



Integration of Agile methodologies in to traditional Engineering Product development (Non-IT projects)

Smart Practices

PMIBC-18-4-008

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ABSTRACT

In a traditional product development process, it is common practice to find that most of the critical work and resolution to issues are accomplished just before a major milestone. The primary reason for this phenomenon is due to the lack of constant stakeholder engagement till the issue resolution and hence decisions are forced to be made just prior to a major milestone. This could have already resulted in a lot of scope creep caused by unwanted iterations and hence impacting project success.

It is generally perceived that Agile is tailored for software development projects, but the agile philosophy can deliver great value for any type of project. This paper demonstrates about a smart practice that integrates agile philosophy in to the traditional product development process, which will create multiple interim milestones before a major milestone and hence issues are resolved within the set interim milestone and a meaningful product is delivered for each interim milestone. This approach also facilitates an effective change management through tracking of scope changes resulted from each interim milestone and hence provides valuable insights in to the processes. This will also ensure that the problems are surfaced sooner than later and the appropriate expectations are set with customer through continuous engagement during the project lifecycle.

This approach involves setting up a measurable Sprint, which will be agreed upon with the customer. Clarifications are sought and clear deliverables for the sprint are defined before the start, resulting in a progressive development of the product through continuous customer engagement.

INTRODUCTION

“On a War footing basis, expeditiously ...” these are some of the jargons we come across when the project is reaching a major milestone or coming to an end. In fact, 80/20 rule applies with most projects – i.e. 80% of the work is completed during the last 20% of the project duration. This phase of the project is often driven by deadlines or a major financial commitment; this is also the critical phase in the project that would put your cost performance metrics off track, as the project is focused on reaching the milestone at any cost. This is very common sight across all sectors – Aerospace, Construction, Rolling Stock etc...

The root cause for the derailing of project performance is not because of the big push just before a major milestone, but because of tasks/activities that are not completed or put on hold during the early phases of the project.

DETAILS OF THE PAPER

Water fall is a sequential linear approach to executing the project. Each phase represents a distinct stage of the product development. Water fall approach is still widely used in the Non-IT industry such as Engineering, Product development, Construction etc... In this paper, we will discuss how traditional water fall project, especially Non-IT engineering projects can be executed using Agile Principles.

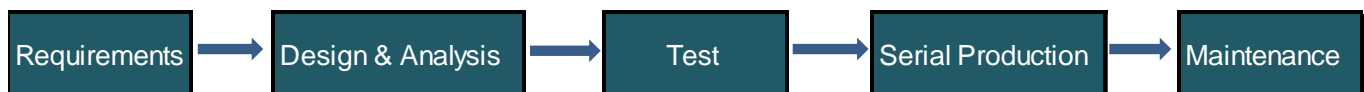


Figure 1: Overview of Waterfall Methodology

Agile methodology refers to an iterative and incremental development of the product, giving a chance to get feedback from the stakeholders as early as possible. This methodology is fairly matured in the Software Product development, but not as much for Non-IT projects.

This paper primarily focuses on the application of agile principles for non-IT projects and the changes that are needed from the Software product development projects.

As per the latest report from Deloitte “US-manufacturing-program-management-aerospace-defense”, total cost overruns have risen from 26% to 48% from 2007 to 2015.

Cost overruns put a significant pressure on the companies and hence smaller players in the market could not sustain. In 2017, a total of \$72bn worth of mergers & acquisitions are announced in Aerospace & Defense industry alone.

Here is a quick summary of some of the major commercial aircraft programs that witness Cost and Schedule overruns outlined in Table 1

S No	Program	Reason for Cost/Schedule Overruns	Delay in years
1	Boeing-787	Use of structural elements made of composites Improper Supply chain process Improper Risk Management process	4
2	Boeing-747-8	Changes in design Limited availability of execution resources	2
3	Mitsubishi Regional Jet (MRJ)	Delayed in testing due to procurement of engine Aircraft weight issues	4
4	C Series	Improper Supply chain process Delay in certification flight testing Engine failure in one of the four test aircrafts	3
5	Airbus-380	Delay in testing due in aircrafts composite fuselage Extensive testing to prove consistency on adaptive wings	2

Table 1: Reasons for cost and schedule overrun for commercial aircraft programs

The reasons for the cost overruns ranges from venturing in to new breakthrough technologies, global supply chain challenges, inadequate risk assessment etc... But using Agile Principles could significantly reduce the cost overruns and schedule delays as the stakeholders are informed continuously rather than at major toll gates.

Agile Methodology in Product Development (Non-IT Projects):

Agile methodology will significantly improve the chance of project success, this is proven model for Software development – the ability to release a software/application in increments and get continuous and early feedback from end user is valuable. However, the challenge with Non-IT projects is the inability to release a product without all the agreed features or launching an intermediate product to get feedback from end users.

Projects that follow waterfall methodology typically have phases that run for very long duration as illustrated in Figure 2. We know that it is very difficult and costly to fix a problem that has originated from a previous phase.

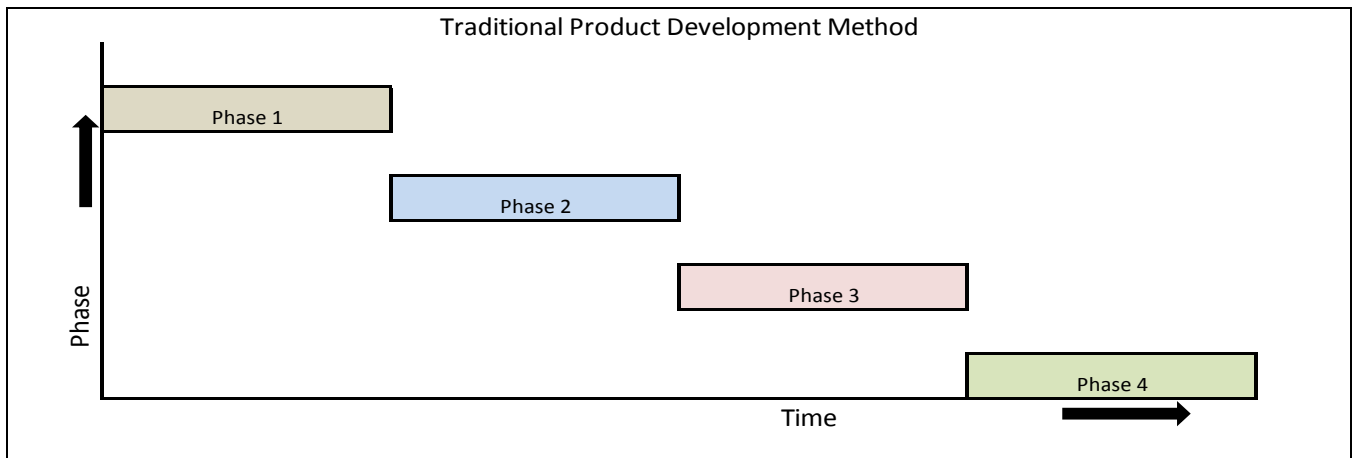


Figure 2: Traditional product Development roadmap

To implement Agile in Non-IT projects, following are the key considerations.

- It may not be possible to get end user feedback through every sprint, however each sprint should get feedback from relevant stakeholders
- Each phase should be carefully divided in to Sprints that makes sense to the organization (1 week to 4 weeks)
- Each sprint should be carefully designed such that the output is reviewed and accepted by the appropriate stakeholders like Approving authority, Regulatory authority.

It is not easy for an organization to embrace the agile methodology that has waterfall methodology ingrained in the DNA. To make a smooth transition to the agile methodology, it would be advisable to create phase wise plans as one would do.

Then carefully work with the stakeholders to split the tasks in to multiple sprints. Focus should be on to plan tasks such that they can be brought to a meaningful conclusion at the end of the Sprint

For example, a sprint could be following 2 scenarios

1. Design 5 components
2. Design 1 component, analyze, write report, gain approvals and release

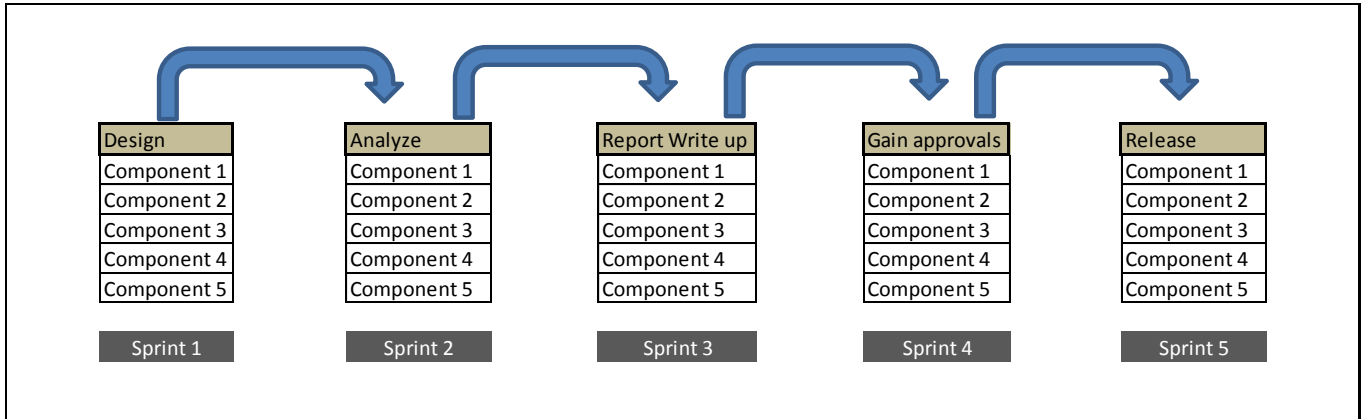


Figure 3: Sprint Planning - Scenario 1

In Figure 3, feedback for the 5 components designed is not known and would probably call for a revision at a later stage.

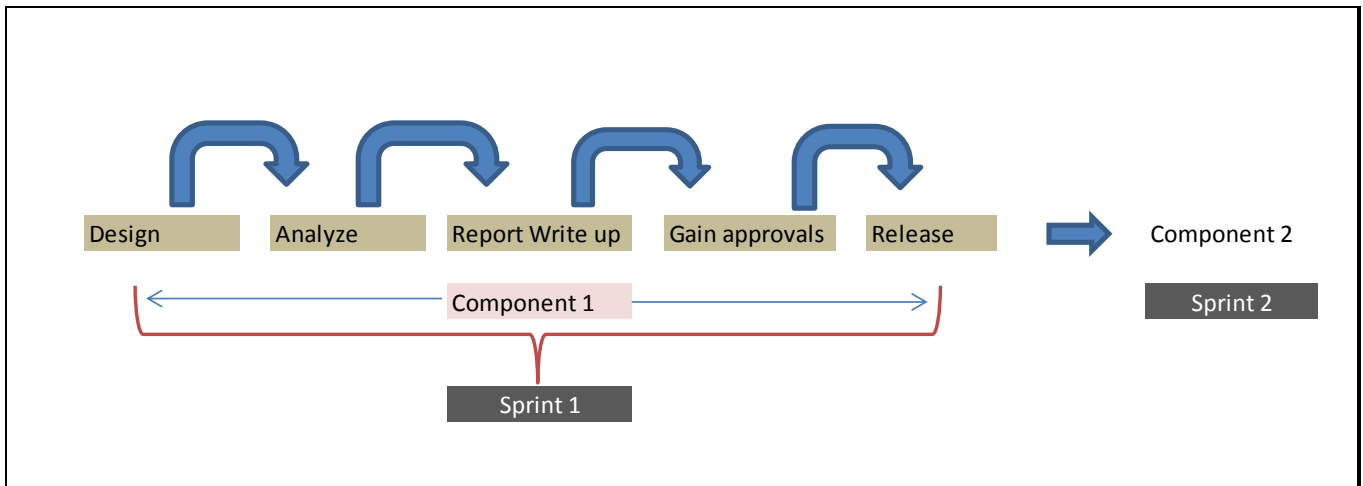


Figure 4: Sprint Planning - Scenario 2

In Figure 4, since the component has completed the entire life cycle, the team can be confident of the design and can be used/referenced at any later date

Figure 5: represents a typical plan, with agile integrated in to the waterfall project.

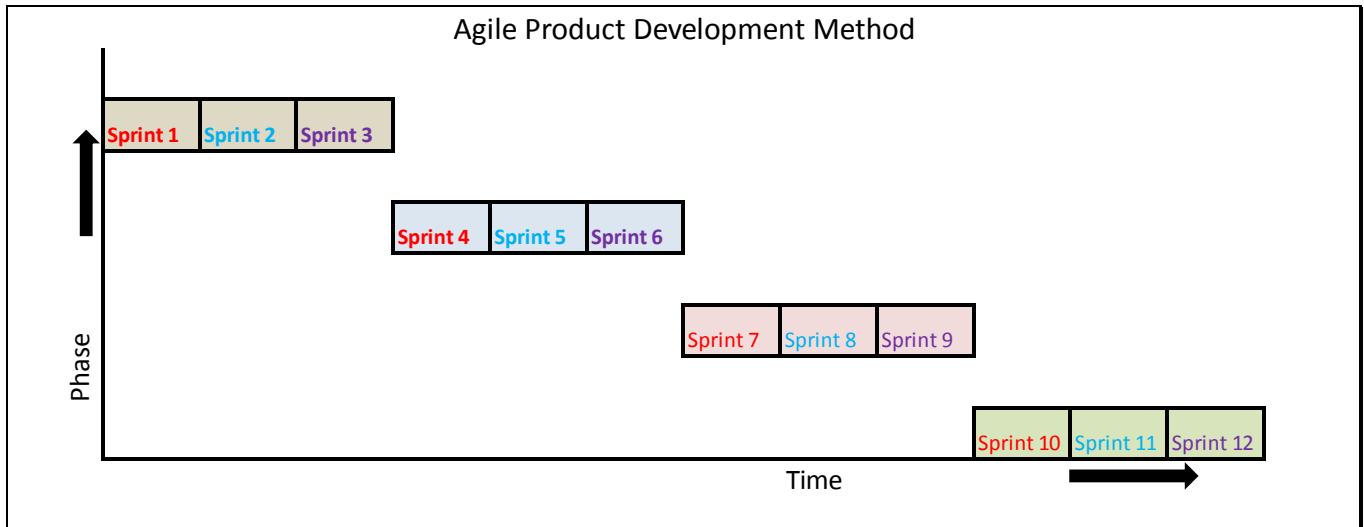


Figure 5: Agile Product Development roadmap

It may not be possible to create a plan as shown in Figure 5 on the first go. It may start with the traditional waterfall phase wise plan and can be divided in to sprints. It does not mean that all the Sprints are planned during the start of the project. It is only an effort to ensure that all the requirements are captured in the plan and to clearly capture any additional requirements in the future for effective change management.

Each sprint planning meeting would consider the product backlog and the pending items from previous sprint. Figure 6 represents the flow of sprints and how they are connected.

SPRINT PROCESS FLOW CHART

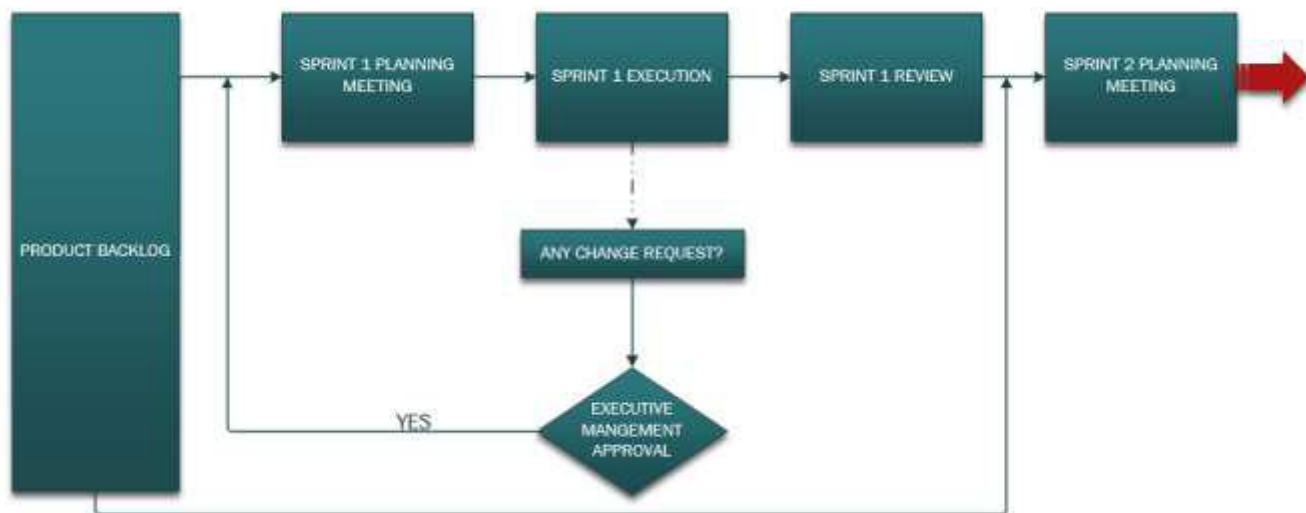


Figure 6: Proposed Sprint Process Flow Chart for Product Development

There are subtle differences in implementing agile when it comes to non-IT projects. Table 2 illustrates some of the key differences.

S No		Agile in IT projects	Agile in Non-IT projects
1	Deliverables	Each sprint is typically concluded with a software build and is released to the end user as appropriate	Each sprint is typically concluded with Drawings, Analysis Reports, Test reports, Regulatory approvals etc...
2	Change Management	Typically, no change requests are allowed during the sprint. Any requests must be accommodated in the future sprints.	There should be every effort to avoid change requests during the course of sprint. However, there may be instances; any such requests must be approved by Executive management and business unit leaders.
3	Planning	There is little focus on the long term planning. Focus is primarily on the current sprint	Planning may be needed for the entire project as it is a prerequisite for the bidding, budgeting, sales & EBIT calculations.

Table 2: Traditional Product development in IT vs Non-IT projects

Sprint Metrics:

Sprint metrics gives an indication of how well each sprint is progressing and the overall effectiveness of agile implementation.

1. Burndown Charts :

The project manager starts at the upper left-hand corner of the chart, before any development work is completed and as tasks/drawings/reports are completed or “burned down,” the project manager tracks that progress with a simple line chart.

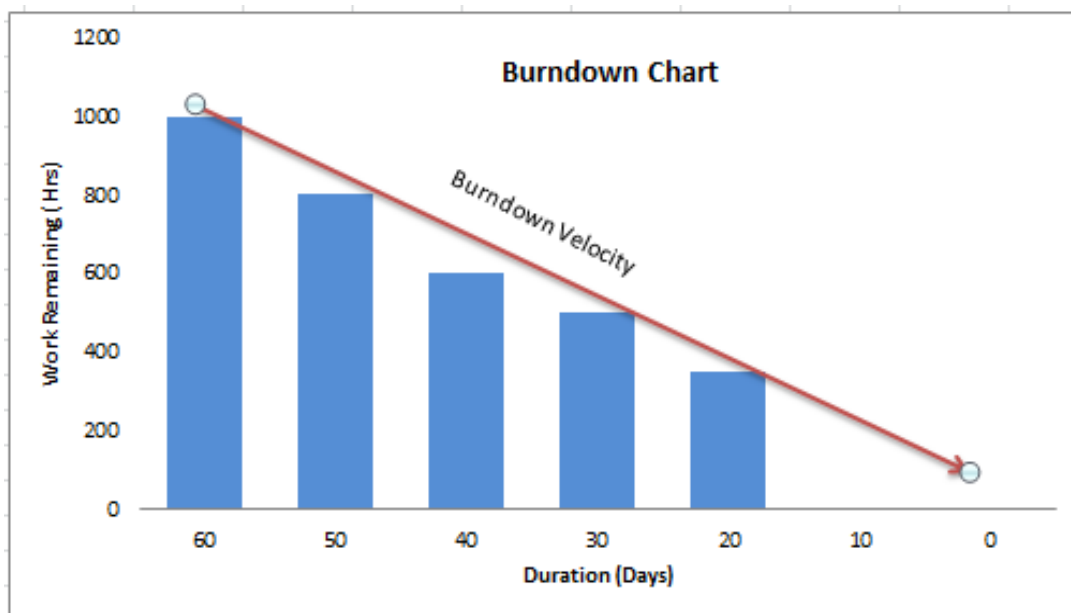


Figure 7: Sample Burn down Chart

If the chart is a flat line and not moving down toward the zero point in the lower right-hand corner, it shows that the team is stuck and not able to make progress as expected. It sends a signal to the project manager that a technical issue, an organizational barrier, or a teammate's productivity requires attention.

2. Earned Value Management System - EVMS :

The EVMS metrics will be measured for each identified Sprint and can be rolled up at a program level. This will provide early indicators and facilitate any “Estimate at Completion” growth discussions.

EVMS for each sprint helps in identify the best performing sprint and the sprint which needs improvement. This will help in better planning of similar projects in the future. The lessons learnt from the least performing Sprint can be implemented in the upcoming Sprints to maintain a healthy status.

Figure 8 represents an EVMS dashboard in an agile product development project.

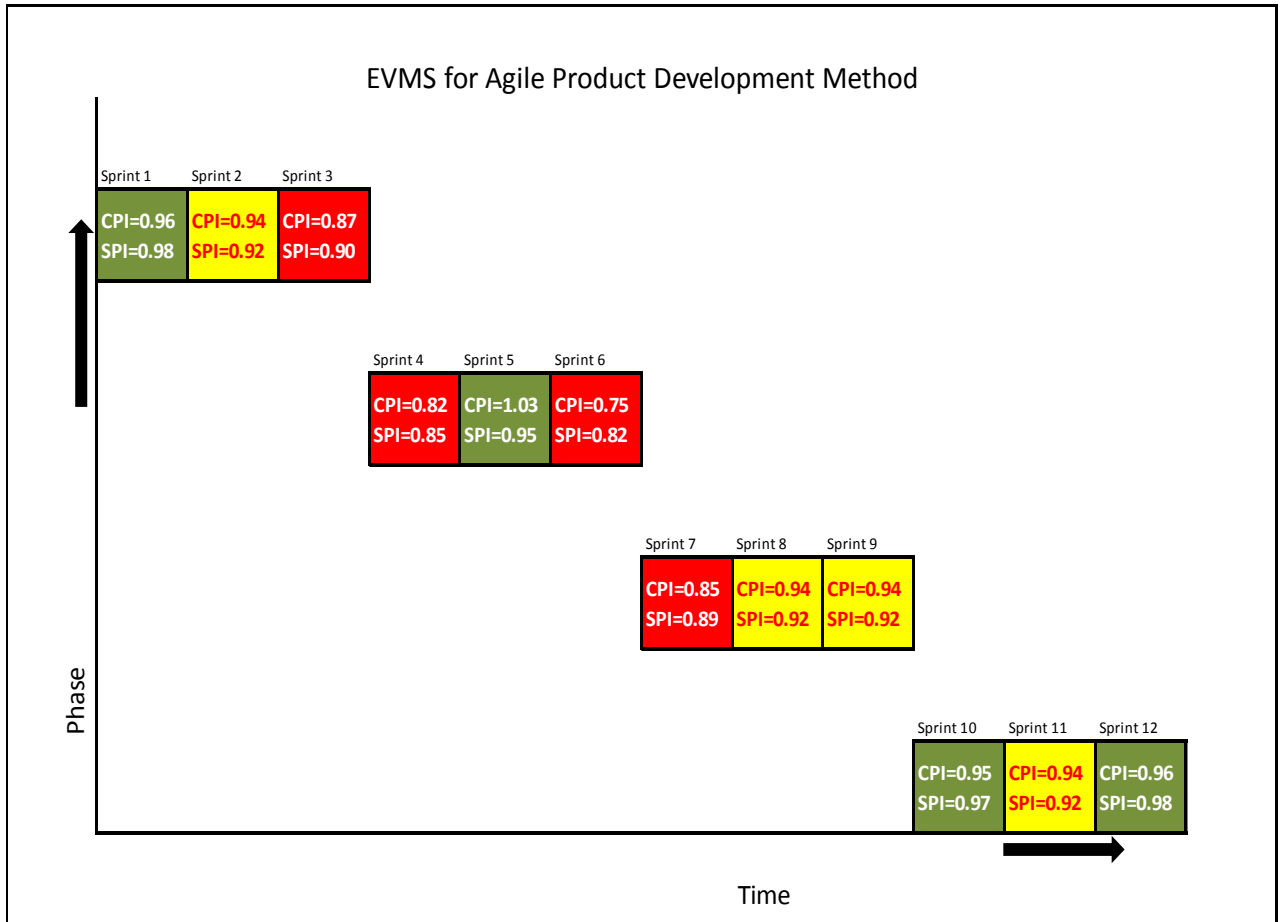


Figure 8: Sprint wise EVMS for Agile Product Development Method

3. **Velocity:**

Velocity is the average amount of work a scrum team completes during a sprint, measured in either story points or hours, and is very useful for forecasting. The product owner can use velocity to predict how quickly a team can work through the backlog, because the report tracks the forecasted and completed work over several iterations—the more iterations, the more accurate the forecast.

It is expected that the velocity of the team is expected to improve over time and should reflect in the numbers. This is also a measure of the effectiveness of the Sprint Planning meeting and any road blocks for the team.

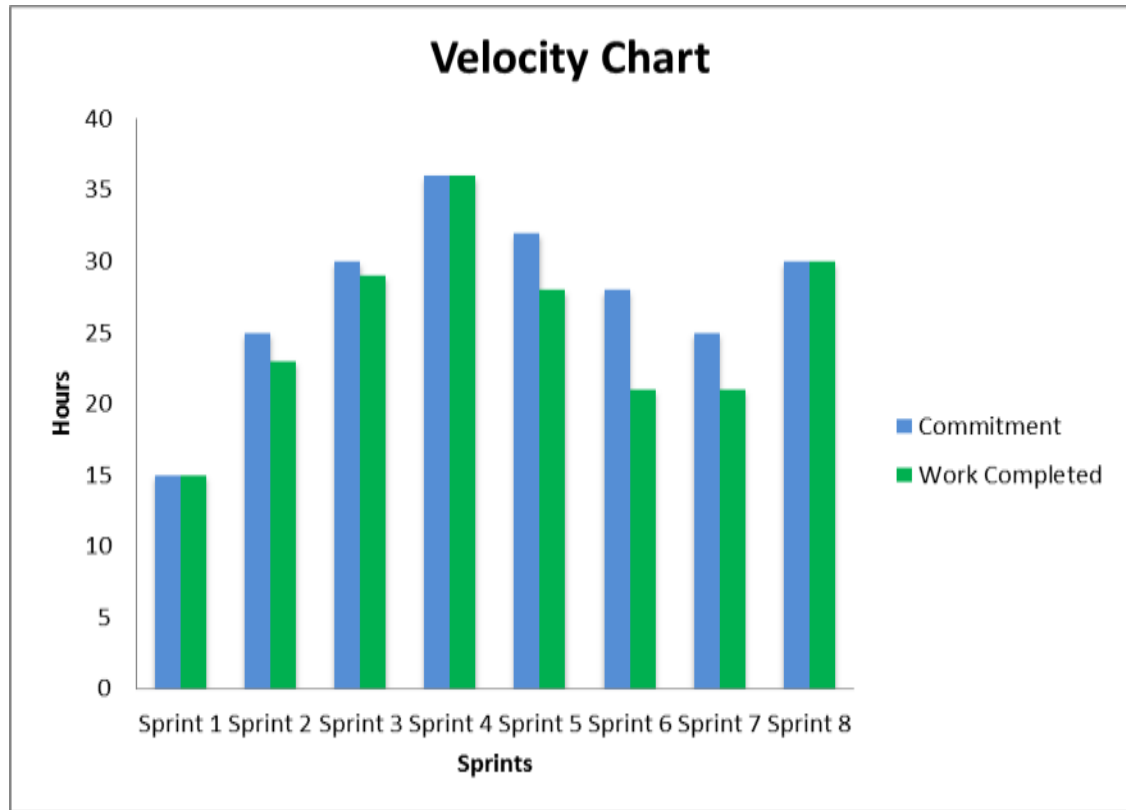


Figure 9: Sample Velocity Chart

Benefits of using Agile in Product Development:

Benefits of Agile implementation are well known and do not need a special mention. However, there are many intangible benefits that are often overseen.

- Work-life balance: With the ever increasing pressure on reducing the “Lead time to market”. Organizations are forced to complete each phase in an expedited manner and the result is impact to the work-life balance of the employee. With Agile implementation, it would help team maintain constant focus through continuous output and mitigate the high risk items in the initial phase.
- Higher motivation: There is always a sense of accomplishment with the team, as there is an interim milestone at frequent interval rather than one major milestone after a long duration.

- Stakeholder engagement: There is a constant engagement with stakeholders at all levels. This gives an option to correct the course of the project sooner than later.
- Ownership: Team feels a sense of ownership as there is an opportunity to interact with key Internal and external stakeholders.

Recommendations for successful implementation:

- To successfully implement agile in the product development (Non-IT) projects, adequate training to be given before implementation and case studies should be demonstrated through a pilot project with in the organization
- To be able to successfully deliver output accepted by stakeholders, teams must be cross-functional. During a sprint, a specific skill may be needed for a few days within the sprint; hence it will be highly advantageous to develop resources with multiple skills
- Teams must be ready to fail in the initial days of implementation. It will take a few sprints to understand what works for the organization. Focus should be on using the agile philosophy, rather than getting hung up on the differences with IT and non-IT projects.
- Engagement and acceptance from management and stakeholders is very critical in implementing agile with non-IT projects. Higher the engagement with stakeholders, bigger the success with agile.

CONCLUSION

Organizations are constantly challenged with cost and schedule pressure. Agile philosophy has done wonders for the software development process and helped organizations mitigate the cost and schedule impacts. Organizations that are on-IT based are still using traditional waterfall approach with the barrier that agile is meant for software development projects only. Many prestigious projects have experienced significant delays and cost overruns due to various reasons like inadequate risk management, not-well defined scope etc...

Non-IT projects can embrace the agile way of executing projects through subtle changes in the planning process and training. The method explained in this paper, integrates agile in to the traditional waterfall approach providing detailed planning through the end of the project, ability to implement earned value management and monitor "Estimate at Completion".

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