International Journal of Engineering & Technology, 7 (3.20) (2018) 876-881

International Journal of Engineering & Technology

Website: www.sciencepubco.com/index.php/IJET

Research paper

Validating the Extended Software Process Assessment and Certification Model through Focus Group

Shafinah Farvin Packeer Mohamed[1]*, Fauziah Baharom[2], Aziz Deraman[3], Yuhanis Yusof[4]

[12,3]UUMCAS School of Computing, Universiti Utara Malaysia, 06010 Sintok, Kedah, Malaysia,
[3]Faculty of Science and Technology, Universiti Malaysia Terengganu, 21030 Kuala Terengganu, Terengganu, Malaysia

Abstract

Rapid growths of computers, mobile phones and Internet technology have created ways for irresponsible people to undertake computer crimes. Millions of users across the globe have fallen as victims to computer crimes, including Malaysia. It is because of current programming condition which is progressively mind boggling, dispersed, keeps classified information and effectively presented to malevolent assaults. Therefore, secure programming process is progressively increasing much significance among programming professionals and specialists. Be that as it may, just couple of studies were led in exploring its present practice in the product business, particularly in Malaysia. Along these lines, an exploratory examination is led among programming experts in Malaysia to consider their encounters and practices on the protected programming process in reality extends. This paper examines the discoveries from the examination, which included 93 programming specialists. Organized survey is used for information gathering reason while factual techniques, for example, recurrence, mean, and cross arrangement are utilized for information investigation. Results from this examination uncover that product professionals are winding up progressively mindful on the significance of secure programming process, nonetheless, they absence of proper execution of the practices**.**

Index Terms*: Secure software practices, exploratory study, software practitioners, Malaysia*

1. Introduction

The fast development of Information and Communications Technology (ICT) use in a roundabout way influences all parts of our day by day life. Numerous procedures which were done physically are presently been modernized. Subsequently, the requirement for programming likewise increments and its utilization has turned out to be increasingly basic in each space. Shockingly, as demonstrated by Jones and Bonsignour [1], contrasted with different items, the disappointment rate of programming is one of the most astounding despite the fact that it is among the most ordinarily utilized item. In this way, clients are constantly worried about the nature of programming created to them. By the by, grumbles on clients' disappointment still exist, which demonstrates that the product quality issues are available. Thusly, programming confirmation has moved toward becoming as one of the components that can give conformance on the nature of programming [2,3].
Affirmation is characterized as "the strategy by which an outsider gives composed confirmation that an item, process or administration fits in with a predetermined qualities" [4]. By having affirmation, clients will feel progressively certain to make interest in a specific association since confirmation includes free evaluation which will at that point lessen the likelihood of programming disappointment.

Voas [5] ordered three methodologies in ensuring programming, which are staff, item and process. Numerous specialists trust that item based methodology can offer certainty to clients about the nature of programming [2,6], anyway by utilizing this methodology, the product should be used for a specific timeframe before it tends to be confirmed. Therefore, it is difficult to be rehearsed. Thusly, in perspective of the Deming's reason that "the nature thing stands affected by the idea of procedure castoff to make it" [7], process based programming affirmation can be an elective arrangement.
Various investigations can be found for the procedure based methodology, anyway they center more around programming process enhancement. Then again, the ISO 9000 gives a component to confirm just on the quality arrangement of an association [8]. Then again, the Software Process Assessment and Certification (SPAC) Model [9] centers around confirming programming process so as to guarantee that the product procedure was done viably and effectively. Shockingly, this model don't address lithe and secure programming forms in its appraisal. Notwithstanding, in the present business condition, the two methodologies have progressed toward becoming determinant elements to deliver superb programming [10]. In addition, existing programming process confirmation models and guidelines don't consider weight esteems in their evaluation despite the fact that the appraisal includes various criteria. The load esteem designation is vital to be considered particularly when the appraisal procedure includes numerous criteria [11].
In like way, an investigation was coordinated to assemble Extended Software Process Assessment and Certification (ESPAC) Prototypical which keeps an eye on these item methodology and

Copyright © 2018 Authors. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

reflects heaviness regards examination. The model endorsement was performed by seven programming specialists through focus gathering talk. This paper discusses the endorsement performed on the ESPAC Model..

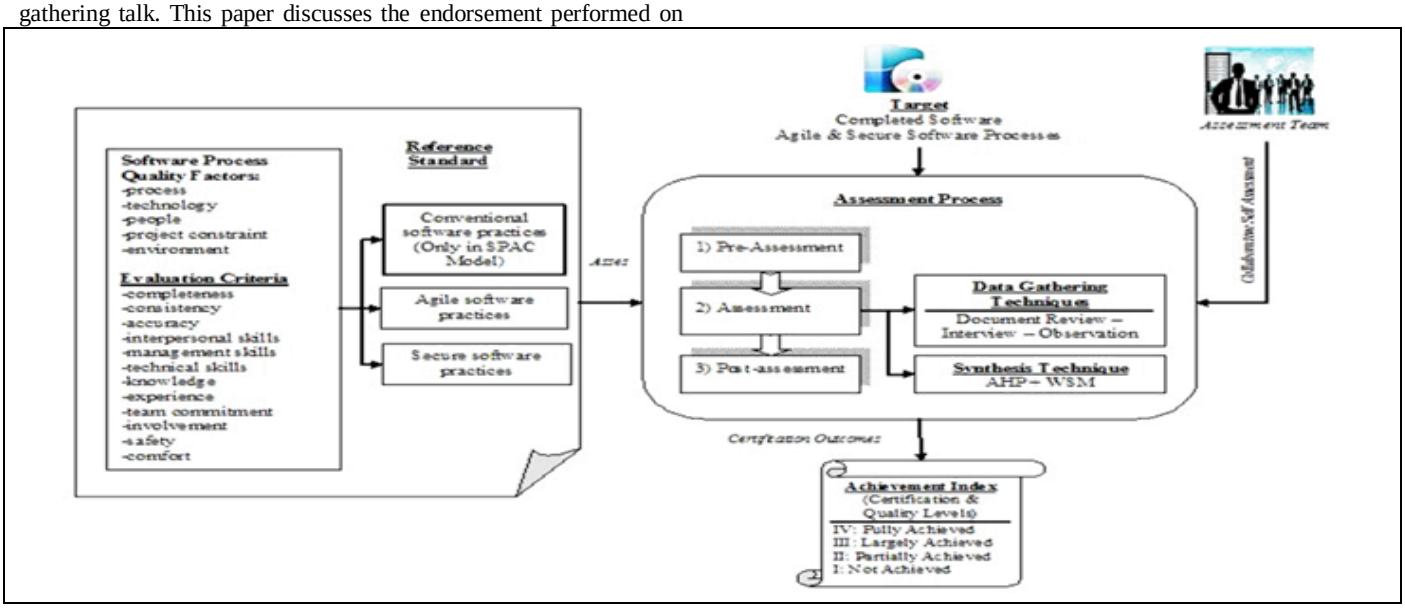


Figure 1: The ESPAC Model

The following segment of this paper examines a look of the ESPAC Model, proceeded with the execution of the center gathering. This is trailed by results and discourses areas. At last, the finish of the investigation is given.

2. A Glance Of The ESPAC Model

Figure 1 demonstrates the ESPAC Model, which aims to assess and certify the quality of agile and secure programming forms. This model was built up by using the results from hypothetical and exploratory examinations [12]. Moreover, the SPAC Model [9], CMM Integrated, ISO/IEC 15504 [8], ISO/IEC 27001 [13] and ISO/IEC 21827 [14] were alluded as the base models. Plus, to accumulate the deft procedure, the lithe strategies and standards were utilized [15]. Furthermore, to accumulate the protected programming process, Microsoft SDL, Touchpoints and CLASP were alluded [16]. Additionally, the blend procedure is enhanced by consolidating AHP [11] for weight esteem allotment. Likewise, the Evaluation Theory [17] is adjusted to decide the segments of the proposed model: the objective, assessment criteria, reference standard, information gathering strategy, amalgamation system, appraisal process and Achievement Index. These parts are expounded further in the accompanying sub segments.

2.1 The target

The objective is the product procedure actualized in the tasks that have been finished and prepared to be conveyed to clients. Moreover, the product procedure involves the Agile and secure programming forms.

2.2 The evaluation criteria

To assess the software process (target), the evaluation criteria are defined. They comprise of the characteristics that need to be accomplished. The viability is estimated dependent on the culmination, consistency and exactness of the procedure in creating programming which can satisfy clients' desires through association of good quality individuals, utilization of proper innovation and soundness of workplace. Then again, the proficiency is estimated dependent on the ability of programming procedure to create programming inside assessed time and spending plan. Every one of the components is decayed into quantifiable sub variables and assessment criteria, as exhibited in Figure 2.

2.3 The reference standard

The reference standard is built dependent on the characterized target and assessment criteria. It comprises of the accepted procedures of nimble and secure programming forms. The Quality Function Deployment approach [18] is connected to sort out them. Every assessment criteria is doled out with suitable lithe and secure programming rehearses.

2.4 The data gathering technique

To direct the accreditation, information are accumulated by utilizing various systems, as the assessors can comprehend the undertaking admirably and give affirmation on the appraisal made. The procedures utilized are the report surveys, meetings and perceptions.

2.5 The assessment process

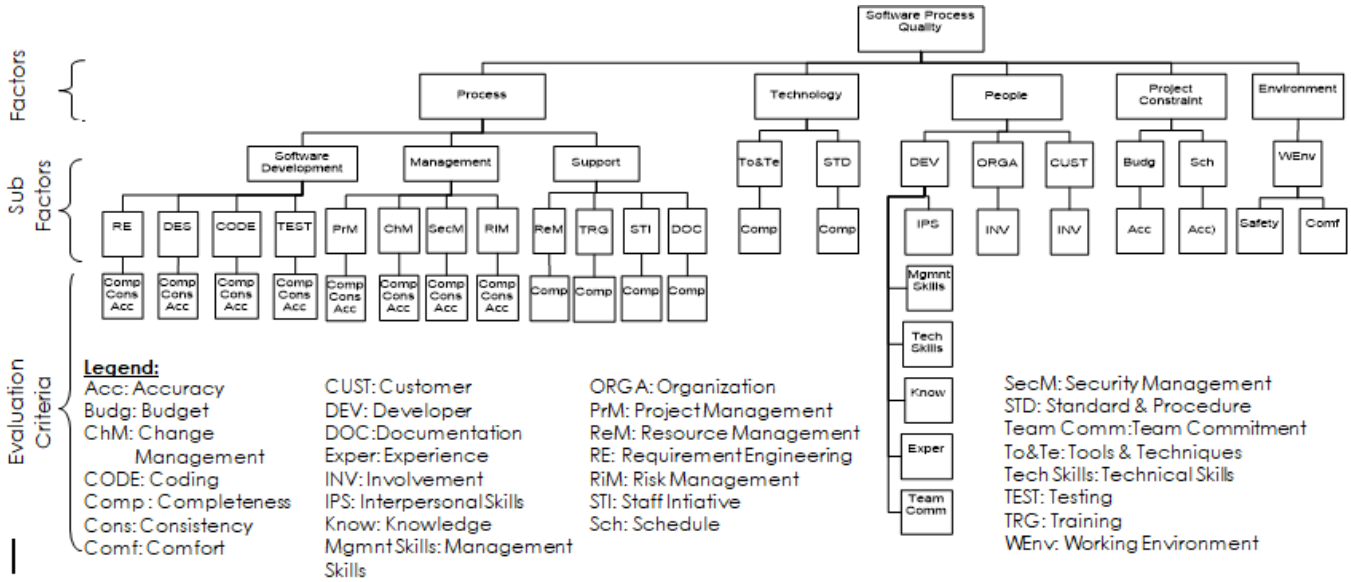
The software certification involves three phases with specific activities, as adapted from SCAMPI [19], SPAC Model [9] and Lascelles and Peacock [20]. They are listed in Table 1.

Table 1: The assessment process

Phases	Activities
Pre-assessment	Develop commitment, form assessment team, identify and analyze candidate project, plan assessment, prepare assessment team and prepare for assessment conduct.
Assessment	Prepare assessment participants, appraisal brochures, achieve meetings, perceive, greatest material collected and synthesize data.
Post-assessment	Determine certification level and quality levels, present

	assessment results and gather feedbacks, and formulate methodological explosion.

The collective self-appraisal strategy is connected for the evaluation, which is adjusted from the self-appraisal [20,21] and cooperative evaluation [6,9]. This implies the appraisal group comprises of association's own staff. It is driven by a venture director and made out of assessors who are programming designers from other group. Likewise, one agent from the surveyed group co-works as one of the assessors to encourage the evaluation. The assessors are among programming experts who have involvement in programming designing and evaluation..



2.6 The synthesis technique

Snthesis procedure is "the strategy used to pass judgment on every model, and when all is said in done, to pass judgment on the objective, getting the consequences of the assessment" [17]. There are two principle stages for incorporating in ESPAC Model. First stage is to decide the load for every assessment measure by utilizing the Analytic Hierarchy Process (AHP) [11]. The second stage is to play out the evaluation by rating the practices with suitable score that ranges from 1 (Never) to 5 (Always). At long last, the aggregate scores for every assessment foundation are gotten through Weighted Sum Method [22].

3. The Achievement Index

In the end, ESPAC Model encapsulates the achievement through quality levels and certification level. They are determined by referring to the Achievement Index, as portrayed in Table 2.

Table 2: The Achievement Index

Score Values	Descriptions
Level IV	This dimension demonstrates a completely fulfilling accomplishment. The product forms were actualized adequately, methodicallly and impeccably or flawlessly.
Fully	
Achieved	
86 ≤ Score≤100	
Level III	This dimension demonstrates a generally fulfilling accomplishment. The product forms were executed deliberately. In any case, some product procedures of low execution exist.
Largely	
Achieved	
51≤ Score ≤ 85	
Level II	This dimension demonstrates an in part fulfilling accomplishment. An orderly methodology has been utilized; anyway the majority of the evaluated programming forms were not executed legitimately.
Partially	
Achieved	
16 ≤ Score ≤ 50	
	This dimension shows unacceptable dimension of accomplishment. The product forms were not actualized efficiently and underneath normal. The strategy use was ignored. The product procedure is considered as neglect to accomplish its objective.
Level I	
Not	
Achieved	
0 ≤ Score ≤15	

4. Execution Of Focus Group

The emphasis collection approach which stayed joined by seven (7) software experts, aimed to validate the ESPAC Model. The key steps of the execution are adapted from [23, 24]. They are depicted in Figure 3. More detailed explanation on the focus group can be found in our paper [25].

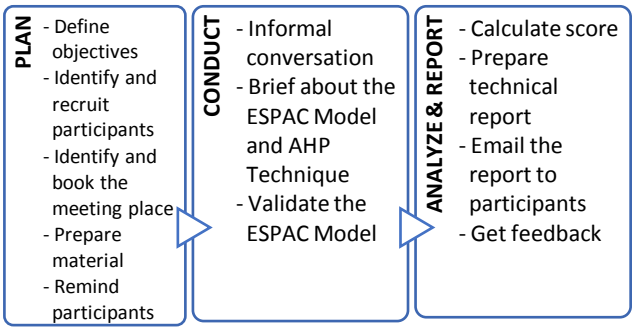


Figure 3: The stages and activities of focus group

Outcomes

The ESPAC Model was validated by assessing seven projects. The validation outcomes of two projects are discussed in our previous papers [26,27]. In this paper another project is discussed (Project A).

4.1 Background of Project A

Project A was developed by a multinational software development and consultation organization. This organization has a broad experience in the software development field, since year 1939. It provides various services such as application services and outsourcing services. One of the applications from this organization was assessed and certified, which is the New Polycarbonate Passport for Immigration Department. This project was developed starting from 4th January 2012 and completed on the 4th January 2013. The main function of this project is to produce new Polycarbonate Passport which includes security feature and follows International standard. It was developed by using a combination of three programming languages, which are Java, C and Websphere. The database used was DB2. The project was developed by using FDD method [28], which enforce on faster delivery. Additionally, this project gave emphasis on the secure software process. Both agile and secure software processes were assessed by using ESPAC Model, however, only the outcomes from the agile software process are discussed here [29].

4.2 Quality and certification levels

The quality levels for Project A are determined based on the scores of the evaluation criteria, as in Table 4. Based on the cumulative score of quality levels, the certification level is attained which is 74% (LEVEL III). This reveals that the project was developed systematically but ignored some important practices.

Table 4: The achievements for quality levels

Factors	Sub Factors	Evaluation Criteria	Scores	Quality Levels
Software Development Process	Requirement Engineering	Completeness	80%	Level III
		Consistency	80%	Level III
		Accuracy	80%	Level III
	Software design	Completeness	71%	Level III
		Consistency	70%	Level III
		Accuracy	80%	Level III
	Coding	Completeness	67%	Level III
		Consistency	84%	Level III
		Accuracy	70%	Level III
	Testing	Completeness	94%	Level IV
		Consistency	80%	Level III
		Accuracy	60%	Level III
Management Process	Project Management	Completeness	68%	Level III
		Consistency	70%	Level III
		Accuracy	80%	Level III
	Change Management	Completeness	75%	Level III
		Consistency	80%	Level III
		Accuracy	80%	Level III
	Staff Initiative	Completeness	60%	Level III
Support Process	Documentation	Completeness	72%	Level III
	Resource Management	Completeness	70%	Level III
	Training	Completeness	67%	Level III
Factors	**Sub Factors**	**Evaluation Criteria**	**Scores**	**Quality Levels**
Technology	Tools & Techniques	Completeness	80%	Level III
	Standards & Procedure	Completeness	68%	Level III
People	Software Practitioners	Interpersonal Skills	76%	Level III
		Management Skills	73%	Level III
		Technical Skills	77%	Level III
		Knowledge	80%	Level III
		Experience	80%	Level III
		Team Commitment	71%	Level III
	Organization	Involvement	67%	Level III
	Customers	Involvement	73%	Level III
Project Constraint	Budget	Accuracy	70%	Level III
	Schedule	Accuracy	80%	Level III
Environment	Working Environment	Safety	80%	Level III
		Comfort	67%	Level III

5. Discussions

All of the assessed evaluation criteria achieved LEVEL III, except for the completeness of testing. The achievements are discussed in detail next.

5.1 Software Development process

Testing activity was almost perfectly implemented, compared to other software development processes which were assessed. However, there still exist some of low performance practices, especially the use of tools, method and technology during testing. It achieved the lowest score. Additionally, the requirement engineering activities were correctly implemented and used the proper tools, methods and techniques.

On the other hand, the completeness of coding achieved low score (67%). Some of the important agile coding practices and the use of tools, methods and techniques might be neglected, for example, the implementation of collective code ownership [30].

Similar to coding, some important agile practices and the use of standards and procedure in software design activities also have been abandoned, even though this activity has used the proper tools, method and techniques. On the other hand, the use of standards and procedure in requirement engineering, coding and testing was emphasized.

5.2 Management process

All of the evaluation criteria assessed achieved LEVEL III. The change management activities were more correctly performed based on the agile principles, compared to the project management. In particular, the team gave less emphasis in implementing few important activities, for instance the daily plan and collaborative planning. Thus, it shows that the management is not yet fully implementing Agile. Also, the standard and procedure for project management was not emphasized. However, the use of tools was taken into consideration. On the other hand, the change management was implemented correctly, but the status of each changes were not usually recorded. This might cause the team to get overwhelmed with the changes.

5.3 Support process

The majority of the evaluated help process accomplished LEVEL III. The most astounding score was accomplished for the documentation, which demonstrates that the group has pursued the vast majority of the accepted procedures of delivering reports in light-footed. Anyway they left a couple of practices, for example, delivering the archives for arrangement close by. On the other hand, the most minimal score was accomplished for staff activity, on the grounds that the best administration gave less accentuation on the staffs' welfare and aggregate the working hours. Also, the assets and offices were not generally allotted appropriately for the staffs. Additionally, the best administration did not concentrate on giving administration trainings, be that as it may, specialized trainings were underscored.

5.4 Technology

The result reveals that the use of tools and technology was emphasized within the organization. However, the top management overlooked the implementation of standard and procedure amongst the staff even though it is required to ensure the consistency of software process.

5.5 People

The ESPAC Model assesses the software practitioners, organization and customers. All of the assessed criteria for the software practitioners achieved LEVEL III. The team members were highly experienced and had high level of technical skills. They also had good interpersonal skills, management skills as well as knowledge. In spite of that, the team commitment achieved the lowest score. Mainly this is because some of the implemented practices did not follow the suggestions of agile team environment, for example team members still depend on managers to make decisions, whereas in agile, the teams are self-organized [14]. This organization encourages face-to-face communication and empowers people.
Besides, the customers' commitment is very essential for the agile team. Overall, this project was able to get customers' involvement and collaboration throughout the development process.

5.6 Project constraint

This project was finished within estimated cost. This demonstrates that the budget was deliberated and managed precisely. Similarly, the schedule of this project was accurately planned and managed.

5.7 Atmosphere

The society gave emphasis on the atmosphere and concerns on the comfort provided to the staffs.

6. Conclusions

The approval of ESPAC Model was performed by seven programming specialists through a center gathering dialog. This paper talks about the approval results from one of the undertakings. The outcomes show the quality and confirmation dimensions of the venture. More or less, the undertaking has been executed efficiently; be that as it may, there exist a few practices that should be progressed. Greater part of the assessment criteria accomplished LEVEL III. The practices that are viably and proficiently actualized are featured other than the practices that can be made strides. By utilizing these results, associations can uncover their present dimension of programming process and use them to design and enhance their up and coming programming process. For our following stage, a vault will be worked to oversee and store the authentic information of affirmation to guarantee that the evaluation information are kept securely and constantly retrievable whenever.

Acknowledgement

The creators might want to earnestly thank the members of center gathering and uncommon acknowledgment goes to the Ministry of Higher Education for subsidizing this exploration through the FRGS give (S/O Code: 11889).

References

[1] Jones, C., & Bonsignour, O. (2012). The economics of software quality. Boston: Pearson Education.
[2] Heck, P., Klabbers and M., Eekelen, M. 2010. A software product certification model. Software Quality Journal, 18(1) 37-55.
[3] Aziz Deraman, Jamaiah Yahya, Fauziah Baharom, Amalina Farhi Ahmad Fadzlah and Abdul Razak Hamdan. 2007. Continuous quality improvement in software certification
[4] environment. International Conference on Electrical Engineering and Informatics, 11-17.
[5] Shakeel PM. Neural Networks Based Prediction Of Wind Energy Using Pitch Angle Control. International Journal of Innovations in Scientific and Engineering Research (IJISER). 2014;1(1):33-7.
[6] Baskar, S., & Dhulipala, V. R., "Biomedical Rehabilitation: Data Error Detection and Correction Using Two Dimensional Linear Feedback Shift Register Based Cyclic Redundancy Check", Journal of Medical Imaging and Health Informatics, 2018, 8(4), 805-808.
[7] Jamaiah Yahya. 2007. The development of software certification model based on product quality approach. (Unpublished doctoral dissertation). Universiti Kebangsaan Malaysia, Selangor, Malaysia.
[8] Shakeel PM, Baskar S, Dhulipala VS, Jaber MM., "Cloud based framework for diagnosis of diabetes mellitus using K-means clustering", Health information science and systems, 2018 Dec 1;6(1):16.https://doi.org/10.1007/s13755-018-0054-0
[9] O'Regan, G. 2012. A practical approach to software quality. London: Springer.
[10] Fauziah Baharom, Jamaiah Yahya, Aziz Deraman and Abdul Razak Hamdan 2011. SPQF:software process quality factor for software process

assessment and certification. International Conference on Electrical Engineering and Informatics, 1-7.
[11] Pressman, R. S. 2010. Software engineering a practitioner's approach 7th Ed. New York: McGraw-Hill Higher Education.
[12] Saaty, T. L. 1990. The analytic hierarchy process. New York: McGraw-Hil.
[13] Shafinah Farvin Packeer Mohamed, Fauziah Baharom and Aziz Deraman. 2014a. An exploratory study of agile based software development practices. Journal of Software Engineering and its Application, 8 (5), 85-114.
[14] P. Mohamed Shakeel; Tarek E. El. Tobely; Haytham Al-Feel; Gunasekaran Manogaran; S. Baskar., "Neural Network Based Brain Tumor Detection Using Wireless Infrared Imaging Sensor", IEEE Access, 2019, Page(s): 1
[15] Davis, N. 2009. Secure software development lifecycle process. Software Engineering Institute. [Online]. From https://buildsecurityin.uscert.gov/bsi/articles/knowledge/sdlc/326-BSI.html. [Accessed on 1 April 2011].
[16] Agile Manifesto. 2012. [Online]. From: www.agilemanifesto.org.[Accessed on 2 November 2009].
[17] De Win, B., Scandariato, R., Buyens, K., Gregoire, J., and Joosen, W. 2009. On the secure software development process: CLASP, SDL and Touchpoints compared. Information and software technology, 51(7), 1152-1171.
[18] Scriven, M. 1991. Evaluation thesaurus: fourth edition. Sage.
[19] Zultner, R. E. 1992. Quality function deployment (QFD) for Software. American Programmer.
[20] SCAMPI Upgrade Team. 2011. Standard CMMI® appraisal method for process improvement Version 1.3: Method Definition Document Handbook
[21] Lascelles, D. and Peacock, R. 1996. Self-assessment for business excellence. Berkshire: McGraw-Hill.
[22] Serkani, E. S., Mardi, M., Najafi, E., Jahanian, K., and Herat, A. T. 2013. Using AHP and ANP approaches for selecting improvement projects of Iranian Excellence Model in healthcare sector. African Journal of Business Management, 7(23).
[23] Shakeel PM, Baskar S, Dhulipala VS, Mishra S, Jaber MM., "Maintaining security and privacy in health care system using learning based Deep-Q-Networks", Journal of medical systems, 2018 Oct 1;42(10):186.https://doi.org/10.1007/s10916-018-1045-z
[24] Martakis, A., and Daneva, M. 2013. Handling requirements dependencies in Agile projects: A focus group with Agile software development practitioners. International Conference on Research Challenges in Information Science, 1-11.
[25] Kontio, J., Lehtola, L., and Bragge, J. 2004. Using the focus group method in software engineering: obtaining practitioner and user experiences. International Symposium on Empirical Software Engineering, 271-280.
[26] Shafinah Farvin Packeer Mohamed, Fauziah Baharom and Aziz Deraman. 2014. Knowledge sharing on implementing software process quality model evaluation: focus group approach. Knowledge Management International Conference, 545-550.
[27] Shafinah Farvin Packeer Mohamed, Fauziah Baharom and Aziz Deraman. 2015. ESPAC Model: Extended Software Process Assessment and Certification Model for Agile and secure software processes. ARPN Journal of Engineering and Applied Sciences, 10 (3), 1364-1373.
[28] Shafinah Farvin Packeer Mohamed, Fauziah Baharom, Aziz Deraman and Yuhanis Yusof. 2016. The validation of Extended Software Process Assessment and Certification Model using Focus Group. IC-ICT4T Conference, 192-197.
[29] ISO (2015). ISO Standards. [Online]. From: https://www.iso.org. [Acessed on 24 January 2013].
[30] Deming, W. 1982. Out of Crisis. Cambridge, MA: MIT Center for Advanced Engineering Study.
[31] Evans, R., Tsohou, A., Tryfonas, T., and Morgan, T. 2010. Engineering secure systems with ISO 26702 and 27001. International Conference on System of Systems Engineering, 1-6.