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Comparative Study and Analysis of Scrum and Lean Methodology

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Abstract: For the development of any product, different software development approaches are embraced. Contingent on the sort of prerequisites and venture a reasonable procedure is embraced. Agile is an overall acknowledged software development process. In the research work we will contrast scrum and lean methodologies. Scrum is an Agile procedure. Lean and agile offer a considerable measure of standards which are in like manner. In the work, the attention is on understanding scrum and lean and their work process alongside the entire procedure. Additionally, the emphasis is on its application in different enterprises and the venture that fused these procedures. The work depicts an analysis amongst them and the contrasts between these two procedures. Likewise, it centers around the factual information gathered by leading a review on an arrangement of inquiries. The statistics collected from the survey indicate which is the best technique acknowledged in different businesses.
Keywords: agile,scrum,sprint,lean,statistical,software development.

I. INTRODUCTION

As the demands are increasing, people are expecting more from Software Industries. If we talk about last few years, software development or different types of IT companies have completely flourished the market. People are demanding more efficient and productive deliverables from companies that can be used to make real world problem much simpler to solve. In case of software development, it is very essential to follow a particular approach that can be used to make things much more organized and understandable. Agile approach is one among them. Agile approach is driven by the terms like incremental and reusable. Agile methodologies try to make things more efficient and transparent to the other members working on the same project. There are various methodologies under Agile that most of the industries are adopting which includes Scrum, Kanban etc. In the accompanying paper, we will talk about Agile system, and it's work process. Further ahead, we will talk about Scrum and how it is changing the viewpoint of the general population who are associated with the development procedure and making it simpler for them to satisfy the client necessities. Scrum parts that aides in the general advancement of the item i.e. Scrum Master, Scrum Product Owner, Scrum Team. Proceeding ahead, we will discuss Lean Development, which is utilized to ad lib the procedure and evacuate codes that are not valuable and information from the undertaking. It goes for fundamentally diminishment and evacuation of waste to streamline the general procedure. Moving ahead, we will examine about the modern uses of both the methodologies. Further analysis is done by taking the reviews of software engineers and users with the help of Google form. The results from the form are collected and further statistical analysis is done on it. After obtaining the results we proceed forward for data visualization and the statistics are represented in the form of bar charts showing which methodology is better and best suited for different types of product development.

II. AGILE AND ITS UNDERLYING METHODOLOGIES:

In order to develop software, diverse techniques have been adopted over the year which includes various software development models such as waterfall, spiral, incremental, agile, etc. Amid all of these, agile is the most widely used and accepted iterative and incremental model which involves transparency, proper communication between developers and stakeholders, reuse and maintenance of the product which can be achieved in the most cost-effective manner. This procedure keeps up a feedback of client's input in regards to the item which is being surveyed always by the group to satisfy the client's necessities.

Under agile, different techniques have been developed throughout the years to make deft the most appropriate model. Few of the methodologies include Scrum, XP(extreme programming), lean development, kanban, etc.
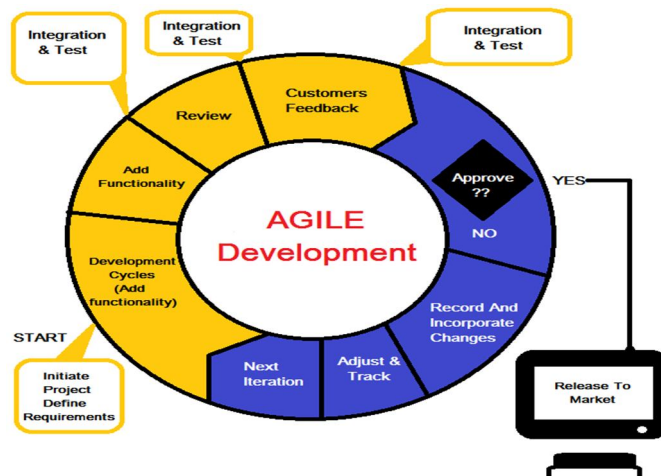
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Fig1. Diagram of agile development

III. SCRUM METHODOLOGY

A. Understanding Scrum?

Agile methodologies focus on various aspects of software development process. Few techniques emphasis on the practices involved while others explain the workflow. Scrum describes the agile framework for software development which handles complex projects easily and explains the complete workflow adopted by Fortune 500 companies across the globe.

B. Principles and Roles

Scrum is completely related to the team-based approach. Team members share a common goal that is to be achieved. Scrum provides a good interactive environment for the team members to work in an efficient and productive manner. In most of the cases, they follow the same team principle to tackle the problems that arise during different phases; they collaborate and help each other to fulfill the customer needs. They make use of the incremental approach. At the end of every sprint, the resulted product is to be compared with the required one to understand the progress.

1) *The Scrum Master:* Scrum master's role is not the same as that of the role of a project manager in Agile development. Its role is to manage the flow of information that is exchanged among the members and to make things easier for the scrum team and product owner. They help team members to remain focused on what they are assigned to do by keeping them isolated from external distraction. The scrum master is also responsible for reviewing the sprints and what all work to be assigned during that particular sprint, though team members can also give their point of view regarding the sprint or any other matter. Scrum masters are not the only ones responsible for the outcomes. It is the sole responsibility of the whole team that the required outcome is achieved. Scrum master asks 3 types of questions to the scrum team members:

a) About yesterday's progress
b) Today's work plan?
c) About the huddles in their ways.

2) *The Scrum Team:* This role consists of individuals who work hard to achieve the common goal as it is requested and demanded by the customer. It mainly consists of developers working on the project. It is required that the members of scrum respect each other, follow same rules and regulations and try their best to achieve a common goal. After the selection of scrum team members it is essential to know their ability, level of maturity, whether they will be able to work in a stress full and demanding situations, values like cooperativeness etc. which can be easily measured with the help of Tuckman model(consists of four phases-forming, storming, norming, performing).

3) *The Product Owner:* The role of the product owner is to convey his opinion to team members that is what he or she wishes to be developed. The product owner is responsible for keeping the records of the requirements of the customer, changes in the market about the competitors and help/guide team members to work in accordance. They also help in prioritizing the requirements that is what is to be developed first and what later, what is important. Product owner also decides whether the product is to be built for commercial purpose or for internal use. Though product owner decides/prioritize the needs of the sprint but the team members are

the ones who decide what they can do and how much they can do in a single sprint. The product owner should have the traits like availability whenever required, knowledge to take decisions effectively and efficiently and good communication skills so as to interact or convey what is necessary to stakeholder or team member.

C. Workflow of Scrum Model

1) Product Backlog: After the product owner lists down the requirements of the stakeholders, the list is prioritized on the basis of what is important or what is not, what is to be developed first, which is divided on the basis of ranks assigned to the requirements.

2) Sprint planning: Sprint planning is done after product backlog is created, in which all the team members come together to plan what all is to be done and how it is to be done. They also divide the tasks in the sprints. It is a time-bounded activity and one sprint period varies from one to four weeks. It is the responsibility of the scrum master to make sure that each of scrum team members understands the task that is to be done in the sprint in an incremental manner.

3) Sprint Backlog: After sprint planning the tasks from the product backlog are pushed into sprint backlog. It is generally done by scrum team member as they will be the one who will work on the tasks or product that is to be delivered. The size and item of things to be included in a sprint backlog depend on scrum team members. It is generally maintained in the tabular format which consists of tasks and days assigned to complete each one of them. Scrum can also update the sprint backlog. But it is advisable not to update the backlog more than once per day. Then the progress is graphed for better understanding.

4) Daily Scrum: It is also a time-bounded event that helps in optimizing the performance and for the improvement of teamwork. It is done on each day of the sprint for around 15 minutes to decide the next 24 hours work or task that is to be done. It is done to reduce the complexity of work. It is also done to evaluate the progress of task previously done to know whether we are heading in the direction of our sprint goal or not.

Daily Scrum is helpful for good communication among the team members and what all is to be done to remove the obstacles that are arising. This improves the level of knowledge and good decision making is also promoted.

5) Sprint review meeting: It is an informal activity. In this meeting, the evaluation of the resulted product is done after the sprint to know whether the product that is produced is well tested, coded, etc. It is done to know the direction of our progress. The product is compared with the goal that was to be achieved to know the deviations and to make it better and more productive.

6) Sprint retrospective meeting: Sprint retrospective is conducted at the end of the sprint. It is done to improve the product or deliverables to make it more productive. A good scrum team member always seeks opportunities to improve the product. During retrospection, a hot topic comes or ideas to improve the product which may also result in the conflicts. There are basically 3 important things that are done:

a) Start Doing: It includes what is to be done or included to improve the product.

b) Stop Doing: It includes what all should not be done in the sprint.

c) Continue Doing: It includes what should be continued as it has proved to be productive previously as well.

The Scrum master is the one who asks each team member to shout out the ideas in reference to start-stop-continue. It is a brainstorming process.
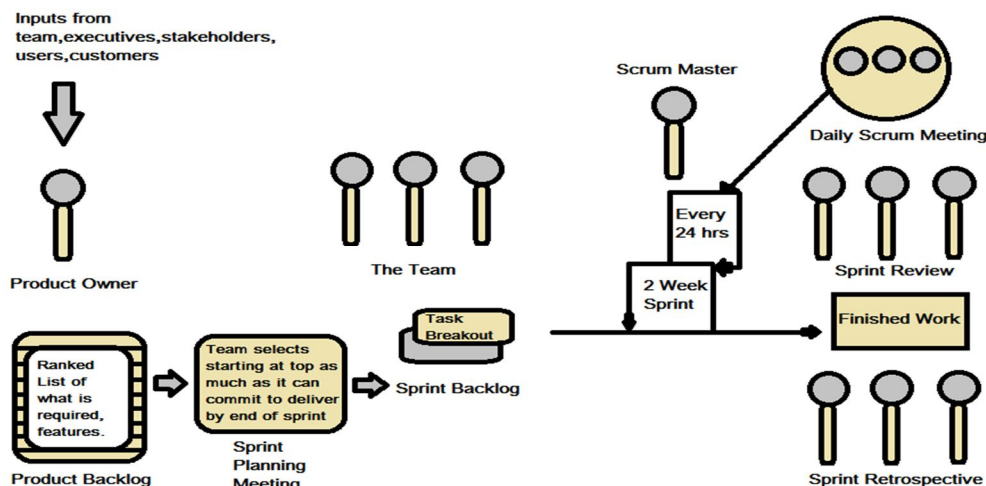

Fig2. Scrum Process and Workflow.

D. Why Scrum?

Scrum is one of the widely used agile frameworks which gives flexibility and enhances the performances when used over other methodologies. This is because of its following unique characteristics:

1) The product is delivered on a regular basis: In the scrum, we have sprint period which is like a cycle or duration of time say two to three weeks. After each sprint, a part of the product/software is delivered which keeps the progress in check.
2) Sprint planning: The whole team decides the sprint duration. And as the end of sprint duration come frequently, in other words, their deadline comes soon, so they get focused and it increases their work efficiency and productivity.
3) The daily stand up meeting helps get updated: An everyday mini meeting is held to discuss their progress after the last meeting, and what they plan to do next.
4) Sprint demo enables transparency: A common meeting is held to show what product has been shipped in that sprint.
5) Sprint retrospective meeting to improvise the productivity of each sprint: It is a kind of review meeting kept to discuss what went well and what did not go well so that they can work on it in the next sprint.
6) Teamwork: No one person gets to decide. The whole team decision matters and everyone have equal say.

E. Industrial Application and Usage of Scrum

Now, obviously before implementing or switching to scrum model one wants to be aware of which companies have adopted this model and on what projects they have applied this methodology. Of all Agile frameworks used by a company, 66% of it is the scrum. Given below are the list of companies that have adopted this model:

1) Google
2) Yahoo
3) Microsoft
4) Facebook
5) Adobe
6) BBC
7) Siemens
8) Nokia
9) CNN
10) Bank of America

Now, coming to the usability, given below are the major projects that were deployed using scrum model:

IV. LEAN METHODOLOGY

A. What is Lean?

Lean software development helps in optimizing the process by eliminating the waste that is by removing whatever is not essential to the final product and helps deliver a product of better and refined quality as it involves a lot of testing. The lean development team focuses on learning and delivering the product as fast as possible to increase efficiency. Lean is considered as an agile development methodology. This is because of lean and agile share so many principals which are in common.

B. Principles of Lean

The basic principles of lean development are listed below:

1) Eliminating Waste: This is one of the main principles that are responsible for eliminating the things that are not useful for the customers are considered as waste. For example, partially done code, defects, managerial activities, etc. are considered as waste. These wastes are to be eliminated in order to reduce the unnecessary complicated solution, amount of rework, developing the wrong product to reduce stress or workload. This should be done iteratively to obtain the efficient and useful product.

2) Amplify Learning: In case of any software development main focus should be on in what ways the work can be improved and not on adding more and more features. It promotes continuous learning in each iteration. It involves discovering newer ways/ideas to write a code or build a product in an optimal manner. In most of the cases, user feedback is also taken to understand their perspective and requirements. It also helps in understanding the constraints that should be kept in mind during development process.

3) Decide as late as possible: Advancement of any item ought not be founded on forecasts or suppositions. This should be possible by postponing the choice until the point that we get very much characterized actuality. The more mind boggling the framework is

the more postponement in choices and responsibilities. Iterative approach advances this rule is the ability to adjust more up to date changes which can be expensive if becomes known after discharge.

4) Deliver as fast as possible: In today's world, the one at the top is not based on the bigger development rather it is focused on developing the product as fast as possible. This also helps in delaying the decision so that customer gets enough time to discover their requirements properly. This helps in getting the product as fast as possible which further helps in improving the product in the next iteration. The shorter the span of iteration, the effective will be the learning and interaction within the team is observed.

5) Empower the team: In the Agile approach it is seen that manager helps the team member in taking any decision, assigning tasks to them, providing them with the decision, suggestion and also help in removing the obstacles but this does not involve team members. Team members should be given rights to decide their requirements. Team members should interact directly with the customer to understand the things from their perspective. It should be the responsibility of the team leader to help them to overcome the problems and hurdles.

6) Build Integrity: There are particularly two types of integrities that are to be achieved in case of any deliverables. First is perceived integrity which is related to the overall experience of the customer with the production, how useful or productive it is, its usability, deployment, delivery, etc. Secondly, we talk about completed integrity in which separate component of the system are to be integrated to make it more efficient, maintainable, responsive, flexible, etc. The information is divided into tasks that are to be achieved then the small tasks are integrated together to form the system as a whole.

7) See the whole: Programming frameworks these days are not just the entirety of their parts, but rather likewise the result of their co-operation. Most of the defect in the software system can be eliminated by developing the system into subsystem and developing them separately using well defined standards. The larger the system, the larger the organization involved in the development which results in the development of complex, efficient and powerful system
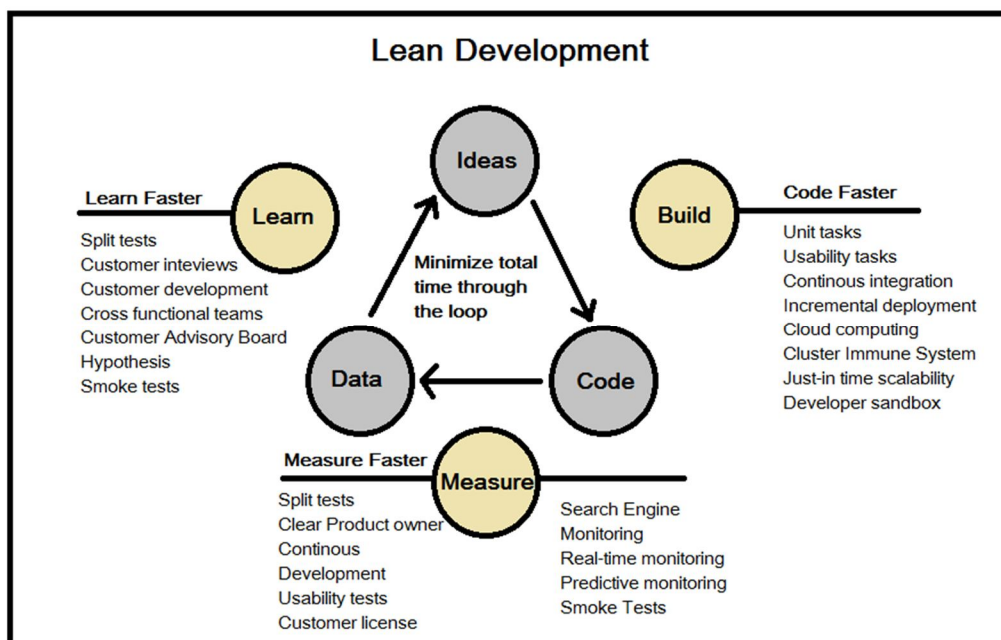

Fig3. Lean Developmental Model

C. Why Lean?

Lean is emerging as a very successful strategy as it focuses on customer and increasing customer satisfaction. It aims at connecting with customer frequently, understanding their value and focuses on its key processes to continuously improve it. In this generation, customers are becoming more and more demanding and the market is becoming customized eventually. It also focuses on two major concepts that are eliminating waste and improving flow. It helps any organization meet the challenge. Lean provides companies with a clear-cut advantage because of the following reasons:

1) Greater throughput and productivity
2) Better and improved quality
3) Reduced cycle times

4) Smoother flow of operation

5) Reduced operating cost

6) It makes any firm more flexible and adaptable to changes and provides a better way to deal with low economic growth.

7) Eliminates Waste: Lean keeps an eye on the Nine Areas of Waste: development, stock, holding up time, transportation, information, quality, overproduction, getting ready and imaginativeness. By killing waste, an association has the opportunity to yearly time spent on inconsequential endeavours.

8) Streamlines company progress: Executing Lean enables a maker to streamline their procedures all through the whole association, from the front office the distance to dissemination. Effectiveness is seen and the producer can work at its maximum capacity. It leads to a diminished assembling cost and expanded speed to advertise.

D. Industrial Applications and Usage of Lean

Following are the various companies that use the lean methodology to develop their product.

1) Intel

2) Nike

3) Caterpillar Inc.

4) Kimberley-Clark Corporation

5) Illinois Tool Works

6) Textron

7) John Deere

8) Ford

9) Parker Hannifin

10) Toyota

E. Difference between Scrum and Lean

Scrum	Lean
It is a software development framework.	It helps optimize the process.
Its primary goal is the people.	Its prime focus is on the process.
It is purely an agile technique.	It is also an agile technique but involves eliminating waste and improving flow
Action plan: sprint backlog, various continuous sprints and then potentially deliverable product	Action plan: It builds, then measures and finally learns.
Its method of indicating progress is by the description of "done".	Its method of indicating progress is by validated learning.

Table 1. Difference between scrum and lean methodology

F. Statistical analysis of Scrum and Lean

Following are the various set of questions that we considered for the survey:

1) Which of the agile methodologies do you find the most useful and productive when it comes to software development?

2) Which of the methodologies of agile is adopted by your company for the development of a product?

3) What kind of products does your company manufacture? Example-software, hardware, car, etc.

4) What do you think is the most suitable type of development framework for your company? Incremental or waterfall.

5) Which among all the methodologies do you think helps in delivering the product most efficiently?

6) Which among all the methodologies do you think helps in delivering the best quality of the product by meeting all the requirements of the customer?

7) Being a software developer/manager which among all the methodologies would you suggest for a newly established company to adopt?
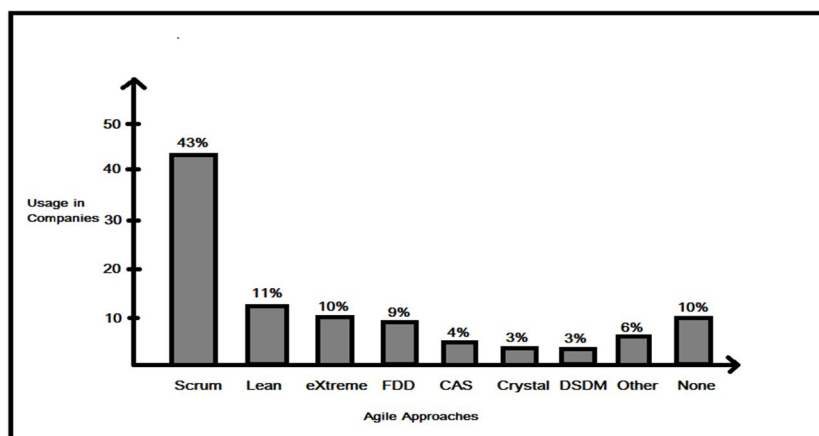
Fig4. Statistical results of the survey

V. CONCLUSION

Scrum and lean methodologies have various features to optimize the productivity and the whole process of the workflow. Bigger organizations undertake such methodologies and work in various sprint cycles to increase the productivity and deploy the product. This whole work process is optimized by lean software development method. Such methodologies have a team with a project manager and a contractor who is the product owner. Like-wise various other incremental and iterative approaches of Agile are used in various industries for the development of a product which turns out to be beneficial.

VI. ACKNOWLEDGEMENT

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