Agile Methodology Vs. Traditional Waterfall SDLC : A case study on Quality Assurance process in Software Industry

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Abstract— **We are very familiar with the phrase 'change is the only constant' and same thing applicable for software industry also. In this new world of software industry, most of the Information technology companies are following a methodology, named Agile where the development work moves quickly. Now a days very few companies are still following Traditional Waterfall Model as software development life cycle method. In software development life cycle one of the most important phase is quality assurance phase or testing phase. In this context we will be discussing how the software testing has been implemented and how it's going to work with agile methodology. Also, we will do a comparative analysis between Traditional Waterfall model Testing approach and Agile testing approach.**

Keywords—Software Development, Waterfall model, Agile, Testing in Agile

I. INTRODUCTION

Agile software development technique refers to rapid, active, and responsive software development. These days, agile software development techniques are generally recognized. It's an iterative method for keeping up with rapidly changing development environments. Traditional software development approaches are ineffective in dealing with changing requirements and short iterations [4]. In the world of software engineering, agile software development has quickly acquired popularity. Despite its freshness, agile software development is a significant study topic within the software engineering field. Software professionals and researchers all around the globe have been drawn to agile software development methodologies [1]. Not only in Software, but Agile methodology also successfully implemented in other are like manufacturing industry [5]. Agile software development is a process of iterative software development. Its core premise is that people come first. Agile Methodologies have a different estimate and scheme than traditional ones. The majority of Agile Development articles published in the United States and overseas focus on the comparison and merger between Agile Development and traditional techniques [2]. Software professionals and researchers all over the globe are interested in agile software development methodologies. Scientific research is still in short supply [3]. In this paper we are going to discuss how Agile Testing approach is effective and efficient over traditional Waterfall testing approach. This case study illustrates a brief discussion about the lifecycle of Traditional Waterfall model, an overview on Agile methodology, discussion of testing approaches in Agile methodology and traditional Waterfall model SDLC. We will also be comparing Agile testing methodology and waterfall testing process, followed by future work and references.

II. WATERFALL MODEL - TRADITIONAL SOFTWARE DEVELOPMENT LIFECYCLE

In 1970, Winston Royce introduced the Waterfall Model. Waterfall model is a sequential project management methodology where one phase finishes before the next phase begins. Referring Figure 1, Waterfall model consists of six different phases. These are – Requirements, Design, Implementation, Verification, Deployment and Maintenance. The waterfall method is easy to understand, simple process to manage production issues and in this process it is easier to keep Software Development on budget.

The waterfall model is a project management methodology based on a sequential design process much like a waterfall face. starting with requirements, because the waterfall model mandates that requirement to be well documented before any other project phase starts, project manager is likely to spend more time gathering requirements starts with a concept or the idea of what the customer wants to do. The project manager will discuss the concept with a customer with subject matter expert's and with other stakeholders to define very specific business needs. Project team approves and completes requirements phase before moves to the next phase, i.e design.

The logical and physical design phases are both included in the design phase. The logical design is a depiction of how software data flows at the outlets in an abstract form. It is frequently represented graphically as a diagram that depicts data flow. The gear, such as storage and network infrastructure, that will make the logical design a reality is determined by the physical design.

During Implementation phase software programmers do the actual coding to build the software according to the design document. This allows for ongoing implementation followed by unit level verification that done by the developers.

Verification is testing the software against the requirements documented in the first phase of SDLC. In the verification phase, the project team select a group of associates, called Tester to test the software. if the software does not meet the requirements and the requirements document, tester send the code back to the software

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engineers for further modification. Once all verification actions are done in the phase and testers approve the outcome, project moves to the next phase.

After this verification phase, development team deploys code in production environment.

The last phase is maintenance, where project team fix production bug/defect and push further build in production with cleaner code.

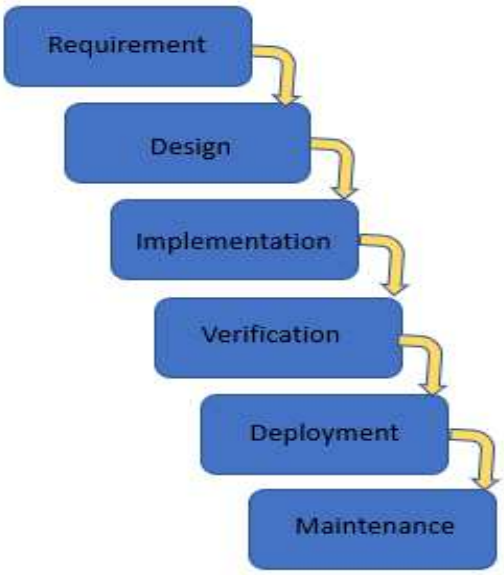

Figure 1: Waterfall Model

III. Agile Methodology – Fast, Flexible and Dynamic

Agile methodologies are software development approaches that are consistent with the Agile Manifesto's values and principles for software development. Agile approaches attempt to offer the proper product through small cross-functional self-organizing teams that supply small pieces of functionality on a regular basis, allowing for customer reviews and correction.

Agile is about being responsive to the market and the consumer by responding fast to their requirements and wants and changing course as the circumstance requires. Agile methods can be used in any industry where, there is a flow of work and delivery of work products, such as IT or software development. Agile methodology helps to reduce risk to make upcoming product 'non-relevant' in market. They accomplish this by dividing the traditionally long wait time (typically traditional "waterfall method") into shorter cycles (called sprints or iterations). Every sprints consist of Requirement phase, Implementation phase and Testing phase (Figure 2).

In every sprint these three phases follow by customer review to make sure that smaller vertical chunks of the product eventually meet their needs and able to meet market needs as well.

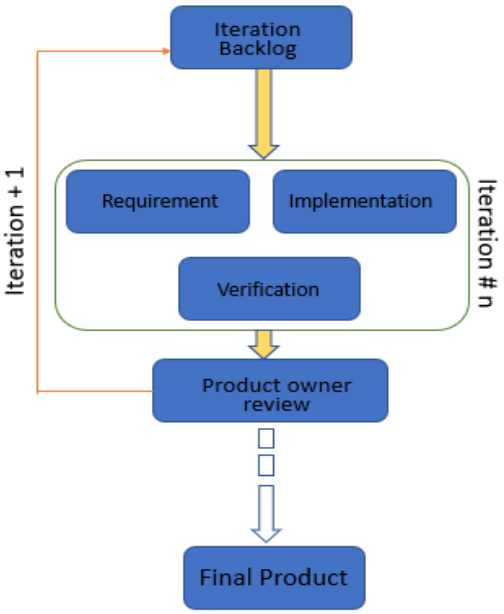

Figure 2: Agile methodology

IV. Testing Procsses in SDLC

There are multiple important phases in software development lifecycle, both in traditional and Agile method. One of those important phases is testing phase. In testing phase the software that developed by the developer, verified and certified by the group of people, called tester or quality assurance engineer. Product goes to production, and it goes live for end users only after getting approval from Quality Assurance team. Overall software development approach is different in Traditional and Agile. And same is true for testing phase also. In following discussion, we are going to have a look how testing works in traditional and agile approach.

A. Quality Assurance in Traditional Waterfall SDLC

Waterfall testing is a sort of software testing in which each phase of testing has its own set of steps and actions are categorized and tested in that order. Only when the first phase or level has been completed, the second level tested. Refer Figure 3 for pictorial representation.

Advantages of waterfall testing are:

1. Waterfall testing approach is well structured and well documented testing process. Every waterfall testing process starts with the test plan document where the test manager or the concern person or concern team prepares a document where testing approach, timeline of testing, estimate of testing recorded for future reference.
2. Waterfall model testing fits for any complexity of project from the low to high.
3. Here all the features of the projects developed and delivered together so there is no concept of part testing. In waterfall model all the features first developed by the developer and then delivered to quality assurance (QA) team or testing team for verification.

4. As all together and whole product delivered to QA for testing so there is not much communication or continuous communication is needed between testers and developers they can work independently. So, there is not much time-consuming meetings are required in waterfall model.
5. This waterfall testing approach is easy to manage because every step has its defined deliverables and a strict review method.
6. This waterfall model testing approach does not have much dependency on any specific associate. Even if team got changed or restructured, still new team or team member can easily pitch into execution as new person gets enough time and supporting document which helps to understand the project need and requirement.

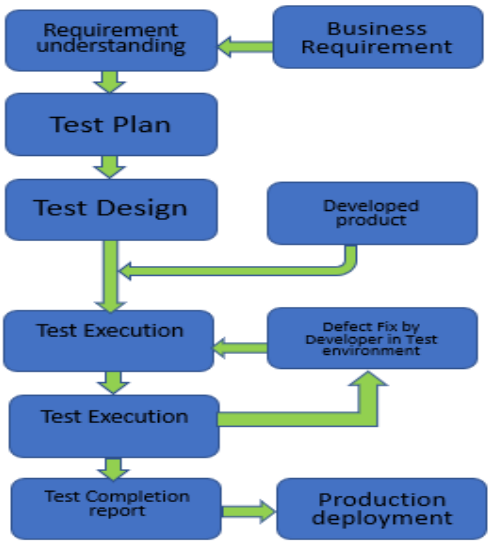

Figure 3: Testing process in Waterfall model

B. *Quality Assurance in Agile Methodology*

Agile testing entails the participation of all members of the project team, as well as specific experts and testers. Testing is not a separate step in agile testing; it occurs concurrently with the development phases, which comprise requirements, design, coding, and test case generation. Refer Figure 4.

Advantages of Agile Testing are:

1. As Agile testing based on the simple structure so, minimal planning is required for agile testing methodology.
2. There's not much documentation is required in agile testing. Usually, project team doesn't follow the process to create test plan, test completion document in Agile testing.
3. In Agile testing QA team works jointly with developers rather, work closely with developers on the project. So, knowledge gap is minimal in Agile testing process.
4. Agile testing fits for both small projects and long-term projects.
5. Here bugs/issues/defects assigned to developers in sub sequential phase. So, defects don't pile up there and it clears out in same flow.
6. Testing process conducted in every iteration so, it helps in quick issue resolving.
7. Continuous feedback from product owner helps to improve verification process as well.
8. Overall Agile process makes QA team flexible and dynamic.

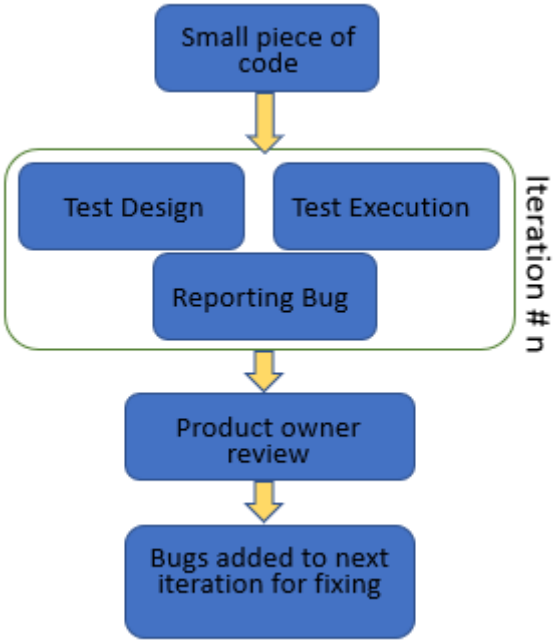

Figure 4: Testing process in Agile methodology

V. Traditional Testing Vs Agile Testing

In both Traditional waterfall model testing and agile testing, basic test incidents are always same, like Test execution, reporting bug, defect triage etc. However as per our case study and experience we would say Agile testing has multiple advantages over waterfall testing process. We will now discuss major points for which most of the IT companies are now following Agile methodology.

1. **Divide and conquer**: In Agile methodology requirements are always divided into multiple parts and same have been developed and tested. In this approach, QA team can give more focus on small piece of code for validation and verification. This 'focus based' testing helps to speed up over all product lifecycle and better end product.

2. **Changes are always welcome**: Changes are readily accommodated. It has no impact on the product since software modules are built independently and then merged afterwards. As a result, if the need changes in the future, there will be no rewrite

3. **Time and cost estimation**: The time period for each unit of the application is given to us is fixed.

As a result, the estimation will be correct when it comes to project time estimates. In same way, estimated project cost also becomes more accurate in this approach.

4. **Customer Satisfaction:** Customer satisfaction is higher because we communicate with clients and stockholders throughout the project and provide demonstrations at each stage of product development. We receive regular customer/client input on business flows and work progress as a result of this. As a result, the application's work and development are completed in a timely manner.

FUTURE WORK

The Agile methodology is well proven SDLC method in software industry along with other industry also [5]. Our future plan is to implement this Agile methodology along with testing phase, in academic projects. In academic area we usually follow either Waterfall model or no specific approach. We have a plan to bring student project inside the radar of Agile methodology and comparing efficiency and effectiveness of overall project with similar projects that runs into traditional approach.

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