Al-Ahgaff University Journal of Computer Science and Mathematics
مجلة جامعة الأحقاف لعلوم الحاسوب والرياضيات

Vol. 1, Issue. 1, jan 2023, pp. 8~16

An Empirical Evaluation for the Improved Model of Agile Kanban: Case Study Results

Hamzah Alaidaros
Faculty of Computer Science and Engineering, Al-Ahgaff University, Mukalla, Hadramaout, Yemen
hamzah@ahgaff.edu
Mazni Omar
Institute for Advanced and Smart Digital Opportunities (IASDO), School of Computing, UUM College of Arts and Sciences, Universiti Utara Malaysia, 06010 UUM Sintok, Kedah, Malaysia
mazni@uum.edu.my
Rohaida Romli
Human-Centred Computing Research Lab, School of Computing, UUM College of Arts and Sciences, Universiti Utara Malaysia 06010 UUM Sintok, Kedah, Malaysia
aida@uum.edu.my

Article Info

Article history:

Received des, 27, 2022
Revised jan, 20, 2023
Accepted jan, 25, 2023

Keywords:

Kanban Method
Monitoring Task
Case Study
Evaluation
Applicability
i-KAM

ABSTRACT

This paper aims to empirically evaluate the applicability of an improved model for the Agile Kanban, which is called i-KAM. The i-KAM was proposed to improve the software project monitoring task of Agile Kanban method, which has critical challenges negatively impact the process of Software Project Management (SPM). To achieve this aim, we conducted a case study in a software house to implement i-KAM in actual projecs within a real environment. In this case, a prototype tool designed based on i-KAM, has been used by team members during their daily work in developing new system for three months. Ultimately, data were collected via an evaluation form designed to measure the applicability of i-KAM based on five factors, which are (1) gain satisfaction, (2) interface satisfaction, (3) task support satisfaction, (4) perceived usefulness, and (5) perceived ease of use. Based on the analysis, the findings indicate that the implementation of i-KAM is not only applicable in the real software organizations but also help in delivering required projects within the prescribed cost and time.

الخلاصة

تهدف هذه الورقة إلى تقييم تطبيق النموذج المحسن لأجايل كانبان تجريبيا ، والذي يسمى i-KAM. النموذج i-KAM تم اقتراحه لتحسين مهمة مراقبة تطوير مشاريع البرمجيات باستخدام طريقة أجايل كانبان ، حيث أن هذه الطريقة لها تحديات حرجة تؤثر سلبًا على عملية إدارة مشاريع البرمجيات (SPM). ولتحقيق هذا الهدف ، أجرى الباحثون دراسة حالة في مؤسسة برمجيات من أجل تطبيق i-KAM في مشروع فعلي ضمن بيئة حقيقية. في هذه الدراسة ، استخدام أعضاء فريق عمل المؤسسة أداة النموذج الأولي لرصد التقدم (PM-PT) – التي تم تصميمها اعتمادا على i-KAM - أثناء عملهم اليومي في تطوير نظام جديد ولمدة ثلاثة أشهر. في نهاية دراسة الحالة، تم جمع البيانات عبر نموذج تقييم مصمم لقياس مدى قابلية تطبيق i-KAM استنادًا إلى خمسة عوامل ، وهي (١) اكتساب الرضا ، (٢) رضا الواجهات ، (٣) الرضا عن دعم المهام ، (٤) الفائدة المتصورة ، و (٥) السهولة في الاستخدام. تشير نتائج التحليل إلى أن i-KAM يمكن تطبيقه فعليا في مؤسسات البرمجيات ، بل إنه يساعد أيضًا على تسليم المشاريع المطلوبة ضمن التكلفة والوقت المحددين.

1. INTRODUCTION

Project Management (PM) traditionally defined as the process of planning, organizing, motivating and controlling resources, actions and rules in order to complete successfully specific goals and objectives within a specified period of time [1, 2]. Typically, this process is used in whole project as a series of activities in order to produce an exclusive deliverable. Meanwhile, it uses deadlines, starting and ending points to reach the target. In this context, the Project Management Institute [3] defines the project management as “the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements”. Hence, Rose [4] claimed that meeting the requirements, on deadlines and within the budget, of project needs an effective management.

Agile Project Management (APM) is an innovative modern approach for managing software development projects [5]. APM allows the organizations to adjust their plans in line with changes in the project

environment, and delivers a number of novelties and benefits for the projects' team and client as well [6]. Kanban is an APM method which is being widely adopted in several fields and numerous settings for the purpose of managing the development of projects [7, 8]. Although this method was initially used in manufacturing domain; however, its adoption in other domains is continuously growing due to its flexibility, reliability, and proven successfulness [9, 10]. On top of that, Kanban method has an effective mechanism for managing projects and visualizing their workflow [11, 12]. Accordingly, the investigation of Kanban method is being a worthy study area, and recently attracted researchers from different perspectives and fields [7].

Among these researches, [11] conducted a study explored challenges of Kanban method in the software development. The results revealed that Kanban has major problem related to the task of monitoring. Thus, the study was concluded by developing a new model based on Agile Kanban in order to improve the software project monitoring task, which so called i-KAM. Though the effectiveness of i-KAM was verified by 11 experts [9] and also re-verified by seven software practitioners [5] [13] ; however, there is a high need to evaluate its applicability of in actual project. Therefore, this study aims to empirically evaluate the i-KAM applicability and ultimately answer the research question: Is i-KAM applicable in the real world environments?

The rest of this paper is structured as follows. Section 2 reviews the related work to this study, while section 3 describes the research method employed to achieve the study objective. Then, the evaluation results are demonstrated in section 4, followed by a discussion of the study findings in section 5. Final section summarizes the current study and provides some recommendations for forthcoming works.

2. RELATED WORK

A study conducted by Panigrahi and Behera [14] confirm that Kanban method has a very good system of production control and industries improvement. In addition, a system for production departments was developed based on Kanban to demonstrate the efficiency of the pull system. The developed system has been employed as a signal in order to automatically renew the parts existed in the warehouse. After implementing this system, the communication flow has been improved and the overproduction has been minimized, whilst the efficiency of the production has been increased notably [15]. Indeed, this success was not only in the manufacturing field, but also in other fields such as sports science, learning, Internet of Things (IoT), student projects, and software development.

Based on Common KADS and Kanban method, a Sports Science Knowledge Management (SSKM) system has been developed by Santirojanakul [16]. SSKM was aimed at improving the performance of the sports scientist's reporting system. The author affirmed that Kanban board supports the collaboration and communication between the sports scientists, executive, staff, and sport association. It also displays different types of sport competitions, sports associations, sports scientists, and athletic evaluations.

Moreover, Fitriawati and Lestari [10] designed an information system based on Kanban method for kindergarten learning evaluation. The Kanban method was used as management as well as control guidelines for all evaluation stages. Results indicated that using Kanban method helped the programmers to easily design the required system according to the system users' needs. This study concluded that Kanban method permits end-users to share the activities' flow and to set the activities' level in line with to their demands.

A study conducted by [8] proposed a new system for managing the IoT sensors via using Kanban method. The proposed system was developed to decrease the consumption power of the sensors. Therefore, this study pointed out that using Kanban method was an efficient management approach that increased the sensor lifetime and decreased the communication traffic. Furthermore, Saltz and Heckman [17] conducted a study compared various methods on how to guide students through computing projects. Their study was aimed to understand if one method is better than the other methods for student teams. The findings confirmed that Kanban is the effective method for guiding and managing student projects, as it improved student outcomes and minimized instructors' workload.

On the other hand, there are several studies conducted to investigate the Kanban method use in the software development [18, 19]. Particularly, in the Software Development Management (SPM), Kanban method has received a significant reputation specially for managing the process of software development projects [20-22]. Kanban method has a board used to visualize the workflow and control the progress of projects [23, 24]. Besides, [25] affirmed that software practitioners have shifted towards using Kanban method due to its effective communication, transparency, and limited by limiting the Work In Progress (WIP) traits.

However, Kanban method has three key challenges, which are: (1) it needs an effective tracking mechanism, (2) it has a difficulty in controlling WIP limits, and (3) it lacks displaying valuable information about the project progress. In consequence, these challenges have a significant impact on the fail of software delivery on the predefined time and cost [24, 26, 27]. To overcome the crucial challenges of Kanban, [11] carried out a comprehensive review to develop an initial model of i-KAM. As a result, sets of criteria were identified and then aligned with three main components proposed to constitute i-KAM.

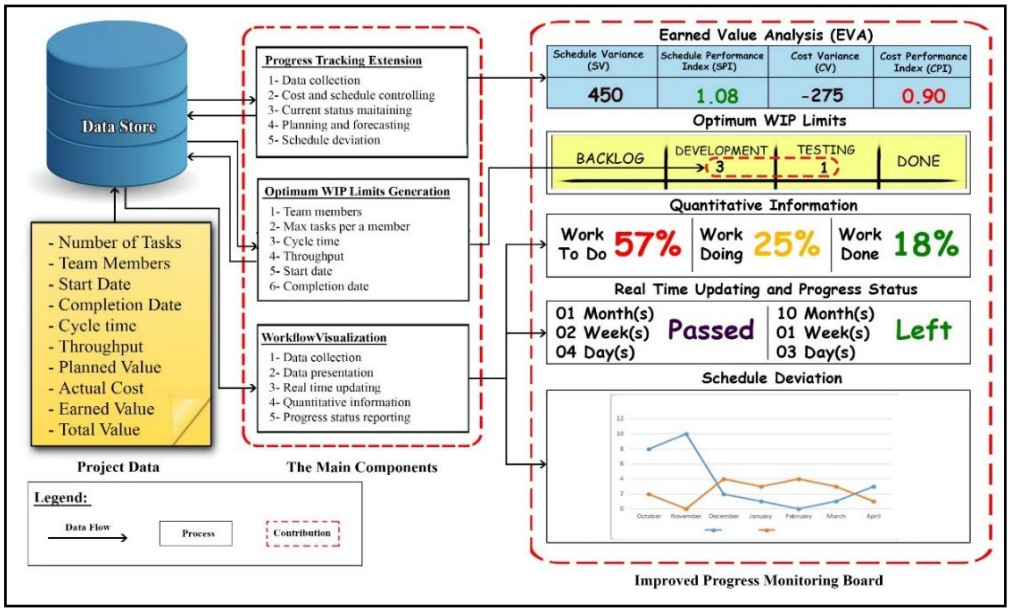

Figure 1. The proposed model (i-KAM)

As depicted in Figure 1, the proposed model consists of three main components, which are (1) extending progress tracking, (2) generating optimum WIP limits, and (3) visualizing useful insights for workflow. Each component has a major influence to solve the current challenges of the monitoring task as confirmed by [20]. In i-KAM, the first component uses the Earned Value Analysis (EVA) method to extend the progress tracking mechanism of Kanban method. The second component finds out the optimum WIP limits for all stages of Kabana board. However, the third component depicts significant information concerning with the project workflow. [28] developed a Progress Monitoring Prototype Tool (PM-PT) grounded on i-KAM to prove its concepts. PM-PT consists of several pages, and each page has different functions represent all tasks and process of i-KAM. For instance, Figure 2 shows the main page of PM-PT that appears after successful login displaying an overview about PM-PT. On the left side, a main menu contains a list of tabs for performing numerous functions executed the functions proposed in i-KAM.

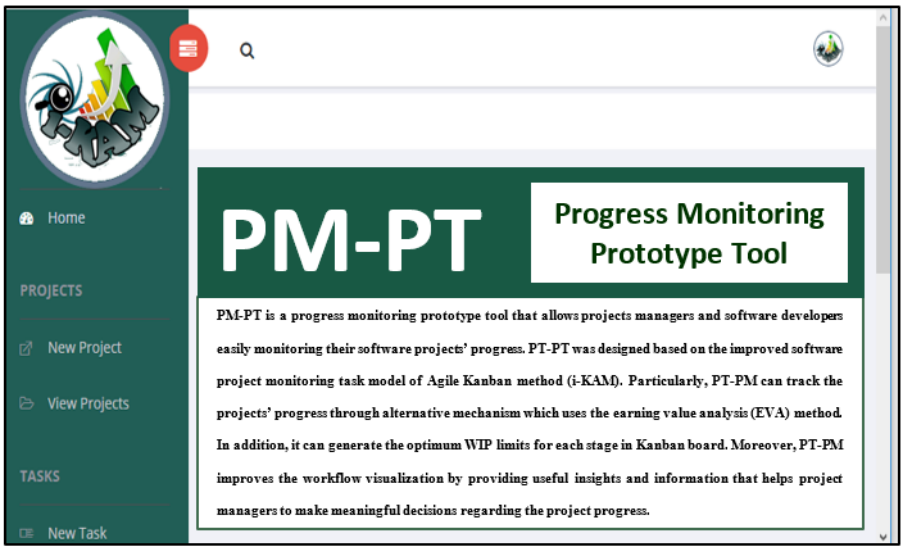

Figure 2. PM-PT main page

Besides that, another key page created to represent the improved progress monitoring board as shown in Figure 3. Mainly, this page contains variety functions and activities that were added to the original Kanban board in order to improve it and address previously recognised flaws and concerns. Notably, the improved board has three stages, which are To Do, Doing, and Done, whereby all projects' tasks are moved through the three stages starting from To Do stage up to Done stage. In addition, the tasks description together with the team member assigned to perform a potential task are visualized. Meanwhile, the improved board visualizes quantitative information regarding the current project status. The displayed insights summarize how much of

work has been done, is doing, and remained. It also visualizes the period passed and period left of project in months, weeks, and days.

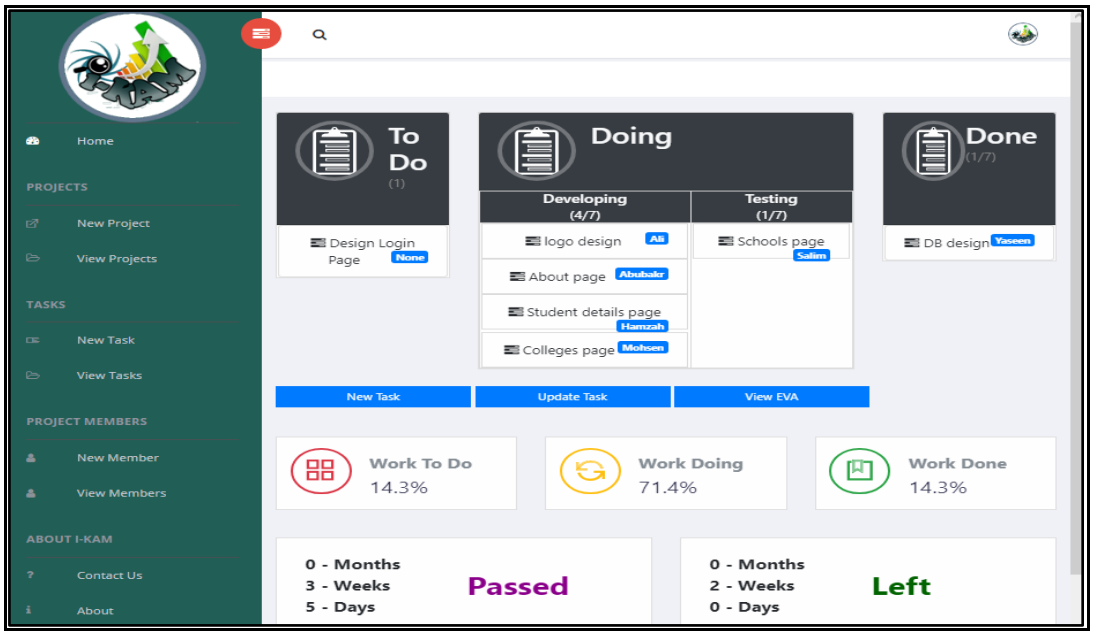

Figure 3. The improved progress monitoring board

In addition, the design of PM-PT has been initially validated through conducting interviews with seven practitioners work in Malaysia software companies [28]. The preliminary outcomes of the study indicated that the PM-PT has got their approval since the tool is an effective solution for tracking software projects. However, some participants suggested implementing PM-PT in actual projects in order to evaluate its applicability in software houses. Therefore, the focus of this study is to evaluate the practical applicability of PM-PT in a real project through conducting a case study.

3. Research Method

This study employed the case study method to empirically evaluate the applicability of i-KAM by software practitioners through using PM-PT in a real project within their organization. The case study method was selected as it is common approach used for evaluating the applicability [29] of the new approaches proposed in Software Engineering (SE) domain [30]. To achieve the study objective, three main procedures, which are (1) planning the case study, (2) conducting the case study, and (3) data collection and analysis, were followed. These procedures were adapted from Altarawneh [31] and Runeson and Höst [32], and discussed in the following subsections.

3.1 Planning the case study

The first procedure was carried out to plan the case study, in which it started by identifying an organization to implement PM-PT. Accordingly, to identify the potential organization, certain characteristics were defined, in which the identified organization should: (1) have a small size team, (2) develop software projects, and (3) have willingness to cooperate in evaluating i-KAM by implementing PM-PT in one of its projects. In this procedure, a focus was given to select an organization based on how it manages the development process of software projects, regardless of the used method in that organization. Consequently, the Universiti Utara Malaysia Information Technology (UUMIT) was selected as it is an educational organization meets the predefined requirements for conducting the case study. Moreover, one of the key reasons for selecting UUMIT is to response to the suggestion provided by a software practitioner during interviewed him when initially developed PM-PT. He suggested evaluating the applicability of i-KAM in educational setting having a small team for developing simple projects [28]. Furthermore, the universities recently became realised the significance of the Kanban method and their researches focus on its trends and applications in the industry [33].

Initially, a formal letter attached with an e-mail was sent to the UUMIT director requests giving the researchers a permission to conduct a case study by applying the designed tool (PM-PT) in any forthcoming system will be developed by UUMIT. Within the application, the purpose of conducting a case study was explained which is to evaluate the i-KAM applicability within a small sized project in a real environment. In response, the UUMIT director agreed on above mentioned request and sent an acceptance letter to conduct a

case study in UUMIT. The director suggested working on the latest project which is a "System for Applying Business License by Student". This system aims to simplify and speed up the application process for business license of students who have business in UUM campus. This appointed system was requested by the Co-operative and Entrepreneurship Development Institute (CEDI), which is an UUM centre, aims to nurture and develop student entrepreneurs through student business entrepreneurs.

After receiving the acceptance, a first meeting was held in UUMIT with the head of University Information Systems (UIS) and the project manager. The UIS is a UUMIT unit which is liable to develop all systems requested by any UUM department. Hence, the first meeting was aimed to introduce the idea of the proposed model and to present the purpose of conducting the case study. It was also aimed to get an overview on the forthcoming project and understand its requirements. Figure 4 displays a side of the discussion during meeting the UIS administration in UUMIT.

Figure 4. Meeting with UIS administration in UUMIT

In the presentation, the researchers introduced the importance and contributions of i-KAM, and briefly illustrated about the tool (PM-PT). Besides that, the case study procedures were explained, and the factors that would be ultimately used to evaluate PM-PT were presented. In addition, the initial steps to start conducting the case study were highlighted along with identifying the information required before developing the project.

3.2 Conducting the case study

The second procedure was carried out to conduct the case study, which has been started by holding the second meeting with the team members of UIS unit who have appointed to develop the nominated project. The purpose of the second meeting was to explain to the team members how to use PM-PT practically. Thus, the researchers illustrated the tasks, which are performed by project manager, and tasks, which are executed by team members during developing the software projects. The explanation was supported by giving examples for creating and updating projects and tasks, along with adding team members to the PM-PT. Moreover, the main functions of PM-PT were also highlighted, which include tracking the progress and utilizing the useful information visualized in an improved progress monitoring board for obtaining an effective monitoring of the project progress. Meanwhile, they were reminded about the factors and items that would be used ultimately to evaluate PM-PT.

After finishing the explanation, the researchers shared with the team members the URL of PM-PT because it is a web based tool, and then provided them by login information to start using PM-PT. The team members have regularly used PM-PT to report their progress when releasing a task or changing its status from stage to another. Furthermore, during conducting the case study, any problems faced the team members were discussed and solved by holding instant meetings or via WhatsApp group.

3.3 Data collection and analysis

The last procedure in implementing the case study was to collect and analyse data regarding the evaluation of PM-PT. As whole, the team members of UUMIT have used PM-PT during a period of three months, whilst the data collection took around two hours as all team members work in one place. They were met to provide their opinion on PM-PT, which has been implemented in developing the project. In this procedure, an evaluation form was used for data collection to evaluate the applicability of i-KAM after using PM-PT.

The evaluation process was conducted based on five factors, which are (1) gain satisfaction, (2) interface satisfaction, (3) task support satisfaction, (4) perceived usefulness, and (5) perceived ease of use as claimed by [30]. After that, researchers started analysing the data collected by the evaluation form that provided by participants. In this procedure, the content analysis approach was employed because it is the common method used in quality researches. Therefore, the content analysis was used to describe the feedback of team members by identifying, coding, and categorizing the main themes in the collected data [34].

4. EVALUATION RESULTS

This section demonstrates the evaluation results obtained from the UIS team members. It starts by providing the team demographic information, followed by discussing each factor in subsection. As required, this project has been assigned to small team involves two members, wherein the development team is typically responsible for developing any projects related to student affairs. The team member's age is 42 and 35 old, and they have 17 and 8 years of experiences in developing software projects respectively. Mainly, the development team with small members enhances interpersonal communication skills [35]. Besides that, Malik [36] confirms that a small team can be highly efficient. Thus, the number of the team members who had participated in the study is sufficient to achieve valid and reliable results.

4.1 Gain satisfaction of PM-PT

The gain satisfaction was assessed based on four variables, which are decision support satisfaction, comparing with current method, clarity, and task appropriateness. The participants were satisfied with the PM-PT, whereby they indicated that tool can help the management to take a well-defined decision regarding to software project monitoring task. In addition, all functions provided by PM-PT were clear to the team members, wherein each phase obviously presents the required inputs, processes, and outputs. Although team members have never use any monitoring tool before, they affirm that having PM-PT would effectively track their progress and thus deliver software products within the planned cost and time. In general, the participants agreed that the PM-PT is an appropriate tool for monitoring the development process of software projects.

4.2 Interface satisfaction of PM-PT

Among the variables that were assessed for interface satisfaction are internally consistent, organization (well organized), appropriate for audience, and presentation. The participants confirmed that PM-PT is internally consistent due to the good design of interfaces that makes performing the PM-PT functions in accurate manner. Moreover, PM-PT is found to be well organized and structured, thus it makes the project tasks easy to be performed. Particularly, it enables project manager creating new projects by keying in main information, such as project name, customer name, e-mail, etc. Then, project manager can assign tasks to a particular project by keying in task description, along with its required cycle time (in days).

Furthermore, the participants pointed out that PM-PT is appropriate for the project managers and development team. They also affirmed that results presented by PM-PT are in a readable and useful format, as showed in an improved progress monitoring board. This board visualizes sufficient information and critical insights for the project workflow. For example, it reports quantitative information on the current project status - by percentage - that helps project managers to make significant judgements concern with the projects' workflow.

4.3 Task support satisfaction of PM-PT

This subsection demonstrates the results provided the participants on the task support satisfaction factor of PM-PT. This factor was measured based on three variables, which are ability to produce expected results, completeness, and ease of implementation. The participants indicated that PM-PT is able to generate expected and valued results. The information visualized in the improved progress monitoring board was very beneficial to the team members. For instance, displaying the project tasks, project duration (passed and left), project status, is a valuable approach to encourage team members performing well. To some extent, the participants were agreed that PM-PT is adequate and sufficient for monitoring the progress task during software development projects. PM-PT can assist to track their tasks and control their schedule during the development of the required system. In addition, participants also asserted that PM-PT is easy to be implemented within actual projects in real world environments.

4.4 Perceived usefulness of PM-PT

The perceived usefulness factor of PM-PT was assessed based on five variables, which are: accomplishing more work, work performance, make tasks easier, usefulness, and increasing productivity. Generally, the participants indicated that PM-PT is useful for their working environment, as it can enable them to accomplish their tasks more quickly. They also affirmed that using PM-PT improved their performance and

made them performing their tasks easier. Meanwhile, the participants highlighted that using PM-PT can partly assist in increasing their productivity.

4.5 Perceived ease of use of PM-PT

This subsection explains the results of the perceived ease of use factor. The assessment of PM-PT was conducted according to six variables, which are ease of learning, confusing, flexible, understandable, effort to become skilful, and ease to use. According to the participants' responses, the PM-PT was perceived as easy to be used because it has well-defined functions and features. Thus, they indicated that learning to operate PM-PT is easy for them and for other software practitioners as well. Moreover, the participants found that they can easily make PM-PT does exactly what they want. Importantly, PM-PT has deemed as flexible tool as the team members confirmed that their interaction with PM-PT was clear and understandable too. Furthermore, the participants indicated that it is easy to become skilful when using PM-PT.

5. DISCUSSION

The current case study has really used PM-PT to evaluate the applicability of i-KAM in developing an actual project. In this context, the required system has been developed by UIS team with employing the PM-PT in monitoring the development process. The findings from the conducted case study confirm that the proposed model (i-KAM) is applicable to be implemented in real projects which are developed by software houses. In addition, the findings indicate that the PM-PT has gained participants' satisfaction, whereby they affirmed that i-KAM deemed as practical model can be implemented in the actual projects. Primarily, the team members emphasize that PM-PT is useful for projects managers to monitor the projects development life cycle.

Moreover, they affirm that tool is beneficial in terms of organizing the project tasks. Thus, developers can know what tasks which need to work on. Particularly, in PM-PT, tasks are assigned to team members clearly, in which they can update their progress easily. Therefore, project manager can straightforwardly monitor all projects tasks. Furthermore, the team members acknowledge that PM-PT enables monitoring numerous tasks because of the work list is more visible and organized too.

In the evaluation form, the participants were asked to provide comments and suggestions towards enhancing PM-PT. In response, they suggested assigning starting/ completion dates for each task of project, thus would help project manager to easily monitor the development team when starting or finishing a task. However, PM-PT provides the similar function which is assigning a cycle time, in days, for each task in a project. Besides that, the participants also suggested to notify the project manager (e.g. by e-mail) when a task has been done by a team member. In addition, the participants recommended adding a button for editing the progress of a developer, in which he/she can search back in the assigned list of project tasks. Nevertheless, this property is already existed in PM-PT wherein team members can update their progress. Moreover, one of the participants argued that PM-PT needs a time to record all project tasks, thus would add more workload to the team members as they are required to update their progress continuously. Conversely, the use of SPM tools has numerous benefits to the team members. For instance, it enable them planning their tasks and collaborating together, as well as monitoring their progress [37]. In addition, using SPM tools in practices is being on the rise within SDOs, because it is one of key factors of successfully managing the development of software projects [26].

Despite of the above mentioned positive findings, one of the main functions of PM-PT was not implemented due to its unsuitable use in the current case. In PM-PT, EVA method is used to track project progress effectively. It mainly requires three inputs values, which are Planned Value (PV), Actual Cost (AC), and Earned Value (EV). In this case, PV is a recognized value; however, the values of AC and EV could not be determined. This is because UUMIT is non-profit in-house organization established to develop systems needed by the UUM departments; accordingly, the customers here are typically under UUM environment. Furthermore, UUMIT development team members only receive their monthly salary, rather than earning any stipend against their efforts in developing systems. In this case, applying EVA method for tracking the progress has not been performed. Therefore, another case study would be conducted in a profit software development house.

6. CONCLUSION AND FUTURE WORK

This paper demonstrated the results of evaluating the applicability of i-KAM. A case study has been conducted in UUMIT, in which PM-PT was used by team members during developing a real project. The case study conducted was ideally suited to achieve valid and reliable results due to the small size team as argued by Malik [36]. The results showed that i-KAM is an applicable model as well as it is easy to be implemented in actual environments. Besides that, the results affirmed that the application of i-KAM will practically contribute to different stakeholders, such as software engineers, software practitioners, and software project managers. By implementing the proposed model, an improved Agile Kanban method would be introduced to SE domain, and thus would be useful for software engineers to be adopted or adapted in different countries or studies areas.

In addition, software practitioners can effectively monitor the development process of software projects' progress. Besides that, useful insights and information are visualized to assist project manager in making expressive judgements with regards to project progress.

In this vein, software houses can deliver their software projects successfully according to its specifications, within the prescribed period and budget. Therefore, the rate of successful software projects would be increased, and will thus help the developers, software houses, and nation to elevate a more advanced economy. However, this study was limited to obtain results from single case study in non-profit in-house organization. Thus, to generalize the results, future work will focus on conducting more case studies in numerous settings, such as profit houses and/or out-house in other countries as well. Within this in mind, different methods, such as experts' review, and controlled experiments, could be used to evaluate i-KAM applicability. Moreover, it is recommended to investigate alternative dimensions and new directions towards enhancing i-KAM effectiveness.

ACKNOWLEDGEMENTS

The authors would like to thank the participants in the case study and special thanks go to the Al-Ahgaff University, Yemen and Universiti Utara Malaysia (UUM), Malaysia.

REFERENCES

[1] K. Schwalbe, *Information technology project management*, 8th ed. United States: John Wiley & Sons, Inc., 2016.
[2] J. R. Turner and R. Müller, "On the nature of the project as a temporary organization," *International Journal of Project Management*, vol. 21, pp. 1-8, 2003.
[3] Project Management Institute, *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)*, Kindle Edition, 6th ed. USA: Project Management Institute, Inc, 2017.
[4] K. H. Rose, "A Guide to the Project Management Body of Knowledge (PMBOK® Guide)—Fifth Edition," *Project Management Journal*, vol. 44, pp. e1-e1, 2013.
[5] H. Alaidaros, M. Omar, R. Romli, and A. Al-Sakkaf, "The Evaluation of an Improved Model of the Agile Kanban Using Focus Group," *Journal of Information Technology Management*, vol. 14, pp. 1-22, 2022.
[6] M. Masood, F. Azam, M. W. Anwar, and A. Amjad, "Defining Meta-Model for Value-Oriented Requirement Prioritization Technique," in *Proceedings of the 2019 7th International Conference on Computer and Communications Management*, 2019, pp. 72-77.
[7] H. Alaidaros, M. Omar, and R. Romli, "The State of the Art of Agile Kanban Method: Challenges and Opportunities," *Independent Journal of Management & Production (IJM&P)*, vol. 12, pp. 2535-2550, 2021.
[8] T. Kurita, K. Matsuo, and L. Barolli, "A Wheelchair Management System Using IoT Sensors and Agile-Kanban," presented at the The 11th International Conference on Intelligent Networking and Collaborative Systems (INCoS-2019), Oita University, Oita, Japan, 2020.
[9] H. Alaidaros, M. Omar, and R. Romli, "An improved model of Agile Kanban method: Verification process through experts' review," *Int. J. Agile Systems and Management (IJASM)*, vol. 13, pp. 390–416, 2020.
[10] M. Fitriawati and R. Lestari, "Design of the Information System for Kindergarten Learning Evaluation used Kanban Methodology," in *IOP Conference Series: Materials Science and Engineering*, 2019, pp. 1-6.
[11] H. Alaidaros, M. Omar, and R. Romli, "Towards an improved software project monitoring task model of Agile Kanban method," *International Journal of Supply Chain Management (IJSCM)*, vol. 7, pp. 118-125, 2018.
[12] H. Lei, F. Ganjeizadeh, P. K. Jayachandran, and P. Ozcan, "A statistical analysis of the effects of Scrum and Kanban on software development projects," *Robotics and Computer-Integrated Manufacturing*, vol. 43, pp. 59-67, 2017.
[13] H. Alaidaros, M. Omar, R. Romli, and A. Hussein, "Re-verification of the Improved Software Project Monitoring Task Model of the Agile Kanban (i-KAM)," in *Lecture Notes on Data Engineering and Communications Technologies*. vol. 72, F. Saeed, F. Mohammed, and A. Al-Nahari, Eds., ed Cham: Spriner, 2021, pp. 1247-1258.
[14] B. Panigrahi and D. K. Behera, "Improvement in productivity using Kanban process based cognitive automation system," *International Journal of Mechanical Engineering and Technology (IJMET)*, vol. 9, pp. 122–130, 2018.
[15] M. Jamaliah, A. Mohamad, and I. Azianti, "Improvements of worksite control for pull system," *ARPN Journal of Engineering and Applied Sciences*, vol. 11, pp. 7699-7705, 2016.
[16] S. Santirojanakul, "The development of sports science knowledge management systems through CommonKADS and digital Kanban board," in *2018 IEEE Symposium on Computer Applications and Industrial Electronics (ISCAIE)*, Penang, Malaysia, 2018, pp. 119-124.
[17] J. S. Saltz and R. R. Heckman, "A scalable methodology to guide student teams executing computing projects," *ACM Transactions on Computing Education (TOCE)*, vol. 18, pp. 1-19, 2018.
[18] M. K. Yacoub, M. A. A. Mostafa, and A. B. Farid, "A New Approach for Distributed Software Engineering Teams Based on Kanban Method for Reducing Dependency," *JSW*, vol. 11, pp. 1231-1241, 2016.
[19] M. Maneva, N. Koceska, and S. Koceski, "Introduction of Kanban methodology and its usage in software development," presented at the International Conference on Information Technology and Development of Education Zrenjanin, Republic of Serbia 2016.
[20] H. Alaidaros, M. Omar, and R. Romli, "Improving the progress monitoring task of Agile Kanban method: An enhanced theoretical framework and its implication," *International Journal of Scientific and Technology Research (IJSTR)*, vol. 9, pp. 611-615, 2020.
[21] I. Shamshurin and J. S. Saltz, "Using a coach to improve team performance when the team uses a Kanban process methodology," *International Journal of Information Systems And Project Management (IJISPM)*, vol. 7, pp. 61-77, 2019.
[22] M. O. Ahmad, D. Dennehy, K. Conboy, and M. Oivo, "Kanban in software engineering: A systematic mapping study," *Journal of Systems and Software*, vol. 137, pp. 96-113, 2018.
[23] D. Dennehy and K. Conboy, "Going with the flow: An activity theory analysis of flow techniques in software development," *Journal of Systems and Software*, vol. 133, pp. 160-173, 2017.

[24] H. Alaidaros and M. Omar, "Software project management approaches for monitoring work-in-progress: A review," *Journal of Engineering and Applied Sciences*, vol. 12, pp. 3851-3857, 2017.
[25] S. Shafiq, I. Inayat, and M. Abbas, "2019 45th Euromicro Conference on Software Engineering and Advanced Applications (SEAA)," presented at the Euromicro Conference on Software Engineering and Advanced Applications, Thessaloniki, Greece, 2019.
[26] M. O. Ahmad, J. Markkula, and M. Oivo, "Insights into the perceived benefits of Kanban in software companies: Practitioners' views," presented at the International Conference on Agile Software Development, Cham, 2016.
[27] J. F. Tripp, J. Saltz, and D. Turk, "Thoughts on current and future research on Agile and Lean: Ensuring relevance and rigor," presented at the Proceedings of the 51st Hawaii International Conference on System Sciences, USA, 2018.
[28] H. Alaidaros, M. Omar, R. Romli, and A. Hussein, "The Development and Evaluation of A Progress Monitoring Prototype Tool for Software Project Management," presented at the the 2019 First International Conference of Intelligent Computing and Engineering (ICOICE), Hadramout, Yemen, 2020.
[29] K. Eldrandaly, "Developing a GIS-based MCE site selection tool in ArcGIS using COM technology," *International Arab Journal of Information Technology (IAJIT)*, vol. 10, pp. 276-282, 2013.
[30] H. Alaidaros, M. Omar, and R. Romli, "The key factors of evaluating Agile approaches: A systematic literature review," *International Journal of Supply Chain Management (IJSCM)*, vol. 8, pp. 954-964, 2019.
[31] M. H. A. Altarawneh, "Monitoring oriented Agile based web applications development methodology for small software firms in Jordan," PhD Thesis, Universiti Utara Malaysia, Malaysia, 2016.
[32] P. Runeson and M. Höst, "Guidelines for conducting and reporting case study research in software engineering," *Empirical software engineering*, vol. 14, p. 131, 2009.
[33] V. Mahnič, "Kanban in software engineering education: an outline of the literature," *World Transactions on Engineering and Technology Education*, vol. 17, pp. 23-28, 2019.
[34] K. Krippendorff, *Content analysis: An introduction to its methodology*. United States: SAGE Publications, Inc, 2018.
[35] R. Hannemann, "Modifying senior design: A design review," in *American Society for Engineering Education Annual Conference and Exposition 2009*, Austin, Texas, USA, 2009, pp. 10560-10568.
[36] F. Malik, "Syntegrating city management," in *Institutional and Social Innovation for Sustainable Urban Development.* vol. 258, ed: ROUTLEDGE in association with GSE Research, 2013, pp. 258-274.
[37] M. Choetkiertikul, H. K. Dam, T. Tran, and A. Ghose, "Predicting the delay of issues with due dates in software projects," *Empirical Software Engineering*, vol. 22, pp. 1223-1263, 2017.