

Experiment No 9

To study estimation techniques

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Aim: To study estimation techniques

Theory:

Need of software project management

Software is said to be an intangible product. Software development is a kind of all new stream in world business and there's very little experience in building software products. Most software products are tailor made to fit client's requirements. The most important is that the underlying technology changes and advances so frequently and rapidly that experience of one product may not be applied to the other one. All such business and environmental constraints bring risk in software development hence it is essential to manage software projects efficiently.



The image above shows triple constraints for software projects. It is an essential part of software organization to deliver quality product, keeping the cost within client's budget constrain and deliver the project as per scheduled. There are several factors, both internal and external, which may impact this triple constrain triangle. Any of three factor can severely impact the other two.

Therefore, software project management is essential to incorporate user requirements along with budget and time constraints.

Software Project Manager

A software project manager is a person who undertakes the responsibility of executing the software project. Software project manager is thoroughly aware of all the phases of SDLC that the software would go through. Project manager may never directly involve in producing the end product but he controls and manages the activities involved in production. A project manager closely monitors the development process, prepares and executes various plans, arranges necessary and adequate resources, maintains communication among all team members in order to address issues of cost, budget, resources, time, quality and customer satisfaction.

Let us see few responsibilities that a project manager shoulders –

Managing People

- Act as project leader
- Liaison with stakeholders
- Managing human resources
- Setting up reporting hierarchy etc.

Managing Project

- Defining and setting up project scope
- Managing project management activities
- Monitoring progress and performance
- Risk analysis at every phase
- Take necessary step to avoid or come out of problems
- Act as project spokesperson

Software Management Activities

Software project management comprises of a number of activities, which contains planning of project, deciding scope of software product, estimation of cost in various terms, scheduling of tasks and events, and resource management. Project management activities may include:

- **Project Planning**
- **Scope Management**
- **Project Estimation**

Project Planning

Software project planning is task, which is performed before the production of software actually starts. It is there for the software production but involves no concrete activity that has any direction connection with software production; rather it is a set of multiple processes, which facilitates software production. Project planning may include the following:

Scope Management

It defines the scope of project; this includes all the activities, process need to be done in order to make a deliverable software product. Scope management is essential because it creates boundaries of the project by clearly defining what would be done in the project and what would not be done. This makes project to contain limited and quantifiable tasks, which can easily be documented and in turn avoids cost and time overrun.

During Project Scope management, it is necessary to -

- Define the scope
- Decide its verification and control
- Divide the project into various smaller parts for ease of management.
- Verify the scope
- Control the scope by incorporating changes to the scope

Project Estimation

For an effective management accurate estimation of various measures is a must. With correct estimation managers can manage and control the project more efficiently and effectively.

Project estimation may involve the following:

- **Software size estimation**

Software size may be estimated either in terms of KLOC (Kilo Line of Code) or by calculating number of function points in the software. Lines of code depend upon coding practices and Function points vary according to the user or software requirement.

- **Effort estimation**

The managers estimate efforts in terms of personnel requirement and man-hour required to produce the software. For effort estimation software size should be known. This can either be derived by managers' experience, organization's historical data or software size can be converted into efforts by using some standard formulae.

- **Time estimation**

Once size and efforts are estimated, the time required to produce the software can be estimated. Efforts required is segregated into sub categories as per the requirement specifications and interdependency of various components of software. Software tasks are divided into smaller tasks, activities or events by Work Breakthrough Structure (WBS). The tasks are scheduled on day-to-day basis or in calendar months.

The sum of time required to complete all tasks in hours or days is the total time invested to complete the project.

- **Cost estimation**

This might be considered as the most difficult of all because it depends on more elements than any of the previous ones. For estimating project cost, it is required to consider -

- Size of software
- Software quality
- Hardware
- Additional software or tools, licenses etc.
- Skilled personnel with task-specific skills
- Travel involved
- Communication
- Training and support

Project Estimation Techniques

We discussed various parameters involving project estimation such as size, effort, time and cost. Project manager can estimate the listed factors using two broadly recognized techniques—

Decomposition Technique

This technique assumes the software as a product of various compositions.

There are two main models -

- **Line of Code** Estimation is done on behalf of number of line of codes in the software product.
- **Function Points** Estimation is done on behalf of number of function points in the software product.

Empirical Estimation Technique

This technique uses empirically derived formulae to make estimation. These formulae are based on LOC or FPs.

- **Putnam Model**

This model is made by Lawrence H. Putnam, which is based on Norden's frequency distribution (Rayleigh curve). Putnam model maps time and efforts required with software size.

- **COCOMO**

COCOMO stands for COConstructive COst MOdel, developed by Barry W. Boehm. It divides the software product into three categories of software: organic, semi-detached and embedded.

Project Scheduling

Project Scheduling in a project refers to roadmap of all activities to be done with specified order and within time slot allotted to each activity. Project managers tend to define various tasks, and project milestones and they arrange them keeping various factors in mind. They look for tasks lie in critical path in the schedule, which are necessary to complete in specific manner (because of task interdependency) and strictly within the time allocated. Arrangement of tasks which lies out of critical path are less likely to impact over all schedule of the project.

For scheduling a project, it is necessary to -

- Break down the project tasks into smaller, manageable form
- Find out various tasks and correlate them
- Estimate time frame required for each task
- Divide time into work-units
- Assign adequate number of work-units for each task
- Calculate total time required for the project from start to finish

Risk Management Process

There are following activities involved in risk management process:

- **Identification** - Make note of all possible risks, which may occur in the project.
- **Categorize** - Categorize known risks into high, medium and low risk intensity as per their possible impact on the project.
- **Manage** - Analyze the probability of occurrence of risks at various phases. Make plan to avoid or face risks. Attempt to minimize their side-effects.
- **Monitor** - Closely monitor the potential risks and their early symptoms. Also monitor the effects of steps taken to mitigate or avoid them.

Project Execution & Monitoring

In this phase, the tasks described in project plans are executed according to their schedules.

Execution needs monitoring in order to check whether everything is going according to the plan. Monitoring is observing to check the probability of risk and taking measures to address the risk or report the status of various tasks.

These measures include -**Activity Monitoring** - All activities scheduled within some task can be monitored on day-to-day basis. When all activities in a task are completed, it is considered as complete.

- **Status Reports** - The reports contain status of activities and tasks completed within a given time frame, generally a week. Status can be marked as finished, pending or work-in-progress etc.

- **Milestones Checklist** - Every project is divided into multiple phases where major tasks are performed (milestones) based on the phases of SDLC. This milestone checklist is prepared once every few weeks and reports the status of milestones.

Intermediate COCOMOs

Intermediate COCOMO computes software development effort as function of program size and a set of "cost drivers" that include subjective assessment of product, hardware, personnel and project attributes. This extension considers a set of four "cost drivers", each with a number of subsidiary attributes:-

- Product attributes
 - Required software reliability
 - Size of application database
 - Complexity of the product
- Hardware attributes
 - Run-time performance constraints
 - Memory constraints
 - Volatility of the virtual machine environment
 - Required turnabout time
- Personnel attributes
 - Analyst capability
 - Software engineering capability
 - Applications experience
 - Virtual machine experience
 - Programming language experience
- Project attributes
 - Use of software tools
 - Application of software engineering methods
 - Required development schedule

Conclusion: Thus Studied project Plan, predict resources and timeline(scheduling)