

# A Review on the Methods of Evaluating the New Approaches Proposed in the Agile Context

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**Abstract**—In the recent years, Agile is being one of the emerging technologies adopted by numerous organizations. The Agile technology has not obtained an extensive acceptance in the software development organizations (SDOs), but it is also being broadly employed in different fields and environments. Accordingly, new approaches have been proposed by researchers and practitioners based on the Agile context, however, there is scarce and – sometimes - absence of describing the evaluation process of these approaches. Therefore, this paper reports the findings of an extensive literature search on how the new proposed approaches are being evaluated. The narrative review methodology was employed to criticize and summarize a body of literature retrieved from various scientific sources. The results reveal that there are various methods used for evaluating the proposed Agile approaches. Nevertheless, this review focuses on explaining the five common methods, which are: (1) case study, (2) survey, (3) interview, (3) focus group, and (5) expert review. Thereafter, the authors discuss the key findings and highlight directions for future researches. This study tends to help researchers and practitioners to select the suitable evaluation methods when constructing new Agile approaches.

**Keywords**-Agile methods; evaluation, new approach; review; software engineering

## I. INTRODUCTION

In software engineering (SE), a software development method is defined as “a splitting of software development work into distinct phases containing activities with the intent of better planning and management” [1]. However, even by applying the existing project management methods, such projects often failed to be delivered on time and within budget. Therefore, several methods have been established for developing software projects since the inception of information technology (IT). These include traditional methods, such as waterfall, which have distinct phases, and Agile methods, which define an iteration process that allows designing, constructing, and deploying different parts of software simultaneously [2].

Recently, Agile is being one of the emerging technologies adopted by numerous companies particularly in the software

development organizations (SDOs). This is because Agile has several characteristics and distinguished features compared to the traditional approaches [3]. According to the Global Project Management [4] survey, 71% of the participating organizations report greater agility over the last five years signifying that agility is recognized in helping them to remain competitive. Moreover, according to the survey [5], the most organizations (97%) practice Agile methods. In another survey, 60% of the IT professionals use Agile methods, whilst 38% use the combination of Agile and other methods as stated in Interop ITX Research Report [6]

Bhatt, et al. [7] claimed that healthcare organization should be Agile in order to provide the best healthcare services to the patient with cost optimization. Mainly, Agile methods have been implemented in different fields, such as engineering, medicine, banking, and manufacturing [8]. Nawaz and Gomes [9] stated that organizations adopt the Agile methods to move quickly and respond to market needs and services. Hence, Agile methods are being used extensively in different project sizes and environments, rather than focusing only on the primary intended scope [10]. Accordingly, alternative approaches of Agile methods have been developed, enhanced, and integrated with other methods in order to support the increased demand of various project environments [11][12]. In this study, the term “approach” refers to any proposed model, method, methodology, framework, or technique in the Agile context.

The existing studies proposed new Agile approaches only focus on their development stages. However, these studies did not describe how proposed approaches are being evaluated [10] although the evaluation process is an essential stage in establishing a new approach as claimed by Silva, et al. [13]. For example, a theoretical framework has been established by Alaidaros, et al. [14] to improve the progress monitoring task of the Agile Kanban method. Nonetheless, authors acknowledged that this framework still needs an extended study for further enhancement, in which its potential evaluation dimensions should be examined and appended to the proposed framework. Hence, the current study aims at reviewing the methods used to evaluate the new proposed Agile approaches.

The reminder of this paper is structured so the following section (section II) explains the research methodology followed to accomplish the study aim. After that, section III presents explanation about the literature of the most methods used for evaluating the new approaches proposed in the Agile context. Then, the study findings are discussed and analysed in section IV. Finally, conclusion, limitations, and insights for future researches are given in the final section.

## II. METHODOLOGY

In doing a research, methodology is the most important stage to come out with a good and useful study. A methodology is defined as a set of principles, activities, and procedures, which guide the researcher, manager, and practitioner to select a suitable method to a particular study [15]. The methodology addresses all required procedures that are taken to answer the research questions and accomplish the research objectives.

The main aim of this study is to explore how well proposed Agile approaches by SE researches and practitioners are evaluated. As part of this work, we aimed to answer the following research question: What are the methods used to evaluate the new approaches proposed in the Agile context? Therefore, the relevant literature has been reviewed in order to gain insights and ideas about the current problem [16], as the literature is rife with gaps which require more in-depth investigation [17].

This study adapted the narrative review methodology, which is employed to criticize and summarize a body of literature, and then draws a conclusion of research topics. In addition, the narrative review synthesizes the current literature to focus on a subset of information, in which different sources are used and thus this review goes beyond the more rigid systematic review [18]. Fig.1 shows the three procedures followed to achieve this study objective. The procedures are: (1) Review the literature, (2) Identify the related literature, and (3) Analyse and discuss the findings.

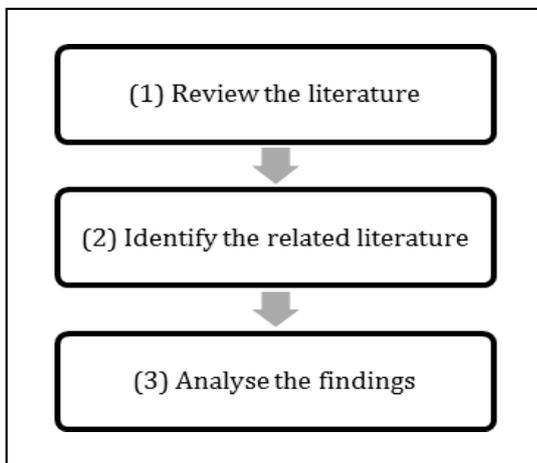


Figure 1. Study procedures

In the first procedure, the literature survey method was used to extensively explore the related works and relevant studies. Machi and McEvoy [19] confirm that this method is used to collect main ideas and information through revision of the related journals, proceeding papers, books, thesis, blogs, and reports. Secondly, the retrieved literatures were skimmed through to understand and identify if the literature is related to the field of research. In this procedure, a qualitative analysis for the retrieved literatures was conducted in order to answer the above research question. The qualitative analysis is an appropriate approach used to enable researchers understanding and investigating the topic in depth and in greater details. It involves analysing and interpreting texts and interviews to discover patterns seeking to describe a specific issue [20]. The content analysis technique was used to explain the research findings, whereby the results of literature review were identified, coded, and categorized into primary patterns [21]. The final procedure was carried out to discuss the findings and highlight its major implication to the body of knowledge. Subsequently, future directions were also identified based on the knowledge gained from this study.

## III. RESULTS

There are various methods used for evaluating the proposed Agile approaches. This review is limited to explain the five common methods, which are: (1) case study, (2) survey, (3) interview, (3) focus group, and (5) expert review. The popularity of these methods is evidenced from a recent systematic literature review conducted by Alaidaros, et al. [10]. These five methods are subsequently described by providing their objectives and illustrating the appropriate types of questions to be best addressed.

### A. Case Study

The case study method is an empirical inquiry involving a study of a case within a real-life, contemporary context or setting [22]. Case study offers deep understanding of the existence of certain phenomena and reveals the mechanisms of the cause-effect relationships occurrence [23]. In this vein, Yin [24] stated that a case study research is used when a researcher wants to understand a real-world case and when such understanding is likely to involve important contextual conditions pertinent to the case. In this method, qualitative data are usually collected using interview, observations, or group discussions. It plays a central role, and offers rich insights into the case. Data collection is always performed with respect to a well-defined unit of analysis. In the SE research, the unit of analysis might be a company, a project, a team, an individual developer, a particular episode or event, a specific work product, and others. A case study can be used to practically validate a tool, method, or model in SDOs [23, 25].

Altarawneh [26] indicated that the case study method is often used as a plain working example of a newly proposed approach that is applied to a limited number of respondents. The participants in a case study can be a small team consists of at least two members. The team with a small number of members helps in enhancing interpersonal communication

skills [27] as well as being highly efficient [28]. Therefore, the two members of a team participated in a case study would be an adequate number for achieving valid and reliable results of the evaluation.

### *B. Survey*

Survey is a retrospective study of a situation that investigates relationships and outcomes from a large scale of population or individuals. According to Sekaran and Bougie [29], survey is a useful and powerful method that is commonly used to measure opinions and awareness. Although most closely associated with the use of questionnaires for data collection, survey can also be conducted by using structured interviews or data logging techniques. Survey is particularly well-suited to studies that are conducted to answer what, how much, and how many questions [23, 25]. Currently, an online survey is being widely adopted as it is an optimal approach used for collecting data from a large international dependences [30]. Pahurkar, et al. [31] indicated that data that is collected through the online survey study can increase its sample size.

### *C. Interview*

The interview method is used to collect primary data by interviewing a number of respondents about existing facts and their opinions. It provides a thorough information on a certain situation. The interview is time saving method in which the interviewees provide their answers based on the questions asked [22, 32]. A semi-structured interview is a technique commonly used in conducting an interview method because it allows the interviewer to be prepared and appeared competent during the interview session. It also offers interviewees the freedom to express their insights without primness [33]. The semi-structured interview provides comparable and reliable qualitative data [34]. Furthermore, the interview method is used for the data collection purpose when using case studies or surveys [35].

### *D. Focus Group*

Focus group is an empirical method used to obtain feedback from software practitioners on designed models or prototypes. It is a suitable method used to obtain qualitative insights on how approaches or concepts are presented [36]. Focus group method is usually conducted in a semi-structured group session, moderated by a group leader or researcher, held in an informal setting with the purpose of collecting information on a designated topic. This method, which can be conducted easily, provides rich source of information and quick valuable feedbacks at low cost [37].

According to Bhat [38], the focus group method is very useful especially to a research related to new products and test new concepts. One of its strengths is the discovery of new insights due to the interactive nature of the setting and different backgrounds of the participants [39]. Moreover, Singer, et al. [40] affirmed that there are two important side benefits of the focus group; (1) introducing the participants to each other and (2) offering the sense of involvement in the research process to

all participants. This method is often adopted and applied by the SE researchers in different evaluation studies to obtain experts' opinions. For instance, Mohamed [41] adopted this approach to evaluate the practicability of her proposed model in the real life environment. However, she stated that it is often difficult to schedule a focus group session with the busy schedules of the software practitioners.

Since the purpose of conducting the focus group session is to evaluate the proposed approaches and explore participants' experiences on its effectiveness and applicability, Kueger and Casey [42] point out that small group is preferable in the evaluation purpose because it is more comfortable for the participants to share their extensive experiences. Nevertheless, there are different opinions pertaining to the suitable number of participants for a focus group. For example, Wibeck [43] believes that four to six participants are sufficient, while Hummelvoll [44] suggests the ideal number of five to eight. For the others, six to ten should be the optimal number of participants in a focus group [41, 45].

### *E. Expert Review*

The expert review is a simple method used to detect and remove defects [24]. According to Morgan [46], the expert review is employed by researchers to gather valid and reliable data -from experts- that concerns with an identified problem. In the SE field, this method is commonly focused on yielding the academic and practitioners opinions in order to verify the proposed approaches design prior to the final evaluation [47, 48]. The knowledge experts can provide unique perspectives on the proposed approaches that allow researchers to obtain high reliability data. They can clarify the significance of those approaches as well as highlighting their strengths and weaknesses based on their thorough researches and academician experiences. Besides that, the domain experts may offer valued perceptions gained through their real setting, in which the proposed model designed with the intension that it would be practiced by team members in the software organizations [41, 49, 50]. The recommendations and suggestions provided by experts are utilized in the improvement of the final model [49, 50].

In the expert review method, there are different opinions related to the suitable number of participants. In a recent study conducted by Omar, et al. [51], six experts had participated in the initial evaluation of their proposed model. Authors confirm that this number of experts is suffice, in which five experts from a pertinent domain would be adequate. In fact, Shneiderman, et al. [52] mentioned that the sufficient number of experts involved in the expert review should be between three to five. As for Molich [53], one domain expert should be enough for such review. However, involving additional experts are recommendable if the expenses are affordable.

## IV. DISCUSSION

This section discusses the study results and highlights its key findings. Initially, in order to guide and assist the researchers to choose the potential evaluation methods, a comparison between the five methods, which have been

previously described, is summarized in Table 1. The comparison was conducted according to five criteria, which are researcher control, focus, cost, time, and sample size. These five criteria were extracted from different studies such as Easterbrook, et al. [23], Yin [24], and Malhotra [25]. Researcher control refers to what extent researcher controls the situation, with direct, precise, and systematic manipulation of the behaviour of the phenomenon to be studied. Focus refers to the effort of the investigation in terms of how the researcher will investigate the phenomenon. Cost refers to the amount of money incurred while performing the method and time criterion refers to the period required. The sample size denotes the number of targeted respondents that are identified to perform the method.

TABLE I. A COMPARISON BETWEEN EVALUATION METHODS

NO	Method	Researcher Control	Focus	Cost	Time	Sample Size
1	Case study	Low	How & Why	Medium	High	Large & Small
2	Survey	Low	How many & How much	Low	Low	Large
3	Interview	High	How & Why	Low	High	Small
4	Focus Group	High	How & Why	Low	Very Low	Small
5	Expert Review	High	How & Why	Low	Low	Small

As shown in Table 1, it is obvious that the case study method focuses on how and why questions, and is suitable for large and small sized samples. However, the method gives less control to researcher and consumes considerable cost and time. The survey method does not support researcher control and concentrates on how many and how much questions. Although utilizes lower cost and time, this method is only suitable for a large sample size. On the other hand, the interview method has a high support for researcher control and concentrates on the how and why questions. This method is only suitable for small sized sample and consumes much time but with low cost.

The focus group and expert review methods provide high control of the researcher, focus on the how and why questions. Both methods are suitable for small sized sample and consume a limited cost when conducted. Nevertheless, focus group requires lower time (maximum three hours) when compared to the expert review.

Based on the above comparisons, the key findings of this study are presented in the following points:

- The expert review is a popular method used to yield the experts opinions on proposed approaches design to detect and remove defects. This method is usually adopted to initially verify the elements included in the proposed approaches by the knowledge and domain experts. The knowledge experts can give useful opinions on the proposed approaches based on their

divers' years of experiences in the academician setting. Nonetheless, the domain experts can provide feedback from the industrial perspective as the proposed Agile approaches are directed to meet their needs.

- The focus group method is an empirical approach used to obtain qualitative insights on how the proposed approach is presented. This method is employed to evaluate the final approach design by verifying its effectiveness and validating its applicability in the real environment.
- Bräuer, et al. [36] affirmed that the focus group turned out to be the most extremely adopted in the evaluation process of the approaches proposed in the Agile context and within the SE research community.
- The case studies and surveys are the most methods used for the evaluation purposes as revealed by Alaidaros, et al. [10]. Besides that, the case studies are conducted to validate the applicability of the proposed Agile approaches and increase their generalizability.

## V. CONCLUSION, LIMITATIONS, AND FUTURE DIRECTIONS

This study confirms that the adoption of Agile methods is being increased by various organizations and environments. As it is an emerging technology received a wide acceptance, organizations have employed the Agile methods to move quickly and respond to market needs and services. As a result, different approaches have been proposed by organizations based on the Agile context, but from different perspectives and fields. However, these approaches are lacking of how its effectiveness and applicability are being evaluated.

Thus, this paper has explored the methods used for evaluating the proposed Agile approaches using the narrative review methodology. Although the results revealed that there are many evaluation methods, this review was limited to explain the five common methods, which are: case study, survey, interview, focus group, and expert review. In addition, this paper presented a comparison between these methods and highlighted their strengths and weaknesses.

Future work will focus to explore the remaining evaluation methods as the current review was limited to five methods. Moreover, it is hoped to extend this study by illustrating the detailed activities and steps of conducting each method. Overall, the present study contributes to the existing studies and researches pertaining the methods used for evaluating the new approaches proposed in the Agile context. Furthermore, this study would benefit researchers and practitioners from the SE field - or other fields - to choose the appropriate evaluation methods when they tend to construct new Agile approaches.

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