

# Agile Project Estimation: An Imperative Approach for Small Software Industries

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## ABSTRACT

In today's world software companies are more inclined towards developing software project using optimized and easiest processes. Developers and Project managers are striving hard to achieve their objective. Companies not only using and giving importance to systematic software development processes, but focuses more on estimating software projects as it's a very crucial activity especially when technologies and development methodologies are changing so drastically.

Agile approach is not only customer oriented approach but it enhances the efficiency of software development process and software developers of any software organization. This research study deepens and expands the benefits of using agile methodology and simultaneously promoting the same for small Software Companies.

**Keywords :**— Software Projects, Software Development Processes, Agile Methodology

## I. INTRODUCTION

Software Estimation is a management activity which is used to estimate the size, effort, schedule and cost of the project keeping some important aspects in mind such as planning, controlling, budgeting, tools to be used and appropriate historical data. It has been said that good estimation of size is the key to good cost estimation. In order to continue with suitable software estimation, an organization must have appropriate formal database with all major past project details. This will be useful for analysing similarities and differences of current project with previous projects [1].

As compare to traditional approach for development, agile approach is more customer-oriented. Throughout the development process customer involvement plays an important role. Agile is a short iterative process with main focus on delivery of software components rather than descriptive documentations. Not only customers but software developers involvement is also very vital as they personally responsible for delivering their components. So, traditional approaches are not considered to be more effective and efficient when comparing with agile approaches [2] [3]. For software development, agile approach balances four vital factors which are interconnected with each other. These factors are Cost or Effort, Schedule, Requirements and quality. So, if any one factor changes automatically it will affect any one of the remaining factors. And it is unpredicted, which factors will get affected also. To some extent agile approach minimizes this dependability and focuses on balancing these factors. Some of the independent factors that affect the Agile Estimation are Project Domain, Performance, Configuration, Transactions, Complex Processing, Multiple sites and Security [4].

## II. LITERATURE REVIEW

An Agile is a group of Software development processes that promote evolutionary design with self-organizing teams. Agile development inspires adaptive planning, evolutionary development, and early delivery of value to your customers [5] Agile is the creation of Agile Manifesto in February 2001. The authors of Agile Manifesto focused on individuals, development processes, tools, comprehensive documentation, customers, respond to changes and planning. In 2005, survey conducted from software companies located in Italy, USA and Switzerland. Following issues in the Table 1 identified during the study.

TABLE I  
PROBLEMS IDENTIFIED [6]

	Problems
A	Difficulty to deliver the software with all required functions on time
B	Lack of qualified staff
C	High competition
D	Relationship with customers
E	Excessive documentation of code
F	Difficulty in managing relationships within the development group
G	High turnover of employees
H	Managing requirements
I	Others

The problems have been mitigated as shown in Figure 1 with some percentage levels because of using agile methodologies. For instance, difficulty to deliver the software with all required functions on time (40%), Lack of qualified staff (10%) and so on. It has been observed that maximum

percentage (60%) problems related to customer relationship have been mitigated after adopting agile methodologies.

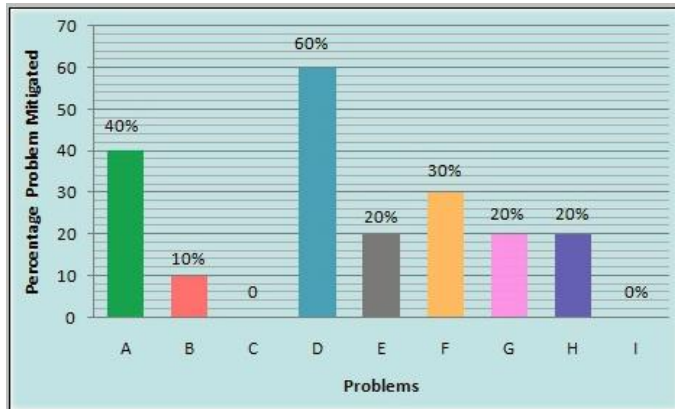


Fig 1: Percentage Problems mitigated [6]

To get the present scenario of software estimation in the organizations, the data from 41 software organizations collected, out of which 20 were ISO and 21 were CMM. The analysis of the collected data is processed using Microsoft Excel and by an online web application Google forms for displaying statistical data reports or figures. Collected data was also compiled in Microsoft Excel sheet for additional statistical analysis and interpretations. Objective was to collect the data from various software organizations to provide suitable estimation techniques for new software organizations for handling any type of projects. The data was collected during the period 17th May-2015 to 03rd Jul-2015. Respondents were Project Managers, Team Leaders, Software Developers, Testing Engineers from CMM and ISO Software organizations. Following is the cross factor analysis:

TABLE III  
SOFTWARE ESTIMATION TECHNIQUES IN PRESENT SCENARIO

Level of CMM or Quality Standards of company?	Software Estimation Techniques Organizations are Using													
	Function Point Analysis	COCOMO	Agile	UCP	NA(Not Applicable)	In-House tool	Don't Have Proper Idea	Analysis Effort method	That's Confidential	PROBE	LOC	Expert judgment	Bottom up estimation	Total
CMM Level-1	1	0	0	0	0	1	0	0	0	0	0	0	0	2
CMM Level-2	0	0	0	0	0	0	0	0	0	1	0	0	1	2
CMM Level-3	1	1	0	0	0	1	0	0	0	0	1	0	0	4
CMM Level-4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CMM Level-5	4	1	1	0	2	4	1	0	0	0	0	0	0	13
ISO 9000	4	4	2	3	0	1	2	2	1	0	0	1	0	20
<b>Total</b>	<b>10</b>	<b>6</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>7</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>41</b>

Software developers rank first with (31.7%) whereas least is recorded about project lead (12.2%) and other (12.2%). Remaining designations and their percentage are : Senior software developers (24.4%), software quality engineer (7.3%) and team lead (17.1%). It was observed that respondents from 41 organizations reported the estimation methods they were using. Out of which 2 reported it's not applicable, some reported they don't know which technique their organization is using. It is essential to note that the organizations may use two or a combination of two or more different methods. It is observed that the most of the organization are using model-based methods. Estimation models used such as COCOMO (14.6%), Use-Case-based estimation and Agile (7.3%), and FPA-metrics (24.4%). Other organizations are implementing and using In-house tools or custom methods (17.1%). (7.3%) respondents either don't know the techniques. 1 response was information is confidential and only 1 response each for Lines of Code (LOC), Expert Judgment, PROBE, and Bottom-up Estimation.

Hence, it was concluded that Agile Estimation is still not in business in the present scenario. It's a very vital question for the software organizations in the present scenario: Is it possible to estimate agile projects or not? Murali Chemuturi suggested any size estimation technique for estimating project size and Task Based Estimation (TBE) for estimating project effort. Size estimation techniques could be SLOC (Source Lines of Code), FPA (Function Point Analysis), OP (Object Point), UCP (Use Case Point), MK-II FPA (Mark-II Function Point Analysis) and the use of story points [7]. The advantage of story point over function point method is that it is relative sizing technique whereas FPA is absolute sizing technique.

### III. ESTIMATING AGILE PROJECTS

Agile Estimating principle says, first estimate the size, then measure the velocity and finally derive the Duration/Points. As far as relative nature or rapidity is concern, story points based size estimation is the best method for estimating Agile Projects. Story point or user stories uses traditional bottom up approach for project estimation. Each story consists of number of software functionalities. Estimating Agile projects involve decomposing the entire project into set of features. Then development team performs series of short fixed length iterations. Iteration may take 2 weeks to 2 months of duration to deliver developed feature at client end. Size and velocity can be measured based on the number of software functionalities and feature delivery speed. Estimation evolves in accuracy with actual velocity data. Velocity can also be measure by calculating the summation of story points which are completed in iteration [8].

Story points can be allocated in the form of Fibonacci series [2] [9]:

1, 2, 3, 5, 8, 13....		
1	:	Smallest
2	:	Small
3	:	Medium
5	:	Medium Large
8	:	Large
13	:	Very Large

Any story with more than 13 can be considered too large for effectual management and control within single iteration. Such stories can be decomposed into other small stories. Let's see how to allocate story point to a story. Let say customer needs a Login page (Story 1). After all review mock-ups, walkthrough, acceptance criteria, task out and estimate, it is decided by the experts to allocate 3 points to Login Page. In the same manner, 5 points can be allocated to the User Permissions (Story 2) as it requires CRUD operations. Again for Listing out the Permissions (Story 3), let's allocate 1 point. In the same way, we can create number of stories and allocate story points. These allocations can be made by referring past completed projects also. But in order to estimate more precisely, Planning Poker or Wide-Band Delphi Approach can be used. In this method, for particular story customer reads the story and development team asks the questions. Then team estimates and each member of the team assign the points. There may be variation in the points. After discussion, team estimates again to get consensus. This process will be repeated unless and until consensus reached as shown in Figure 2.

After finding number of story points per iteration, total size for the project can be evaluated by summation of all the story points of all the iterations. Iteration duration can be estimated based on the total story points per iteration. Team velocity can be evaluated using following equation:

$$\text{Team Velocity (V)} = \frac{\text{Story Points Completed}}{\text{Iterations(I)}}$$

Hence, we can evaluate the estimated schedule and estimated cost of the agile project based on size and velocity. (S) denotes Total Size or Story points completed, (V) Team Velocity, (D) Iteration Duration, (TN) Team Members per iteration, (TC) Team Cost (per member per iteration) and (I) as Estimated iterations. Then estimated schedule and cost can be calculated by using following formulas:

$$\text{Estimated Schedule} = I \times D$$

$$\text{Estimated Cost} = I \times TN \times TC$$

. The process flow diagram for estimating size using Wide-Band Delphi Approach [2] for individual iteration is as shown in Fig 2:

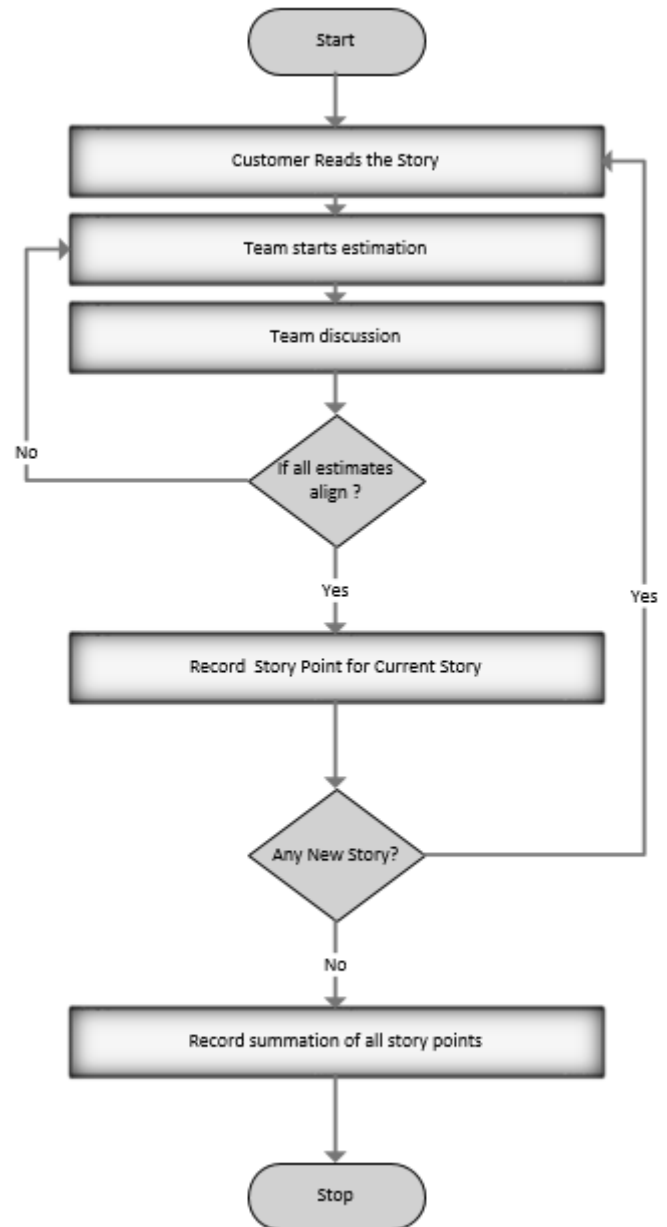


Fig. 2 Wide-Band Delphi Approach for per Iteration

At the end there must a review process for comparing actual values with the estimated values. This will help the development team to improve accuracy in estimating future projects. Also, it will improve the development skills of the developers [2].

#### IV. LIMITATIONS

There are few limitations of the study. Data collected from specific origin or state and of limited time period. Some of the respondents were may be inexperienced to answer questions

related to estimation techniques. There could be multiple responses from each organization so that analysis will become more accurate and adaptable. But, data collected from 41 unique software organizations one response from each.

## V. CONCLUSIONS

This paper provides a brief introduction of agile methodology and how it is different from traditional software development methodologies. Moreover, it focuses on Agile project estimation and describes the evaluation of size using story points. The data for the research collected from 41 unique organizations for identifying which estimation approach is presently trending in software organizations. After analysis, it was found that still Agile Estimation is not so popular in the present software organizations. This study will motivate new developers, researchers and estimators to develop agile projects by using agile estimation and process explained in detail. From research study it was observed that for estimating agile projects, we need expert opinion and analogy. Story point is more suitable method for size estimation. Developers are taking responsibility of delivering the developed features to the customers. Here, developers must be of same skills in order to balance out the differences in the productivity. This approach is quick and effortless as compare to other estimation techniques. Small software organizations will be definitely benefited out of agile estimation.

## VI. FUTURE SCOPE

Referring above research study, new developers can apply the agile approach for their ongoing projects. Researchers can apply the same approach for real time case studies for the analysis and research perspective. Enhanced algorithmic models can be constructed for improving the estimation accuracy.

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