

Understanding and Proper Selection of Agile Processes in Software Development

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Abstract: *In today's world, the Software industry is growing rapidly and is catering to many aspect of life like Health Care, Finance, Food Services, etc. Due to which there is a rapid increase in the requirements of software products from the developers. Thus, observing the past 40 years tends and methodologies applied to achieve the required output and product cannot be used in this new age of the software development. Many software development companies nowadays aim to produce valuable software in short period of time, in lesser cost and with varying requirement from the client. Agile Methodologies was thus introduced to meet the new requirements of the new age software development companies. This method claims to be people-oriented rather than process-oriented and is more adaptive than the previous methods used in the industry. This method reaches the desired target objective by establishing an efficient link between the developers and stakeholders. The focus of this research paper is to emphasis on the effectiveness of the Agile Method in the software industry and proper implementation of the method in software development.*

Keywords: Agile, FBB, SCRUM, CRYSTAL

1. Introduction

The process of Software development involves proper planning and logical implementation of the technical knowhow of computer programming, documenting, testing, and bug fixing, which are involved in the creation and the maintenance of the Software. These process are tedious and hard to plan out.

The Success of a Software development thus lies in the proper planning of all the stages and steps involves in the development. As proper planning of the step in the development of a code for the Software, optimizes the process, providing a faster delivery, reliable source code for the software and efficient utilization of the recourses in hand.

Many methods have been implemented and utilized all over the world for efficient development. Still Agile software development methodologies have been greeted with enthusiasm by many software developers because work is done at different levels in parallel [1].

Agile provide the team tools to handling ever changing requirements throughout the life cycles of development of the Software. The modeling of the method is in such a way that delivery of the final products can be achieved in shorter time span and in lower cost as compared to other traditional methods. These two characteristics are the most significant characteristics of the method which differentiates it from the other methods.

2. History

The art of coding began with the simple languages like Basic, Cobol, Pascal, etc in the year 1950's. [2] As the requirements and the code started to become complex, the languages also began to evolve to be user friendly, and then

came the birth of object oriented programming. Simultaneously the method and planning process of a product also evolve alongside the languages.

The planning method for a product provides the developer a guideline through all the steps and phases of a software development process. Hence the selection of a ideal method of planning and execution is critical for the successful development of a product.

The Methodology or development approaches came into existence in the year 1970s [3]. It was due to the efforts of the developers to reduce the effect and increase the output. It resulted in the proper study and application of methodologies for the development processes. It divided the development process which was once taken as a complete action into smaller parts called phases which were easier to achieve and were realistic. Due to this the result was reduced numbers of errors, lower cost, lesser time, and proper distribution of the effort on the different features of the product. [3]

After the evolution of the structured and more formulated methods and approaches, software development approached at the stage where it evolved into Object-Oriented (OO) methodologies, which include the method like: Unified Process and Rational Unified Process (RUP). They include not only the objects and object oriented principles, but also the best practices from structured methodologies [3].

3. Agile Introduction

In the age of Software development, only the ability to develop and produce a product was not necessary. As this resulted in issues along the process like, communication gap, ineffective utilization of resources, missing deadlines, budget issues, etc. These difficulties increased as the products became more complex. In order to counter these problems, the develops came up with different methods of planning and

controlling the resource applied to the accepts of the project and the product.

These methods started to be applied by the developing teams and individuals in the real time scenarios. The result of their experience with the methods applied and the researches done on these methods paved the way to the proper development and understand of the importance of new methodologies that have many common feature.

One of such methodologies was created in the year 2001 by the amalgamation of the various concept of on the same principles of planning and resource management, this methodology came to be known as “Agile Software Development Manifesto”. [4] This approach was developed on the rule that the best way to check a product is to deliver the working version to the client and continue to include the changes and updates according to the notes and new requirements of the user.

Agile builds its methodologies on four primary principles, which are as follows: [5]

1) Customer Satisfaction:

The main objective of Agile and the desired object of a good project is customer satisfaction. Hence to fulfil this objective, agile aims to provide regular updates to the customer and the continuous delivery of the working version of the software. Agile also has the provision of accepting changes in the requirements which stretches the working scope of the project.

2) Dynamic Requirements:

The principle of accepting the changes in the different phases of the project provide the strength of dynamic approach to Agile. This principle grants the customer satisfaction as mentioned in the previous point and the developer the scope to expand the product.

3) Communication:

Agile provides a clear and proper channel of communication between the customer and the develops. The regular meeting and catch up between the customer and develop results in the clear communication of the requirements and hence results in the satisfaction of the customer.

4) Delivery duration shorter:

Agile focuses on all the aspect of development equally and parallel like code development, testing, etc. The simultaneous concentration on all the aspects, results in the faster and smoother production of the code, also in the proper utilization of all the resources. After every small change the product is tested resulting in low error rate at fast production.

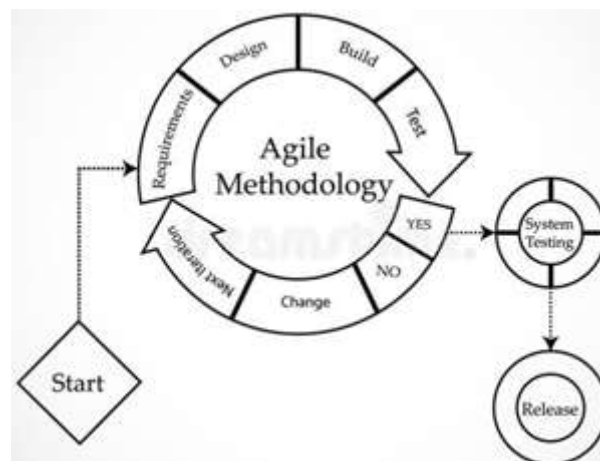


Figure 1: Line diagram of Agile Methodology

Agility in short means reducing the complications of development and promoting a faster response to the ever changing environments of development

Agile methodologies include the following:

- Extreme Programming
- SCRUM
- Crystal methodologies family
- Feature-Driven Development

a) Extreme Programming

Extreme Programming was introduced as an Agile Methodology in software development for fast and effective utilization of the resources and for more reliable outcome.

The XP focuses the whole team on common, and reachable goals. Using the values and principles of XP, teams apply appropriate XP practices in their own context. [6] The practices of this method encourages the creativity of the development team. This method was initially adopted by the fast paced small sized technical companies. Whereas the success of this method has encouraged many companies to adapt this method instead of the older production methodologies. [7]

Extreme Programming is successful because it stresses customer satisfaction. Instead of delivering everything you could possibly want on some date far in the future this process delivers the software you need as you need it. [8] The solution is provided in a simple, specific, and efficient manner to the development team, which can be followed point to point as a guideline, throughout the phases of the software development, which are planning, coding, designing, and testing.



Figure 2: Line Diagram of XP

The Benefits of Using this methodology in the practical scenario of software development can be simplified and divided in the following pointers, which are called the value of XP:

- **Easy Communication Medium:**

The building and construction of a software requires free and easy channels of communication with clarity and swiftness. In formal software development methodologies, this task is accomplished through documentation which was slow and ineffective.

Extreme Programming techniques can be viewed as methods for rapidly building and disseminating institutional knowledge among members of a development team. [9] The Goal of XP is to have a shared view point between the developers and the users. Which creates easier understanding and faster operating.

- **Simplicity:**

This method starts with the development of a simple solution and later moves to a better and complex one. The difference between this approach and more conventional system development methods is the focus on designing and coding for the needs of today instead of the future predicted or anticipated requirements. [9]

The only drawback of this is that it might entail more effort in the future, and that the requirement keeps changing rapidly.

- **Feedback:**

This method creates easily channels for feedback which encourages the fast and responsive development of the software. The feedback is characterized in three categories which are from the system, from the customer, and from the team. It is closely related to communication and simplicity. The flaws of the system can be easily communicated by using the unit tests.

- **Courage:**

Courage enables developers to feel comfortable with refactoring their code when necessary. Meaning reviewing the existing system and modifying it so that future changes can be implemented more easily. Example of this value would be the act of throwing away the code: courage to

remove source code that is obsolete, no matter how much effort was used to create that source code. [9]

- **Respect:**

The XP method encourages team members to maintain respect in the team for every member as they should never commit changes that break compilation, or delay the work of other in the process. The respect for their individual work is attained by striving for high quality and most efficient design for the solution proposed.

Apart from the Values, XP method also encourages some principles in its operations. These principles, in short encourage the team to implement more flexible and transparent solutions. These principles with the values of the method only promote effective and high quality solutions.

The Extreme Programming is best suited for the projects with the dynamic requirements. As the method focuses on the current requirements only, and don't need a predicted outcome for the future requirements. But this method would fail in the scenario where the development team is large and the future requirement meant to be of priority. This method is best for small teams, ranging in number from 2 to 10. As the method requires strong coordination and communication between the developer and the customer. These two factors are easy to maintain in a small team.

b) SCRUM

The Practice of SCRUM was being used before the Agile was implemented, but observing that the process and objective of both these processes to be similar the method of SCRUM was incorporated in the Agile Methodology. SCRUM has been used with the objective of simplifying project control through simple processes, easy to update documentation and higher team iteration over exhaustive documentation [10].

SCRUM is similar to other agile methodologies in their concepts and implementations, but its main benefit of using SCRUM is that it comprises project management as part of its practices. It guides the team developing to search out the major or minor tasks or actions at each development iteration. In addition to this the SCRUM also focuses on building a backlog, so that a track of the work to be completed is kept in the front of the team. Backlog is a section on the planning board where all requirements pending for a project can be viewed and recorded effectively. The time provided or allocated for the backlog is defined by the complexity of the task at hand. The notes of Backlog are always simple and short, as in to guide and initiate the discussion among the team members.

The SCRUM practices comprise of three roles, these three roles are as following:

- **Product Owner:**

The person is the interface between the team and the stakeholders. The tasks and responsibilities of the particular Product Owner are never the same and are dynamic in their nature, and then makes this role one of the most complex role in the process. [10] The PO is responsible for the

success of the product delivered, makes decisions of importance, provides and interpreters the vision of the product to the team, responsible for User Stories for the team and validates and maintains the quality of work and the final output.

- **Scrum Master**

The Scrum master is responsible for the supervision of the entire team and for the proper implementation of the set tasks. The Scrum master is not the lead on the activities of the team, but only intervenes when the members of the development team are not following the rules of the SCRUM process.

- **Development Team**

This body of the process comprises of the developers and the testers. The initial communication with the client specify the tasks and the user stories. Upon the target of the User Stories, the team decides which can be accomplish in one sprint and proceeds accordingly. It constructs the tasks and distribute the responsibilities. [11][12]

The process of software development by applying the method of SCRUM, the team of developers divides the project into small achievable parts called phases. In each phase, one feature of the product is fully developed by the team, it is tested, and then sent to the production region. The developers do not move to the next phase till the previous phase is completed

The main approach of SCRUM can be divided into parts: Planning, in which the team analyze the problem at hand and then approach the problem definite idea, Review, in this step the team review extensively their approach an work done and lastly the meeting, this accept of SCRUM cover the daily communication between the recourses involve for a smooth processing.

Current studies on traditional SCRUM development have shown that despites its advantages, it is not best suited for products where the focus is on usability [12]. The method is not able to address the usability factor of the user.

- c) **Crystal:**

The Crystal methodology can be defined as a collection of Agile software development approaches for the development of the product in which the focus is kept on the people involved whether as user or development team. Unlike traditional development methods, Crystal doesn't fix the tools and techniques of development, but keeps people and processes at the core of the development process. [13]

In Cockburn's words, "Crystal is a family of human-powered, adaptive, ultra light, 'stretch-to-fit' software development methodologies." [14] "Human-powered" means that the focus is on achieving project success through enhancing the work of the people involved. "Ultra light" means that for whatever the project size and priorities, a Crystal-family methodology for the project will work to reduce the paperwork. "Stretch-to-fit" means that you start with something just smaller than you think you need, and grow it just enough to get it the right size for you.

In conclusion it can be stated that this Methods provides more importance to the people that is why in this method the processes should be modeled and designed to meet and fulfill the requirements of the team.

- d) **Feature-Driven Development (FDD)**

Feature-Driven Development (FDD) is a client-centric, architecture-centric, and pragmatic software process. The term "client" in FDD is used to represent what other processes call customer or stake holder. [15]

The FDD working in iteration modeling fashion. At the start of the project the goals are defined and throughout, the predefined goals are reflected. The second important feature of the method is to group the similar features in the same iterations with similar subject and objectives. This list in known as a Feature List in the method.

These Feature are distributed among the small divisions of the team and targeted efficiently.

In short it can be termed as the Methodology following the rule of " Design By Feature and Build By Feature"[15]

4. Advantages of Agile

The advantages of the Agile are as follows:

- 1) **Stakeholder Engagement:**

Agile provides multiple opportunities for stakeholder and team engagement – before, during, and after each Sprint. [16] The Method has proper involvement of the client at every step, and encourages collaboration between the client and the development team. This results in clear view and understanding of the requirements by the development team.

The frequent deliveries and the clear communication channels increase the Stakeholders' confidence in the development team, and increases the quality of the final output.

- 2) **Transparency:**

The frequent meetings among the client and the development team, and the clear channels of the communication results in the Transparency in the development of the product. The client is across the whole process at every step of the development of the features and can provides input at any time if they find the project going of track or if there is a change in the requirements.

These aspects of the Agile provide the clarity between the two parties and hence results in the high quality of the final output.

- 3) **Greater Agility:**

The conditions while developing a project does not remain static but keeps on changing from the start of the project to the end of the project.

The main reason why the Agile methods are called "Agile" is because the iterative lifecycle is designed to accommodate change. Work is done in short "iterations" (or Sprints) of only a few weeks, and the transition from one iteration to the

next includes taking stock of what may have changed since the iteration began and how to adapt to those changes. [17]

Hence it can be concluded that the method incurs the changes which are observed during the production process and adapts accordingly, due to which the development team has to be proactive and adaptive all the same. These properties of the method result in increasing the agility of the project.

4) Productive Development Team:

The Agile projects have significant checkpoint at the conclusion of every iteration and delivery of working software to the customer. Because these reasons the development team can never afford to slack in their activities and have to be proactive to meet the deadlines. Thus they are always driven to achieve the resultant in shorter durations, making them highly productive

Methods used by team to increase productivity can be summed up as following:

Doubts in the requirement and the unknowns are not left alone by the team, but are focus upon in the early phase of the project to eliminate the uncertainty, so that the deadlines are not missed and the productivity is maintained.

The team develops and keeps rectifying the features coded, so that the time is not wasted in the end to re-solve the errors.

The code is always in the dynamic state. It keeps on moving from the developing team to the testing team to keep it ready at all times, hence increasing the productivity.

5) Good Quality Software:

The advantages discussed above in the paper are responsible for the maintaining the quality of the developed product.

The customer at the start of the project has a vision of the software's quality in terms of working and design. This vision is communicated to the development team on frequently, and is dynamic. As the method has clear communication channels and the priority is given to the customer, it results in the proper understanding of the quality expected by the customer. Hence the development team can aim and achieve the good quality in the desired time.

5. Limitations of Agile Methodology

Agile Methodology is fast paced development method which focuses on the requirements of the Customer and the fast delivery of the working code. But the limitations of the method cannot be ignored. The limitations of the method can be categorized as following:

1) Problem of analysis and predicting the requirements in the beginning of the Project

In the real life scenario it can be realized that agile is unable to make proper prediction of the full potential to be placed in the project and the resources to be utilized.

As it is hard to fully quantify all the recourses and use them ideally, but best method to overcome this issue is to provide

the delivery to the customer with the most valuable requirement first and then to focus on the updates and the secondary requirements.

2) Testing Through Out the phase

Agile suggest fast delivery of the product which results in the testing resources to be ready throughout the phase. This results in the excessive cost incurred by the project to maintain the testing resources even when they are not being utilized hence there is an additional cost to the project to adopt continuous testing throughout.

3) The Continues availability due to frequent deliveries

The method encourages the delivery of the product in small packages of feature which are ready to be used. Due to this proactive and continuous availability of the developers and the testers are required irrespective of the time boundation. Also every feature before being realized in the production region need sign off from the users, this also demands the users to be available as soon as the team has finished the feature development, because the new phase is only taken up when the previous phase is over.

Though the time is process consumes a lot of time but consuming of time is resultant to the quality of the product.

4) Reusability of the software

Agile methodologies concentrate on the quality of the skills and pace of the developers, as modules and sub-modules are created mainly by single developer. Thus when this software has to be reusable, then agile methodologies does not provide the best outcome. As only one resource is properly across the understanding and the flow of the developed feature for the software.

5) Unclear Customer on the Outcome of the Product

If the customer is unclear on their idea and views of the final outcome of the product they want, then that in turn results in frequent changes in the requirements for the feature in a single phase itself.

This limits the project by increasing the cost incurred, not being able to produce the required releases of the features which in turn stops the team on moving forward to the next phase of development, resulting in the increased time duration.

6. Conclusion

In the current scenario of software development in manufacturing companies, Agile methodology is over taking many older well-known techniques as it provides faster and high quality products. The qualities of the method also assist the developer to be more productive and be more efficient. Yet in the real life scenario there is still confusion in deciding a correct process of Agile according to the project requirements and there are problems in executing the functionalities of these method properly.

This paper describes the essence of the Agile Methodology and the proper selection of its process according to the requirement of the project. Here the analysis of few main processes is stated, to make the Agile user understand the

difference and the functioning of the processes, along with the limitations of the methodology to overcome these issues during the real life utilization of the method.

The objective of this paper is to provide assistance to the developer to understand the key features of the processes in the methodology of Agile.

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[Fig1] The line diagram to understand the process of Agile methodology. Google images

[Fig2] The line diagram of Extreme Programming methodology for clear understanding. Google images.

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