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Enabling the Usability Heuristics of Agile Base Systems to Improve Quality of Local Software Industry

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ABSTRACT

Many agile software development practices are promoted to improve the quality of software products. In recent years agile software development overlooked the usability features that effected system productivity.Usability is a main feature of interaction. Interaction is a way of a farming relationship between people and designed objects. An interactive model provides the way to band application together to achieve target user's need. Usability gained attention of researchers and engineers because of its own importance. Agile software methods and usability engineering played a major role for producing better and reliable products, because both of them are concepts of methods as well as practices. The purpose of this research was to highlight the need of usability practices. The proposed model demonstrates that usability heuristics were much compatible with agile methodologies and would help to improve its productivity by reducing time and cost. Action research was applied for the development of framework proposed. The framework was evaluated using case study and further results were compared with existing related work.

Key Words: Agile Development, Interactive Interface, Productivity, Usability Practices and User Friendly.

1. INTRODUCTION

Almost from 50 years, all experiences show that traditional development methods are poor in a result as well as poor in user experience. The related issues are; organizational culture and understanding, quality management, leadership, training and development, project management and motivation are of highest priority [1]. So that there is the need of a well-organized model that can resolve the main issues of local industry evolution effectively. To deal with these hitches, agile methods can be very effective [2]. Since each agile method has its own strong points and limitations, different researchers have projected hybrid models assimilating the strengths of different agile methods and suppressing their weaknesses. One of the key principles of agile is maximum involvement of end user throughout software development life cycle [3]. In any case, there are two different things what user wanted and what was needed [4]. There are two perspectives one is getting requirements of a product and other delivering that product. Best way to test the reliability of a product is that check how the end user will interact with the particular software somehow this is called usability testing.

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Agile software development tries to produce more useful and reliable products, within short period called iteration [5]. One iteration of development extends up to four weeks and all main functionalities are incorporated in upcoming iterations. In the past few decades, majority of the software organization have shift their software trend towards agile software development [6]. Main key attribute of usability is the interaction of end user with the software product resulting in enhanced learnability, efficiency, memorability, error recovery, and end-user satisfaction [4]. Although agile development methods and usability share some common objective, however, there is a distinct difference from user context [7]. In recent years agile family has paid less attention to the usability features which lead projects towards failure [8]. Thus, main resolution of this study is to portray need of usability within agile development context. The usability heuristics have been incorporated in order to improve agile usability features [9].

As mention above different researchers have projected hybrid models assimilating the strengths of different agile methods and suppressing their weaknesses. In this research usability heuristic and agile methods are combined to achieve reliable product. As agile only focuses on functionality rather than interface therefore, before implementing any design, developer must negotiate with stakeholder/users shown in Fig. 1. Development team tends to design mockup of a product according to requirements and further evaluated through discussions with scheduled usability expert meetings with stakeholders [7]. Heuristics for usability such as; visibility of system status, error preservation, usability control and freedom and more have been performed.

Throughout the literature, the definition of usability is varied. Nielsen describes the usability as a subset of a system for "discipline where usability is not just argued about but is systematically approached, improved, and evaluated" [11]. Five component of usability is learnability, efficiency, memorability, errors, and satisfaction. Rubin [11] supports Nielsen usability component by writing similar terms in his research such as usefulness, effectiveness, learnability, and attitude.

FIG. 1. DEVELOPING DESIGN PROCESS [3]

Tesoriero [12] defines usability generally as a distinctive feature of an interface and also specify the goal of usability to improve the ease of use of the interface and improving the ease of use of learnability of interface. Carvajal et. al. [13] argued that usability varies in definitions because usability is not a measurement tool or a methodology.

Best way to test the reliability of a product is that check how the end user will interact with the particular software somehow this is called usability testing. Many issues were raised because the level of developers and users were not same. Mostly they code the software which is not compatible to the real end users. Because the level of developer is high than the users. Developers must know regarding basic requirements of the users before developing the product. Usability engineering demonstrates that usability method/practices gave the way to produce more valuable projects and also increased the user experience [14].

Huo et. al. [15] suggest the story boarding for system representation, which help the developer in system Evaluation and also help in negotiation with customer/ stakeholders. To filter requirement during project development negotiation is important factor. For reducing risk element more than two programmer work on same code. One of the important practice of agile development is refactoring. Refactoring only change the internal structure while external remain same. Code is reconstructed by the developer during refactoring process. Usability play an important role in agile development. Its main aim is determine how the end user will interact with the system. Many researchers find the way to integrate usability with agile development.

Most usability investigation has focused on technologies involved to evaluate the interface or how the individual user interacts with the particular interface. Very few have examined the effect of interaction model on multi-user usability by considering the actual socio-human needs [16].

For last few decades, there is a number of challenges which organizations have to face one of the main challenge is poor user experiences due to incorrect requirement specification. This occurs due to mismatch need of user and the developers. Therefore, in this research, we have proposed an innovative framework which will cater interactivity problem.

2. MATERIALS AND METHOD

Action research has been applied for conducting this research. Relevancy of action research with the study was its learnability feature as it generated frequent results and handled the problem in iterative way. Applied action research has been described in Fig. 2. Each step further explains the implementation of process. Problems were identified through literature review which lead to the development of more reliable and efficient agile usability framework. Literature was obtained from IEEE Xplore, ACM and google scholar. After identifying problem solution is presenting by proposing model with the help of usability heuristics. Usability improve the design interactivity. At the end case study conducted to evaluate the proposed model.

The proposed framework incorporated handover concepts of pre-delivery, transition and post- delivery phases. According to proposed model as shown in Fig. 3 developer and designer were responsible for approving developing design process in pre-delivery phase.

Release planning was scheduled at the transition phase. Similarly, designer/developer along with the team was responsible for iteration completion, deployment and documentation. User testing was performed before implementation phase; detailed description of user testing is shown in Table 1. At post-delivery phase owner, developer and designer with their team were responsible for the working of product according to the vision. Documentation was also maintained and need of training was reduced because of usability heuristics.

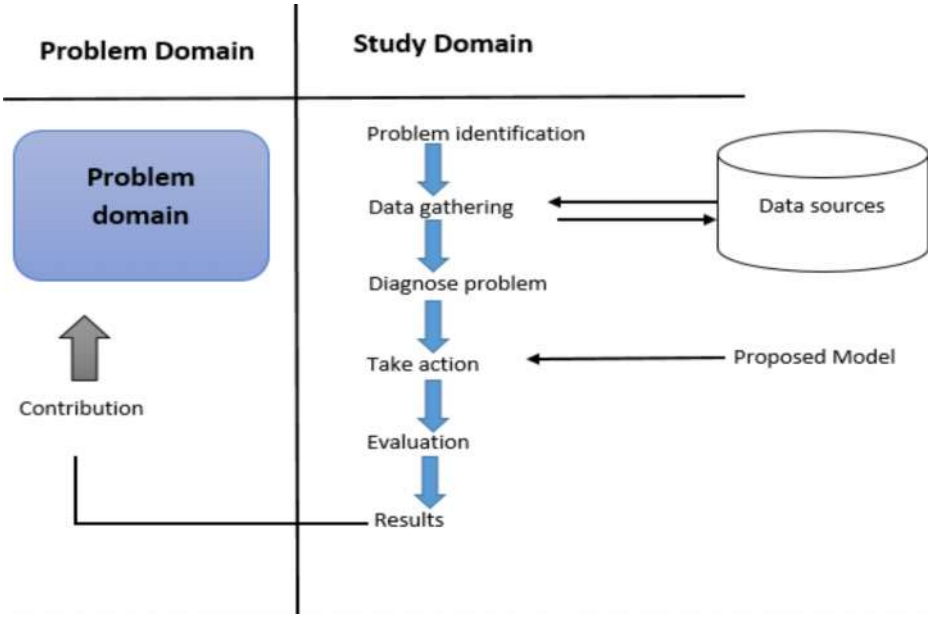

FIG. 2. ACTION RESEARCH FLOW [14]

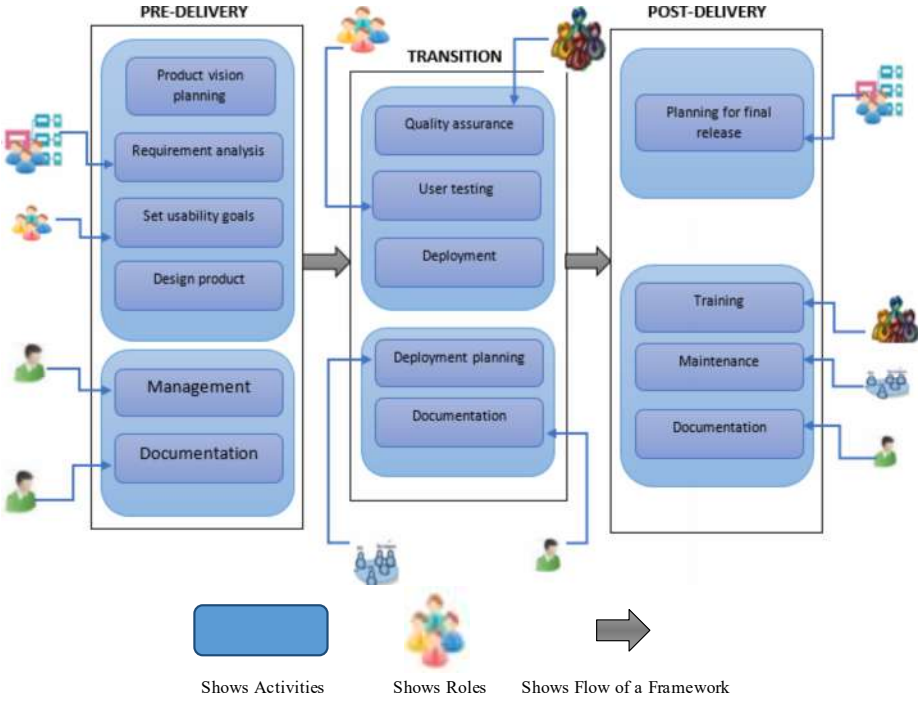

FIG. 3. PROPOSED FRAMEWORK

3. RESULTS AND DISCUSSION

Case study has been applied to validate the proposed framework. The purpose of applying this case study was to investigate the phenomena in real world in order to know their needs and make interactive interface [17].

Data collection was conducted through participants that included project owner, end user, and customer or team members of three companies. Semi-structured interviews were conducted from 54 participants of different three companies. Interview comprised of 14 questions in total out of which 9 were related to experience and background. While other questions were related to the underlying project. Multiple issues were identified through qualitative analysis performed on gathered data. Once finished with the analysis phase, issues were discussed with participants and shareholders and further improvements were noted.

Evaluation of the Proposed Framework using Case Study: Study involved six groups of people including three usability experts. Every individual in a team had separate responsibility according to their skill. Roles related to the development team comprised of the project manager, product owner, development leader, usability expert and technical leader as shown in Table 2 [23].

The development team completed the project in five sprints. Sprint meetings were conducted on daily basis. The artifacts related to the project were shown in a Table 3 [24]. Agile methodologies faced some threats during project development as shown in Table 4 [23]. Proper threats mitigation strategies are formulated in Table 5 [24]. The benefit of using proposed model was also considered at the end of the project as shown in Table 6 [7]. The result of Case study were shown in Fig. 4.

Main objective of this research was to propose an effective framework for agile methodologies with the help of usability heuristics. For the evaluation of the proposed framework case study was performed. During the case study some agile threats were highlighted. The mitigation strategies were formulated properly with the help of usability heuristics. However, it was observed during study that lack of stakeholder involvement which raised many issues. Case study results showed that proposed framework mitigated the agile threats and improved the production quality. There is a need of usability expertise in a development team to make its development effective.

To make proposed framework more accurate statistical analysis was performed which shows the reliability and accuracy of proposed framework. Two statistical tests

TABLE 2. TEAM ROLES

Individuals	Roles
1	Project Manager
1	Product Owner
1	Development Team Leader
4	Development Team
3	Usability Expert
2	Technical Leader

TABLE 1. USER TESTING

Testing	Description
Acceptance Testing	Test were managed to check the requirements specification [7]
Usability Testing	Usability testing was qualitative testing, intended to check the system performance as well as user satisfaction [8]
Usage Testing	Usage testing was conducted to check the logic captured behind the system design before implementation [7]

were performed reliability test and KMO (Kaiser-Meyer-Olkin), Bartlett's Test. Reliability is basically checking the consistency or stability in the results of a test. A test is called as reliable, if and only if, in repeated

TABLE 3. PROJECTS ARTIFACTS

Artifacts	Description
Management structures	The organization structure and team configuration
Project charter	The definition of scope and intent of the project with assigned stakeholders. The charters authorized work to meet the need of stakeholders
Project schedule	The documents that define the list of activities, assigned resources, duration, and cost of execute project
Project design	The degree to which a person believes that using a particular system would be free of effort
Design about technology	The capability and quality of hardware and software available in domain
Financial statements	The financial statements include labor hours, increased cost, budget and project cost. The return on investment (ROI) the calculation and other financial projection made by team during the project developments

TABLE 4. AGILE'S THREATS

Agile Threats	Description
Project complexity	Agile method was mostly proposed by the programmer who did not pay much attention towards interaction design.
Fragment integration	Risky task to integrate complete fragment. It needed additional team work and domain knowledge expertise as well.
End user expectation	System not encounter User requirements.
Delay in project delivery	Due to Complex nature of a project.
End users conflicts	Improper requirement gathering.
Technical complexity	Lack of usability expertise.

TABLE 5. THREATS MITIGATION STRATEGIES

Agile Threats	Mitigation Strategies
Project complexity	Concern with usability expertise at the very start of the project. Usability testing bridged the gap b etween programmers and customers.
Fragment integration	Perform functional testing before deployment of a product.
End user expectation	Proposed framework helps to achieve user expectation.
Delay in project delivery	Proper release planning of a developed product
End users conflicts	Proper requirement gathering, more consideration on user interest.
Technical complexity	Concern with expert domain.

TABLE 6. BENEFIT OF STUDY

Agile Threats	Benefit of Mitigation Strategies
Project complexity	Employee expertise
Fragment integration	Conducting proper testing
End user expectation	Use of usability heuristics
Delay in project delivery	Improved releasing plan
End users conflicts	Perform requirement analysis
Technical complexity	Employee domain experts

administrations the results remain the same. Factor analysis is also a statistical method.It is used to describe variability among observed, correlated variables in terms of potentially lower number of unobserved variables commonly known as factors.

This method searches for joint variations in response to unobserved latent variables. Table 7 shows the reliability statistics where cronbach's alpha (α) is 0.881 which is fair enough. Similarly, Table8 portrays case processing summary. Tables 9-10 are representing item and scale statistics. For factor analysis, KMO and Bartlett's test was performed using SPSS (Statistical Package for the Social Sciences). Values of KMO Measure of sampling adequacy and Bartlett's test for sphericity are .710 and .000. So, these are very good, because we need KMO to be greater than .6 and Bartlett's value should not be greater than 0.000.

According to the expert and statistical analysis we provide a good approach for the software development. Previous framework may overlook usability [20] which increased cost and time. However, there were some lacking in existing solutions, like understandability,

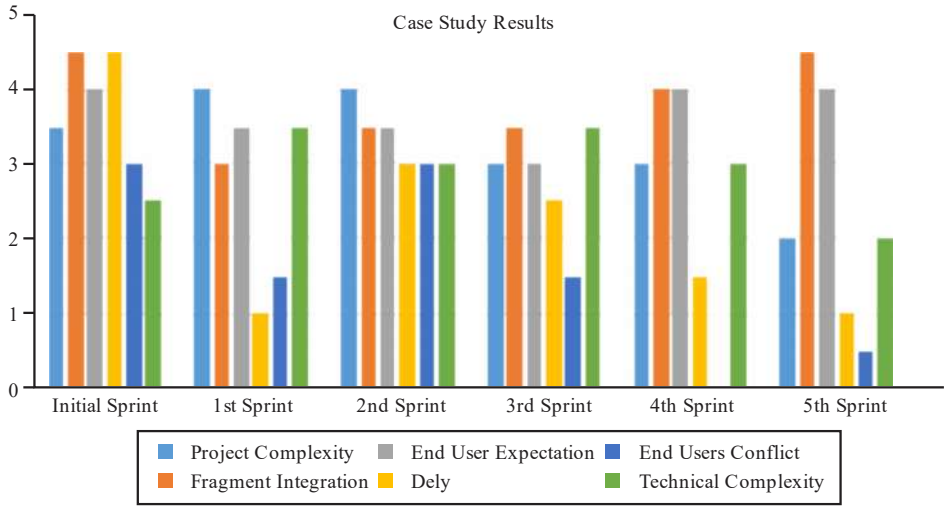

FIG. 4. CASE STUDY RESULTS

TABLE 7. RELIABILITY ANALYSIS

Cronbach's Aplha	Cronbach's Alpha Based on Standardized Items	Number of Items
0.881	0.899	16

TABLE 8. CASE PROCESSING SUMMARY

		N	%
Cases	Valid	61	100.00
	Excluded*	00	000.00
	Total	16	100.00

TABLE 9. SCALE STATISTICS

Mean	Variance	Standard Deviation	Number of Items
82.00	285.990	14.999	16

interactivity, flexibility, usability heuristics, maintenance capability and overlook usability testing feature as mention in Table 11.

We constructed review in three different companies among team members by using our framework on the prescribed parameters. The results of parametric review shown in Fig. 5, depict that our framework improves the quality of products and reduce mismatch between users and developers. Most of the participants verified that our frameworks improve the quality of local software development.

TABLE 10. KMO AND BARTLETT'S TEST

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.810
Berlett's Test of Sphericity	Approximately Chi-Squre	4.937
	Difference	100
	Significance	0.000

TABLE 11. ANALYSIS OF PARAMETRIC REVIEW

Parameters	Strongly Agreed (%)	Agreed (%)	Neutral (%)	Disagreed (%)	Strongly Disagreed (%)
Understandability	30	60	6	3	0
Usability Heuristics	33	59	5	3	0
Interactivity	40	59	1	2	0
Usability Testing	44	53	2	1	0
Reduce Effort	36	56	6	2	0
Flexible	43	54	2	1	0
Productivity	44	53	2	1	0
Maintenance Capability	54	43	2	1	0
User Satisfaction	43	54	2	1	0

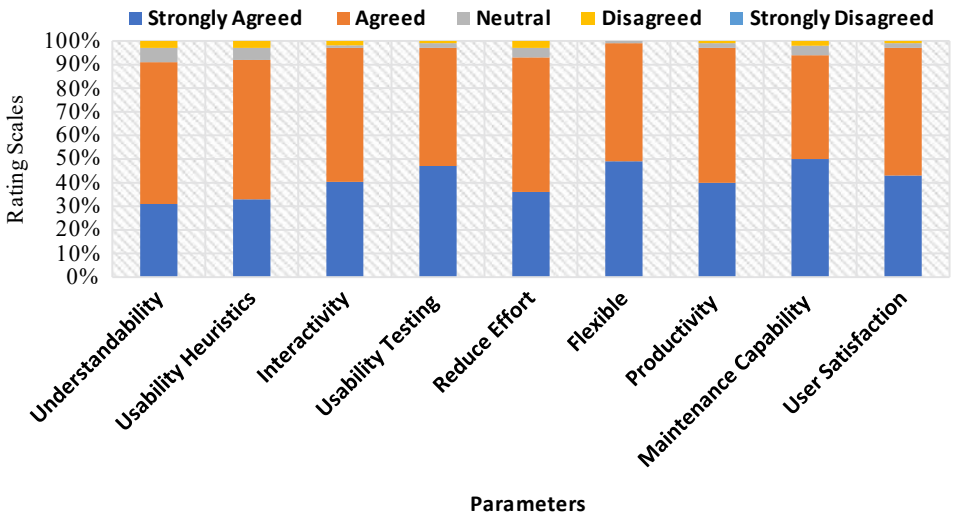

FIG. 5. PARAMETRIC RESULTS

Comparison with existing model shown in **Fig. 6**. In comparison expert opinion is shown regarding proposed framework and also shown lacking in existing models i.e. PACMAD (People at the Center of Mobile Application Development), MDE (Mobile Driven Engineering) and ASEC (Analysis Synthesize Evaluation Change) user Action. According to the comparison proposed framework is better than existing framework because it incorporate usability heuristics and usability testing feature.

Usability improved the agile productivity. Five parameters were used for comparison which were, usability heuristics, usability practices, agile practices, productivity and user satisfaction level.

4. CONCLUSION

This paper argues that usability practices help agile to improve its productivity. Agile's main focus was to identify how the project would be developed rather than its working. In this research paper usability features combined with agile software development to improve its performance and reliability. For making good products agile needed to adopt usability heuristics and also to add usability expertise in a team as a usability tester. For evaluation purpose case study, statistical analysis and comparison with existing framework was performed. Evaluation showed that proposed framework improved the agile productivity and life cycle by reducing time and cost. The future of this paper may be extended with the help of applying artificial techniques with the cloud computing in order to minimize usability issues for agile methods.

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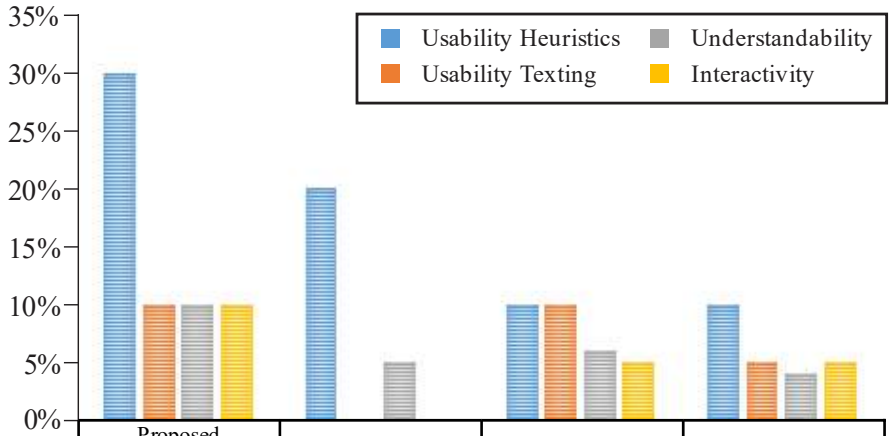

	Proposed Framework (%)	PACMAD (%)	ADE (%)	ASEC (%)
Usability Heuristics	30	20	10	10
Usability Testing	10	00	10	05
Understandability	10	05	06	04
Interactivity	10	00	05	05

FIG. 6. COMPARISON WITH EXISTING FRAMEWORKS

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