# Current State of the Research in Agile Quality Development

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*Abstract – With the changing trends in software development methodologies since 1990's the focus is more on iterative incremental approaches for software development. One of such approach is "Agile Approach" also named as lightweight model for development. Agile is more about communication and collaboration between team members working on software project. For good quality software it's important to select the appropriate model for the development of software. Another factor that is important to be considered while model selection is that in what respect quality gets better if we choose either traditional or agile approach. Quality assurance techniques for traditional heavy weight development rely on inspections, reviews made at end whereas quality assurance techniques for agile light weight development rely on routine activities by teams. This paper aims to review various success factors of agile software development and various challenges faced in terms of assuring quality in agile.*

*Keywords – Agile Methodology; Agile Software Development; Assuring Quality of development process; Critical Success Factors; Traditional Software Development; Quality Assurance (QA).*

## I. INTRODUCTION

With the changing trends in software development methodologies since 1990's the focus is more on iterative incremental software development approaches. Software Industries adopting this approach for dynamically changing needs and quick development. "agile development" that defines agility in its process and is being used by modern software industry for the delivery of high quality software at faster rate.

With the accretion in quality software's, choosing relevant development process is necessary. Agile is more about communication and collaboration between development team members. Incorporating agile methodology to counter ever-increasing software complexity and its success factors that lead to customer satisfaction and timely software deployment is a good option. Software organizations embracing quick approach for developing software, however, organizations are still uncertain about agile quality development. Various studies has been published that shows the positive impact on quality of agile development by providing number of factors of agile success, proving quality of agile development process qualitatively, but in industry still organizations are not able to ensure quality of agile in quantifiable manner [10]. The paper provides a review of various success factors of agile software development and various challenges faced in terms of assuring quality in agile.

The rest of the paper is organized into different sections. Section II discusses the process that agile approach follows. In section III the success factors of agile methodology are discussed. In section IV various challenges faced by organizations in respect to ensure quality of agile will be discussed. Then in section V conclusions are drawn from the review and include future work to ensure and manage software quality developed in agile environment. Finally references at last.

## II. AGILE SOFTWARE DEVELOPMENT

Agile methodology is characterized as iterative and incremental approach. Software is developed in short iterations which result in small incremental releases with new functionalities. Each iteration follow the phases of SDLC respectively for development of each user story within a defined sprint to ensure quality of the software product. In 2001, agile manifesto introduced which laid out the concept of agile development.

As their exists various of software development models in traditional methodology named as waterfall basic model of development, prototype model, spiral model, rapid development model and many more. Similarly, in agile also there are various models that are used according to the changing requirements of the software. These models include a unified process, scrum, extreme programming, adaptive software development, kanban, feature driven development and dynamic system development method. From various studies it has been found that scrum is the most popular method in software industry for the development of software in agile methodology [1]. The main focus of scrum is on how to deal with changing requirements of customer. It is also called as a flexible approach of development. Pathak & Saha [6] presented review of different agile methodologies (FDD, XP, SCRUM etc) with their prons and cons.

And also discuss about difficulties in adopting agile in software development.

There has been lot published about the inefficiency of traditional quality assurance practices when applied within agile environment. The focus of researchers has been on the agile development activities while less attention given to quality assurance activities. Authors [2] Caste & Villasana communicate that there is a lack of an agile software quality frameworks with holistic perspective by discussing CHAOS report published by an international organization that in average only 68.4% of the original features are presented in

the software product release and only 39% of the software development projects are completed properly. Authors named Jinzenji et al. study supports that there is an increasing need for rapid software releases to business but quality evaluation scheme is lacking in a quantifiable manner [11].

Various studies show that the overall quality assurance for products developed with agile approach is missing somehow. For agile it is perceived that the main focus is on agility of development teams, customer satisfaction with each release, however the fact is that it requires the whole organization to get into the agile process to adjust with frequent changes involving Quality Assurance (QA) as a key factor for the project to succeed.

Activities helping ensuring quality have to be combined in the incremental, rapid cycles so that development must be in proper flow and provide benefits to ever improving software product quality.

### III. AGILE SUCCESS FACTORS

With the continuous need of software development process and the challenges of choosing appropriate model various research have been carried out. Research has been done to compare the traditional approaches and agile approach for software development. In the past few years' researchers have devoted effort in finding out the main reason behind emergence of agile methodology and how the software development process can be automated in order to reduce cost, time, effort, maintainability, increasing efficiency, reusability and hence improving the quality of the software. Huo et al. [19] presented software quality technique for traditional waterfall and agile model. The technique shows how agile methodology achieves software quality under various constraints such as time, unstable requirements using software quality assurance technique and verification & validation technique. Various contributions to agile methodology following the agile manifesto and its future perspective are summarized by Dingsøyr et al [12].

Various studies have been carried out to identify critical success factors in agile software projects. Chow & Cao [17] presented survey study to check whether the given success factors given by prior researchers are actually contributing as success factor for an agile project to be successful by using quantitative approach. The critical success factors according to them important for agile includes: correct delivery strategy, agile software engineering techniques and high caliber team. Review about the advantages, limitations and strengths of agile model known in industry and different perceptions of customer, developer given by Dyba & Dingsøyr [16]. Misra et al.[14] describes a hypothetical framework for defining success factors of agile approach by conducted survey that influence success of the software projects and validate using data analysis technique.

Chan & Thong [15] presented review that address the literature on the acceptance of traditional and agile software development methodologies based on knowledge management perspective (emerging new technologies, domain knowledge about which software is to be developed, policies for developing software,

how much team members know about the software). Stoica et al. [7] describes how agility is important in today's scenario to cope up with complex business environment and proposes a method how to move forward towards agile from traditional approach. Other perspective of research present combination of both traditional and agile software development methodology. c presented possibility of combining both the approaches in single project management technology by taking few concepts of traditional and few from agile, as neither of them fully would be the best approach.

### IV. QUALITY ASSURANCE LACKING

Now days, quality plays an important role in every business to get into the market. Various aspects that define quality to prove it that agile approach is much better than traditional development with improving quality includes customer satisfaction at the top. Each and every feature required by the customers must be included in the software product. Other aspects are budget and timely delivery of the software product as second and third aspect of quality assurance.

Aggarwal et al. [3] focuses on the measures of quality for agile software by highlighting the role of QA within agile development process. Testing as a key component discussed with a brief understanding that in agile no separate testing team exists. Authors have also provided some metrics for measuring quality in agile as a future scope.

In [2], Villasana & Castello aims to show that there is a lack of an agile software quality frameworks with holistic perspective by discussing CHAOS report published by Standish group international which provides the status of software development in organizations using agile methodology that in average only 68.4% of the original features are presented in the software product release and only 39% of the software development projects get completed successfully. They mentioned the importance of software quality and also discuss different software quality approaches presented so far (QA approaches, QA models, QA frameworks).

Janus et al.[9] proposed and validate the 3C approach for agile quality assurance as an extension to the agile practice continuous integration (CI) approach with the need of converting traditional quality assurance practices for agile development. Continuous Measurement (CM) and Continuous Improvement (CIM) added as an subsequent activity to the existing approach. However, the proposed approach and tools referred are only applicable on java based projects.

Silva et.al [4] presents an agile Quality Assurance Reference Model (AgileQA-RM) for improving quality by implementing activities of QA with CMMI maturity models and Agile practices. The proposed model consists of 5 maturity level,18 process areas, 43 expected results and 31 informative work products supporting quality improvement. However, the model proposed can only be used by organizations that already have CMMI or MPS.BR maturity levels and want to make their process more agile.

Bhasin [10] presents various factors of agile quality that are faced by organizations in terms of assuring quality. Based on

these indicators of quality, author has proposed a framework to identify what aspects of agile methodology can improve the quality of the software product in terms of bug rates, development time and costs. By this helping organizations to overcome problems faced in adopting the agile approach as a tool for software development and ensuring quality. As a whole various models have been proposed with quality perspective for agile development but still organizations are in way to find out an answer or a solution to agile quality assurance with a holistic perspective. There is a need of a quality model that must ensure that moving from traditional development to agile development leads to ever-improving quality of the software.

## V. CONCLUSION AND FUTURE WORK

Quality Assurance needs to be integrated in agile method with an aim to provide organizations a management system that manages agile development framework to ensure quality. Organizations must understand the effect of different factors that influence quality which in turn results in better productivity and increase business value. In the present paper, vvarious models are discussed above to overcome with the quality assurance problem for agile development but still organizations are in way to find out the answer or a solution to agile quality assurance with a holistic perspective.

Future work includes consideration of various critical success factors of agile development and issues that must be taken care off while modeling a quality model for agile so that organizations with either small or larger teams adopt agile software development methodology providing ever-improving quality of software in a quantifiable manner.

## REFERENCES

[1] Gurpreet Singh Matharu, Anju Mishra, Harmeet Singh, and Priyanka Upadhyay, "Empirical Study of Agile Software Development Methodologies: A Comparative Analysis" *ACM SIGSOFT Software Engineering Notes*, Vol. 40, pp. 1-6, 2015.

[2] Guillermo Villasana and Rodolfo Castello, "An Agile Software Quality Framework lacking", Computer Applications and Information Systems (WCCAIS), *World Congress on Computer Applications and Information Systems, IEEE*, pp. 1-4, 2014.

[3] Anil Aggarwal, N K Garg, and Avirag Jain, "Quality Assurance for Product Development using Agile", *International Conference on Reliability, Optimization and Information Technology- ICROIT, IEEE*, pp. 44-47, 2014.

[4] Fernando Selleri Silva, Felipe Santana Furtado Soares, and Angela Lima Peres, "A Reference Model for Agile Quality Assurance: Combining Agile Methodologies and Maturity Model" *9th International Conference on the Quality of Information and Communications Technology, IEEE*, pp. 139-144, 2014.

[5] Mario Spundak, "Mixed agile/traditional project management methodology-reality or illusion?", *Procedia Social and Behavioral Sciences, Elsevier*, Vol. 119, pp. 939-948, 2014.

[6] Kaushal Pathak, Anju Saha, "Review of Agile Software Development Methodologies", *IJARCSSE*, Vol. 3, pp. 270-276, 2013.

[7] Marian Stoica, Marinela Mircea, and Bogdan Ghilic Micu, "Software Development: Agile vs. Traditional", *Informatica Economică*, Vol. 17, pp. 64-76, 2013.

[8] Kirti Mathur, "Contribution of Agile Methodology for Software Process Improvement", *Global Research Analysis*, Vol. 2, pp. 31-33, 2013.

[9] Ander Janus, Andreas Schmietendorf, Reiner Dumke, and Jens Jager, "The 3C Approach for Agile Quality Assurance", *WETSoM, Zurich, Switzerland, IEEE*, pp. 9-13, 2012.

[10] Sonali Bhasin, "Quality Assurance in Agile –A study towards achieving excellence", pp. 64-67, *IEEE*, 2012.

[11] Kumi Jinzenji, Takashi Hoshino, Laurie Williams, and Kenji Takahashi, "Metric-Based Quality Evaluations for Iterative Software Development Approaches Like Agile", *Software Reliability Engineering Workshops (ISSREW), IEEE*, pp. 54-63, 2012.

[12] Torgeir Dingsøyr, Sridhar Nerur, Venu Gopal Balijepally, and Nils Brede Moe, "A decade of agile methodologies: Towards explaining agile software development", *The Journal of Systems and Software, Elsevier*, Vol 85, pp. 1213-1221, 2012.

[13] Kuda Nageswara Rao, Kavita Naidu, and Praneeth Chakka, "A Study of the Agile Software Development Methods, Applicability, ans Implications in Industry", *International Journal of software Engineering and its Applications*, Vol. 5, pp. 35-46, 2011.

[14] Subhas Chandra Misra, Vinod Kumar, and Uma Kumar, "Identifying some important success factors in adopting agile software development practices", *The Journals of system and softwares, Elsevier*, Vol. 82, pp. 1869-1890, 2009.

[15] Frank K.Y. Chan and James Y.L. Thong, "Acceptance of agile methodologies: A critical review and conceptual framework", *Decision Support Systems, Elsevier*, Vol. 46, pp. 803-814, 2009.

[16] Tore Dyba and Torgeir Dingsøyr, "Empirical studies of agile software development: A systematic review", *Information and Software technology, Elsevier*, Vol. 62, pp. 833-859, 2008.

[17] Tsun Chaw and Dac Buu Cao, "A Survey of Study of Critical Success Factors in Agile Software Projects", *The Journals of system and softwares, Elsevier*, Vol. 81, pp. 961-971, 2008.

[18] Geir K. Hanseen and Tor E. Faegri, "Process fusion: An industrial case study on agile software product line engineering", *Journals of Systems and Softwares, Elsevier*, Vol. 81, pp. 843-854, 2008.

[19] Ming Huo, June Verner, Liming Zhu, and Muhammad Ali Babar, "Software Quality and Agile Methods", *International Computer Software and Applications Conference (COMPSAC), IEEE*, Vol. 1, pp. 520-525, 2004.

[20] Scott W. Ambler, "Agile Model Driven Development is Good Enough", *Software, IEEE*, Vol. 20, pp. 71-73, 2003

TABLE I.        CRITICAL SUCCESS FACTORS OF AGILE METHODOLOGY

| Authors | Success Factors of Agile |
|---|---|
| Spundak [5] | Appropriate usage of agile methods Highly qualified project teams Right delivery strategy Appropriate management process, organization environment & customer involvement. |
| Stoica et al. [7] | Agility in:Human resource Information technology Business management |
| Misra et al.[14] | Customer satisfaction, collaboration & commitment Decision making time Corporate culture Personal & control attributesSocial culture Training & learning environment |
| Chan & Thong [15] | New technologies must be known Understanding about domain of software to be developed Policies & practices for development About team members |
| Dyba & Dingsøyr [16] | Individual and team collaboration Corporate responsibility Development skills |
| Chow & Cao [17] | Correct delivery strategy Agile software engineering techniques Higher caliber team |
| Huo et al. [19] | Simple planning Short iterations Earlier release Frequent customer feedback |