Quality Aspects of Scrum in Agile Software Development: A master thesis proposal

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Group Member's Participation

The contribution of individual group members is involved in conducting the research project and reporting this document is shown in Table 1**.**

Group Members	Literature Review	Identify the Research Gap	Research Design	Report writing
Akshay Kumar Jilla	34%	34%	34%	34%
Sai Priyatham	33%	33%	33%	33%
Sai Kumar Bodicherla	33%	33%	33%	33%

Table 1. Group Member Contribution

ABSTRACT

In this research proposal, we look forward to put forth the challenges and their respective enhancements through the introduction of the topic and literature review. We propose to perform a survey and the results yielded are estimated and potential threats towards with respective to our survey have also been presented. Implementation of grounded theory for the extraction of qualitative data is conducted and the summaries of the results expected have also been listed out in this paper. 'Scrum' being the most used model for implementation of agile, is striking in regards to our line of research and we propose to portray our research findings and the motivations behind in the following sections.

Author Keywords

Scrum, Scrum process, Scrum tools, Agile software development, Agile scrum framework, Scrum team Agile testing, Computer industry, Product development, Project management.

ACM Classification Keywords

Software and its engineering**:** Software development process management

Software and its engineering: Software development methods

Software and its engineering: Agile software development

INTRODUCTION AND MOTIVATION

Software Engineering is the step by step procedure for providing a high-quality software to the end users. It assures the developers that the different parts of software architecture work as defined by them [14]. In spite of the evolution of software engineering from the past few decades, the software projects undergo several changes in their requirements. Software Development Methodology(SDM) can be defined as the blueprint of the various policies, procedures and process used for implementing the software engineering [24]. Every SDM has its own Software Development Life Cycle(SDLC) to design, develop and test high-quality software to meet the needs of the customers cost-effectively, within the stipulated time [14].

Previously, traditional models such as waterfall model and Spiral model were used in the software industry for developing the software which was proven to be tedious and inefficient [17]. As a much-needed alternative, Agile software methodology came into existence and became popular for providing better, faster and cost effective solutions for the software problems [5]. Due to the

advantages of the agile model in providing a quality product to the end users, many organizations are exhibiting their interest towards adopting this model.

Further classification of agile development contacts to various models as Scrum, Extreme programming (XP), Crystal, Dynamic Systems Development Method (DSDM), Feature-Driven Development (FDD), Lean Development. When the comparison between different methodologies is done in agile, Scrum process is the widely used agile model adopted by the Software organizations. The literature supports the scrum methodology to be very efficient and better than the other methodologies with respect to given parameters. Scrum is an iterative and incremental model which completes the given set of tasks in the form of Sprints. Scrum is an artifact for creating and managing complex products and consists of many roles, events and artifacts [3]. Scrum consist mainly of three roles namely Scrum Master, Product owner, Team Members. Scrum meetings are daily held to review about the accomplish tasks. The main focus of our research is identifying the defects regarding the quality aspects of Scrum. Even though Research has been conducted in various other areas of the scrum, much literature was not available in regards to the scrum quality.

The coming sections contain the summaries of the Literature review performed, Research questions formulated, Research method taken, Data collection method performed, Data analysis method, expected outcomes and the Further scope for research to be performed.

LITERATURE REVIEW

The search for the literature review was done using Scopus and ACM database. The search string used in the database was: "*TITLE-ABS-KEY (quality aspects) AND TITLE-ABS-KEY (scrum) AND TITLE-ABS-KEY (agile software development"*. After the search was performed 16 documents were displayed. Out of which 9 articles were included. The search conducted in ACM database resulted in 27 article. From these articles after the exclusion of irrelevant articles, 5 articles were included in our Literature. The remaining 6 articles were obtained from snowballing the obtained articles. Total 20 articles were included which consists of Journal articles, Conference papers, Research articles.

Inclusion-exclusion criteria

The following inclusion-exclusion criteria was applied on the articles while performing the search:

- The papers which are written in English are only included.
- The papers related to departments other that computer science were excluded.
- Only peer-reviewed Research articles, Journal articles and Conference papers were included.

Article [1] **: (A case study on the impact of scrum)**

Authors Chris Mann and Frank Maurer [1] in this article, have mainly focused on the change in the amount of overtime of the developers and the increase in the customer satisfaction after the introduction of scrum into an existing software organization. In this context, they have also stated that ample research was present which describes the success stories of the introduction of scrum into Software Company but there were no such experience reports. To fulfill this gap, the authors have used a two-year exploratory longitudinal case study to understand the long-term rather than short-term effects of the scrum. The quantitative results indicate the difference in overtime patterns worked by the team before and after the introduction of the scrum. They also additionally provide support for the qualitative results which indicates the change in customer and developer satisfaction. The authors mentioned that the empirical results from the case study show that after the introduction of scrum into an existing software organization, the customer satisfaction increased and the amount of overtime of the developers decreased. The authors wanted to implement this methodology because before the introduction of scrum the software development process was considered as ad-hoc and the planning was very limited. F-test and T-test were performed to compare the periods before and after the introduction of the scrum. The results obtained were positive to the research problem stated. This particular paper was chosen because it stated the importance and working of scrum. It was helpful to analyze the outcomes before and after the introduction of scrum into a company. We also got to know about how the introduction of scrum had a positive impact on customers and developers.

Article[2]**: (Product backlog rating: A case study on measuring test quality of scrum)**

Authors Imrul Kayes, Mithun Sarker, Jacob Chakareski [2] in this specific paper have proposed a metric Product Backlog Rating (PBR) which measures the quality of the

testing process in the scrum. PBR was considered for measuring Product Complexity Level (PCL) and Test Assessment Rating (TAR) which offers a numerical score. According to the authors, many metrics were proposed for agile environment for measuring the quality of requirements but there were no metrics to measure the quality of the testing process. To fulfill this gap the applicability of this metric was presented by using a case study from "Software People" (A Denmark-based marketing company). Challenges were faced to measure the software quality attributes even after using the software for a long period and to present how process characteristics influence these attributes. The roles of different members of scrum team were explained and enough literature was provided to support the statements about the advantages of scrum. Empirical values were tabulated neatly for PBR, PCL and TAR factors for the sprint. As stated by the authors, the PBR value was calculated as "3.11" and earns a moderate level of the test quality of sprint. This was beneficial in solving the problem area. Since we were performing research on the quality aspects of scrum, this specific paper complemented our curriculum. It provides information regarding the scrum process, artifacts and had a clear impact in measuring the quality of the testing process in scrum.

Article[3]**: (An agile implementation of scrum)**

Author Michele Gannon [3] in this conference paper have discussed the fundamentals of Scrum and experimented on whether a team with no experience in agile methodology successfully implement and use Scrum. The experiment was implemented on a project at John Hopkins University Applied Physics Laboratory. The author described the scrum process and elaborated how he implemented the experiment. The empirical values of the hours of effort spent for the tasks against a number of days were tabulated neatly as sprint backlog and graphical representation was provided for days in a sprint against the number of hours as sprint burndown chart. The purpose of the software this team was developing was to remotely control and monitor equipment that builds a connection from a manned workstation to a satellite to a remote site which houses various components.

The author stated that to track down the progress of each task in the sprint the team used a Kanban chart which provided a visual representation of the status of team at a particular point in time. Each sprint and the final working product was an ultimate success in meeting the end user requirements. The author shared his experiences during the experiment and also explained how there was an improvement in the sprint retrospective, sprint review, sprint planning, productivity and quality. This particular paper helped us in proving information about the Scrum process. The author used his experience and stated the three key requirements to successfully implement scrum in agile software development which was helpful for our problem domain.

Article[4]**: (A capstone course on agile software development using Scrum)**

In this research paper the Author Viljan Mahnic [4] thinks that due to the increasing use of agile methodology in the software industry, there is a need for teaching agile methods for students in software development. So he performed a survey on 49 capstone projects using different software processes. Enough literature base was provided to support his statements regarding the capstone projects and the need for the teaching scrum to the students.

Later, Synopsys of the course design is explained. The explanation was provided as to how the survey was performed and quantitative results for pre and post results of the survey were tabulated neatly. Wilcoxon's signed ranks test and Statistical tests were performed to analyze the significance before and after the tests. The author mentioned that the 98 percent of the students found the introduction of this course useful for their professional career. The comparison was done for estimated and actual effort. The lessons learned from the survey were elaborated. The survey made by the author was apt for our research problem. The outcomes of the survey such as how crucial is the role of the product owner and the scrum master for the success of scrum project influenced us to take this paper into our curriculum.

Article[5]**: (An industrial case study for scrum adoption)**

The authors Hassan Hajjdiab, Al Shaima Taleb and Jauhar Ali [5] in this journal article have discussed the various challenges faced in an unsuccessful situation where scrum was adopted in a multi-team and multi-project environment in a government entity in the United Arab Emirates (U.A.E). The line of argumentation of the authors was that there were many successful stories about the adoption of scrum in small scale and large scale organizations but there was very little research done on adoption of scrum in multi-team/multi-project environments.

A case study method was used to find the solutions to these challenges. Quantitative data for the various Sociological factors, Project Specific factors, Ergonomic factors and Geographical factors was tabulated and the various challenges of agile adoption in this entity was identified. Rather than just generalizing the case study, the context factor of the entity was recorded and the development factors and the context factors of the project in the entity were presented. In the end, the solutions were presented to overcome these challenges. The main motivation for including this paper in our curriculum is that the authors have done a case study on an unsuccessful project environment and provided solutions for the challenges faced. The analyzation of these challenges and solutions were helpful in improving the quality of the scrum.

Article[6]**: (An Empirical Study on the Relationship between the Use of Agile Practices and the Success of Scrum Projects)**

Authors A. César C. França, Fabio Q. B. da Silva and Leila M. R. de Sousa Mariz [6] wanted to correlate the critical factors considered for the success of the scrum projects with the results of software projects in industry. It was stated that from the nine years of agile practice very little empirical study was done on the actual effect of adopting agile practices on the project success. Therefore, to fulfill this gap the authors related a hypothesis raised by Chow and Cao to the software companies that use scrum projects located in the city of Recife, Brazil.

A cross-section survey was performed to assess the utilization of these factors in 11 software projects that used Scrum in 9 different software organizations. To perform this survey, a questionnaire was prepared and distributed among 65 developers and Scrum Masters representing 75% of the professionals that have participated in the projects. The data analysis was done using SPSS® Statistics Package software, version 171 and the quantitative results project success correlation test were tabulated. The empirical results indicated that 8 of 25 attributes describe by Chow and Cao were useful for the project success. Since our method of research is survey, we chose this paper to analyze how useful was agile practices for the developers and scrum masters.

Article[7]**: (A Qualitative Study of the Determinants of Self-managing Team Effectiveness in a Scrum Team)**

Authors Cleviton V. F. Monteiro, Fabio Q. B. da Silva, Isabella R. M. dos Santos, Felipe Farias, Elisa S.F. Cardozo, André R. G. do A. Leitão, Dacio N. M. Neto, Miguel J. A. Pernambuco Filho [7] in this research article related scrum teams with autonomous teams. They proposed to study the practical behavior of autonomous teams that uses scrum in software organizations and how the software companies support the adequacy of such groups.

Literature support was provided to support the positives about these Autonomous teams. The line of argumentation was that rather than the potential benefits of autonomous teams in scrum, much research was not performed on the effectiveness of these self-organizing teams. Thus, to accomplish this task an in-depth case study was performed to assess the actual behavior of a mature scrum team in the industry. Three research questions were formulated based on the problem domain.

Qualitative data was collected using semi-structured interviews and observations of the participants. The characteristics and practices obtained from these interviews were analyzed using Cohen's theoretical model. Answers to the research questions were explained in detail. We considered this paper into our curriculum so that we can assess the effectiveness of scrum teams in the industry.

Article[8]**: (Customization of Scrum Methodology for Outsourced E-commerce Projects)**

The conference paper written by Nayoung Hong, Junbeom Yoo, Sungdeok Cha [8] focusses on the customization of scrum method for outsourced E-commerce projects. With the use of waterfall model, the outsourced projects experienced more delays and failures. To overcome this the authors applied the customized scrum process to three different scenarios. The method used to perform the task was not mentioned clearly but by observation, it can be deduced as a case study.

In the customized scrum process the progress was monitored using a number of completed web pages. Application evaluation was performed qualitatively and quantitatively. Quantitative results were tabulated as a comparison of defective ratio and idle time between each unit which indicated that by using customized scrum process defective ratio significantly improved when compared with normal test cases.

The qualitative evaluation suggested that 17% of the respondents were very satisfied, 66% were satisfied and 17% were not satisfied.
It was mentioned that for future this study could be useful to verify how the scrum methodology affects productivity and how efficiently can it be applied when the outsourced company is in other location. The survey made by the Authors was in line with our topic which motivated us to include this paper in our study.

Article[9]**: (How Scrum Tools May Change Your Agile Software Development Approach)**

Authors Matthias Eckhart and Johannes Feiner [9] in this particular paper have focused on the various problems of the scrum tools the scrum masters are facing in agile software development. The line of argumentation was that the scrum masters were complaining about the scrum tools that they were not suiting to their daily needs resulting in the lack of communication between the clients. Therefore, to overcome this problem the authors have implemented a case study on 120 different companies. Interviews were performed with the scrum masters and high qualitative data was collected and tabulated as "Determined minimum requirements for Scrum tools, based on our study results, including specific quotations made by the interviewed Scrum Masters".

In-depth analysis of the data was done and important factors were prioritized. Based on the experiences of the scrum masters a web-based scrum tool named Scrumpy was created so that it can serve as the complete solution for all the problems.
These interviews provided solutions to the problems areas regarding Scrum tools and in turn helped in improving the quality of scrum projects. This particular paper contained discussion about the problems and their solutions regarding Scrum quality which is our main topic of discussion. This motivated us to consider this paper in our study

Article[10]**: (Agile Software Project Management with Scrum)**

In this particular article the authors Viljan Mahnic, Slavko Drnovscek [10] shared their experience about using scrum in a project at The University of Ljubljana. Initially, the project on which they were working was using SSADM for analyzing and design. This experienced activity which was behind schedule and rework for the change in requirements. So, the authors decided to implement Scrum as an alternative. Their experience was presented in this paper as a case study. Work was divided in the form of sprints and the quantitative results of Product backlog at the beginning and ending of the sprint was tabulated neatly. The introduction of Scrum was found useful by the team members. Communication improved between them resulting in maximized co-operation. The case study made by the author was close to our topic of discussion. It helped us in gaining knowledge about the importance of Scrum in agile software development.

Article[11]**: (ScrumS- A Model for Safe Agile Development)**

Authors Rene Esteves Maria, Luiz Antonio Rodrigues Junior, Nelson Alves Pinto [11] have centered their study on improving the issues regarding the quality, reliability, security of Scrum. The line of argumentation was that top priority should be given to security software aspects from the beginning of the development process because software attacks have become more powerful but they are not recognized. Therefore, a new secure project model named ScrumS was proposed and a case study was present where ScrumS was applied. Three user case stories were with one asset was considered and inventory risk with the three cases were tabulated. Quantitative data was collected using survey and risk analysis was performed for data analysis. Limitations were identified and the results of the study were presented neatly. A case study was performed on the security aspects of scrum in agile development which in turn contributes to the quality of Scrum. This motivated us to include this paper in our study.

Article[12]**: (How product owner teams scale agile methods to large distributed enterprises)**

The author of this article Julian M. Bass [12] has centered his study on tailoring of an agile method based on the descriptions given by practitioners to meet the needs of large-scale off-shore development enterprises. The main focus was on tailoring the role of the product owner where customer needs were gathered and prioritized by the product owner. The author was concerned about the project failures caused by large-scale offshore enterprise development programs due to high pressure of delivering a quality product in less span of time. This resulted in damaging the publicity and reputation of those companies. To overcome this problem, the author has proposed a case study on eight international companies. Qualitative data was collected by interviewing 46 practitioners and Grounded theory was used to identify

the teams for product owners. Nine product owner functions that are used to scale agile software methods to large projects such as Groom, Prioritiser were described. These product owner functions identified were mapped to Scrum-of-Scrums process. After this mapping, the product owner functions were divided client-side and production-side functions. The taxonomy of product owner team functions was distinguished as business functions and technical functions. These product owner functions help agile methods governing in CMMI maturity level 5 organizations. The problem area on which the author was working got resolved. This paper discusses on how tailoring of agile methods helped large scale companies to achieve their goals which in turn reflects on improving quality. So, we included this paper in our literature study

Article[13]**: (Moving Back to Scrum and Scaling to Scrum of Scrums in Less Than One Year)**

Authors Rafael P. Maranzato, Marden Neubert, Paula Herculano [3] in this article shared their experience about initializing scrum in a team which had failed previously in implementing an agile software methodology. Formerly, the Research and Development department the authors were working on used Rational Unified Process (RUP) for documents and template which was not that efficient. A hypothetical experiment on a case study about the positive effects of scrum introduction was presented. Initially, Scrum was not successfully implemented in the project but after including a group of experienced project managers and two of the authors of this article the Scrum process was fruitful. Training was given to the professionals involved in product development about agile methodologies. Experiences were shared the First agile methodology implementation and Scrum process. The team was compared with multiple feature-oriented teams using Scrum of Scrums process.

The important factors that contributed to their success and the mistakes for the failure of initial implementation of Scrum were identified. Quantitative results of the increase in velocity and productivity monthly were presented graphically. The experiment made by the authors was useful in determining how the implementation of Scrum contributes to the project success which was the motivation behind including this article in our literature study.

Article[14]**: (Issues and Challenges in Scrum Implementation)**

This journal article written by Akif, R. and H. Majeed [14] discusses the various challenges and issues in Scrum implementation and proposing solutions to these problems. The author thinks that much importance in research has not been given to areas of Scrum such as training, management, involvement etc. So, to fulfill this gap, a survey was conducted in two companies namely Digital Prodigy Limited (DPL) and Bentley Systems Pakistan. Both experienced and inexperienced members of both the companies participated in the survey. The solution was also provided socio-cultural differences issue. Qualitative data collected through survey was audio tapped and logged. A technique called Data mining was used to find out the hidden relation between different concepts. Grounded theory analysis was the data analysis technique used to refine the inferences collected from the data. The problem identified and the suggested solutions for those problems were elaborated neatly. By studying this paper, we can analyze the various problems in Scrum and the possible solutions for those problems. This will be useful for the survey we are conducting.

Article[15]**: (Empirical Study of Agile Software Development Methodologies: A Comparative Analysis)**

Authors Gurpreet Singh Matharu, Anju Mishra, Harmeet Singh and Priyanka Upadhyay [15] in this research article proposed a comparative study on the most popular agile methods such as Scrum, Extreme programming, and kanban. Due to the increasing customer requirements, agile software development methods were becoming popular and used by the developers to obtain a quality product. A literature review was performed on the surveys conducted by various other authors. Definitions and characteristics were elaborated for the three above mentioned agile methodologies. Comparative analysis of the three methodologies was tabulated based on the different parameters. A survey method was performed on 15 different software companies where 10 companies favored Scrum, 3 companies adopted Extreme programming and 2 companies followed kanban. Based on the empirical results it was concluded that the most of the software companies showed their interest in adopting Scrum when compared to other two agile development methods. From this paper, it was inferred that Scrum has a higher advantage over other development methods which motivated us to add this paper to our curriculum.

Article[16]**: (Scrum and Agile Methods in Software Engineering Courses)**

Authors Jennifer Campbell, Stan Kurkovsky, Chun Wai Liew, Anya Tafliovich [16] in this particular article describes their experience and challenges of introducing Scrum for students in Software engineering courses. The authors stated that in the past few years, due to the change in customer requirements agile software methodologies such as Scrum and Extreme programming have evolved a lot. The importance of introducing Scrum in computer science course was described. The experiences of all the authors at different colleges and universities was elaborated. The various challenges faced by them were identified and stated. We think that this paper in partially irrelevant in terms of our field of research as no research method or data analysis method was described. Further, we did the best of our abilities to infer the views of the author which addressed agile to have a paramount impact when learned from the university level.

Article[17]**: (Study and practice of Import Scrum agile software development)**

Author Hu Guang-yong [17] in this article have introduced Scrum in a vehicle spare parts management system project. The importance and evolution of Scrum in agile methodology from the use of waterfall and spiral model was explained. The research method was not explicitly mentioned but as per out observation, we infer it as to be a case study to implement Scrum in a vehicle spare parts management system project. Whiteboard and sticky are the two tools used for the Scrum process in this scenario. The description was provided as to how the Scrum process was implemented and quantitative results for productivity and quality were tabulated. Based on the results, it was concluded saying that the productivity and quality of the project have enhanced a lot while delivering the product on time. The motivation behind including this paper in out literature was that the case study made by the author was helpful in analyzing the usefulness of Scrum in project implementation and was partly linked to our problem domain.

Article [18]**: (A Documented Approach in Agile Software Development)**

Authors Nitin Uikey, Ugrasen Suman, and A.K. Ramani [18] in this journal articles emphasis on the importance of documentation and maintenance of the various happenings in Scrum process. A new role called the 'Technical writer' was proposed for performing that job and the relationship between documentation and technical writer to enhance the productivity and maintainability were presented. The authors were concerned that much importance was not given to documentation in agile methodologies in spite of its advantages. Sufficient literature support was provided to support the points regarding the importance of documentation. The method used by the authors was a literature review. The documentation model and the various sub-components of documentation such as contract document, Requirement specification document etc. were explained in detail. The various advantages and disadvantages of documentation were mentioned and was concluded stating how documentation can be beneficial to developers, stakeholders, technical writer.

Article[19]**: (Agile public relations planning: The Reflective Communication Scrum)**

Author Betteke van Ruler [19] in this article proposes to introduce a new agile methodology with digitalization and implement it on Public relations planning. The author's in line of research and line of argumentation boils down to what is known to be 'undesirable illusion of control' from which we inferred as the lack of intended control. The research method taken was an experiment performed by introducing Scrum as a planning method in the public relations planning program in Netherlands. Literature support was presented to support his statements regarding the 'Illusion of control'. The various changes implemented were elaborated neatly. The different challenges faced while implementing Scrum such as permanent monitoring of change, programming of interventions in time-boxed sprints, daily team reflections in stand-up meetings were precisely addressed. The discussion section contained the experience of the author during the one-year experiment conducted. This paper contained the various challenges faced while implementing Scrum. This was useful for our study to analyze the different problems in Scrum which is the reason for including this research article in out literature.

Article[20]**: (Usage of SCRUM Practices within a Global Company)**

Authors Mauricio Cristal, Daniel Wildt and Rafael Prikladnicki [20] in this industrial report have discussed the experiences about their implementation of Scrum process in two projects. The authors argumentation was that the global companies which were using waterfall model as their software development model wanted an improvement in that model due to its inefficiency. Therefore, an experiment was performed by implementing Scrum in two pilot projects of a global company. The Scrum process was explained and the

various challenges and strengths faced while performing the experiment were addressed. Qualitative data obtained was tabulated as 'Projects analyzed in this paper' and 'Challenges faced'. Suggestions were presented as practical recommendations for the various challenges such as Use cases should be integrated with user stories, SCRUM master needs to be a strong negotiator, keeping valuable documentation are elaborated to provide a clear insight into the different challenges. Conclusions were confronted stating that implementing Scrum in the non-agile environment was difficult and the initial results were successful. This paper was included in our curriculum because it had the different challenges while implementing Scrum and possible suggestions for those challenges which is the main topic of our discussion

PROBLEM DOMAIN

On critically analyzing and scrutinizing the above-mentioned literature regarding Scrum in agile development, we can come to a conclusion that research was done in the areas such as security in Scrum, Scrum tools, tailoring of agile methods, change in the overtime of developers and reliability of Scrum. In [1]critical factors considered for the success of the scrum projects were correlated with the results of software projects in industry. In [10]and [14]the authors have implemented Scrum in various organizations and identified the solutions to the various challenges while implementing it. In[15]comparative study was performed between the most popular methodologies namely Scrum, Extreme programming and Kanban and found that Scrum was the better option. Much literature was not available identifying the quality aspects of Scrum. We think that the quality of the Scrum process is much important for the final delivery product to be efficient. The major problems which contribute to diminishing the Scrum quality include deadline pressure on the project team due to the less available time. So, to fulfill this research gap we decided to perform research in this particular field to find out the various challenges and determine the respective enhancements for those challenges. We have set a list of objectives accordingly and formulated two research questions elaborated in the sections below.

RESEARCH QUESTIONS

The research question has been formulated based on the literature review:

RQ1: What are the quality issues faced in scrum while adopting agile in software development?

Motivation: During the research conducted, we found that Scrum has been adopted by most of the software organizations when compared with other models in Agile methodology [15]. The quality regarding Scrum has been a major concern in the recent times. Hence, this research question was proposed to identify the various factors challenging the quality in Scrum. A literature review was performed and by narrowing down the topic the above research question was formulated.

RQ2: what are the possible enhancements that could be a part of the research scenario that can help overcome the issues?

Motivation: The second research question has been proposed to determine the various enhancements for the identified challenges. Through Survey, the above-mentioned research question will be answered. Data analysis method, data collection methods are explained in research approach.

PILOT STUDY

Initially, a research gap is identified by using literature review. After the research gap has been recognized, online survey will be published on sites like LinkedIn and Git community. Data will be collected by including a questionnaire in the online survey. Using grounded theory analysis, the collected data will be analyzed. Analysis of the data will give the results and conclusions drawn from those results will be stated. Finally, threats to validity of the research will be confronted.

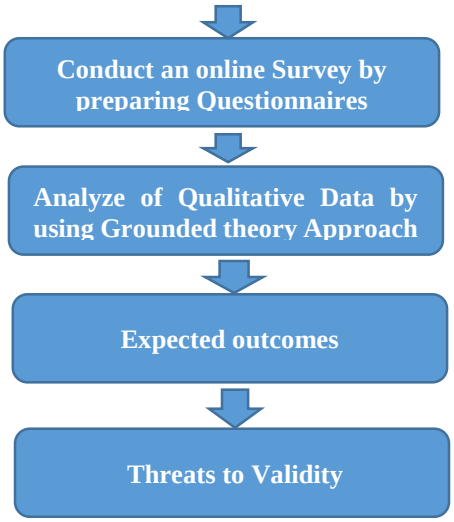

Figure I: Pilot study for the research

A Step by step infographic is presented stating the research procedure. These steps are elaborated in the research proposal.

RESEARCH PROPOSAL

Research Objective

The aim of the research proposed is to identify the quality issues faced while adopting scrum in agile software development. The following objectives must be achieved in order to fulfill our aim:

- Identifying the issues and reasons faced by practitioners while adopting Scum in agile software development .
- Conducting a survey of the companies which are adopting scrum to get qualitative data.
- Analysis and synthesis of the data are performed .
- The results of the analyzed data answer the challenges, which could provide further scope for research to be conducted in future research.

Research Method

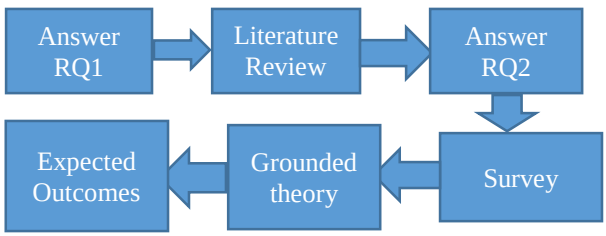

Figure II: Different steps illustrating our Methodology

The goal of this research paper is to provide wider insights into quality issues faced in scrum while adopting agile environment in software development. We have also defined few goals for ourselves such as identifying and understanding the research problem and conduct further investigations in order to determine a qualitative solution for the problem.

In order to fulfill the above criteria, we analyzed and chosen online survey as the best method for answering the identified quality issues. Generally, there are three types of surveys, they are mail surveys, street surveys, telephone surveys.

In this article, we selected mail survey. We selected this survey for its ability to collect large data economically, then telephone and street surveys [21]. In survey non-respondents and drop-out, questions can be controlled. In online surveys, data is stored immediately after a response. State of practice, identify improvement potential, or investigating the acceptance of a technology can be experienced in surveys which make the survey more attractive to be considered as a research method[21].

Time Frame:

We are proposing a tentative research plan with respect to the research timeline as it takes a considerable amount of time for the scout of reliable respondents.

Method	Days
Extended SLR	20
Survey	70 - 75
Documentation	25 - 30

The questioner formulated in the survey acts as the means through which qualitative data is collected.

Data analysis method

The data analysis method which will be used is grounded theory analysis, this approach provides flexibility in interpretation data. Data formulated is divided into axial, selective and open coding[22].

Grounded theory determines how subjects are responsive to the changing environment by the repercussions of the emphasized actions. It also unveils the relevant environments where the subject is involved. The data obtained from grounded theory is qualitative and comes from different sources. Formulated data after performing grounded theory is open to interpretations and involves data collection methods. Here, since our data collection process is a survey, our analysis provides a wider void to the triangulation of data.

DISSCUSIONS:

Expected Outcomes

The survey is conducted and the obtained results are analyzed for answering the research questions. From our analysis for the research question one, the quality issues faced while adopting scrum in agile software development such as missing the agile master, pressure of a small deadline, the absence of pilot project, and support from upper management [5]. These are the challenges with respect to scrum in agile software development.

Agile master or agile coach guides the team to adopt scrum. Usually, organizations which are adopting scrum from the previous model ignore to appoint a scrum master which results in the unsuccessful adoption of scrum. Though pilot project seems to be unimportant, it is necessary to evaluate the plan to change from the previous model to new model scrum. Experience in scrum implementation is essential as the employees who have no experience in scrum implementation leads to a poor quality outcome. Support from upper management is also crucial to gain quality software. If the development team does not have support from its upper management, then it becomes very difficult for developer teams to gain resources[5].

For the research question two, enhancements for the research question one are analyzed. In adopting and implementing scrum, the agile master plays an important role as he guides the team members in adopting scrum in step by step process, hence the role of the agile master should be recognized and should be considered for successful adoption. As we discussed above, pilot study is crucial for planning the change from old model to new model (scrum), many organizations may fail to identify the need of pilot study, which leads to the poor adoption of scrum. Experience in scrum implementation comes with rigorous training sections. Once the training is obtained for scrum, then its implementation becomes familiar. Support from upper management is necessary for an organization as the resources are sanctioned from them, so the benefits of the agile software are to be demonstrated effectively so that they understand the need of agile and support the adoption or maintenance of scrum.

CONTRIBUTIONS AND FUTURE WORK

Threats to validity

Four types of validity threats that can leap into our research are:

- ***Internal Validity***: For our research method of practitioners' survey, one of the internal validity threats might be the selection of the participants and their maturity. The tools that are used as a part of the data collection and their environments could be a threat as the readability of those tools are at reasonable stakes.
- ***External Validity***: A threat that relates to generalizing the results of the sample of respondents remain unchanged. This threat, to the best of our abilities, has been mitigated by taking the sample that is very analogous to the population. This shall be further reduced by taking the surveys from the professionals who have experience in our field of research and experience no less than 5 years.
- ***Construct Validity***: Due to certain time constraints, surveys which were unsuccessful in answering may not be conducted again. The credible audience might have time constraints and thus ended up not answering our survey.
- ***Conclusion Validity***: This can be due to the lack of knowledge in the proposed field and a small set of population can be a valid threat. Implementing proper research method will mitigate the threats to a wider range.

CONCLUSION

The bottom line of our current research is Scrum implementation in agile software development. The research in agile software development involves in communication, objectivity, a greater focus on development and customer interaction, conceptual simplicity, high quality, technical excellence, lower costs, dynamism regarding changes to project requirements, flexibility, autonomy, efficiency of development and quickly delivery of functional software[23]. From the above-mentioned areas, quality has been opted as our

research topic. Two research questions were formulated as a consequence. Further Survey will be performed in order to answer these questions. The data obtained through the survey will be analyzed using Grounded theory analysis and the possible enhancements for the proposed problems in quality will be addressed.

In the near future, this can be implemented with case study as an individual reflection in our research can be seen. A shift in perspectives might yield and unveil newer dimensions of Scrum in agile adoption.

REFERENCES

[1] C. Mann and F. Maurer, "A case study on the impact of scrum on overtime and customer satisfaction," in *Agile Development Conference (ADC'05)*, 2005, pp. 70–79.

[2] I. Kayes, M. Sarker, and J. Chakareski, "Product backlog rating: a case study on measuring test quality in scrum," *Innov. Syst. Softw. Eng.*, Feb. 2016.

[3] M. Gannon, "An agile implementation of SCRUM," 2013, pp. 1–7.

[4] V. Mahnic, "A Capstone Course on Agile Software Development Using Scrum," *IEEE Trans. Educ.*, vol. 55, no. 1, pp. 99–106, Feb. 2012.

[5] H. Hajjdiab, A. S. Taleb, and J. Ali, "An industrial case study for scrum adoption," *J. Softw.*, vol. 7, no. 1, pp. 237–242, 2012.

[6] A. C. C. França, F. Q. B. da Silva, and L. M. R. de Sousa Mariz, "An Empirical Study on the Relationship Between the Use of Agile Practices and the Success of Scrum Projects," in *Proceedings of the 2010 ACM-IEEE International Symposium on Empirical Software Engineering and Measurement*, New York, NY, USA, 2010, pp. 37:1–37:4.

[7] C. V. Monteiro, F. Q. da Silva, I. R. dos Santos, F. Farias, E. S. Cardozo, A. R. do A Leitão, D. N. Neto, and M. J. Pernambuco Filho, "A qualitative study of the determinants of self-managing team effectiveness in a scrum team," in *Proceedings of the 4th International Workshop on Cooperative and Human Aspects of Software Engineering*, 2011, pp. 16–23.

[8] N. Hong, J. Yoo, and S. Cha, "Customization of scrum methodology for outsourced e-commerce projects," in *Software Engineering Conference (APSEC), 2010 17th Asia Pacific*, 2010, pp. 310–315.

[9] M. Eckhart and J. Feiner, "How Scrum Tools May Change Your Agile Software Development Approach," in *Software Quality. The Future of Systems- and Software Development*, D. Winkler, S. Biffl, and J. Bergsmann, Eds. Springer International Publishing, 2016, pp. 17–36.

[10] V. Mahnic and S. Drnovscek, "Agile Software Project Management with Scrum," in *EUNIS 2005 Conference–Session papers and tutorial abstracts*, 2005.

[11] R. E. Maria, L. A. Rodrigues Jr, and N. A. Pinto, "ScrumS: A Model for Safe Agile Development," in *Proceedings of the 7th International Conference on Management of Computational and Collective intElligence in Digital EcoSystems*, New York, NY, USA, 2015, pp. 43–47.

[12] J. M. Bass, "How product owner teams scale agile methods to large distributed enterprises," *Empir. Softw. Eng.*, vol. 20, no. 6, pp. 1525–1557, Jul. 2014.

[13] R. P. Maranzato, M. Neubert, and P. Herculano, "Moving Back to Scrum and Scaling to Scrum of Scrums in Less Than One Year," in *Proceedings of the ACM International Conference Companion on Object Oriented Programming Systems Languages and Applications Companion*, New York, NY, USA, 2011, pp. 125–130.

[14] R. Akif and H. Majeed, "Issues and challenges in Scrum implementation," *Int. J. Sci. Eng. Res.*, vol. 3, no. 8, pp. 1–4, 2012.

[15] G. S. Matharu, A. Mishra, H. Singh, and P. Upadhyay, "Empirical study of agile software development methodologies: A comparative analysis," *ACM SIGSOFT Softw. Eng. Notes*, vol. 40, no. 1, pp. 1–6, 2015.

[16] J. Campbell, S. Kurkovsky, C. W. Liew, and A. Tafliovich, "Scrum and Agile Methods in Software Engineering Courses," in *Proceedings of the 47th ACM Technical Symposium on Computing Science Education*, 2016, pp. 319–320.

[17] H. Guang-yong, "Study and practice of import Scrum agile software development," in *2011 IEEE 3rd International Conference on Communication Software and Networks (ICCSN)*, 2011, pp. 217–220.

[18] N. Uikey, U. Suman, and A. K. Ramani, "A Documented Approach in Agile Software Development," *Int. J. Softw. Eng. IJSE*, vol. 2, no. 2, pp. 13–22, 2011.

[19] B. van Ruler, "Agile public relations planning: The Reflective Communication Scrum," *Public Relat. Rev.*, vol. 41, no. 2, pp. 187–194, Jun. 2015.

[20] M. Cristal, D. Wildt, and R. Prikladnicki, "Usage of SCRUM Practices within a Global Company," in

2008 IEEE International Conference on Global Software Engineering, 2008, pp. 222–226.

[21] T. Punter, M. Ciolkowski, B. Freimut, and I. John, "Conducting on-line surveys in software engineering," in *Empirical Software Engineering, 2003. ISESE 2003. Proceedings. 2003 International Symposium on*, 2003, pp. 80–88.

[22] B. G. Glaser and A. L. Strauss, *The discovery of grounded theory: Strategies for qualitative research*. Transaction Publishers, 2009.

[23] M. de A. Santos, P. H. de S. Bermejo, M. S. de Oliveira, A. O. Tonelli, and E. J. Seidel, "Improving the management of cost and scope in software projects using agile practices," *ArXiv Prepr. ArXiv13031971*, 2013.

[24] N. Nurmuliani, D. Zowghi, and S. Powell, "Analysis of requirements volatility during software development life cycle," in *Software Engineering Conference, 2004. Proceedings. 2004 Australian*, 2004, pp. 28–37.