The Development of Interview Protocol to Explore Hybrid Agile Software Development Phases

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ABSTRACT

Agile practices are a development approach based on agile manifestos that value individuals and interactions, working software, customer collaboration and responding to change. Recently, Software Engineering (SE) team is combining agile with non-agile development approaches, which lead to hybrid agile. Hybrid agile is a mixture of a plan-driven development approach and agile practices. Hybrid agile has gained the interest of software engineering team as one of the development approaches for recent software development projects. However, there are uncertainties of security measures of hybrid agile. Therefore, the security strategies of a software project developed based on hybrid agile needs further investigations. This research is a proportion of a study on hybrid agile, in which this research focuses on the development of the data collection instrument to study hybrid agile. This research explores the development and validation of an interview protocol that will be the instrument for studying the hybrid agile approaches and methods implemented by the Software Engineering team and discovering the security strategies taken to ensure reliable software will be deployed to the end-users. This paper will discuss the questions designed for research, which involves the development of the interview protocol. This paper also explains the validation process and reliability examination of the interview protocol to ensure the interview protocol is reliable for the actual data collection process from the identified sample population

Key words : hybrid agile, security, software development lifecycle, interview protocol

1. INTRODUCTION

A software development lifecycle (SDLC) is a sequence of development phases that produce working software. Some examples of a SDLC model are Waterfall, Spiral, Unified Process and Verification and Validation (V-Model). Also, Waterfall is one of the oldest traditional models of a software development lifecycle [1]. However, along with the trend of computer technology and the size of a software project, a new development approach was introduced by Agile Alliances, the method is called Agile. Agile is a development approach based on four agile manifestoes and guided by twelve agile principles [2]. Since then, agile has been implemented by the software engineering team. Nevertheless, the current software engineering team has slowly chosen the hybrid agile. Hybrid agile itself is a combination of a plan-driven approach with an agile development approach [3].

This research is a part of a study investigating the hybrid agile implementation by the software engineering team and exploring the agile software engineering team's security strategies to ensure the software develops using hybrid agile is testable, reliable and maintainable. This study's big picture is to explore the software development lifecycle models implemented by a software engineering team that lead to the hybrid agile and investigate to what extent hybrid agile considers the security strategies in the development phases before end product deployment. Thus, to answer the questions and align with the research context, a qualitative research approach is adopted, and an interview is chosen as the data collection method.

The main focus of this paper is to describe the development of interview questions and the design of the interview protocol which will be used as the instrument to explore the agile development methods and approaches that lead to the hybrid agile and also the security strategies taken. Additionally, this research elaborates on the validation of the interview protocol. The main concern of this research is to ensure the data that will be collected using the interview protocol is reliable, valid, and answering the research questions. Therefore, the designed interview protocol is reviewed by an expert before the interview pilot test. Moreover, this research will probe further on the construction of interview questions, the pilot test design, and the outcomes.

2. RELATED WORK

This section discusses the literature related to interview protocol, agile development approach, hybrid agile and security in agile methodology.

2.1 Interview Protocol

An interview is one of the qualitative study data collection approaches. An interview allows researchers to explore the details and understand the experiences, motives, and opinions of others to see the world from the respondents' perspective [4]. Interviews are particularly useful for getting the story behind participants' experiences [5]. This research uses the interview to explore the details, experiences, and opinions of the software engineering team who have been implementing the hybrid agile development approach and gather in-depth information from the interviewee on each project's security strategies. Additionally, interviewing appear to be the most popular forms of ethnographic data collection [6]. Moreover, an interview's advantage allows the researcher to do a follow-up to certain respondents to further investigate their responses. Thus, if further clarification needs from the respondents of the interviews, the respondents can be contacted.

One interview type is the standardized open-ended interview. The standardized open-ended interview is extremely structured in terms of the wording of the questions, and participants are always asked identical questions. Still, the questions are worded to open-ended responses. This open-ended question format allows the participants to contribute as much detailed information as they desire. It also allows the researcher to ask probing questions as a means of follow-up. Moreover, standardized open-ended interviews are likely the most popular form of interviewing utilized in research studies because of the nature of the open-ended questions, allowing the participants to express their viewpoints and experiences [7].

In addition, an interview protocol needs to be designed before any interview is conducted. An interview protocol is one of the crucial instruments to facilitate an interview session. Interview protocol is a script in which an interviewer reads and questions and records the answers [5].

2.2 Agile Development Approach

Agile was founded in 2001 based on the idea of a group of Agile founders known as the Agile Alliance [8]. Since then, Agile has been growing as one of the development techniques or approaches implement by software engineering teams. Sprint, user stories, Scrum, eXtreme Programming (XP), Lean, and Kanban are among agile development techniques and approaches widely used [7]. Each of the approaches, techniques or methods of agile are based on twelve principles of Agile Manifesto. Agile Manifesto promotes: i) Individuals and interactions over processes and tools, ii) Working software over comprehensive documentation, iii) Customer collaboration over contract negotiation, and iv) Responding to change over following a plan.

Narrowing to research related to agile implementation, Jorgensen [9] surveyed a sample of the population of Norwegian software professionals on the relationship between agile, size of project and project performance. The study indicated that one of the success factors between software development with the relationship between a project and agile practice is the competent providers (software professionals) and clients. The finding aligns with the agile manifesto one, which promotes individual interaction and collaboration in a software project.

Additionally, the main goal of Agile is to deliver working software frequently in a shorter timescale [2]. Yet again, VersionOne [7] found that Agile accelerates software delivery at 78% and positively recorded 98% of the project with Agile is successfully executed. Although agile has proven successful in delivering a successful project, it seems nowadays; software process team has started venturing into a hybrid agile. Figure 1 detailed the agile approaches, methods and techniques implemented by the respondent of a survey. It shows that 54% of the existing project uses Scrum, followed by around 24% of the software project adopted hybrid agile, which shows that the hybrid agile is second after Scrum.
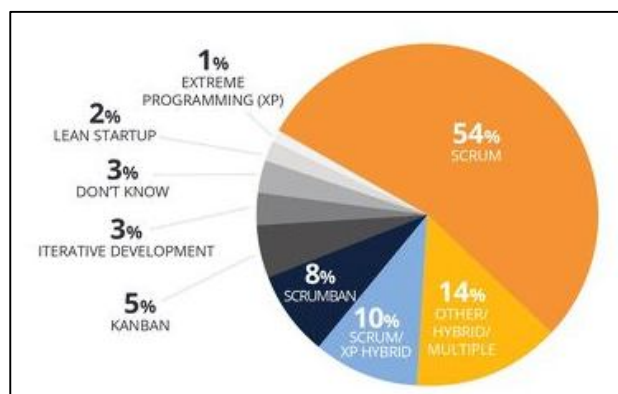

Figure 1: Agile Methodology Used [10]

2.3 Hybrid Agile Development Approach

Hybrid agile is a combination of plan-driven development approaches and an agile process model that consider the internal and external aspects of software [3, 10]. Similarly, Cooper and Sommer [11] defined hybrid agile as a combination of agile development approach like Scrum, eXtreme Programming with a more traditional development model like Waterfall, Spiral, or V-Model. Much the same Alliances [2] in Figure 2 represents the definition of hybrid agile in a diagram as the combination of plan-driven development approach with agile methodology, and it is executed incrementally and iteratively along with the relationship between degrees of change of a software project with the frequency of the project delivery.
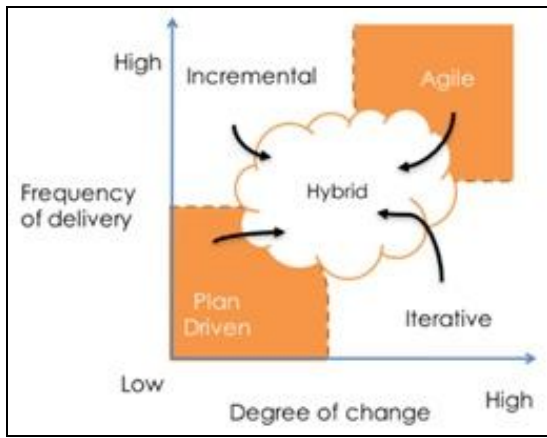
Figure 2: Degree of Change on Agile Approaches [2]

2.4 Hybrid agile implementation in a software project

Focusing on projects using hybrid agile, Lom, Pribyl [12] researched smart cities procurement systems. The system adopted a hybrid agile by combining agile principles with the Systems Engineering Management Plan (SEMP) principles. Systems Engineering Management Plan (SEMP) is the key document covering the activities, milestones, organization, and resource requirements necessary to ensure the system-of-interest accomplishes its intended goals and mission [13]. Wherein the implementation of SEMP is tailor to the need for a particular project. SEMP focuses on a technical plan of a project and systems engineering processes to provide detailed information on the processes, deliverables, roles, and quality gateways for the smart cities procurement project. Figure 3 depicts the glance of the V-model of a SEMP framework, which focuses on activities of a software project, including the requirements gathering. In that research, Lom, Pribyl [12] proposed Hybrid Agile Methodology (HAM) to guide how a smart municipality employee can improve the development process with smart cities. The HAM is illustrated in Figure 4, and amazingly, the combination of Agile and SEMP shows a smart working city procurement system.
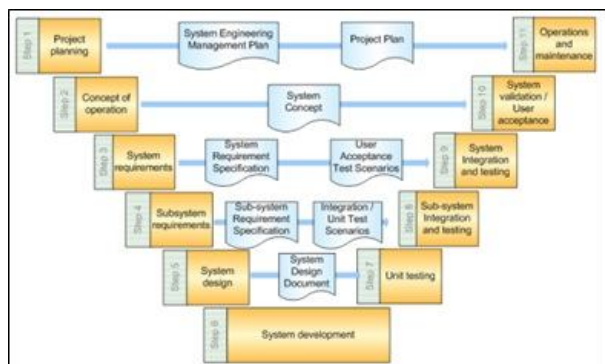

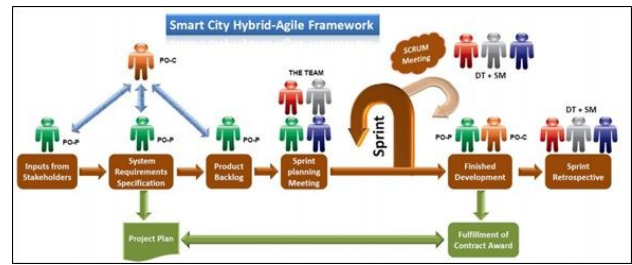**Figure 3:** Systems Engineering Management Plan (SEMP) Framework [12]

Figure 4: Smart City Hybrid-Agile Framework [12]

Sultana, Motla [14] experimented comparing hybrid agile with Scrum. In their experiment, two software engineering teams are given a similar weightage project with one team to develop using Scrum and another team to develop the project based on their proposed hybrid agile, as shown in Figure 5. The researcher stated that each agile approaches have its strength and flaws. Scrum aids to increase the productivity of a team, eXtreme Programming (XP) practices improve the quality of the code, and Dynamic Systems Development Method (DSDM) enhances the productivity and maintenance of the project. Considering Scrum, XP, and DSDM together provides a good place to develop technical excellence and engineering practice project. Thus, a hybrid agile model is proposed by Sultana, Motla [14] as illustrated in Figure 5. Figure 5 shows the combination of management practices, engineering practices, testing and quality assurance practices and productivity and maintenance practices to provides all core practices that must be followed to develop quality software. The findings from their case study and the comparison reveal that their proposed hybrid model is suitable for the industry to build quality software within budget and time.
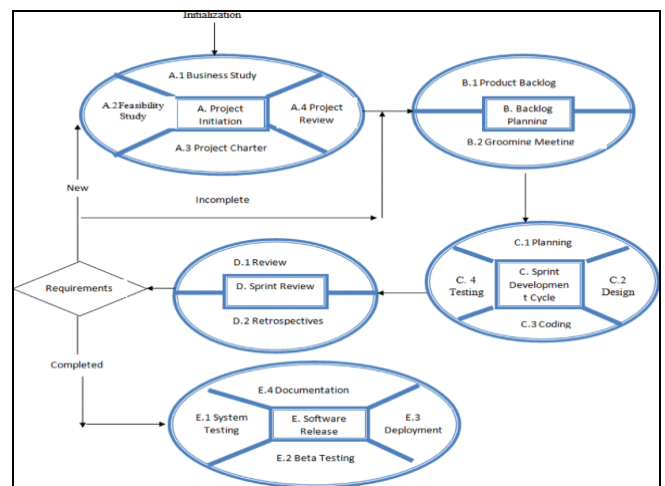

Figure 5: Propose Hybrid Model [14]

2.5 Security on Agile Methodologies

Moyon, Beckers [15] proposed a method for achieving continuous and secure development by mapping the

requirements of security standards into an agile process model. The method proposed by Moyon, Beckers [15] comprises a process model of extended Scaled Agile Framework (SAFe) elements and comply with the requirements of IEC 62443-4-1. SAFe is a scaling framework in agile that incorporates practices from Scrum, Extreme Programming, Kanban and Lean with the core value to build in quality, transparency, alignment and program execution [16]. Significantly, the preliminary results of [15] with a subset of both standards (SAFe and IEC 62443-4-1) show that practitioners find that the extended process to achieve continuous and secure development is intuitive, precise, and suitable for being applied in their intended environment.

While Poller, Kocksch [17] stated that Scrum and a security initiative are still maturing. Poller, Kocksch [17] studied how security consultancy affected organizational routines in a software development group. Poller, Kocksch [17] also reported that security consultants tested their product, reported vulnerabilities and delivered security training. As a result of the consultancy, stakeholders improved their understanding of security issues but could not effect a change of routines within the given organizational structure. Poller, Kocksch [17] conclude that security work did not attract more engagement in the software engineering process. Ultimately, security work remained a reactive, unguided activity mostly dependent on the unsystematic actions of individual developers. Despite Agile ability to release products on time [18], it also hinders the team from dealing appropriately with every system's critical aspect, which is information security. Maria, Rodrigues Jr [18]introduced a safe, agile development model, which added for the traditional Scrum a Secure Project technique. They mapped the Risk Analysis process, and the outcome was possible to deliver a security software release.

3. RESEARCH METHOD

3.1 Phases of Interview Protocol Development

Qualitative research is chosen as the approach for data collection also for data analyses to study the hybrid agile and the security strategies taken by a software engineering team. To be more specific, an interview is selected as the method of data collection. An interview is a technique to collect data from respondents despite their nationality, occupation, sex, or other variables. The flow of interview protocol development consists of the design, development, and conduct of the interview is presented in Figure 6. The first process is the development of interview questions. The questions are developed based on the suggestion by Corbin and Strauss [19], in which the questions developed would answer the research questions and containing the inquiries that are aligned with the objective not only to gather information but also to focus on the actions such as asking, doing, and locating. The set of questions was identified and developed to answer the research question to identify the software development lifecycle models used by the software

engineering team and to understand the security strategies taken since day zero of a project until it is deployed. The questions were designed based on McNamara [5], and the wording of the questions is intended to be open-ended, neutral, only one question at one time, and observed the cause-effect statement. Not forgetting the sequence of the question also based on McNamara [5]. Once the questions were identified and developed, the second step is the development of the interview protocol.

The interview protocol was developed based on a suggestion by [6, 20, 21]. The interview protocol will be used as the main script in each actual interview session. In the third step, the interview protocol is hand-over to experts for review. The peer review/examination is the process of discussion regarding the process of study, congruency of the findings with the raw data, and tentative interpretation [22]. Based on the expert review, a few changes have to be made, especially on the questions' clarity and wordings. The updated interview protocol is then pilot tested. Lastly, the pilot test was conducted with a practitioner who has been involved in a software project with more than ten years experience
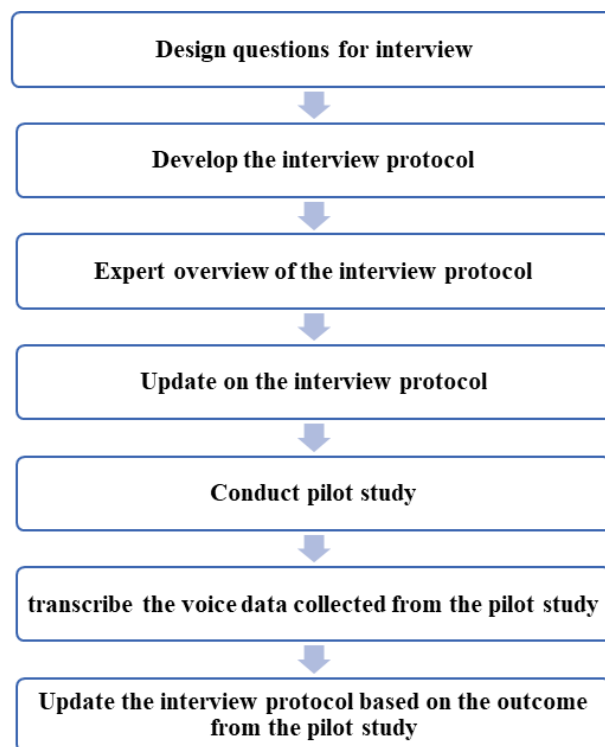

Figure 6. Phases of Interview Protocol Development and Validation

4. RESULTS

4.1 Interview Protocol

The interview protocol consists of four sections. The first section comprises an introductory protocol, which explains how the interview will be conducted and includes a brief

description of the objective of the interview. The introductory part is essential in an interview protocol. The introductory gives a quick idea of the whole interview session to the participants, also crucial to build rapport between interviewer and interviewees. Nevertheless, interview protocol introductory useful to please the respondents that all their responses will be treated confidentially. Following is the statement in the introductory part that assurances that the interview is privy, all facts, information, details and every element in this interview will be treated confidentially and none interviewees details and the company the interviewees attached will be exposed to the public. For the reporting, the interviewees' details and the organization/company his/her attached to will not directly reveal.

The second section consists of questions on Agile and hybrid agile. The second section aims to identify the Agile practice or approaches and the plan-driven development approaches implemented by the software engineering team in a software project. In the second section, the questions begin with the query on the Agile framework, model, approach, or technique implemented by the respondents, then slowly exploring the plan-driven development approach and finally focusing on how hybrid agile is implemented. Following is the content of Question 2 in the interview protocol.

Question 1

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Question 2

In a software project, a software engineering team will follow certain development phases like requirements gathering, analysis and design, coding, testing, and project deployment.

i) Could you please **explain the development phases** *of* _____ *[mention the model that the respondent mentioned in question number 1(i)] model/framework/approach/method?*

ii) **How** *do you implement the* _____ *[mention the phases that the interviewee answered in question (i) above] phase.*

iii) **When** *do you implement the* _____ *[mention the phases that the interviewee answered in question (ii) above, relate the phases] ?*

iv) Which project development phase is crucial to execute?

    a) **Which** *development* **phase is important***? Will it be on the design, coding, testing or some other phases?*

    b) *Do your* **priorities change** *when a* **deadline** *approaches?*

        [If the answer is **YES***, ask this question:]*

        1. *Is there any reschedule being enforced?*

        2. *How are the changes is being implemented?*

        [If the answer is NO, ask this question:]

        1. **Why** *are the priorities* **not being changed***, although the deadline is approaching?*

v)**Do you combine** *the* _____ *[mention the models that the interviewee implement] model* **with any other development model** *such as* **Waterfall,** Spiral or any other SDLC in a software project?

Based on Question 2 above, the section starts with question one(i), which focuses on getting the framework, model, approach, technique that the respondents implement in their projects. The responses by the respondents in Question 1 will be used by the interviewer in question Question 2 as presented above.

Thus, the interview protocol needs the interviewer to grasp the respondents' responses and to intertwine with other questions. Lastly, is the question (v) in question number two

in section two queries on the model implemented by the respondents besides their answer in bullet (i), (ii) and (iii).

Section three is to explore the security strategies or security measures taken in a software project. To be more specific, section three enquiries on the security measures, methods, techniques, models or frameworks implemented by the software engineering team in their project. Thus, the questions meant to understand how and in which software project phases the security strategies are implemented. While the last section, section four is the conclusion, wherein the interviewer requests for the suggestion of documents, source code, or materials that researchers may access to understand better hybrid agile and security strategies implemented by practitioners.

A pilot study was conducted, and the session is voice recorded and then transcribed. Based on the pilot interview, few sentences need to be revised and rewrite to suit the general overview of practitioners. Align with the findings from the pilot interview, a diagram is added in section three of the interview protocol to minimize the misinterpretation in development phases and security strategies, which has been taught in the university academic syllabus; however, the terms are bewildered to some practitioners. Furthermore, the request for documents, source code, or materials, as stated in section four is deleted since it creates an uncomfortable ambience in the interview sessions. Moreover, participants prefer not to share the materials due to privacy and confidential issues.

5. CONCLUSION

As mentioned earlier, this research is a part of a study to investigate the hybrid agile implementation by the software engineering team. Also, to explore the security strategies taken by a software engineering team to ensure the software develops using hybrid agile is testable, reliable and maintainable. Thus, to execute the research, the interview is selected as the data collection instrument. One of the critical phases is the interview protocol development and to make sure that each question designed is answering the research questions. Thus, there are procedures, steps and rules that need to be observed and trailed to create relevant interview questions and to develop the interview protocol.

Additionally, the questions and the designed interview protocol reviewed by an expert and later was pilot tested. The pilot test is conducted to check for the reliability of the interview protocol. Positively, the pilot interview outcome indicated that two changes need to be made, which require a diagram to be added and the need to delete one question in section three. The diagram is necessary to be added since it helps the participants have a clearer picture of the whole idea of the questions in section three. Besides the two amendments that need to be made: i) add a diagram and ii) delete the

suggestion on documents, source code or materials, the findings from the pilot test indicated that each of the questions developed is well described and explains. It is in line with Merriam and Tisdell [22] suggestion whereby the question needs to be revised by an expert, and the designed question have to be informative and well-described. Finally, the interview protocol will be used in the data collection to answer the hybrid agile implementation by the software engineering team also to explore the security strategies taken by the software engineering team in a software project.

REFERENCES

[1]   Everett, G.D. and R. McLeod Jr, **Software Testing: testing across the entire software development life cycle**. Published by the John Wiley & Sons, 2007.

[2]   Alliances, A., **12 Principles Behind the Agile Manifesto,** 2019, available at https://www.agilealliance.org/agile101/12-principles-behind-the-agile-manifesto/.

[3]   Rahim, M.S., et al., "**ScrumFall: A Hybrid Software Process Model"**. International Journal of Information Technology and Computer Science Vol 10, PP. 41- 48, 2018.

[4]   Rubin, H.J. and I.S. Rubin, **Qualitative interviewing: The art of hearing data.** Published by the Sage, 2011.

[5]   McNamara, C., **General Guidelines for Conducting Interviews,** 2017, available at http://managementhelp.org/businessresearch/interviews.htm.

[6]   Creswell, J.W. and C.N. Poth, **Qualitative Inquiry and Research Design: Choosing Among Five Approaches**. Published by the Sage Publication, 2016.

[7]   VersionOne. **12th State of Agile State**, 2018, available at https://www.stateofagile.com/?UTM_CAMPAIGN=SOA&UTM_SOURCE=PRESSRELEASE&UTM_MEDIUM=SOCIALWWW.STATEOFAGILE.COM#ufh-i-423641583-12th-annual-state-of-agile-report/473508.

[8]   Beck, K., Beedle, M., Van Bennekum, A., Cockburn, A., Cunningham, W., Fowler, M, G. J., Highsmith, J., Hunt, A. & Jeffries, R., "**Manifesto for agile software development**", 2001.

[9]   Jorgensen, M., "**Relationships between project size, agile practices, and successful software development: results and analysis",** IEEE Software, 36(2), PP. 39-43, 2019.

[10] Schuh, G., Rebentisch, E., Riesener, M., Diels, F., Dölle, C., & Eich, S., "**Agile-waterfall hybrid product development in the manufacturing industry - Introducing guidelines for implementation of parallel use of the two models**", IEEE International Conference on Industrial Engineering and Engineering Management, 2018.

[11] Cooper, R.G. and A.F. Sommer, "**The agile–stage☐gate hybrid model: a promising new approach and a new research opportunity**", Journal of Product Innovation Management, **33**(5), PP. 513-526, 2016.

[12] Lom, M., O. Pribyl, and T. Zelinka. "**Hybrid-Agile Approach in Smart Cities Procurement. in Paper accepted for presentation**", The 20th World Multi-Conference on Systemics, Cybernetics and Informatics: WMSCI ,2016.

[13] Board, B.E., **The Guide to the Systems Engineering Body of Knowledge (SEBoK)**, 2017.

[14] Sultana, S., Motla, Y.H., Asghar, S., Jamal, M., & Azad, R., **A hybrid model by integrating agile practices for pakistani software industry**. International Conference on Electronics, Communications and Computers (CONIELECOMP) IEEE, 2014.

[15] Moyon, F., Beckers, K., Klepper, S., Lachberger, P., & Bruegge, B., **Towards continuous security compliance in agile software development at scale**. IEEE/ACM 4th International Workshop on Rapid Continuous Software Engineering (RCoSE), 2018.

[16] Putta, A., M. Paasivaara, and C. Lassenius. "**Benefits and challenges of adopting the scaled agile framework (SAFe): preliminary results from a multivocal literature review**", International Conference on Product-Focused Software Process Improvement, Springer, 2018.

[17] Poller, A., Kocksch, L., Türpe, S., Epp, F.A., & Kinder-Kurlanda, K, "**Can security become a routine? A study of organizational change in an agile software development group**". ACM conference on computer supported cooperative work and social computing, 2017.

[18] Maria, R.E., L.A. Rodrigues Jr, and Pinto, N.A., "**ScrumS: a model for safe agile development**", Proceedings of the 7th International Conference on Management of computational and collective intElligence in Digital EcoSystems, 2015.

[19] Corbin, J. and A. Strauss, **Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory**. Published at the Sage publications, 2014.

[20] Jacob, S.A. and Furgerson, S.P., "**Writing interview protocols and conducting interviews: Tips for students new to the field of qualitative research**". Qualitative Report, 17, PP 6, 2012.

[21] Castillo-Montoya, M., "**Preparing for Interview Research: The Interview Protocol Refinement Framework**." Qualitative Report 21(5), 2016.

[22] Merriam, S.B. and Tisdell, E.J., **Qualitative research: A Guide to Design and Implementation**. Published at the John Wiley & Sons, 2015.