

Estimating Forecast Deliverable of New Agile Project Using Historical Data to Improve Productivity

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Abstract - Performance of a project can be used to determine the forecast deliverables of a new project. Performance depends on people and project factors. Various factors such as capability, skill match, domain experience, Project objectives, Requirement stability, life cycle selection and product sizing are considered to improve forecast deliverable of a new project. This paper discuss about to verify Historical project's tools, technology, domain, work experience and team with new project. If both are same, then historical project team velocity and capacity can be used to the new project to determine the forecast deliverables. Velocity is calculated from average number of completed usecase points. Capacity of the team depends on active working days and programmers involved in Historical project. Determination of forecast deliverables can be used to the project manager to manage the project easily.

Keywords: Historical Project, Velocity, Capacity, Focus Factor, Forecast Deliverables

I. INTRODUCTION

Project forecasting consists of taking the project status information and extrapolating the current project performance to the end of the project. Forecast can be made with respect to project duration, overall project cost, and performance/quality level of project deliverables or any combination of these. A key element to forecasting is to review the risk events that occurred and the remaining risk triggers. A caution when doing forecasting, ensure the adequate information to realistically forecast performance. A general rule of thumb is to wait until an activity phase or deliverable is at least 25% - 40% complete before trying to forecast. Forecast what features will make a release deadline and experiment with scope and start order. This can be done early in the planning process to make better decision about feature scope and start order by showing what will make a target delivery date with a simple set of desired features. Project forecasting consists of taking the project status information and extrapolating the current project performance to the end of the project. Forecasting, arms the project manager with valuable knowledge enabling proactive project and resource management. It creates confidence in meeting client demands and allows thoughtful consideration for outsourcing.

II. LITERATURE SURVEY

This section discuss about some of the key research work area related to this topic. Discussion on identifying the people factors for the success of agile software project [1]. Author describes assessing individual programmer capability through personal point concepts [2]. This paper investigate the software practitioners perspective on the people and organizational factors, that lead to success of

software project which adopts agile methods[4]. A multidimensional view of success factors are discussed and make them more applicable [5]. Research reports provide understanding the extent to which agile tools, techniques are practically used in corporate project management methodologies to determine the level of agile commitments[6]. Basic principles of agile testing and there is a defined testing team responsible for testing deliverable features in traditional software development are described[7]. Various metrics in agile software development methodology are discussed [8]. Author describes Prince2, Project Management methodology is suitable to work with complex projects[9]. There are still a lot of metrics left that are related to scrum and estimations that needed to boost up the agile team and process[10]. Some of the Key criteria should be considered to conduct agile research to integrate lean and agile [11].

III. KEY FACTORS TO SUCCESS WITH AGILE FORECASTING APPROACHES

In order for reality based forecasting to be effective, there are a couple of requirements. Team's past velocity to be a good predictor of the future. Performance based forecast deliverable depends on people and project related factors. These factors are used to improve the productivity of forecast deliverable

A. PEOPLE FACTORS

Most important people factors are discussed. These factors scrutinized from multiple people factors to improve the forecast deliverable through questionnaire survey.

a. CAPABILITY

A well known agile capability of high performance is the self organization of the team. High performance requests the development of qualities, attitudes, conceptual knowledge and understanding, habits and skills in all members of the team. Capability of high performance starts out as a simple set of attributes and grows in complexity and strength overtime. Capabilities to carry out more complex activities are built onto capabilities for more simple activities. Little by little high performance can be realized in this way.

b. SKILL MATCH

A person with T-shaped skills has the ability to do different jobs but has “deep knowledge” of only a few of

them. The team member must have ability to work outside of core area. Ability to understand the needs of other teams and deep knowledge about the functional area, discipline or specialty. This approach can enable development team to boost the efficiency of other teams and simplify the interaction between different areas. Professional services teams would benefit enormously from better installation practices or better deployment documentation. A team comprised of members with this kind of skills is more flexible when facing a bottleneck. When certain team members are too busy, another member with broad knowledge of the tasks can carry out and share the load. This can be represented in Fig. I

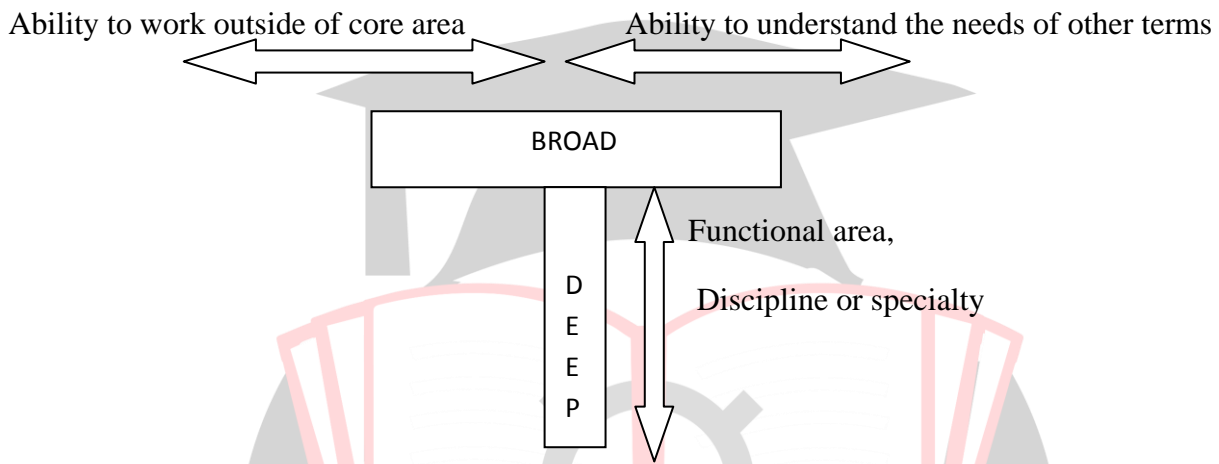


Fig. I

c. DOMAIN EXPERIENCE

Domains are types of software development projects among which certain common artifacts may be reused or shared. Domain characteristic represent characteristics that may determine whether or not one or several artifacts can be reused or shared within or across organization. The characterization function of domains are mapping of projects, described by characteristics into domains. At the end of successful project, the team will all be experts in the domain of the software. Domain knowledge is used to quickly grasp schedule estimates. Having domain knowledge means the team member can contribute on a conceptual level and sometimes prevent incomplete or poor specification from impacting the stakeholders. Domain experience can be used to identify the domain and reuse the project experiences ie) identifying types of projects for which

- Similar development or maintenance standards may be applied
- Data & models for cost schedule and quality are comparable.

The goal of domain analysis procedure is to assess the feasibility of reusing or sharing a set of software artifacts or across organization.

B. PROJECTS FACTORS

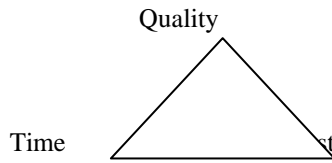
Some of the project related factors to support forecast deliverable concept are discussed below.

a. PROJECT OBJECTIVES

Project objectives describes the status, which should be achieved at the end of the projects. It represents an information management according to the three dimensions of the magic triangle [quality, time and costs] . The objective is compared with the result at the end of the project. The objective is achieved through project phases, project goal definition, work steps, project tasks definition, controlling of use, qualification requirements, project organization and competence matrix. Without objectives team member can spend a lot of time working on things that really aren't all that relevant to the project and that can be a massive waste of effort. There are 6 types of objectives. They are financial, quality, Technical, Performance, compliance and business. Agile product objective need to identify

- ❖ Key product goals : Benefit of the product to the company and what specific company strategies does the product support?
- ❖ Customer : Who will use the product?

- ❖ Need : Why does the customer need the product? What features are critical to the customer?
- ❖ Competition : How does the product compare with similar product?
- ❖ Primary differentiation: What makes this product different from the status quo or competition or both?



b. REQUIREMENT STABILITY INDEX

Requirement stability index (RSI) is a metric used to organize, control and track changes to the originally specified requirements for a new system project. In the software development project, requirement stability is an importance factor which relates to success or failure of software project. RSI is used to measure changes in business requirements added or deleted, compared to the original requirements decided on at the start of the sprint.

$$RSI = (Tot. No. of bus. Req + No. of reqs changed till date + No of req. del + No. of Req. add) / Tot. no. of original req.$$

The team can use RSI to

- ✓ Understand how much time was spent on rework
- ✓ Show the rework time to product owner
- ✓ Make an argument to keep the sprint scope stable
- ✓ Persuade the product owner to prepare requirement beforehand

The aim of requirements stability is not to prevent changes to requirements from happening. They will happen. Agile teams treat requirements as stable during as Iteration. In agile projects, the requirements are fixed during Iteration and flexible during the project. Discouraging them or ignoring them is no solution. What matter is that projects and teams are sufficiently capable with changes and can maintain during development.

c. LIFE CYCLE SELECTION

Selecting the right life cycle is a process in itself that organization can implement internally or consult for. Life cycle selection depends on what's driving the project, whether schedule or technical risk. Project drivers are feature set provided to the customers release date and defect rate. In general, life cycles are combined to get the maximum values to the project. Life cycles help to gain the most throughputs for the project and remove obstacles.

Key points to select the right life cycles are

1. Learn about life cycle models
2. Assess the need of stakeholders
3. Define the criteria to select life cycle
4. Describe the life cycle.

d. PRODUCT SIZING

Measuring the quantitative properties will determine the size of product. User stories/Use cases are used to measure the product size. Use cases contain list of requirements needed to develop a project. Requirements can be functional and non-functional requirements. High-level requirements are decomposed into child requirements and all requirements are individually testable.

IV. PROPOSED METHOD

To forecast the performance of project deliverable the project manager could rely on prototype & preliminary analysis. When the project does not have these, the risk that the project will not achieve the desired performance or quality established at the time of project planning is higher. If performance is the most important attribute of the project deliverable, then the risk of missing the forecast project duration or cost is much higher. In an agile environment, forecasting the number of possible deliverables in iteration can be arrived by considering the capacity and velocity of a development team. To determine the forecast deliverables of a new project historical achievement of the team is most important which can be used for prediction. Flow diagram I represents data flow to determine forecast deliverable.

Algorithm for determining forecast deliverable of new project with historical project usecases

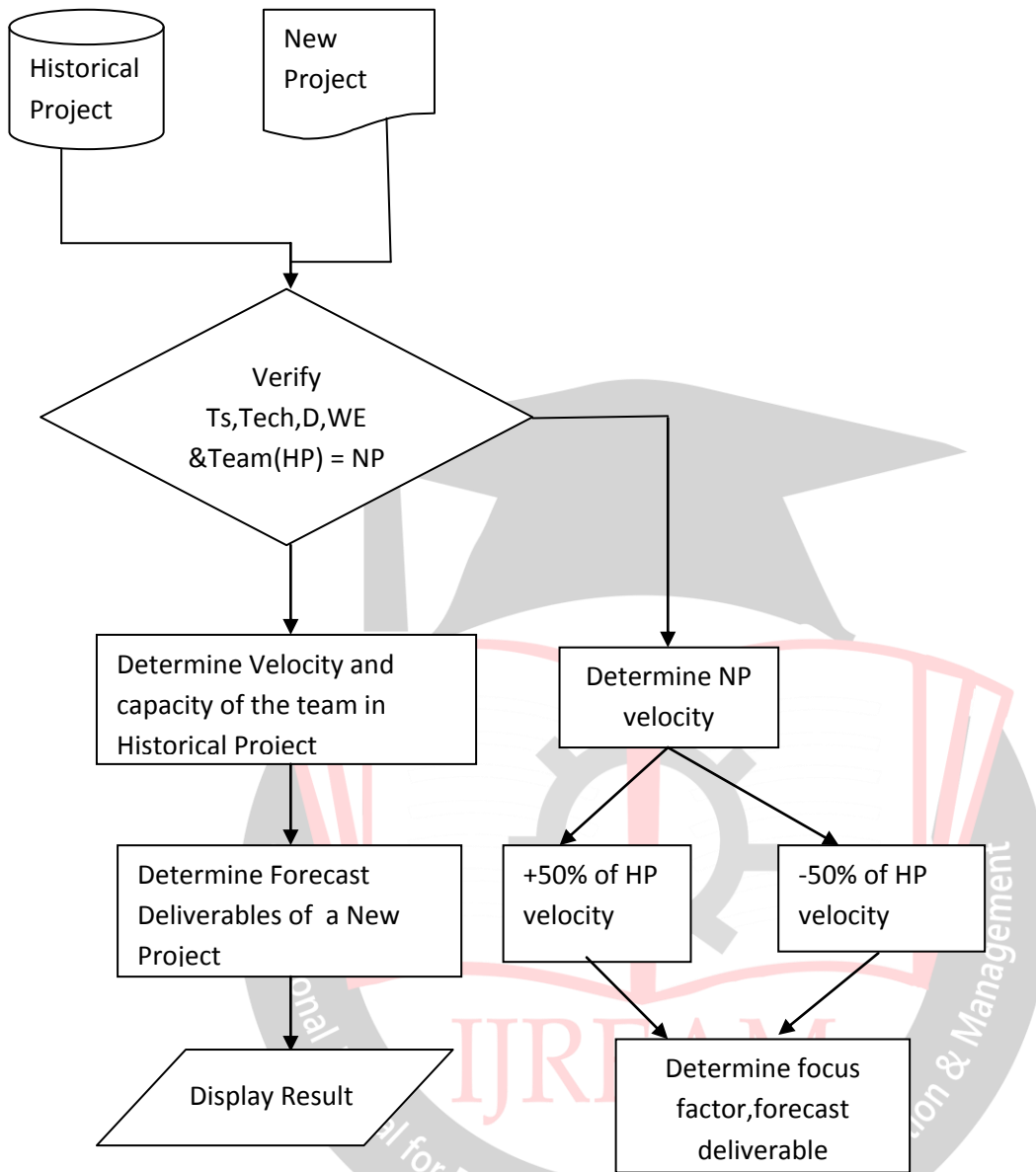
- If (Ts, Tech, D, WE, T) HP = NP then
- Estimate velocity of HP
- Estimate usecase points using requirements
- Determine the development team's capacity
- Estimate focus factor
- Estimate forecast deliverable of a team
- Estimate focus factor for each functional group
- Else
- Estimate NP velocity as +/-50% of HP
- Velocity
- Estimate focus factor
- Estimate forecast deliverables
- End if

[Note: Ts-Tools, Tech-Technology-Domain, WE-Working Environment, T- Team, HP = Historical project, NP- New Project]

This Algorithm explain to determine forecast deliverables of a team for the next iteration. First, New project Backlogs and Historical Project Backlogs are collected and compared to verify tools, technology, domain, working

environment and team are same. If both are same, then Historical project usecases, usecase points and number of sprints are used to determine velocity, capacity, focus factor and forecast deliverables for the new project . If not,

velocity of a team is +/-50% of Historical project velocity, team should be fixed and forecast deliverable is uncertainty value.



Flow diagram I

A.DETERMINING FORECAST DELIVERABLES

To determine a new project forecast deliverable, focus factors are used. To do these, Historical project details are collected, to calculate usecase points and velocity. Velocity and capacity of the team is used to calculate the focus factor. The focus factors are used to calculate forecast deliverables. The following formulas are used to calculate the forecast deliverable.

$$\text{Velocity} = \frac{\text{Number of usecase points completed}}{\text{Number of sprint}}$$

$$\text{Capacity} = \text{Number of programmers} \times \text{Number of Active working days/week}$$

$$\text{Focus factor} = \frac{\text{velocity}}{\text{capacity}}$$

$$\text{Forecast} = \text{focus factor} \times \text{capacity}$$

V. IMPLEMENTATION

Historical Project are collected, which contain usecases, usecase points, number of sprint and number of programmers. If New Project and Historical Project's Tools, Technology, Domain, Working Environment and Teams are same, then Historical Project velocity are used to the New Project to determine the forecast deliverable.

Example from Historical project:

$$\text{Number of programmers} = 4$$

$$\text{Active Working Days} = 6$$

$$\text{Number of Usecase points} = 147$$

$$\text{Number of sprint} = 7$$

$$\text{Velocity of a Team} = \frac{147}{7} = 21$$

$$\text{Capacity} = 6 \times 4 = 24$$

Focus Factor = $21/24 = 0.87$
 Forecast deliverable = $0.87 \times 6 \times 4 = 21$ [story points]

Factors	With Historical project	Without Historical project	
		+50%	-50%
Velocity	21	32	11
Capacity	24	24	24
Forecast deliverable	21	32	11

Table I With & Without Historical Project

Number of Programmers	Forecast Deliverables
4	20
5	26
6	31
7	37
8	42
9	47
10	52

Table II forecast deliverables with Historical Project.

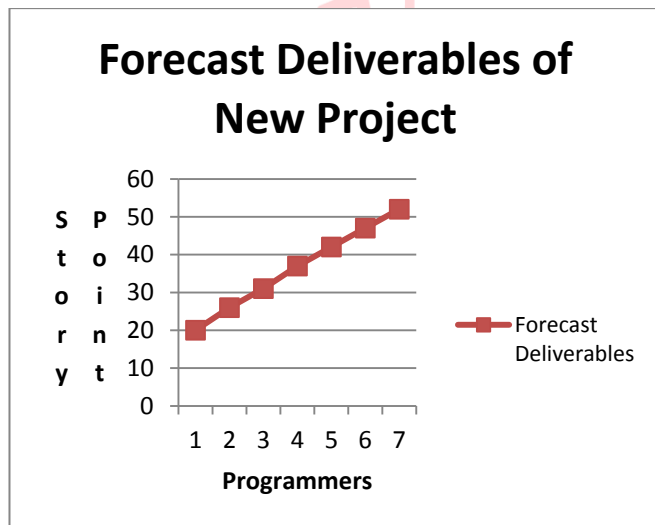


Chart I Programmers Vs. Forecast deliverables

Table I contain calculation of velocity, capacity and forecast deliverables for with historical project & without historical project. It also shows the difference between the two cases. Table II shows that, the forecast deliverables can be calculated with historical project for varying number of programmers. Chart I represents forecast deliverables of new project in next iteration. If Number of programmer increased then the forecast deliverable also increased. But the programmer should satisfy the above said criteria, ie.) They should work on specified Tools, Technology, Domain, Team and Working environment. People factors and project factors are used to know whether they satisfy the criteria or not. To determine forecast deliverable without historical project, number of programmers should be constant.

VI. RESULTS AND ANALYSIS

Software developers need to deliver software products on time, within the budget and user expected quality. Result of the Algorithm shows number of usecase points to be delivered for the next iteration. It can be determined from the concept of forecast deliverables. To identify this, Historical project and new project’s tools, technology, domain, working environment and team should be verified as same. With the help of Historical project, team velocity and capacity are calculated. Using this, focus factor and forecast deliverable of a team for the New project can be determined by the project manager. Time and budget of a project can be determined from forecast deliverables. In case, Tools, Technology, Domain, Working Environment and Team are not same, forecast deliverable can be estimated as +/-50% of Historical project team velocity. This may lead to produce uncertainty of forecast deliverables. Because, software developers demand more functionality, higher reliability, higher performance and budget. Uncertainty of forecast deliverable will affect the quality, budget and time of a new project.

VII. CONCLUSION

Traditional project development technique identifies project deliverables at the beginning of the project. In agile, forecasting deliverable can be determined from the performance of the team. Team performance can be determined from Historical project. Thus the result shows that focus factor are estimated from Historical project velocity and capacity of the team member. New project deliverables can be predicted by using focus factor. Forecast deliverables can be used to determine time and cost of new project. Without Historical project data, uncertainty of forecast deliverables are determine, which will provide uncertainty of time and cost of a new project. To resolve this uncertainty, forecast deliverables of a New Project are determined with historical project.

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Historical project usecase details and sprint execution plan are given below

Use Case Details Of Historical Project

Use Case	Configuration Items	Units	Complexity
Create Objects	Custom Objects (1 object)	9	Medium
Create Simple Fields	Custom Fields (10 fields)	26	Medium
Create Complex Fields	Custom Fields (10 fields)	2	Medium
master data upload (> objects/org)	Data Migration	25	Complex
Development: Internal View	VF Page	7	Complex
Development: Internal Controller	Apex Class	8	Medium
Development: Internal Controller	Triggers	4	Medium
Development Test classes	Test Class	15	Medium
Development: Admin	Email Templates (1 Template)	1	Medium
Development: Admin	Report Type (1)	1	Medium
Development: Admin	Work flow (5)	2	Medium
Development: Admin	Validation (5 Validation)	2	Medium
Development: Admin	Security	4	Medium
Development: Admin	Page Layout (1 Layout)	36	Medium
Development: Admin	Record Type (2)	4	Medium
Development: Admin	Profile(1)	24	Medium
Development: Apex	Web Service	2	Complex
Development: Admin	Report (1)	3	Complex
Development: Admin			
Development: Quarterly Detail	Test Class	2	Simple
Development: Quarterly Detail	Page Layout (1 Layout)	1	Simple
Development: Quarterly Detail	Record Type (2)	1	Simple
Development: Quarterly Detail	Work flow (5)	1	Simple
Development: Quarterly Detail	Profile(1)	1	Simple
Development: Total Budget	Test Class	2	Simple
Development: Booked Revenue Detail	Web Service	1	Simple
Development: Booked Revenue Detail	Test Class	2	Simple
Development: External User Screen	Tab	0	Simple
List view	Page Layout (1 Layout)	0	Medium
CSV Input Template Designing		0	Simple

Historical Project Sprint Execution Plan

