
Prof. and Head Deptt. Of CA
Samrat Ashok Technological Institute, Vidisha, India

Abstract: Project plan plays a vital role in development of the software projects. The software projects can be successfully managed and controlled by managers with the help of effective effort, schedule and estimated size plan. Due to uncertainties in requirements, complexity and size of software systems increases. There are many methods for effective project management in context with measuring and estimating size and productivity. One of the method in this category is use case point. Use case point approach enables to produce a reliable estimate in the size of software systems. There are many methods for effective project management in context with measuring and estimating size and productivity. One of the method in this category is use case point. Use case point approach enables to produce a reliable estimate in the size of software systems.

Keywords: UCP, Use case, SPM.

1. INTRODUCTION

The important technique for increasing the new product design effectiveness is Project management. Basically project management means laying out tasks to make sure tasks are in sequence and dependency between tasks is clearly defined, making sure resources assigned to tasks are not overloaded, making sure enough contingency is put in place to cover various different risks. People, Product, Process and Project are four p’s of Project management [1][8]. The relationship is defined between them. Every project follows a process to develop a product by the people. To fulfill the requirements of stakeholder project manager should develop an effective project plan. There is dynamism in software projects [4]. Additional measures have to be added to the management and development of software projects due to change in technology and market scenario. An intelligent framework and appropriate solutions are required for development and management of software projects as complexity and uncertainties have increased a lot in software development of projects [9]. So planning phase of SPM is emphasized to resolve uncertainties and complexity of software projects. The four phases of Software project management process are initiation phase, planning phase, executing phase, monitoring and controlling phase. In initiation phase approval of the project is done. In the planning phase scope document is developed on the basis of collected requirements [6]. Scope document includes budget, time line, size, security initial review etc. In the executing phase communications and information distribution is done. In the monitoring and controlling phase performances are reported, final training, security final approvals are done. Also final budget and timeline approved changes are verified [14].

In this paper, at the initial stage of software project development we have shown the importance of planning phase. For requirement elicitation we have used use cases. This paper is organized as follows: II section contains an introduction of planning phase; III section describes Use case point method. It also includes the formulas for calculation of software size. IV Section applies use case point method for estimating size of cardiac medical system, V Section gives the conclusion.

II. PLANNING PHASE OF SPM

In planning and execution phase of SPM, various tasks are allotted to resources in order to achieve the timelines and budget related goals of the projects [11]. In planning phase various plans like project, resource, financial, quality, risk, communication and acceptance are prepared.

Basic theory concepts and approaches should be included in an intelligent and complete framework. So first of all planning of project is important [2]. After the initiation phase, the planning of project is done till an apt level of detail. The SPM planning phase involves creation of a scope document which helps and guides the team in other phases of SPM. The primary aim of planning phase is to plan time, cost and resources as shown in figure 1, to find the estimation of work needed and to effectively manage risk during execution of project.

An inadequate plan greatly reduces the development and completion of project successfully and thereby it stops initiation phase to accomplish its goals. The artifacts are gathered through the software development process. They are the evidence that the process is followed. The artifacts of planning phase are project team identified, business process mapping, current and planned Work Breakdown Structure, project plan mitigation strategy, budget, resource, communication and change plan [7].

Project plan shows timeframes required to deliver the project, along with resources and milestones. A resource plan outlines the resource levels required for successful completion of project. A properly documented resource plan will specify the exact quantities of people, equipment and materials needed to complete your project. It helps in calculating efforts and creating schedule. The financial plan summarises the total expenses to be incurred across the project and this is treated as project budget. A quality plan assists to schedule tasks related to customer’s needs. It makes sure that customer’s needs are done. It consists of
quality assurance plan and quality control plan. A risk plan helps to identify risks and identify actions to prevent them from plan is occurring. An acceptance plan contains deliverables produced by the project. It is an agreement with the customer. Customer gives its concern for schedule tasks. A communication plan recounts how it is intended to send right messages at the right time to the right people [3].

**III. USE CASE POINT APPROACH**

In initial phase of software development life cycle, software effort estimation requires large amount of time[5]. Large amount of efforts should be calculated accurately to avoid underestimation and overestimation. Use Case Point (UCP) approach is developed by Gustav Karner [12]. Requirements are represented by using use case diagrams. The purpose of use case approach is to measure projects at a their initial stage.

The use cases are to be treated as building blocks for any software effort estimation method based on use case point model. A use case diagram is composed of use cases and actors. Each use case is represented by a use case scenario. In use case point method the software size is calculated according to the number of use cases and actors in a use case diagram multiplied by their complexity factors. The classification of different levels of use cases is done on the basis of number of transactions in a use case. Use Case point method calculates size through two stages [10].

1. Calculation of Unadjusted Use Case Point (UUCP)
2. Calculation of Adjusted Use Case point (AUCP)

Terms used in Use Case point approach are defined as follows:

1) **UAW** - UAW represents unadjusted actor weight. There are three classification classes on the basis of type of interaction with the system. They are: Simple, Average and Complex. In simple class simple programming is used for communicating with the system.

2) **UUCW** - UUCW represents unadjusted use case point approach. Use Cases are classified as simple, average and complex. The UseCase classification is shown in table 1.

3) **UUCP** - It represents Unadjusted Use Case Point. Sum of Unadjusted Actor Weight (UAW) and Unadjusted Use Case Weight (UUCW) gives UUCP.

   \[ UUCP = UAW + UUCW \]  

4) **AUCP** - It represents Adjusted Use Case Point. It is equal to the product of UUCP, TCF (Technical Complexity Factors and ECF (Environmental Complexity Factors).

   \[ AUCP = UUCP \times TCF \times ECF \]  

The imperative role is played by software in medical domain. The health care system is very important for benefit and safety of people. Health care model of Cardiac department is shown in fig. 2 where

\[ TCF = 0.6 + (0.01 \times TF) \]  
\[ ECF = 1.4 + (-0.03 \times EF) \]  

Health care job is a complex, highly supported, time-pressured process. The health system checking should be very appropriate and it should have well planned, well-defined and Factors and weights are considered of both technical environmental factors. There are total 13 technical factors and 8 environment factors as suggested by Karner[12]. Values taken by factors vary from 0 to 5. Their significance is shown in Table 2 below:
The weights and factors are assigned below in a health care model.

IV. HEALTH CARE MODEL

On the basis of requirements elicited from cardiology department in reference to health care system, for different scenarios different use cases are prepared [13]. Classification for 17 use cases shown in Table 3 is done as 4 simple, 6 medium and 7 complex. In reference to user tasks for system development scenario preparation is a basic element.

Scenario preparation as a top down approach starts with the requirement elicitation process. It identifies the properties and limitations of domain to be worked upon [14]. We have shown use cases in figure 3 and figure 4 for different scenarios.

Table 2 Significance of Factor continuous improved processes for success.

| UseCase No. | Description          | Complexity |
|------------|----------------------|------------|
| 1          | OPD Appointment      | Medium     |
| 2          | Disease Confirmation | Complex    |
| 3          | Update Information   | Medium     |
| 4          | Appointment for      | Complex    |
| 5          | Patient History View | Complex    |
| 6          | Test Performance     | Simple     |
| 7          | Admission in Hospital| Complex    |
| 8          | Update Patient Details| Medium    |
| 9          | Update Hospital Details| Medium   |
| 10         | Maintain account     | Complex    |
| 11         | Payment By patient   | Simple     |
| 12         | Surgery Details      | Complex    |
| 13         | Discharge Process    | Complex    |
| 14         | Next Appointment     | Simple     |
| 15         | Clear Accounts       | Medium     |
| 16         | Update patient file  | Medium     |
| 17         | Send message         | Simple     |

Table 3 Use cases for health care system

| Factor Values | Significance            |
|---------------|-------------------------|
| 0             | No significance         |
| 1             | Insignificant effect    |
| 2             | Moderate influence      |
| 3             | Intermediate effect     |
| 4             | Significant influence   |
| 5             | Very strong influence   |
Extensions:

1a: If patient hasn’t taken an appointment token then: 1a.1 Notify the patient to meet the clerk.

2a: If patient have symptoms of Heart problem then: 2a.1 Send to emergency for heart check.

Post Condition: The patient has been treated in OPD.

Similarly there are 15 more use cases for different scenarios.

Use case point approach is applied on health care model. The weights assigned for technical and environmental factors are shown in Table 4 and Table 5.

### Table 4: Technical Factor Weights

| Factors                        | Score | Weights | Total |
|--------------------------------|-------|---------|-------|
| Distributed system required    | 3     | 2       | 6     |
| Response time is important     | 3     | 1       | 3     |
| End user efficiency            | 5     | 1       | 5     |
| Complex Internal Processing required | 3     | 1       | 3     |
| Reusable code must be a focus  | 4     | 1       | 4     |
| Installation ease              | 5     | 0.5     | 2.5   |
| Usability                      | 5     | 0.5     | 2.5   |
| Cross-platform support         | 0     | 2       | 0     |
| Easy to Change                 | 4     | 1       | 4     |
| Highly Concurrent              | 1     | 1       | 1     |
| Custom Security                | 4     | 1       | 4     |
| Dependence on third party code | 0     | 1       | 0     |
| User Training required         | 5     | 1       | 5     |

Technical factor = 40, Using eq. 3, we get

\[ TCF = 0.6 + 0.01 \times 40 = 1.0 \]

### Table 5: Environment factors

| Factor                                    | Rating | Weight | Total |
|-------------------------------------------|--------|--------|-------|
| Rational unified process familiarity      | 3      | 1.5    | 4.5   |
| Application Experience                    | 1      | 0.5    | 0.5   |
| Object Oriented programming exp.          | 3      | 1      | 3     |
| Lead analyst capability                   | 4      | 0.5    | 2.0   |
| Motivation                                | 5      | 1      | 5     |
| Stable Requirements                       | 5      | 3      | 15    |
| Part Time Staff                           | 0      | -1     | 0     |
| Difficult programming language            | 3      | -1     | -3    |

Using eq. 4, we get

\[ \text{Environment Factor} = 1.4 + (-0.03 \times 26) = 0.62 \] (5)

Using eq. 2, we get

\[ \text{UCP} = 107 \times 1.0 \times 0.62 = 66.34 \] (6)

The effort is assessed by multiplying UCP and standard effort rate(ER) in person-hours/UCP. Generally the researchers use ER=20 person-hours per UCP. Effort is assessed as:

\[ \text{Effort} = \text{UCP} \times \text{ER} \] (7)

Using Eq.7, and considering 9 hours per day we get

66.34 * 20 = 148 Person-Days

On considering 8.5 hours per day we get 157 person-days

The size is reliable and closer to the efforts applied iteratively. Thus in the very early stage in the development cycle the size is assessed of model of health care.

V. CONCLUSION

The importance of planning phase of software project management is shown in this paper. Requirements are elicited by using use cases for different Scenarios. On the basis of Project plan tasks, resources, schedule is planned. Project Plan helps to review actual against planned. Weights between 0 and 5 are assigned to existing factors for health care model. Then efforts are estimated using use case point approach. It is mandatory to evaluate the weights properly as the weighted values influence each factor. The weights will vary according to the type of Project. Many factors including technical and political have impact on the software development process. The estimation at initial stage can decrease error.

VI. REFERENCES

[1]. A Guide to the Project Management Body of Knowledge, 5th edition, PMI, USA, 2013.

[2]. Project Management Institute, “PMBOK – A guide to the project management body of knowledge,” Newtown square, PA: Project management institute, 4th edition, 2008.
[3]. Chin Hooi Tan, Keem Siah Yap, Hisao Ishibuchi, Yusuke Nojima and Hwa Jen Yap, “Application of Fuzzy Inference Rules to Early Semi-automatic Estimation of Activity, Duration in Software Project Management”, IEEE Transactions on Human-Machine Systems, Vol. 44, No. 5, October 2014, pp. 678-688.

[4]. Ravinder Singh, Kevin Lano, “Literature survey of previous research work in models and methodologies in project management”, IJACSA, Vol. 5. No. 9, 2014, pp. 107-122.

[5]. Hewagamage, Champa., Hewagamage, K. P., “Redesigned Framework and approach for IT Project Management”, IJAEA, Vol. 5 no. 3 July, 2011, pp 89-106.

[6]. A. B. Nassif, L. F. CAPRETZ AND D. Ho, “Estimating Software Effort Using an ANN Model Based on Use Case Points”, 11th International Conference on Machine learning and Applications, DOI 10.1109/CMLA.2012.138, IEEE computer society, 2012.

[7]. Meenakshi Saroha, Shashank Sahu, “Tools & Methods for software Effort Estimation Using Use Case Points Model – A Review”, International Conference on computing, communication and automation (ICCCA 2015), IEEE, pp 874-879.

[8]. Ian Sommerville, “Software Engineering”, Pearson Publication, Ninth Edition, 2011.

[9]. Peiwei Mi, Walt Scacchi, “A knowledge based environment for modeling and simulating Software Engineering Processes”, IEEE transactions on knowledge and data engineering, Vol. 2, No. 3, 1990.

[10]. Pankaj Jalote, “Software Project Management in practice”, Pearson Education, Ninth Impression, 2010.

[11]. Mauricio Covolan Rosito, Ricardo Melo Bastos, “A model to integrate Software Project Management with organizational workflows”, 12th International Conference on Intelligent Systems Design and Applications, IEEE 2012.

[12]. G. Karner, “Resource Estimation for Objectory Projects”, Objective systems 1993.

[13]. I. Jacobson, M. Christerson, P. Jonsson and G. Overgaard, “Object Oriented Software Engineering: A Use Case Driven Approach”, Addison Wesley Longman, Inc, 1992.

[14]. Vincente K: Cognitive work analysis: Toward safe, productive and healthy computer based work Lawrence Erbaum Associates Mahwah (1999).