An Improvement in Defect Detection Efficiency -A Review

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Abstract

Objectives: The defect detection efficiency has to be improved by comparing different software development lifecycles and finding the best of defect detection methodology, along with the accurate defect rate analysis and classification and to achieve 100% efficiency in defect detection and attain 100% customer satisfaction. **Methods and Statistical Analysis:**- Agile methodology, with In-memory analytics is employed to improve the effectiveness of defect detection efficiency. Along with Agile methodology, defect comparison and classification of defects based on defect rate with respect to the standard threshold values, at each stage of the design process can be employed. In memory analytics can be employed for Defect classification. This method provides effectiveness of defect classification and rates defect as low, high and medium. This method easier the tasks of designer to detect the severity of defect and rectify, to avoid the defect being added to subsequent phases. **Findings:** It is found that, In Waterfall model, the product is tested only after the product has been completely manufactured. The defect detection effectiveness considering an average of 15-20 percentages of defects originating at each phase is 50 percent. In Six Sigma approach, the defect detection effectiveness which is improved to 99.9997 percent with the same percentage of defect originating at each phase. While 100 percent defect detection effectiveness is not practically possible. Hence the greatest challenge is how the testing engineers can meet 100 percent testing standard. The testing engineers need to adapt a unique technique to remove the defects before they get added to the system. Such technique will not only helps to detect defects faster but also reduces the high cost of poor quality products.

Keywords: Defect Detection Methodology with Accurate Data Analytics, Defect Detection and Classification, Defect Analysis, Defect Characterization, In-Memory Analytics

1. Introduction

The model and the system approached here is Agile. Monika Yadav[1] (2015) remarks on the adaptation of Agile Methodology over traditional approach of Software development life cycle proves practically beneficial to industrial organization. This software development process provides solution to the drawbacks of the traditional Waterfall methodology. In this approach the product design is subdivided into small modules, where each module is tested in weekly or monthly schedules and at the end of each test schedule, based on the priority, tests are run. These test schedules allow error to be discovered and debugged. Customer feedback is given importance in the design process before the next development cycle. This allows changes to be made after initial planning. Based on client's feedback, program can be rewritten as expected.

To detect the defect of the product efficiently, defect analysis has to be done and classified based on the severity and priority of the defect. Margaret Rouse[2] (2014)has stated that, In–memory analytics approach can be implemented at each stage of the product design, where in after the analysis of each stage of the product, the output can be stored in computer's random access memory (RAM). This overcomes the drawback of querying data, stored on physical disks. In-memory analytics tool/approach provides classification of the output defect based on severity and priority, which provides great decision for the designer for analyzing the defect and rectifying it in a more efficient way. With Agile Development process,

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products can be accurately tested for defects and can be launched within the specified deadline. As a result the product is more successfully launched and released as customer demand within the deadline.

2. Comparison of Different Software Development Approaches

2.1 Waterfall Model Approach

The Software development lifecycle comprises Requirements, Design, implementation and testing. Waterfall model is one of the general Software lifecycle Model. MargaretRouse[3] has stated that, Waterfall model follows a regular sequence of order in the product development. This model allows departmentalization and managerial control. The advancement of every phase is in a linear and regulated order. While if any failures occur, once the product is developed then the cost of fixing such Defect affects the performance of the product and affects the overall budget.

Figure 1. Shows the Waterfall model approach for software development process, where the product is tested once the product is manufactured. In this stage, the rate of defective product is high; there is no customer issue backlog processing performance.

2.2 Six Sigma(6σ) Approach

Six Sigma (6σ) approach follows step by step evaluation in product development lifecycle and follows practical objectives as reduced time consumption, reduced cost, reduced wastage, evaluating customer feedback and increased profit. This approach makes up a mark for improvement in defect detection. Maryam Rchmat[4] has proved that Six Sigma (6σ) can provide a defect free product with <3.4 defects per million opportunities, which is the World class benchmark. While any product design not is satisfied by the customer is considered as defect.

Figure 2. shows one of the popular Six sigma methodology that follows the steps as Define › Measure › Analyze › Improve ›Control (DMAIC),is considered as the basic approach in Six Sigma (6σ)methodology of the defect detection, applied for already existing process in the product development lifecycle. The second methodology follows, Define ›Measure ›Analyze› Design› verify (DMADV) applied while designing a new process. While Six Sigma (6σ) approach can be applicable only to small scale Industries and others find it a complex, long run process, as it takes a long time to train employees and work through all of the steps DMAIC and DMADV each time a problem needs to be solved. Six Sigma (6σ) approach rejects the highly defective product to achieve standardization, but this affects the profit.

2.3 Agile Approach

Beck, Kent[5] believes that every project needs to be handled efficiently and existing methods need to be tailored to best suit the project requirements. This method is suitable for fixed or varying requirements. This approach follows iterative execution of product test management. In context with cent percent customer satisfaction, it provides continuous attention to defect free design. Hence designer can compete and achieve 100 percent defect free

Requirement Analysis	Design	Implement	Testing	Deploy	Maintain

Figure 1. Waterfall model approach.

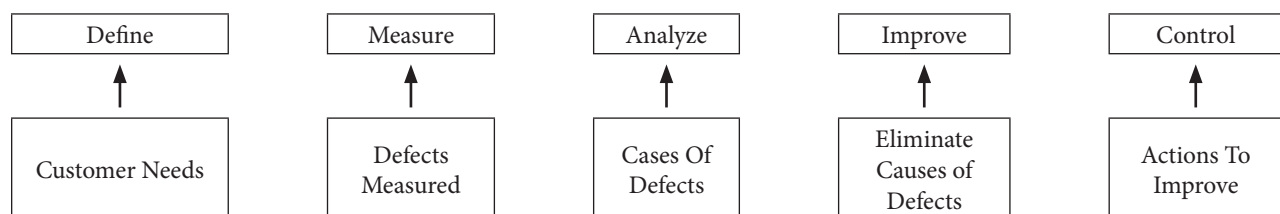| Define	Measure	Analyze	Improve	Control
Customer Needs	Defects Measured	Cases Of Defects	Eliminate Causes of Defects	Actions To Improve

Figure 2. Six sigma approach.

and a good quality product. Here the process or product development is carried out in an iterative way, in the weekly sprints.

Table 1. shows the Agile Software Development Lifecycle. The Key principle of Agile Software Development Lifecycle is it involves regular inspection of the working product as it develops, and testing is integrated throughout the lifecycle. This provides clear visibility and ensures necessary decisions to be taken at the earliest. It involves active Stakeholder to provide feedback in the design decisions, error handling and provides a complete defect free product with complete customer Satisfaction.

Different methodologies in Agile development process are:

2.4 Extreme Programming

This methodology provides communication between the end customer and the production team. It enables releases in short schedule of product development lifecycle and is adaptable to the new customer requirement updates.

2.5 Scrum

Scrum methodology takes care of the product backlog. This methodology is best suited for product-focused IT shops.

2.6 Feature – Driven-Development Approach

Feature-Driven-Development methodology prioritizes on specific modules of the design as product design, code and then prioritizes the main module of design.

3. Defect Analysis

In-memory analytics[2] is an approach which promotes defect detection intelligence and provides analytical approach for faster identification of defects. It classifies the defect based on severity of the defect as low, medium and high levels of defect. This analytics approach, avoids querying the data from In-Memory online analytical processing cubes or aggregate tables. While data is directly queried and reported from RAM. This analytics provides analysis of the defect and also rate the defects. Hence provide excellent decision for the Designer to speed up in identifying the defect and rectify it.

Types of In-memory analytics approach:

3.1 In-Memory online analytical processing (OLAP)

This approach is applicable to large scale industries .It maintains the databases in an organized cube maintained by an administrator. It provides an optimal way of querying the data rather than transactions.

3.2 In Memory Relational Online Analytical Processing

This approach supports larger user data groups and is used when there is need to handle large amounts of data.

3.3 In-Memory Index

This approach involves less modeling compared to In-Memory online analytical processing.

3.4 In-Memory Associative Index

This approach is applicable when there is need for high speed querying of data. It involves querying of the data without any model constraints.

Table 1. Agile software development process

Agile Software Development						
Planning						
Analysis Develop Test Integrate Validate	Analyze with In-memory Analytics, Correct And Deploy	Analysis Develop Test Integrate Validate	Analyze with In-memory Analytics, Correct And Deploy	..	Analysis Develop Test Integrate Validate	Analyze with In-memory Analytics, Correct And Deploy
Iteration 1		Iteration 2			Iteration N	
A Defect Free Product with customer satisfaction and Backlog Processing						

3.5 In-Memory Spreadsheet

In-memory Spreadsheet involves an array loaded into memory. Analyses is carried out as simple as filtering a spreadsheet.

4. Defect Characterization

Comparator with error threshold[6] for online testing applications can be designed, which provides best comparison of the defects and rate it. A Comparator can differentiate between two different threshold levels. It compares the input signal with a reference level, noise level and any threshold level. The output of comparator produces the difference of the two inputs .This provides accurate percentage of deviation of the output signal with input or threshold level.

Classification of the defects is further carried out based on priority and severity of the defect. Systematic Classification using In-memory analytics provides an efficient way to classify the defect. It provides fast response and an efficient way to classify the defects.

There is increasing evidence that Agile approaches lead to higher success rates. Beginning in 2007, Ambler, a leader in agile database development conducted numerous survey relating to IT projects success rates. It was found that only 63 percent of traditional projects and data warehousing projects were successful, while Agile projects experienced a 72 percent success rate. The 2008 survey on Quality, functionality, sequential development methods, Return on investment, it was found that Agile methods,

significantly out-performed.2010 survey continued to show that Agile methods in IT produce better results.

Table 2. illustrates the Case study[7] comparing the defect detection effectiveness of three Methodologies In

average we can conclude that Waterfall Model is 50% effective in defect detection in each phase of Development Lifecycle. Six Sigma[8] analyses are effective by 99.9997% and Agile Methodology[9] with In Memory Analytics[2] can be 100% effective in detecting the defects at each stage of the design process.

While comparing the Six sigma and Agile methodology, Six sigma is a quality management tool. It eliminates wastage, customer rejections and improves the process in an optimized level. While Agile is a process which the project or development team will be in the same page of data or progress and the team will get a very good clarity about their daily deliveries or targets.

5. Conclusion

Agile software development approach is the best approach over other approaches in Product Design for small, medium to large product design approach comparing the Waterfall model and Six Sigma approach. Customer centric approach with cent percent customer satisfaction can be achieved with Agile development process with In memory Analytics. The analysis of the defect based on severity and priority using In-memory analytics provides a defect free product with less than 3.4 defects per million opportunities as compared to Six Sigma approach .Hence 100% of product yield can be achieved.

6. Future Work

Among the various kinds of Agile Software development approaches and In-memory analytics approaches, the best suitable choice has to be made for specified product design process. And one should truly automate as

Table 2. Case study comparing the defect detection effectiveness of waterfall model, six sigma methodology and agile methodology

Software Development Phase	Average percentage of Defects Originating in each Phase	Defect detection effectiveness in Waterfall Model	Defect detection effectiveness in Six Sigma Model
Requirements	15%	50%	99.9997%
Design	35%	50%	99.9997%
Unit Coding	30%	50%	99.9997%
Integration coding	10%	50%	99.9997%
Documentation	10%	50%	99.9997%
System Testing	10%	50%	99.9997%
Operation	10%	100%	100%

many routine processes as possible. Test automation and build automation are one of the truly difficult tasks. Agile Analytics should seek to automate all processes that are tested more than once. With this, one can focus on developing better user interface.

7. References

To Refer to a Publication of Proceeding

1. Yadav M. Agile Methodology over Iterative Approach of Software Development-A Review. International Conference on Computing for Sustainable Global Development (INDIA.Com) ,New Delhi; 2015:542–7.

Internet Source

2. Rouse M. In memory analytics. Essential guide; 2014. p. 1–13.

3. Rouse M. Waterfall model. Essential guide: CIO guide to project management basics DevOps and Agile; 2016. p. 1–50.

4. Six Sigma process improvement approach [Internet] available at six_sigma_tutorial.pdf and Available from: http://www.tutorialspoint.com/

5. Kent B. Manifesto for agile software development. Agile Alliance; 2010 Jun 14. p. 1–7.

Internet Source

6. Rui Xiao. A Fully Programmable Analog Window Comparator..

7. Aoyama M. Agile software process model. IEEE Software, Washington, DC. 2002. p. 454–49.

8. Cugola G, GhezziC. Software processes: a retrospective and a path to the future. In Proceeding of the Software Process Improvement and Practice Conference. 1998; 4(3):101–23.

9. Gain D. SQA from theory to implementation. Pearson Education Limited; 2004. p. 1–617.