



## A Review on Integration of Usability and Agile Methods in Software Development Practice

Nuhu Yusuf and Kamalu A. Marafa

Mgt. & Information Technology Department, Abubakar Tafawa Balewa University, Bauchi, Nigeria  
yusufnuhu99@gmail.com, kamalu4all@gmail.com

**Abstract**—Agile and usability integration is a multi-disciplinary research area that comes across the interest of many researchers. Many approaches have been proposed in many research papers with a view to provide better integration. In this paper, we provide an insight into some of the integration approaches that were investigated. Based on the review of some related literature we found that scrum and Extreme programming are the major agile methods adopted. Also communication between teams still needs an improvement. We recommend further studies on on-going projects and the ways to improve communication between teams in different geographical areas.

**Keywords**-Agile; usability; software development; software practices

### I. INTRODUCTION

In the recent years, software development industries witnessed the emergence of many methodologies aimed to address the shortcomings of traditional software life cycle. Agile method [1] is one of these methodologies that come across the interest of many researchers and practitioners. It was regarded as the most popular methodologies especially for small and medium software development companies [2]. This is because agile method can deliver software within short time with less cost.

To avoid end users frustration with the developed software, usability issues must not be ignored by software developers and must be integrated with agile methods. [3] Stated that usability focuses on how the customers or end-users would use the software. Mostly in practice, end users can quickly identify software usage problems. Many research papers attempt to integrate agile methods with usability.

Our research paper aims to provide an insight into how agile methods and usability integrate. Other sections of the paper are organized as follows: I Introduction, II review of related literature, III Agile and usability integration, IV Discussion and V Conclusion and Future works, VI Copyright.

### II. REVIEW OF RELATED LITERATURES

Agile software development focuses on interaction and incremental development where requirements and solutions develop through collaboration.

#### A. Agile methods

Agile software development methods [4] focus on interaction and incremental development where requirements and solutions develop through collaboration

##### 1) Scrum

Scrum [5] is an agile method which focuses on how people can overcome complex problems while producing high quality software products within specified time frame. It includes scrum team such as producer development team and scrum master. Scrum master must organize regular teams meeting between development teams. To make scrum better and simple, few development teams are required.

##### 2) Extreme Programming (XP)

Extreme programming depends on best practice to provide quality software. It considered as the most popularly and widely agile practices [6]. In extreme programming, programmers maintain a constant communication with various users of the products so that any useful observation made by them will be made effective. Also, the earlier version of software will be made available to customers so that useful changes would be made.

##### 3) Future Driven Development

Future driven development depends on interaction design to combine the model-driven (best practices) and agile development through certain process.

##### 4) Crystal Methodologies

Crystal methodology [7] is also another agile method where emphasis is made on team work communication to minimize bureaucracy issues that would arise. As a lightweight adaptable approach, it was consist of crystal clear, crystal yellow, crystal orange based on certain futures like team size and project priorities.

##### 5) Dynamic Software Development Method

Dynamic software development involves customers in software development by providing frequent software release. The customer will try the released version and provide suggestions or feedbacks about the products. Corrections would be made on the feedbacks before another test would be carried out.

##### 6) Kaban Software Development

Kaban [6] encourages using a good initiative to deliver software as early as possible but not making members so stressful. It is an incremental and evolutionary method that depends on principles such as start with what you do know,

agree to pursue improvement through evolutionary change as well as encourage acts of leadership at every level from the individual contributor to senior management.

## B. Usability Methods

### 1) Usability Inspection

Usability inspection [8], [9] was the most widely usability approach used apart from testing. For many years now, usability approaches practices comprise heuristic evaluation, cognitive walkthrough, formal usability inspections, and the pluralistic usability walkthrough. These were the most important usability inspection approaches [10] used by usability professionals. Cost-effectiveness is the factors that consider which approach to use. For example, Heuristic evaluation uses certain guidelines to examine usability problems is more cost effective than others

### 2) Usability Testing

Usability testing [11], [12] carried out by testing teams with a view to determine the performance of the software. Task coverage guides the testing teams to identify areas that need improvements. In agile software development project, users would be allowed to use the system and the usability expert [13] will look at whether the system satisfied users need.

### 3) Usability Inquiry

Usability inquiry comprises field observation, focus group, interviews and questionnaires. Usability professionals use field observation to observe the users and their work places with a view to determine how the users use the system to accomplish their tasks within a time frame. They can also interview users using questionnaires to obtain information [14], [15] on the areas that need modifications.

## III. AGILE AND USABILITY INTEGRATION

Many researchers in the fields of software development and human computer interaction [5], [16],[17] have in the recent time try to marriage their work by integrating usability[18], [19] with agile methods. This is mostly because of their interest satisfying customers or end users. For instance, [20], [21] provided detailed analysis on user-centered agile software development. The analysis focused mainly on certain principles found based on the review of different related literature [22], [23]. They suggest further investigation of their empirically.

[24] Identify the tensions between usability and agile methods. Even though the research is in preliminary stage, it identifies common approach of agile methods and usability engineering by so many literatures. There is need for the research to provide additional quantitative information to be more convincing.

Agile methods considered usability as implicitly rather than explicitly. This is because of their focused on communication and customer satisfaction. Adopting usability in agile methods explicitly can provide more benefits to software development companies' especially small and medium ones. Agile methods maintain constant customers' involvement in stages of software development processes [25] as such early customers' satisfaction would result.

The relationship between the practices of agile software development and usability engineering [8] [26] using

structured approaches to software engineering where usability engineering has been integrated into an agile software development method. The research need to be further improving to include best practice

In [27], a case study was provided on how agile methods integrate with usability in a large software projects. Three different companies involved in the IT projects under investigation, thus provide the opportunity for developers and usability experts to interact and communicate to users. At the end of the project analysis, they discovered five different tactics which have immensely contributed towards the integration of agile method with usability. These tactics cannot be suitable for a large IT project with many scrum teams as such it is good to have tactics with wider coverage. Also, even though it is a large IT pension project, the companies involve are relatively small not even medium considering the number of employees involved. They further recommend an investigation into how different teams can communicate in different geographical areas with a view to integrate agile methods with usability. On the other hand, their analysis was based on already completed IT project. Further analysis need to be on project that is undergoing instead of relying on case study.

[28] Considers the integration of agile methods and usability with the emphasis on ongoing project rather than relying on case study. Combining tools and process are the best way of achieving integration in three organizations considered for their studies. They collected the data at the work place. Participants' were selected from scrum teams which basically based in United Kingdom. Also based on their observation they discovered that acceptable behavior and mutual awareness are the keys to integrations.

Value and decision making assumptions [29] are the key areas that would help to integrate agile usability in practice. Their studies were also carried out in a live (on-going) IT projects that use scrum agile method. The conclusion that was drawn from the study indicates processes and techniques would not be the only alternative for usability and agile integration as such other alternatives must also be investigated. They suggest further investigation in area of contextual information.

[30] Also used case study to proposed how extreme programming (XP) can be integrated with usability. To solve geographical distance problem, they discovered that phone calls, video-conferencing [31] and by e-mails will be a good source. They also proposed additional approach to tackle the integration using five different instruments.

There is difficulty in integrating agile method with user experience [32] based on the analysis of interview result conducted in a telecommunication company. Their finding suggest that the roles of user experience professionals must be taking into consideration so as effective communication with developers. In addition to that, communications between teams in different geographical areas also serve as a setback. Their research paper also specifically focuses on case study.

Tiago Silva [33] conducted a field study to determine how the proposed framework would help in integrating agile with usability through theory and practices. They focused on on-going project to observed and interview professionals. At the end of their investigation, they found that there are no

collaboration software developers and usability experts though participates requirement meetings. The requirement meetings help them to understand some of the system functionality. In their suggestions, further studies need to be carried out in different companies with some projects that are undergoing.

#### IV. DISCUSSION

In [34], their study relied on case study obtained from the reviewed of previous researches. The papers mostly focused on small/medium/ large companies adopting either scrum or extreme programming (XP) in their analysis. Their study was based on experience reports obtained from these companies. Also, research into the integration of agile and usability are limited. Therefore additional researches need to be carried out to identify more areas that need to be integrated. [29] Studies were based on uncompleted project in medium software development companies. They conducted on two scrum teams and usability team. It was observed that both agile and usability teams focused on customers. Also the study only considered scrum teams which in practice cannot be possible to generalize the results. [32] Explores agile and usability practice of software developments in large telecommunication company. The studies were based on completed project that carried out by scrum teams with emphasis customer focused. Issues of either to go centralization or decentralization for usability remained unsolved in this study and therefore difficult to generalize the findings. Integrating extreme programming (XP) with usability within projects [32] creates value in software development practices. The study focused on few development team members that adopt extreme programming (XP) approach. Usability approach was based on heuristic and cognitive walkthrough methods of usability inspection. [3] Also adopt a case study approach to study the integration of agile and usability. In their study, they found that scrum and XP are the major agile methods used. It was

also found that usability inspection and inquiry play a major role in the integration. Both agile and usability focused on communication between development teams though the study is in preliminary stage. In [27] case study approach was adopted where usability and agile have been integrated in large company. The project also adopts scrum agile and usability inquiry methods with clear collaboration between them. The results of the investigation cannot be generalized because fewer individuals were involved. Also [20] investigate the integration in completed project that uses both scrum and usability inquiry.

#### V. CONCLUSION AND FUTURE WORK

In this paper, we provide an insight into agile and usability integration in software development practices. The major idea behind our paper is to provide the current and future direction of such integration. We review some related literature and the extensive comparisons demonstrate that it is still an open research area.

However, it is also showed that most of the studies depended on case study. The communication between teams in different geographical areas still needs to be addressed. From Table 1, we can see that most of the relationships were in the area of communications. The further work considers both case study and on-going projects. It will also see how to improve communication of team members in different geographical areas.

This paper presented review limited research papers on agile and user-centered. Thus, further research will consider more in-depth review on the topic.

#### ACKNOWLEDGMENT

The authors wish to acknowledge the support of the faculty of management science staffs, Abubakar Tafawa Balewa University (ATBU) Bauchi for advice and guidance towards making this research paper.

TABLE I. COMPARISION TABLE

Approaches Authors	Project study	Size of the company	Agile method	Usability method	Agile & usability relationship?	Limitations
1. Kurosu M. (2011)	Case study	Large	Scrum	Inquiry & inspection	Customer Focused	Generalization
2. Parsons, et al. (2007)	Case study	Large	Scrum & XP	Participatory design	User involvements	Limited research
3. Sohaib, et al. (2010)	Case study	Large/medium/small	Scrum/XP	Inquiry & inspection	communication	Preliminary study
4. Jennifer et al. (2012)	On-going	Small/medium	Scrum	Inquiry	Teams, process & tools arrangement	Generalization
5. Zahid et al. (2012)	Case study	Small	XP	Heuristic & Cognitive Walkthrough	Teams communication	No clear collaborations between teams
6. Adeola et al. (2014)	Case study	Large	Scrum	Inquiry	Collaboration	Generalization
7. Brhel, et al. (2015)	Case study	Small	Scrum	Usability inquiry (interview)	Teams communication	Based on completed projects
8. Zahid H. et al. (2009)	On-going	Large	Scrum	Low-Fidelity Prototyping	Teams communication	preliminary results
9. Fox et al. (2008)	Case study / On-going	Small	Scrum/XP	Inquiry	Collaboration	need broader empirical basis generalization

## REFERENCES

- [1] P. Abrahamsson, J. Warsta, M. T. Siponen, & J. Ronkainen, (2003, May). New directions on agile methods: a comparative analysis. In *Software Engineering*, 2003. Proceedings. 25th International Conference on (pp. 244-254). Ieee.
- [2] K. Beck, (2000). *Extreme programming explained: embrace change*. addison-wesley professional.
- [3] O. Sohaib, (2010). Integrating Usability Engineering and Agile Software Development :, 2(Iccda), 32–38.
- [4] G. S. Matharu, A. Mishra, H. Singh, & P. Upadhyay, (2015). Empirical study of agile software development methodologies: A comparative analysis. *ACM SIGSOFT Software Engineering Notes*, 40(1), 1-6.
- [5] K. Schwaber, & J. Sutherland, (2013). *The Scrum Guide*, July 2013. Scrum.org.
- [6] R. V. Anand, & M. Dinakaran, (2016). Popular Agile Methods in Software Development: Review and Analysis. *International Journal of Applied Engineering Research*, 11(5), 3433-3437
- [7] N. Sharma, & M. Wadhwa, (2015). eXSRUP: Hybrid Software Development Model Integrating Extreme Programming, Scrum & Rational Unified Process. *Indonesian Journal of Electrical Engineering and Computer Science*, 16(2), 377-388.
- [8] D. G. Novick, & T. Hollingsed, (2007). Usability inspection methods after 15 years of research and practice.
- [9] D. Wixon, (2003). Evaluating usability methods: why the current literature fails the practitioner. *interactions*, 10(4), 28-34.
- [10] M. Isomursu, A. Sirotkin, P. Voltti, & M. Halonen, (2012, August). User Experience Design Goes Agile in Lean Transformation--A Case Study. In *Agile Conference (AGILE)*, 2012 (pp. 1-10). IEEE.
- [11] G. Lindgaard, (2007). Usability Testing : What Have We Overlooked ?, 1415–1424.
- [12] D. Wixon, (2003). Evaluating usability methods: why the current literature fails the practitioner. *interactions*, 10(4), 28-34.
- [13] T. P. Thyvalikakath, V. Monaco, H. Thambuganipalle, & T. Schleyer, (2009). Comparative study of heuristic evaluation and usability testing methods. *Studies in health technology and informatics*, 143, 322.
- [14] T. Jokela, & P. Abrahamsson, (2004, April). Usability assessment of an extreme programming project: Close co-operation with the customer does not equal to good usability. In *International Conference on Product Focused Software Process Improvement* (pp. 393-407). Springer Berlin Heidelberg.
- [15] Z. Hussain, H. Milchrahm, S. Shahzad, W. Slany, M. Umgeher, T. Vlk, ... & P. Wolkerstorfer, (2012, January). Practical usability in xp software development processes. In *The Fifth International Conference on Advances in computer Human Interactions, ACHI* (Vol. 2012).
- [16] A. Seffah, M. C. Desmarais, & E. Metzker, (2005). HCI, usability and software engineering integration: present and future. In *Human-Centered Software Engineering—Integrating Usability in the Software Development Lifecycle* (pp. 37-57). Springer Netherlands.
- [17] D. Parsons, M. Lange, & M. Lange, (2007). *Software Development Methodologies , Agile Development and Usability Engineering*.
- [18] D. Fox, J. Sillito, & F. Maurer, (2008, August). Agile methods and user-centered design: How these two methodologies are being successfully integrated in industry. In *Agile, 2008. AGILE'08. Conference* (pp. 63-72). IEEE.
- [19] Z. Hussain, W. Slany, & A. Holzinger, (2009, November). Current state of agile user-centered design: A survey. In *Symposium of the Austrian HCI and Usability Engineering Group* (pp. 416-427). Springer Berlin Heidelberg.
- [20] M. Brhel, H. Meth, & A. Maedcher, (2015). Exploring principles of user-centered agile software development: A. *Information and Software Technology*, 61(C), 163-181.
- [21] D. Salah, R. Paige, & P. Cairns, (2014, September). A practitioner perspective on integrating agile and user centred design. In *Proceedings of the 28th International BCS Human Computer Interaction Conference on HCI 2014-Sand, Sea and Sky-Holiday HCI* (pp. 100-109). BCS.
- [22] A. Seffah, J. Gulliksen, & M. C. Desmarais, (Eds.). (2005). *Human-Centered Software Engineering-Integrating Usability in the Software Development Lifecycle* (Vol. 8). Springer Science & Business Media.
- [23] A. Sharma, (2016). A review of agile methodology in software development, 1325–1329.
- [24] E. Tensions, B. Usability, & A. S. Development, (n.d.). *Towards Extremely Usable Software Exploring Tensions between Usability Plan*.
- [25] Å. Cajander, M. Larusdottir, J. Gulliksen.: Existing but not explicit - the user perspective in scrum projects in practice. In: Kotzé, P., Marsden, G., Lindgaard, G., Wesson, J., Winckler, M. (eds.) *INTERACT 2013, Part III. LNCS*, vol. 8119, pp. 762–779. Springer, Heidelberg (2013)
- [26] C. Salvador, A. Nakasone, & J. A. Pow-Sang, (2014, April). A systematic review of usability techniques in agile methodologies. In *Proceedings of the 7th Euro American Conference on Telematics and Information Systems* (p. 17). ACM.
- [27] A. Y. Wale-kolade, (2015). The Journal of Systems and Software Integrating usability work into a large inter-organisational agile development project: Tactics developed by usability designers. *The Journal of Systems & Software*, 100, 54–66. <http://doi.org/10.1016/j.jss.2014.10.036>
- [28] A. I. Adamu, T. Mantoro, S. A. Muhammad, “Dynamic Interactive 3D Mobile Navigation Aid”, *International Journal of Theoretical and Applied Information Technology (JATIT)*, vol. 37, no. 2, pp. 159 – 171. 2012..
- [29] J. Ferreira, H. Sharp, & H. Robinson, (2010, June). Values and assumptions shaping agile development and user experience design in practice. In *International Conference on Agile Software Development* (pp. 178-183). Springer Berlin Heidelberg.
- [30] S. R. Humayoun, Y. Dubinsky, & T. Catarci, (2011, July). A three-fold integration framework to incorporate user-centered design into agile software development. In *International Conference on Human Centered Design* (pp. 55-64). Springer Berlin Heidelberg.
- [31] Z. Hussain, H. Milchrahm, S. Shahzad, W. Slany, M. Tscheligi, & P. Wolkerstorfer, (2009, May). Integration of extreme programming and user-centered design: Lessons learned. In *International Conference on Agile Processes and Extreme Programming in Software Engineering* (pp. 174-179). Springer Berlin Heidelberg.
- [32] M. Kurosu, (2011). *Human Centered Design: Second International Conference, HCD 2011, Held as Part of HCI International 2011, Orlando, FL, USA, July 9-14, 2011, Proceedings* (Vol. 6776). Springer Science & Business Media.
- [33] T. S. Da Silva, M. S. Silveira, F. Maurer, & T. Hellmann, (2012). User experience design and agile development: From theory to practice. *Journal of Software Engineering and Applications*, 5(10), 743.
- [34] K. N. Rao, G. K. Naidu, & P. Chakka, (2011). A Study of the Agile Software Development Methods , Applicability and Implications in Industry, 5(2), 35–46.