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Comparative Analysis of Iterative Waterfall Model and Scrum

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ABSTRACT
Software development models have been categorized into traditional methodologies and modern methodologies. Iterative waterfall model comes under traditional methodologies in which software develops in time-box iterations, whereas scrum is an agile methodology for software development. It relies on inspect and adapt principle, therefore it is becoming the fashion in IT industry. Scrum is an iterative and incremental software development approach. Scrum came into existence even when iterative waterfall model and incremental model exist. This paper is intended towards analyzing the comparison between iterative waterfall model and scrum. The result of research has been shown in comparison table and proved with the real project.

General Terms
Comparative Analysis, Parameters.

Keywords
Iterative waterfall model, Software development methodologies, Scrum.

1. INTRODUCTION

Choosing the right software development methodology is a very challenging task. Difference between methodologies should be clearly understood for choosing right development approach. SDLC models have been categorized into traditional and modern development methodologies. Waterfall, RAD, Spiral, RUP and V-shaped comes under traditional and classical methodologies whereas Component Based Software Development and Agile comes under modern methodologies[1].Traditional methodologies focus on documentation during development while the modern methodologies such as agile focus on working software rather documentation. Traditional methodologies choose for critical projects where the chances of evolving requirements are almost zero, but dissimilarly modern methodologies used for low critical projects where requirements change quite often [1].

Iterative waterfall model is the mini-waterfall model, which overcomes the drawback of waterfall model. Waterfall model is the sequential process in which feedback is not possible. Iterative waterfall model came to existence which allows feedback to each phase except feasibility phase.

Modern technologies such as agile are rapidly adapting by IT industry. Scrum is the very famous agile methodology which is highly appreciated by the industry. It is iterative and incremental approach. The idea of this research is to explore the statement “Scrum is iterative and incremental approach”.

There are lots of dissimilarities between iterative waterfall model and scrum. The aim of this review is: -

- to explore the both scrum and iterative waterfall model
- to compare the scrum and iterative waterfall model

Review has been conducted through the literature survey. Overview of Literature survey is given in Section 3. Both Scrum and Iterative waterfall models has explained briefly in Section 2. Comparison has been done on the basis of fifteen different parameters. These parameters are related to process, quality, requirements, development and feedback. The comparison table has mention in section 4. These comparisons are proved with the real project “HTML Tutorials”.

2. BACKGROUND

In this section we described iterative waterfall model and scrum. Advantages and disadvantages also discussed respectively.

2.1 Iterative Waterfall Model
Iteration waterfall model is an enhancement of waterfall model. In waterfall model feedback to proceeding phases is not possible. It overcomes the drawback of waterfall model. All phases are same as waterfall model and occur in several cycles. These cycles are called iterations. In short, each iteration is a mini-waterfall model. During iteration, focus is given on the delivery of work not on the valuable work.

The process starts with requirement gathering and analysis. Major requirements should be clearly understood. Other evolving requirements can be add later during the development. Requirements divide into chunks and prioritize. The requirements with high priority will develop in early iteration. In iteration, the development goes through the design phase, implementation and unit testing phase, integrating and system testing phase. At the end, each iteration releases work. Iteration waterfall model has shown in Figure 1.

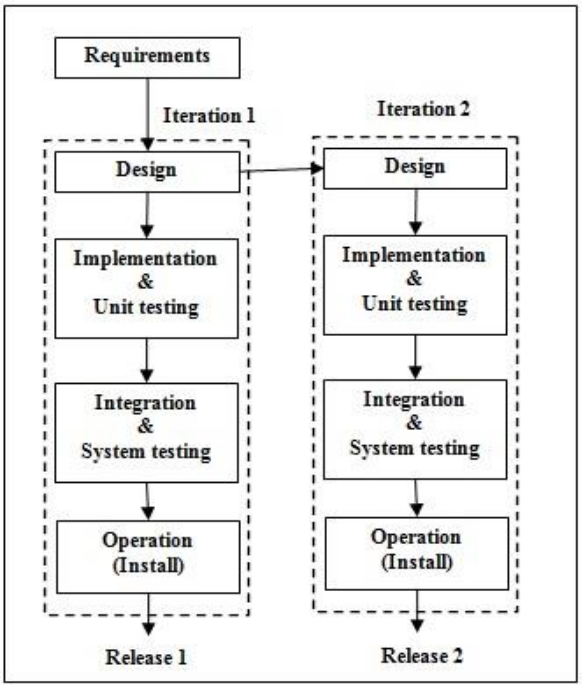

Figure 1: Iterative Waterfall Model

2.1.1 Advantages of iterative waterfall model

1. It allows feedback to the proceeding phases.
2. Product builds and improves step by step.
3. Sketches and blueprints make the feedback reliable from user.

2.1.2 Disadvantages of iterative waterfall model

1. Each phase of iteration is rigid.
2. Cost of system architecture or design issues may arise.
3. Milestones in development are not clear.
4. It is difficult to manage.

2.2 Scrum

Scrum is the rapidly growing agile methodology in IT industry. It is founded by Jeff Sutherland and Ken Schwaber in early 90's. Scrum is compared with rugby game as in scrum cross-functional team work collaboratively in sprints to develop deliverables.

Any software development starts with the feasibility study and requirement gathering process. In Scrum, requirement management tool is Product Backlog. It is a prioritized list of product backlog items. Product backlog item can be new feature, bug and technical enhancement. Product owner is responsible for the creation and grooming of product backlog. During Sprint planning meeting product owner, scrum master and entire team plan the sprint goal. They create the sprint backlog during this meeting. They select the highest priority requirement to develop. Sprint backlog is the list of tasks to complete the sprint.

After this meeting, the team starts working on sprint backlog in sprint. Sprint is a time-boxed process of 4 weeks. During Sprint, it is the duty of Scrum Master to keep the team focused and remove the impediments due to which development and team get affected. After 24 hours team and scum master meet for 5 minutes to discuss the progress of sprint. At the end the output of sprint is "deliverable" ready to handover to stakeholder. Sprint ends with the sprint review and retrospect. This process continues throughout the development. Scrum methodology has shown in Figure 2.

2.2.1 Advantages of Scrum

1. It delivers product more quickly.
2. Requirements and their prioritization can change throughout the development.
3. It enables customer involvement throughout the development.
4. It is lightweight and very flexible.
5. It is easy to understand.
6. It provides transparency, inspection and adaption in software development.

2.2.2 Disadvantages of Scrum

1. It demands only experienced team members.
2. It is difficult to manage.
3. It is one of the leading cause of scope creep.
4. If any of the team members leave during development, it can have a inverse effect on the project team.

3. RELATED WORK

In [1] authors represent the different model of software development with pros and cons. They also give comparative analysis of traditional and modern methodologies. They discussed that scrum is a project management process that is applicable to any project with aggressive deadline with complex requirements and degree of uniqueness. Author mentioned that the scrum has three phases: pre-game phase, development phase, post-game phase. Pre phase consider as product backlog creation and grooming, development phase consider as sprint and post-phase is consider as review and retrospect.

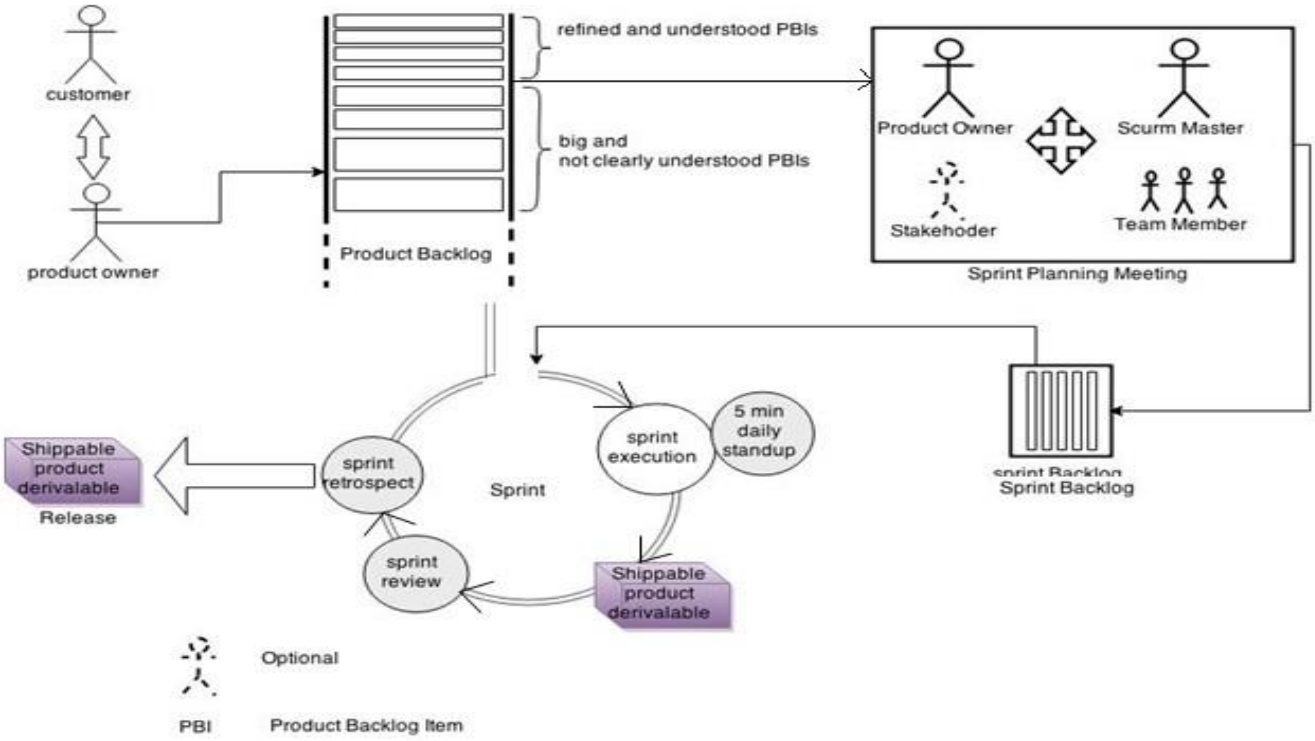

Figure 2: Scrum Methodology

Four traditional models that are waterfall model, iterative waterfall model, spiral model have compared in [7]. Author discussed that in iterative waterfall model project is divided into small divisions and developed in iterations. Each iteration is a mini-waterfall model. It provides greater flexibility than waterfall model.

The main idea of research in [10] is to explain the scrum in global software development. They stated scrum provides inspect and adapt strategy. In scrum the software is delivered in increments called sprint. Scrum artifacts, meetings and roles are explained by the author.

Five different models have been compared by author in [9]. They stated that in iterative waterfall model phases can overlap when needed. They mentioned five XP and agile principles. They also stated that agile is an lightweight methodology which produces good team cohesion and emphasis final product. It is an test based approach to quality assurance and requirements.

4. RESULTS

Scrum develops software with iterative and incremental approach by following the agile practices and principles. However iterative waterfall model doesn't follow the agile practices and principles.

The comparison of iterative waterfall model and scrum has been done on fifteen parameters. The result is shown in Table 1.

Table 1: Comparison of Iterative Waterfall Model and Scrum

S.no.	Parameter	Iterative Waterfall Model	Scrum
1	Scope	Well-Define and Fix	Variable and define in User Goals
2	Requirements	Defined	Evolving
3	Planning to Start	High	Low
4	Risk Management	Low	High
5	Customer Involvement	Low	High
6	Implementation	Certain	Uncertain
7	Focus on Document	High	Low
8	Quality Management	Low	High
9	Teams	Functional, Not-Self Organized	Cross-functional, Self Organized
10	Prioritization	Static	Dynamic
11	Delivery	Work/code after iteration with refinement	Valuable product after every sprint
12	Resources required	High	Low
14	Iteration Time	3-6 months	30 days
15	Phases	5	3

To prove some important parameters, we have applied these parameters on real website project named "HTML tutorial". HTML tutorial is a website for learning HTML online.

1. Scope

In beginning, the scope of project was to create the static website of HTML tutorial. In the middle, customer wanted to upgrade this website to dynamic website. In case of iterative waterfall model, scope cannot vary therefore it is very difficult to jump from static website to dynamic website. But in scrum it is easy to jump from static to dynamic website.

2. Requirements

In beginning the user just demanded to create the HTML tutorial web pages. After two months, customer demanded CSS tutorial web pages along with HTML tutorial web pages. In iterative waterfall model it is not possible to grip this big requirement in between the development. But in scrum it is possible because requirements can evolve during the sprint. Scrum team gives 5% of sprint to product backlog grooming process. During product backlog grooming customer can add new requirements. In this meeting, refinement of big requirements is also done by team.

3. Customer Involvement

In iterative waterfall model customer give its feedback after the release of some high priority web pages. However, customer involvement is very important part of scrum. Customer can involve during grooming process, review meeting, and optionally during sprint meeting.

4. Implementation

In case of iterative waterfall model the major requirements of HTML tutorials are well-understood, therefore the implementation is certain. However, in case of scrum, requirements are not well understood in beginning. It get refined after grooming process. It is impossible to predict the implementation; therefore in scrum implementation is uncertain.

5. Focus on documentation

In iterative waterfall model, first the SRS of HTML tutorial was created. On the SRS basis, analysis and design document has been created. Therefore, iterative waterfall model focus on documents. But in scrum the more emphasis is given on working product that is implementation of HTML tutorial web pages.

6. Delivery

In iterative waterfall model, during iteration developers focused on the delivery of completed code. However in scrum during sprint team focused on HTML basic web pages (valuable product) so that after deploy increment customer can get advantage of return on investment.

7. Resources required

Iterative waterfall model demands system analyst, programmers, testers for development of HTML tutorial website. But scrum has product owner, scrum master and team of 3- 6 member. However, members should be experts.

5. CONCLUSION

Scrum is an iterative and incremental methodology. But it doesn't mean that iterative waterfall model and scrum both are same. There are lots of differences between them which are elaborated in this paper. Scrum adapted the idea of iterative model however it allows development in iterations by following the manifesto's and procedures of agile. The aim of iterative waterfall model is code refinement until we got the final product whereas scrum focuses on delivery of valuable product. By comparing the result with real website project it has been proved that scrum is more flexible as compare to iterative waterfall model.

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