"REVIEW ON USABILITY AND QUALITY ASSURANCE OF AGILE METHODOLOGY"

SOFTWARE ENGINEERING (CO-301)

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Review on Usability and Quality Assurance of Agile Methodology

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Abstract. Agile methodology is a way to focus on people and results in order to develop software. In the fast-moving world, simultaneous working has grown in the technology sector, and we cannot afford to stop certain working software as it will cause huge losses. Agile helps to take people's demands into consideration and also works in such a way it does not affect other functions of procedure a bit. But, only being focused on certain people's demands can lead to inefficient software which has less quality assurance.. The main goal of the paper is to clarify the different ways to incorporate usability along with quality assurance in an agile environment. As it is a very vast topic for research, a lot of papers are available on the agile methodology but there are a few papers that have written about the usability and quality assurance of agile methodology. So, we have narrowed it down to a few research papers over the years where we have shown studies of different forms, methods, and tools to incorporate to make software development more effective and efficient to the developers and also the mass. Usability can reduce risks and improve product quality where the inter-relations and the inter-dependencies between quality factors also play a huge role.

Keywords: Agile, usability, quality assurance, Scrum, Kanban, Hybrid agile.

1   Introduction

Agile is nothing more than a chain of quick development and is a methodology for rapidly deploying an application in a much more structured manner. It breaks down the whole program into little bits of code and then works on those small services one at a time, ensuring that we initially adhere to the micro services architecture while also avoiding affecting the overall application. Because iteration is used to progress with development and the user is replaced as the advocate, there is concern regarding the methodology's quality assurance and usability.

Throughout the project lifecycle, agile techniques emphasize providing the smallest functional portion of the project as quickly as feasible, then improving it and putting together meaningful functionality. Agile assists in reducing overall risk and enables the project to agree to receive changes quickly. In addition to more written papers, agile methodologies place a strong focus on good communication. For a few years, the focus has shifted to improving programming

development practices by increasing re-usability, understanding of requirements, programming delivery speed and cost-effectiveness, and a variety of other attributes. Our objective is to see how recent research have attempted to combine these two areas, to assess and evaluate the quality of these studies, and to map the barriers to usability and agile integration.[1]

1.1 Background

- **Agile Software Development:**
  In early 2001, a group of seventeen software development experts gathered in Utah to debate and exchange novel software development methodologies. The "Manifesto for Agile Software Development" was produced as a result of this conference. The Agile Manifesto's ideas are intended to assist software engineers in succeeding in changing and unexpected contexts, as well as to promote and accelerate responses to changing environments, requirements, and deadlines[2]. The agile methodology aims to produce better software by involving the customer representative early in the development process and delivering software in small iterations as rapidly as feasible. Time spent on user research, experience design, or usability testing, on the other hand, was not included in. Agile approaches have gained popularity during the last two decades. Agile enhances communication, cooperation, and progress visibility between team members and clients. Agile also improves the capacity to adjust to new situations. Although agile approaches, particularly Scrum and XP, were originally advocated for lightweight development, the benefits of agile have gained traction with enterprise software teams as well. As a sector in which the software development process is a test to design and standardize development in order to generate the desired and required project outcome. Several agile approaches have been suggested in the literature, including Extreme Programming (XP), Scrum, Feature Driven Development (FDD), and Dynamic System Development Method (DSDM). Agile software development is built on an iterative cycle, with the primary goal of delivering software quicker while ensuring continued user interaction.Traditional software development prioritized detailed feasibility documentation for project success, but agile software development places less emphasis on requirement collection and comprehensive feasibility studies. The Agile paradigm enables speedy software development, but it does so at the expense of effective design [3].

- **Usability and Quality assurance:**
  Usability isn't a hot issue because it's one of many non-functional needs and quality features, yet it's become a critical factor in thriving in highly competitive marketplaces. Usability testing in software development provides extremely valuable input, making it a vital component in developing usable and useful software for the target audience.[4].Usability testing highlights places where real users are having problems with an app and supports them in generating improvement suggestions. Usability testing is a

technique for assessing a platform's user interface and human factors applications with the people who will use it. The agile methodology has developed significantly in contrast to established techniques. In order to satisfy the client's needs, the technique stresses quick invention, quick review, quantifiable progress, and continuous delivery. As a result, agile development process measurement is necessary.[5]. In this context, recent research efforts analyze the interrelationships and interdependencies among the identified quality factors (QF), finding which QF have high driving and reliance power, and therefore indirectly contributing to the success of the agile development process. This study provides a new agile quality model based on the interpretive structural modeling (ISM) technique.[6].

2   Literature Review

Ndizihiwe [7], by incorporating the model developed using a human-centered design methodology into the agile development process. If the user's task isn't properly supported, the user's needs or requirements aren't met, and the software's aim isn't satisfied. The exciting performance of agile approaches to rapidly develop system products that meet the expectations, efficiency, and satisfaction of users with a given degree of quality is connected to the combination of Agile and User Experience Design. The primary goal was to create a usability testing method based on Agile and Human-Centered Design concepts (HCD). The HCD process begins with a review of the needs, desires, and behaviors of individuals who may benefit from the final product. The HCD staff works hard to understand and listen to end users' wishes. User-centered design (UCD) is a user-centered approach to user interface design and development that involves users at every stage of the process. It is not just concerned with comprehending the needs of the users of a product under development. Here, the name of the prototype is "Odoo". Identifying user needs is the most important in a software project, it's impossible to move forward in the right direction without considering users' requirements. The team should identify the role of the users; then they proceed to understand and analyze the context of a user following design requirements.The prototype is then implemented and evaluated using a demo and feedback. LoadCompletetool was used to test the prototypes. To construct tests for the LoadComplete tool, the researchers began by collecting HTTP requests and responses while considering user situations. Oddoo is an OpenERP that was chosen as a product to be developed in an agile way. The prototype was built using agile and human-centered design approaches, and it was developed in PHP with an object-oriented design and MySQL as the backend database. The end outcome of the study reveals that loading the load page in the Oddoo application took substantially longer than loading the prototype model. When comparing the Odoo and prototype models, it is clear that the Odoo ERP might reduce productivity by taking a long time to load, which has always been a major issue for users. Odoo's response time is likewise noticed to be faster than the prototype response time when the number of virtual users grows. The prototype is then implemented and evaluated using a demo and feedback.

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Jain [8], The current study proposes a new quality model based on ISO 9126-1. The model was presented after defining the quality elements and using the ISM technique to construct interrelationships among these identified factors, as well as extracting an overall tree-like structure that depicts a hierarchical structure model. After that, a MICMAC analysis technique is used to gain a comprehensive understanding of the influence of quality aspects. Only four of the quality characteristics can be used to solve the described problem or issue, verifying the process quality of agile techniques, according to the proposed agile quality model, which is based on the ISO/IEC 9126-1 quality model. For this, ISM is applied to the 19 quality variables discovered, and a customized agile quality model in the form of a hierarchical structural model is offered as a result. ISM is an interactive learning method that identifies the structural model that depicts the interrelationships among the 19 quality factors that have been determined.As a result of this MICMAC research, all 19 QF were classified into distinct levels depending on their Driving and Dependence Power. QF has also been divided into four groups: Linkage, Independent, Autonomous, and Dependent.The test cases were divided into four clusters, with the first cluster having 3QF emerging as a Linkage variable with both high dependence and driving power (being the most powerful), the second cluster having 8 quality factors emerging as independent variables with high driving power and low dependence power, the third cluster being autonomous and none of the QF being autonomous, and the fourth cluster having 8QF emerging as dependent variables. During the agile development process, focusing more on Independent QF by development team members, together with Linkage QF, contributes to the success of the agile development process.[8]

Deraman [9], the paper is based on a software management tool that is used to integrate usability evaluation activities in agile methodology. Agile development teams may use this tool to manage a continuous assessment process that is strongly tied with the development process, allowing them to produce high-quality software with a sufficient degree of usability. . It was stated that usability evaluation activities be managed while working in an agile software development paradigm.The author's contribution is a management tool born of a methodology for implementing usability assessment in an agile environment that combines both a usability assessment environment and an agile environment. It states that the usability assessment model needs to be integrated. First, potential integration points are mapped based on their end effect and overlap with the usability assessment and software development process. The following is a

look at the links between activities and artifacts to show the flow of information within each process. Finally, the convergence artifacts of both processes are recognized. The system aims to organize, track, and facilitate usability activities that have long been considered one of the most important aspects of the software development process. The management system is created as a software prototype for use in a real environment. Use plug-in technology to link with other tools such as integrated development environments (IDEs) and usability tools. A JavaScript server was used to run this system(JSP) create. Using the open source program MySQL and using the Internet WEB for database management can also help you develop your database. It was created with four key features in mind: an artifact repository, monitoring development activities in both sectors (usability and software development), evaluating usability assessment techniques, and creating plans. The tool's actions, artifacts, dependencies and relationships, and selection usability techniques criteria, according to the majority of experts, are complete, intelligible, adequate, accurate, and well structured.To bridge the gap between usability testing and development, the authors of this paper created a software management system. The communication connection is critical to the creation of a system since it is efficient, as well as appealing and beneficial to the end-user. Furthermore, efficient communication saves time by minimizing the number of topics for argument by eliminating discrepancies in understanding. The management tool will combine both fields and enhance precision and completeness as a consequence of the development process by employing the plug-in function. According to the conclusions of evaluations, the tool pleased development teams and was practical for use in the software project.[9]

Baig [10] , adopted ERP (Enterprise Resource Planning) solution where it was successful as quality assurance and quality control played a huge role. In this paper, the findings suggest that agile methodologies (daily scrum meetings, pair programming, and regular reviews) minimize ERP implementation complexity and improve quality.Testing accounts for 25 percent to 50 percent of the entire expenditure in most ERP deployments, however comprehensive quality control and assurance takes a bigger amount of the budget. Business process reengineering, configuration, customisation, integration, data conversion, and maintenance are all steps of ERP deployment. There are several efficient methods for quality control and assurance of each process. However, because there was a minor stumbling block, the writers looked into it more. The impact of agile methodologies on quality control and assurance in an ERP system is examined in this article. The authors have used "grounded theory" [11] in their research. They chose grounded theory for three reasons: 1. It allows them to construct a new theory based on acquired data rather than utilizing evidence to confirm an existing theory; 2.There was relatively little material in the literature about our issue, and grounded theory comes in handy in such instances; 3. a flexible emphasis on people and communication They used "grounded theory," interviewed practitioners, used "open coding" on aggregate data, and then used "selective coding" to find concepts and ideas relevant to ERP quality. Further, into the research, they combined codes into groups in "category development", followed by "sorting" and "write up".

Practitioners have three distinct perspectives on the success of agile methodologies for increasing ERP installation quality. 70% of respondents agree that using choice agile methodologies based on the scenario and requirement may enhance ERP installation quality. While 25% believe that whole agile frameworks should be employed since selecting agile approaches that are appropriate for the context is challenging. They hope that their approach will make quality control and assurance for ERP implementations a simple process and cut down limitations. [10]

Hayat [12], They conducted a study of several software organizations in the paper, and found that the majority of them adopt agile development (Scrum), with a beneficial outcome. Scrum is the most extensively used agile project management approach and is the framework of agile methodology. It focuses on day-to-day project management. Scrum was established to increase the repeatability of development processes, match individual and corporate dictums, build a recital-centered culture, assist the production of shareholder value, have a positive performance message at all levels, and improve differentiated development and class of life. Scrum processes entail the participation of a scrum master, a scrum team, and a product owner. It also contains sprints, it is the smallest block in which a team can assign tasks, it will be done in 3 to 4 weeks. The authors have done 6 kinds of surveys like; 1. Organizational Survey; 2. Project Scope Management Survey; 3. Project time and Cost Management; 4. Project Quality Survey; 5. Project Risk Survey and lastly 6. Project Human Resource Management Survey. They have shown graphs, pie charts, and numbers to explain how Scrum is the most effective and used agile development among companies which gives quality assurance of the agile environment. [12]

Rahmat [13], developed a club management system to test usability in the "Kanban" agile process. This study is primarily concerned with the use of the Kanban technique in the establishment of a university Club management system, as well as the importance of its application to students (end users). The Kanban method focuses on project management through the use of a Kanban board. The effectiveness of Scrum and Kanban were investigated in the study, and Kanban's productivity was shown to be equivalent to Scrum's. Kanban streamlines productivity by emphasizing the importance of prioritizing and attention. Kanban is a suitable choice for smaller team population projects when time and money are constraints since it allows more flexibility. Because some elements are taken into account, a somewhat different technique is adopted. GitHub, an online versioning management system for software development, will be used to maintain the project's artifacts. Documentation, source code, project management, problem management, and other artifacts are among them. Using GitHub Kanban has the advantage of automatically tracking your progress. Tasks are placed in the Todo column and will be transferred to the In Progress column whenever the developers are ready to start working on the features. The cards will then be transferred to Review In Progress, where they will be checked to see if the feature is being developed appropriately in accordance with the requirement. This Kanban board will be utilized during the project's entire lifespan. The functional and non-functional criteria were evaluated using functional and usability testing.

Functional testing is carried out using black-box methodologies, which include checking the program by interacting with it through the user interface and examining the output and outcomes. The WAMMI (Website Analysis and Measurement Inventory) template is used for usability assessment.In this scenario, having an online systematic approach for club management may increase a university's overall club effectiveness. Students and instructors might considerably benefit from it, which would boost the university's club system's relevance. Based on the results of the functional and usability testing, the authors believe that the Kanban technique is acceptable for producing usable software.[13]

Shameem [14] tried to discover human-related issues that might have a negative impact on agile methodologies in GSD (Global Software Development) enterprises, as well as to suggest a hypothetical approach to address the highlighted obstacles in expanding agile techniques. SLR was used to identify a total of eleven issues in the findings. The Critical Problems (CChs) for scaling agile approaches were also reported in this study, utilizing a threshold of challenges with a frequency of less than 50%. Six out of eleven difficulties were identified as key hurdles in expanding agile methodologies, according to the findings. In the planning phase, they chose some research questions and throughout the primary studies, they selected some papers to find out the challenges and presented a hypothetical model. The model is based on the eleven difficulties identified and their link to agile development scaling initiatives. To develop the proposed hypothetical model, they selected eleven independent factors, a dependent variable, and one additional variable (moderating variable), such as organizational size. The moderating variable's objective is to examine the similarities and differences between the independent and dependent variables. As there were some limitations based on their SLR and the limited search string. They mentioned the snowball sampling approach and empirical study for their future work to overcome the limitations. The authors indicate that the findings of their study will serve as a knowledge basis for GSD organizations in completing agile projects and advancing them in the GSD paradigm.

Mathur [15] worked for identifying a strategy that fits the needs of mobile application systems. They researched agile procedures to match the criteria, making mobile application development easy and well-suited to mobile device features. Agile methodologies have been shown to be the best match for developing mobile apps since they are rapid, adaptable, and improve time management. According to the authors, they looked at a variety of agile approaches, but no research has shown any compelling reasons to use Agile as a mobile app development model. So, they offered a modified Agile methodology for mobile application development that would be the ideal Agile strategy that would satisfy the benefits of each selected technique for mobile software engineering while removing the weaknesses. A modified hybrid agile methodology based on agile methodologies such as XP, Scrum, Crystal, and FDD is presented to meet the demands of agile mobile application development. The result is a fluid and dynamic process map that can be used to describe and identify appropriate agile approaches for mobile app

development. They used data collection approaches, tools, theoretical modeling methodology, and experimental procedures to reach their purpose.

3 Discussion and Result

Name of Author	Year of Publication	Method/ framework used	Remarks	Merits	Demerits
Ndizihiwe	2017	Agile and Human-Centered design combining together	The result shows that response time took 19% for the prototype while Odoo took 81%. , both Odoo and the prototype consumed approximately the same memory usage 68% and 67% for memory utilization. But load time of the prototype and Odoo is simultaneously 26% and 74%.	Less usage of memory improves the performances, short response time and load time save time and increase efficiency.	If CPU and memory usage remain high, then system performance and processing can be unstable. If system resources are high, then the user experience will degrade.
Jain	2019	Interpretive Structure Modelling (ISM) and Matriced' Impacts Croise's Multiplication Applique´es UN Classement (MICMAC) approach.	During the agile development process, a larger focus on Independent QF by development team members, as well as Linkage QF, leads to the agile development process's success.	Interrelationships and interdependencies between the quality factors were identified which improve agile process quality, having a high influence on the success	It is limited to theoretical validation when proving real-life projects.

Deraman	2018	The evaluation model is based on incorporation usability into an agile environment	As a consequence of the development process, the management tool created will integrate both sectors and improve precision and completeness. The tool met the needs of development teams and could be used in the software project. The tool's purpose is to bridge the gap between usability testing and development.	The produced tool meets its specifications, and all needed components are present in good working order, allowing usability testing to be included.	Agile methodology experts view differs working experience and user-centered design might not be likable and feasible for everyone, need a good understanding to use the tool
Baig	2017	ERP implementation	According to their research, the majority of 70 percent feel that chosen agile approaches tailored to the context and demand may improve the quality of ERP deployment. Though a grounded theoretical theory cannot guarantee 100 percent validity, the study will be expanded to eliminate the restrictions.	ERP deployment is complicated, large-scale, and requires domain knowledge. ERP causes significant changes in the organization's environment, everyday procedures, and relationships.	The validity of a theory based on grounded theory cannot be guaranteed. Its legitimacy may be supported by living garments. The majority of the interviews in the Data Gathering system are performed over Skype. This may restrict the findings of our research. Unfit to record interviews from interpreters of other ERP products in the case of Confined ERP products.

Hayat	2019	Scrum agile approach	They proved Scrum to be efficient. They showed graphs, pie charts, etc in this regard.	Scrum has a favorable influence on software project management knowledge domains. Scrum has a favorable impact on the project's time, cost, scope, quality, risk, and scope.	Scrum constraint is that some organizations are resistant to the concept of self-organizing teams and strong cooperation. Traditional command and control arrangements are based on hierarchical organizations. Such a structure is incompatible with the agile process.
Rahmat	2020	Kanban agile approach, usability testing through WAMMI, laravel php framework	The authors concluded Kanban is the better approach for usability testing in an agile environment and also is suitable for generating useable software based on the results of the functional and usability tests. USe of WAMMI for the usability testing which has global reliability of 90%	A Kanban approach may be defined as a specific application of lean methodology that aids in the visualization of work, the limitation of work-in-progress, and the optimization of efficiency; it also helps to eliminate chaos in workflow by emphasizing the need for priority and attention. Kanban is a suitable choice for smaller team population projects when time and money are constraints since it allows more flexibility.	Kanban does not fit a dynamic environment. There are no timeframes attached to each step, which might be a drawback.

Shameem	2018	The hypothetical model developed by the scaling program used 11 independent and dependent variables and one moderating variable.	The moderating variable's goal is to look at how the independent and dependent variables are similar and different. The study's findings will serve as a knowledge base for GSD firms as they complete agile projects and move them forward in the GSD paradigm.	Identified human-related issues that impede program scaling; 11 human-related difficulties were identified (of which 6 were significant); serves as a knowledge-base for GSD organizations to succeed.	The limited scope of SLR, limited search string, lack of depth understanding about recent advancement.
Mathur	2019	Hybrid agile methodologies consist XP, Scrum, Crystal, FDD	The study of hybrid agile methodology is considered to be successful in terms of mobile software development performance, quality, and numerous observations, all of which point to a large amount of choice for further investigation in the research	Assist in agile mobile application development. The flexible and versatile map is capable of modeling and selecting suitable agile techniques	Time-consuming, as it necessitates the use of several case studies to estimate the outcome.

TABLE I : THE SUMMARY OF THE PAPERS REVIEWED

Agile methodology is being used the most in software development nowadays. According to the statistics, more than 65% of various IT organizations in the world are using agile instead of traditional software development methods. So, ensuring usability and quality for the development process is very much needed. We can say combining user-centered methodology with agile, performing MICMAC analysis and even many researchers and developers are coming up with new management tools to assure quality and easy mass use in software development. Some approaches might be theoretical as of now but there is the future scope for proving them effective also.

Besides, Though the WAMMI template is used to check the usability testing for a kanban approach, it passed all the usability factors. Along with that, a systematic review scaling the human-centered challenges which have negative effects and guides to overcome negative effects for the successful output for GSD organizations. Different agile approaches were used to modify a hybrid for the benefit of mobile developers and managers, with the result of modeling selecting appropriate agile strategies for mobile application development. Agile approach has a significant

impact on software project management knowledge areas, we may say. Agile has a big impact on project timelines, budgets, scope, quality, risk, and scope. Agile has a big impact on human resource management since some firms prioritize goal-oriented staff hiring while others do not. Agile reduces risk, keeps expenses in check, and provides a high-quality product that keeps projects on track.

The socio-economic factors also give positive outcomes in agile methodology like; in the fast-moving world, we are using software predicting the weather, disaster, Softwares predicting the stock market, software handling the crypto market, Facebook, Netflix, etc. all these software can not afford to be taken down even for a small amount of time for maintenance purposes. Again, the usability of the software to be so precious and efficient that millions of people around the world can use it easily and also at the same time without disturbance. So, we can conclude here that agile and ensuring usability and quality is the most efficient for today's world.

4   Future Scope

Future research might build on the quality assurance and concerns identified in this study to do more research on the intersection of usability and agile software development. It's important to remember that systematic reviews are limited by the time period, sources, and search query employed. As a result, further replications of this work are possible (from table 01). We're also intrigued about the issues, constraints, and tensions that exist between quality assurance and agile software development. We propose that additional studies be done on the integration of usability in agile development through technologies and people (teams) as a research agenda for the future. Other research topics, such as the differences in the integration process in different business settings and different types of software, remain unanswered. Another aspect that was absent from the studies that were chosen was the artifacts that are or may be utilized for this integration. The particle testing of this methodology will be necessary for the future to determine the extent to which usability and quality assurance may be integrated into agile development methodologies. Finally, it is vital to invest in higher-quality primary and secondary research in order for the results to be truly valuable and to give target readers greater trust.

5   Conclusion

Many software models are used in industry, including waterfall, RAD, and scrum. Agile is the quickest software development approach out of all of them. Software development in agile is focused on an iterative cycle, with the main goal of delivering software quicker with ongoing user interaction. Traditional software development prioritized detailed feasibility documentation for project success, but agile software development places less emphasis on requirement

collection and a comprehensive feasibility report. Throughout the analysis, we used a total of 18 studies where there are 3 systematic reviews, 2 systematic surveys, and 7 testing and mapping studies, and the rest are used for the framework and understanding of concepts. Six categories emerged from this research: processes, techniques, recommendation, merits/ demerits, output, and some approaches which are described in table I. After reviewing the research, it was determined to divide the approaches to incorporating usability into agile development into broad categories. Agile software development techniques have progressed from non-agile software development methods to agile software development methods, the most flexible methodology for software development in which the development team continuously improves the product with ongoing user engagement. On the other hand, agile methodologies are rarely integrated with usability approaches, which are crucial for software usability. In order to achieve this crucial quality, the usability process must be included into the agile development approach.

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