Knowledge Sharing on Implementing Software Process Quality Model Evaluation: Focus Group Approach

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ABSTRACT

The Extended Software Process Assessment and Certification(SPAC) Model is a model that assesses and certifies the effectiveness and efficiency of software process, which focuses on the agile and secured based software development practices. The proposed model was evaluated using focus group approach. This approach is not often used in the software engineering field even though it has various benefits. Therefore, this paper shares the experiences on the implementation of the focus group for model evaluation to reveal its usefulness. The detailed discussion on the steps taken to implement the approach is discussed. Based on the experience, it is found that this approach is very time effective, can be conducted easily and can get more evaluation done at once.

Keywords: Extended SPAC Model, model evaluation, focus group.

I INTRODUCTION

Software certification has become a mechanism to give conformance on the quality of software(Heck, Klabber & Eekelen, 2010; Aziz, Jamaiah, Fauziah, Amalina Farhi & Abdul Razak, 2007). Certification is defined as *the procedure by which a third party gives written assurance that a product, process or service conforms to a specified characteristics* (Rae, Robert & Hausen, 1995). With software certification, customers feel more confident on the quality and dependability in selecting the desired organization for investments. Moreover, certification involves with independent assessment, thus it is possible to reduce the risks.

Voas (1998)summarized that certification in the software industry can be implemented in three approaches which are personnel, product and process. Even though many researchers believe product based approach can give confidence to customers about the quality of software (Heck et al., 2010; Jamaiah, Aziz & Abdul Razak, 2007; Voas, 1999), at the same time, they admit that the quality assessment for product based approach is hard to be practiced without implementing the software for a certain period of time. Thus, based on the Deming's premise that "*the quality of product is influenced by the quality of process used to develop it*" (Deming, 1982), it is believed that process based software certification can be an alternative solution.

Several studies were intended to produce models and standards for software process improvement (SPI) including ISO/IEC 15504 (Pyhajarvi &Rautiainen, 2004; O'Regan, 2002) and Capability Maturity Model Integration (CMMI Product Team, 2010). On the other hand, the ISO 9000 (Sedani & Lakhe, 2009) provides a mechanism to certify only on the quality system of an organization. Besides, the Software Process Assessment and Certification (SPAC) Model which introduced by Fauziah, Jamaiah, Aziz and Abdul Razak (2011) mainly focuses on certifying software process in order to ensure that the process was carried out effectively and efficiently. Unfortunately, this model did not address the agile and secured based software development approaches in their assessment. However, in today's business environment, both approaches have become as determinant factors to produce high quality software (Merkow & Raghavan, 2010; Pressman, 2010; Mouratidis & Giorgini, 2007). Consequently,a study was conducted to construct Extended SPAC Model which addresses these approaches.

The objective of this paper is to discuss the experience of evaluating the Extended SPAC Modelthrough focus group discussion. This approach has been widely used in sociological studies, marketing research, product planning, politic campaigning, clinical psychology,defining business services and usability studies (Stewart, 2007; Morgan, 1998). However, its usage in the software engineering is still limited, whereby its use as an empirical research tool was only been discussed recently (Kontio, Bragge & Lehlota, 2008). This approach has been used for evaluation or obtaining practitioners' experience (Daneva & Ahituv, 2011; Mazza & Berre, 2007; Kontio, Lehlota & Bragge, 2004; Lehlota, Kauppinen & Kujala, 2004). Therefore, this approach has been used in this study to reveal its usefulness in the field of software engineering, particularly in model evaluation.

This paper is organized as follows: Section II provides overview of Extended SPAC Model, Section III gives some background of focus group, continued with Section IV which discusses the result and Section V which highlights the benefits of focus group for model evaluation. This paper is ended with the conclusion.

II OVERVIEW OF EXTENDED SPAC MODEL

The Extended SPAC Model is a process based software certification model which focuses on the agile and secured based software development approach. It is aimed for assessing and certifying the quality of software process. At the end of the certification exercise, the model produces certification level and quality levels of the assessed software process. The modelformulated by referring to existing software process certification models or standards which are SPAC Model (Fauziah et al., 2011), Capability Maturity Model Integrated (CMMIProduct Team, 2010), ISO/IEC 15504, ISO/IEC 27001 (Evans, Tsohou, Tryfonas & Morgan, 2010) and ISO/IEC 21827 (Davis, 2009). Besides these, the agile principles and methods were referred for eliciting the agile based software development practices. For eliciting the secured based software development practices, three most prominent models were referred, which are the Microsoft SDL, McGraw Model and CLASP (De Win, Scandariato, Buyens, Gregoire and Joosen, 2009). There are six components of the model, which are adapted from Evaluation Theory (Lopez, 2003; Scriven, 1991). The components are target, evaluation criteria, reference standard, data gathering technique, synthesis technique and assessment phases, as elaborated further below:

A. The target

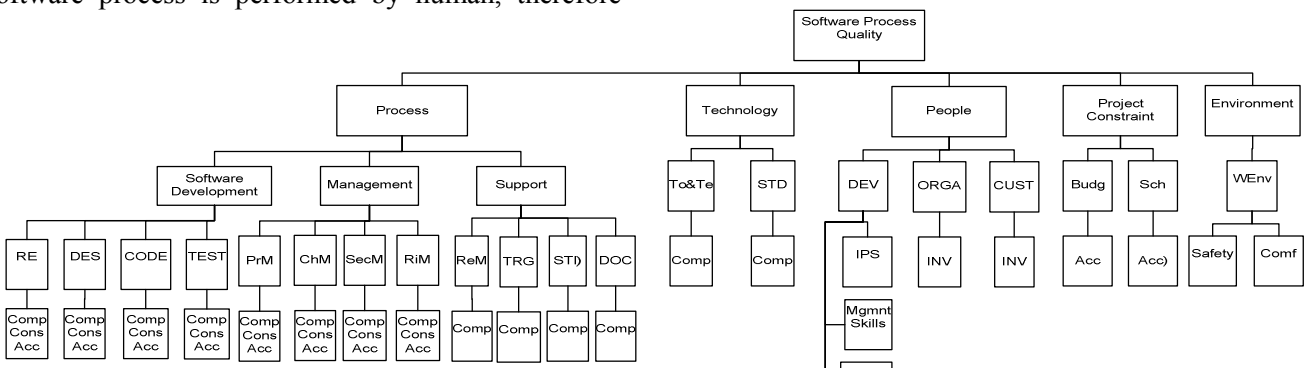
The target is '*the object under evaluation*'. Defining the target is the first essential process in any assessment. By defining the target, the assessor can get insight on what should be assessed. In this study, the target is software process. Nevertheless, since software process is performed by human, therefore there are other factors which can influence the quality of software. They are the people, technology used, project constraint and environment (Fauziah et al., 2011; Hazzan and Dubinsky, 2009; Ares, Garcia, Juristo, Lopez & Moreno, 2000). Each of these factors is decomposed to sub factors. They are represented in a hierarchy tree, as depicted in Figure 1.

B. The evaluation criteria

The evaluation criteria are '*the characteristics of the target'*. Basically the evaluation criteria are comprised of the characteristics that need to be accomplished in order to achieve the effectiveness and efficiency of software process.The effectiveness is measured based on the completeness, consistency and accuracy of the process in developing software which can fulfill customers' expectations through involvement of good quality people, use of appropriate technology and stability of working environment. On the other hand, the efficiency is measured based on the capability of software process to produce software within estimated time and budget (Fauziah et al., 2011). Each of the factors is assessed based on particular criterion, which are represented by the lowest level of the hierarchy tree in Figure 1.

C. The reference standard

Based on the defined target and evaluation criteria, the reference standard is constructed. It consists of the best practices of agile and secured based software development practices. The Quality Function Deployment (QFD) (Zultner, 1992) approach is utilized to organize them. Each evaluation criterion is assigned with appropriate agile and secured based software development practices.



Legend:

Acc: Accuracy
Budg: Budget
ChM: Change Management
CODE: Coding
Comp : Completeness
Cons: Consistency
Comf: Comfort
CUST: Customer
DEV: Developer
DOC:Documentation
Exper: Experience
INV: Involvement
IPS: Interpersonal Skills
Know: Knowledge
Mgmnt Skills: Management Skills
ORGA: Organization
PrM: Project Management
ReM: ResourceManagement
RE: Requirement Engineering
RiM: Risk Management
STI: Staff Intiative
Sch: Schedule
SecM: Security Management
STD: Standard & Procedure
Team Comm:Team Commitment
To&Te: Tools & Techniques
Tech Skills: Technical Skills
TEST: Testing
TRG: Training
WEnv: Working Environment

Figure 1. The target and evaluation criteria

D. **The data gathering technique**

The data are gathered by using multiple techniques, which are assignation techniques and opinion (Ares et al., 2000; Lopez, 2003). The assignation techniques used in this model are the document review and interview. On the other hand, the opinion technique denotes the observation. Using multiple data gathering technique can improve the understanding for the assessment team and give better confirmation on the assessment made (SCAMPI, 2011).

E. **The synthesis technique**

There are two main stages for synthesizing. First is to determine the weight for each evaluation criterion, which is accomplished by performing the AHP technique (Saaty, 1990). The second stage is performing the assessment by comparing the reference standard with the practices performed during project development. Each practice is assigned with appropriate score which ranges from 1 (Very unsatisfied) to 5 (Fully satisfied). Then, the total scores are obtained for each evaluation criterion by utilizing the WSM (Mollaghasemi, 1997). These scores are then used to determine the quality levels and certification level for the assessed software process.

F. **The assessment**

The Extended SPAC Model is performed in three assessment phases. Each of the phases has several activities, as adapted from SCAMPI (SCAMPI, 2011) and SPAC Model (Fauziah et al., 2011):

- Pre-assessment: analyze the organization and candidate project, plan the assessment, form the assessment team, prepare the assessment team and prepare for assessment conduct.
- Assessment: prepare assessment participants, perform JAD session, review documents, perform interviews, observe, record the information gathered and synthesize and analyze data.
- Post assessment: determine certification level and quality levels,present assessment result and gather feedback, collect lessons learned feedback, collect lesson learned and prepare technical report.

The Extended SPAC Model was evaluated through the focus group approach in order to ensure that it is practical in the real life environment.The focus group approach was chosen as the evaluation approach because it is a rich source of information (McLafferty, 2004). Moreover, focus group can provide valuable feedbacks quickly at low cost, as well as can be conducted easily (Martakis & Daneva, 2013; Kontio et al., 2008; Krueger, 1994). Some background of this approach is provided in the succeeding section.

III FOCUS GROUP DISCUSSION

Focus group is a group discussion participated by a number of people with common interests and background (Liamputtong, 2011). It is monitored, facilitated and recorded by the moderator. It is a way to understand how people think about an issue,practice or service. Several guidelines for conducting focus group are available in literature, as follows.

A. **The number of participants**

Generally, the number of participants is recommended to be six to ten participants, but some may have up to twelve people (Liamputtong, 2011; Stewart et al., 2007). On the other hand, Krueger and Casey (2000) suggest six to eight participants.

B. **The meeting place** (Stewart et al., 2007; Powel &Single, 1996; Foch-Lyon & Trost, 1981):
- The focus group discussion should be conducted on a day and time that is convenient for the participants.
- The meeting place should be chosen as a place which is considered neutral
- Successful sessions can be conducted in hotels, offices or clubs.
- The meeting place should provide comfortable environment.
- The location of meeting place should be close to participants and easy to be found.

C. **Conducting the focus group**(Stewart et al., 2007;Powel&Single, 1996; Krueger, 1994):
- The rapport should be created among the participants and moderator: the moderator should greet the participants and establish a friendly contact. Also, some time can be allocated for an informal conversation before the discussion starts.
- The participants should be served with coffee, soft drinks and a light snack.
- The formal discussion should start with welcoming speech, inviting the participants to introduce themselves, providing some overview of the research and ground rules.

Based on these guidelines, the focus group was conducted; they are discussed further in next section.

IV RESULTS AND DISCUSSIONS

This section discusses in detail on the implementation of focus group for validating the proposed model. The key steps for performing the focus group were adapted from Martakis & Daneva (2013), Daneva & Ahituv(2011), Mazza and Berre (2007) and Kontio et al. (2004). They consist of three main stages, as discussed subsequently.

A. **Stage 1: Plan the focus group**

A thorough planning is needed to effectively implement the focus group. In planning the focus group, five activities have been performed, as discussed further subsequently.

i. Define the objectives of the focus group

Basically the objectives of the focus group are twofold. It is aimed for verifying and validating the proposed model. In particular, the objectives are:

1. To verify the comprehensiveness, accuracy, understandability and organization (Kunda, 2002) of the agile and secured based software development practices that are included in the software process certification model.
2. To validate the model in real environment based on its gain satisfaction, interface satisfaction and task support satisfaction (Kunda, 2002).

ii. Identify and recruit the participants

The participants were selected by using purposive sampling, since this technique is normally adopted for identifying the participants in focus group (Liamputtong, 2011). They were chosen based on four characteristics: 1) agile software practitioners, 2) work in Kuala Lumpur or nearby area 3) have experience in secured based software development, 4) have software development experience for more than 5 years. Initially, the respondents of the survey which was previously conducted in this research were approached through telephone and emails. Unfortunately, only one of them was willing to participate.It was hard to get participation among the software practitioners as they are busy people.

Since the focus group needs a range of six to ten participants (Morgan, 1998; Powel & Single, 1996; Krueger, 1994), alternative ways were used to gather the participants. The potential participants were approached through the places they tend to assemble, either virtually or actual meetings (Stewart et al., 2007). They were approached through social networking groups such as Agile Malaysia group in Face book and Scrum Malaysia Community by Google. The invitation was posted on the wall of these groups, as well as randomly emailed them on a personal basis. In addition, they were approached face-to-face during Agile Symposium in Melaka, Scrum Master Training in Kuala Lumpur, APAC Agile & Lean Conference 2013 organized by Intel Malaysia (Penang Campus) and Agile Malaysia group monthly meet up which was held in one of the software development companies in Putrajaya. Brochures which brief about the focus group were distributed to them during these meet ups. By using these various approaches, finally eight participants agreed to participate in the focus group.

iii. Identify and book the meeting place

The suitable meeting place was identified and booked. The place chosen is central for all of the participants. It was one of the hotels in Kuala Lumpur which provides meeting room facilities such as discussion table and LCD projector. As suggested by Powell and Single (1996), the meeting place is considered neutral, as it did not have special significance to the participants and no bearing to the objectives of the focus group. Additionally, it provided pleasant and comfort environment for the participants. Furthermore, the focus group was scheduled on Saturday, which was convenient for the participants (Folch-Lyon & Trost, 1981).

iv. Prepare interview guide and materials

Prior to conducting the focus group, the interview guide was developed. The principles of preparing interview guides were adapted, whereby the discussion was planned to be started by general topic, which is the introduction of the research. Then, the next agenda was to verify and validate of the proposed model. These key sequential activities were determined based on their relative importance to the research, as provided by the second principle of preparing interview guide (Stewart et al., 2007). Additionally, materials for the focus group session were prepared, namely the presentation slides, documents for the participants, besides the incentives and certificates of participation. The incentive includes the refreshments and lunch treat.

v. Remind the participants

One day before the focus group was conducted, the participants were reminded about the session and their attendance was confirmed. This is to ensure that they do not forget about the session and make them feel their importance in attending the session.

B. **Stage 2: Conduct the focus group**

The focus group was conducted on the scheduled day and time. However, one of the participants who agreed to come could not attend the session. Thus, only seven of participants turned up to attend the session. Upon arrival at the meeting room, the participants were greeted and a friendly contact was established in order to create rapport. This is done by having an informal conversation among the participants and moderators before the formal discussion begins. They were also served with refreshments. This is intended to make the participants feel comfortable and relaxed. On top of that, this enabled the moderators and participants to get to know each other.

In the formal session, the participants were seated in a

U-Shaped discussion table to facilitate interactions. They were provided with the materials that needed for the session. Once all of the participants were seated, they were welcomed with a speech from the moderator. Then, the moderator introduced herself and the assistant moderators. In the same manner, each of the participants introduced themselves to the group. This is a useful way to build rapport and a good sense of building group cohesion (Liamputtong, 2011). Then, they were briefed about the objectives and ground rules of the focus group. They were encouraged to express their experience and points of view freely and spontaneously. The participants were also reminded that the data gathered from them will be confidential and only will be used strictly for the research purposes. Then, they were briefed about the Extended SPAC Model. During this presentation, the participants started to interact freely by clarifying the issues that were not clear from the presentation.The participant worked in two stages: 1) verify the agile and secured based software development practices and ii) validate the Extended SPAC Model. Figure 2 shows the process of verifying and validating the proposed model.

Figure 2. Verifying and validating the proposed model

They are elaborated further:

i. Verify the agile and secured based software development practices

The first stage of the focus group was to verify the agile and secured based software development practices. Verification is intended to ensure that the proposed model conforms to its specification (Sommerville, 2007). Therefore, the participants were instructed to fill in the forms for verifying each of the practices.They determined the suitability of the practices included in the model one by one. Additionally, they verified whether the whole practices are comprehensive, understandable, accurate and well-organized (Kunda, 2002).

ii. Validate the Extended SPAC Model

The second stage of the focus group was to validate the Extended SPAC Model. Validation is the process of determining whether a model meets customers' expectation, as well as whether it is an accurate representation of the real world from the perspective of the intended usage (Sommerville, 2007). During this stage, the participants were asked to implement the model by assessing one of the projects that they have completed. They were provided with the assessment form for the assessment exercise. Based on their experience in the project, they self- assess the project and assigned the score for each of the practices in the model.

C. Stage 3: Analyze data and report results

After completing the focus group session with the participants, the researcher analyzed the data obtained from the focus group. The total score for the assessment and certification exercise were calculated. Then, the quality levels as well as the certification level for each project were obtained. To ensure the accuracy of calculation and reduce human error, the calculation was completed by using the Excel file. The outcomes were then reported in technical reports by representing them in tables and charts. These technical reports were then emailed to the participants. Based on the report, the participants emailed back their feedbacks on the validation of Extended SPAC Model. The validation criteria for validating the proposed model are gain satisfaction, interface satisfaction and task support satisfaction. On the other hand, the verification result revealed that majority of the practices included in the model are suitable, comprehensive, understandable and accurate. However, a few practices were suggested by the practitioners to be reorganized.

V BENEFITS OBTAINED

Based on the experience of the researchers, there are benefits that can be revealed by performing the focus group for model evaluation:

- Time effective, compared to other evaluation methods. This is because the evaluation can be performed all at once, unlike other approaches such as interviews and case studies that need to be performed one by one, at different places and time.
- Can be performed more easily, as it is conducted outside organization. Unlike case studies which need suitable case study site that might be restricted, since not all organization is willing to participate in the research.
- Can get more projects to be evaluated at once, whereby the number of participants is at least 6, therefore the validation can be performed for at least 6 projects at once.

VI CONCLUSION

This paper has discussed on the evaluation of Extended SPAC Model that was performed through focus group, which was attended by seven software practitioners. This approach has been widely used in other fields, for instance sociological studies and marketing research, nevertheless its usage in the software engineering field is still limited. Therefore,

this study used the focus group approach to reveal its usefulness in evaluating the proposed model. Based on the experience of the researchers, the focus group was found to be time effective, can be performed more easily andcan get more evaluation done at once.

ACKNOWLEDGMENT

The authors would like to thank the participants of this study. Additionally, special thanks go to the Ministry of Higher Education for supporting this study through the FRGS grant (S/O Code: 11889).

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