Improving The Progress Monitoring Task Of Agile Kanban Method: An Enhanced Theoretical Framework And Its Implication

Hamzah Alaidaros, Mazni Omar, Rohaida Romli

Abstract: Several studies claimed that software project management (SPM) failed in realizing software projects due to inadequate progress monitoring. Indeed, the successful implementation of software projects relies entirely on effective monitoring approaches. Recently, the adoption of Agile Kanban method in SPM is continuously on the rise despite its shortcoming in its progress monitoring task. Therefore, this paper aims to enhance the theoretical framework for improving the progress monitoring task of Agile Kanban method and highlight its implication on SPM domain. To achieve this aim, an exploratory research design was employed to identify the problem, review the related literature, and to develop the enhanced framework. The findings confirm the highly need of improving the monitoring task of Agile Kanban method, which would assist project managers to effectively monitor the development process of software projects. Accordingly, the results of literature have been utilized to construct an enhanced theoretical framework, thus delivering software products on time within budget could be achieved. Practically, it is hoped that the framework can provide a guideline for developing models focus on improving the progress monitoring task.

Index Terms: Agile Method, Kanban Method, progress monitoring task, software project management, theoretical framework.

1. INTRODUCTION

Software project management (SPM) is defined as the sub-discipline of project management in which software projects are planned, engineered, implemented and monitored. In order that software products are delivered on time, within the allocated budgets and fully conforming to the user requirements, it is imperative that software projects are appropriately designed, executed and well monitored [1]. SPM aims to achieve adequate product quality and to keep all other project variables, such as time and cost, under control [2]. Consequently, the success rate of the software projects can be increased, wherein the goal of each project manager is realizing successful projects. Hence, Alaidaros and Omar [3] affirms that monitoring the process of software development is an essential task of SPM that assurances the progress of the project plan in accordance with predefined specifications. Likewise, Demir [4] confirms that successful implementation of software projects relies entirely on effective monitoring approaches, whilst the absence of projects oversight results in the failure of different projects [5]. SPM suffers from the change, which is unavoidable issue, as the real world changes during the execution of the project management activities. That is, it is necessary to update the project plan although it is not surprising that the plans are difficult to be maintained. In this regard, Koskela and Howell [6] emphasized that keeping an up-to-date schedule is difficult and thus the plan must be systematically and ideally extracted. Likewise, Warburton and Cioffi [7] argued that it is important to include the dynamic nature of project management, such as the effect of operation shifts, their implementation times, and their costs. Besides that, they have confirmed that the plan changes occur during the execution of real-world projects, and then the impacts of the schedule and cost follow. According to [8], plans are input into execution and, despite the plans being developed prior to execution, the key is to recognize that project data are an important entity to be entered. Hence, it is feasible that when the project data changes, related components can automatically derive an updated plan. In consequence, providing a theory for project management may have the potential to illuminate the path to better model or tool building. In software development organizations (SDOs), the Agile Kanban is a widespread approach adopted to manage and monitor the development of software projects. This is due to the greater consistency that possess in developing software engineering (SE) projects [9], [10]. Nevertheless, the progress monitoring task of Agile Kanban method has significant deficiencies in terms of tracking, controlling, and visualizing the workflows' progress [11]. In turn, those issues negatively impact the success of software projects, as the delay in projects schedule leads to late products delivery [12], [13]. Besides that, a recent report [14] indicated that the successful software projects are represented about one-third out of the developed projects, while the remaining projects are considered as challenged or failed projects.

Accordingly, a theoretical framework for improving the progress monitoring task of Agile Kanban method has been proposed [15]. However, it still requires an enhancement by exploring its evaluation dimensions and highlighting its significant impacts to the domain of SPM. Therefore, this study aims to enhance the developed theoretical framework to improve the progress monitoring task of Agile Kanban method. Vinz [16] stated that theoretical framework provides a logical justification demonstrates that study is established in scientific theories. The remainder of the paper is structured accordingly. Section 2 describes the research design and methodology used to conduct this study. Section 3 discusses the results retrieved from conducting each phase of research methodology, whilst section 4 explains study findings and implications. Final section, section 5 concludes this study and proposes recommendations and remarks for the future works.

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2 RESEARCH DESIGN AND METHODOLOGY

According to Ruslimi Zakaria and Hadzratullathfi Syed Omar [17], the research design must be selected seriously to ensure that the results and analysis are presented optimally. Therefore, this study employed the exploratory research design which is usually used to explore the problem, review the literature related to the potential situation, and then develop new ideas. The exploratory research design is the appropriate design for this study as it focuses on gaining insights and well-grounded information for investigation as claimed by [18]. As such, Nieswiadomy [19] stated that the exploratory design is adopted when the subject under research has limited information and knowledge. Fig. 1 depicts the research design and methodology, which is consisted of three phases, followed to achieve the objective of this study.

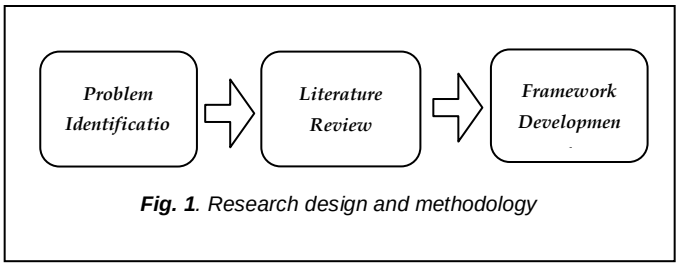

***Fig. 1**. Research design and methodology*

As demonstrated in Fig. 1, the research methodology is initially determined the recent challenges face software practitioners in managing their software development process. Then, the literature review is conducted as it is one of the most effective data gathering approaches used in exploratory design [18]. Hence, literature review is conducted to gain insights and ideas about the current problem of Agile Kanban method. Ultimately, the theoretical framework is developed based on the analysis of literature findings. Overall, the research design followed in this study was quite adequate as it assisted the researchers in identifying the elements that need improvement, examining related theories to progress monitoring tasks, highlighting the key evaluation dimensions, and finally helping to enhance the theoretical framework for improving Agile Kanban method.

3 RESULTS AND DISCUSSION

This section present the results retrieved from conducting this study. It also discusses the outcomes of each phases of the research methodology.

3.1 Problem Identification

Currently, Agile methods have been used to address the challenges of managing complex software projects during the development process. They have received wide recognition within the SDOs due to their numerous advantages, such as flexibility and effectiveness. Moreover, Agile methods provide a shorter development cycle, higher customer satisfaction, and rapid changes to the business requirements in the software development environments [3]. On top of that, these methods have been implemented different project sizes and numerous project fields, such as medicine, engineering, manufacturing, and banking [20]. A recent systematic literature review conducted by [21] affirms that Agile methods are becoming more popular compared to traditional methods due to the their flexibility in developing software projects and delivering business value in short iterations. The 12th annual state of Agile survey showed that 56% of the respondents practice Scrum among other Agile methods, while only 8% and 5% are practiced Scrumban and Kanban methods respectively [22]. So far, it is clear that Scrum is the most followed method, whilst still other Agile methods are being practiced by fewer practitioners in various SDOs. Nonetheless, various studies, such as [9], [10], confirmed that Kanban method, recently, has got popularity in SDOs among Agile methods. This method has various benefits and significant influence on effectively managing SE projects. Thus, the present research concentrates on Agile methods in general, and Kanban method in particular. Nevertheless, the progress monitoring task of Agile Kanban method has significant deficiencies in terms of tracking, controlling, and visualizing the workflows' progress. In sequence, this problem negatively impacts the success of software projects because the delays in project schedule lead to late product delivery [11], [12], and [13]. Therefore, the outcomes of this phase emphasizes that there is a highly need to improve the progress monitoring task of Agile Kanban method for assisting project managers to monitor the development process of software project, and thus can deliver software on time within budget.

3.2 Literature Review

In this phase, an extensive review of the literature was carried out to find the related studies and works that could help to tackle the identified problem. The results obtained are subsequently explained. A recent study [23] affirms that Kanban method could be improved among three main directions, wherein these directions having negative effects toward enhancing its progress monitoring task. Accordingly, the theoretical framework proposed in [15] was focused to improve three main directions, which are (1) progress tracking, (2) limiting WIP, and (3) progress visualization. In addition, the criteria influence the progress monitoring task of Agile Kanban method were identified in [11]. Hence, the present study will continue enhancing the proposed framework by examining its potential evaluation dimensions. Usually, the evaluation process is based on two main stages, which are verification and validation. According to the IEEE Standard Glossary of Software Engineering Terminology [24], verification is defined as "The process of evaluating an approach or components to determine whether the products of a given development phase satisfy the conditions imposed at the start of that phase." Similarly, the verification process is conducted to verify the approach design in terms of justifying its potential for developing practical solutions [25]. Sulaiman, Okere, Awang and Mean [26] claimed that the model verification using expert reviews is necessary before a final model evaluation can be obtained. Thus, the verification stage is carried out to verify the effectiveness of the components and criteria included in the proposed model. Particularly, proposed approaches need to verify its understandability, relevance, feasibility, organization, and comprehensiveness through knowledge and domain experts [20].

Besides that, IEEE Standard Glossary of Software Engineering Terminology [24] defined the validation as "The process of evaluating an approach or components during or at the end of the development process to determine whether it satisfies specified requirements." In other words, the validation process concerns with the stage of determining whether the proposed approach is accurately represented from the perspective of the intended usage [25]. Therefore, the validation stage is carried out to validate the applicability of the proposed approach in real world environments. Specifically, the factors, such as gain satisfaction, interface satisfaction, task support satisfaction, perceived usefulness, and perceived ease of use, are adopted to validate the approaches applicability [20]. On the other hand, in developing a theoretical framework, theories form the discipline and direct the analysis of the phenomenon. Additionally, theories and practices are typically established together, whereby theory is explained, investigated, and refined in an ongoing dialog between groups of scientists and practitioners. Typically, the related theories are added to the theoretical framework, along with the main concepts and elements that apply to problem described [16]. Although the SE and SPM fields are relatively young compared to other areas, a previous study [15] identified the theories which are very closely related to enhance the progress monitoring task of Agile Kanban method. The identified theories are (1) The explicit theory of project management (TETPM), (2) Progress monitoring theory (PMT), and (3) The program theory (TPT). Accordingly, three theories were used to establish a theoretical framework for improving the progress monitoring task of Agile Kanban method. Nevertheless, such theories must be tested and matched with the components that influence the solution of the current issue. Based on above discussion, the outcomes of this phase suggest enhancing the theoretical framework proposed in [15] by including two main evaluation dimensions, which are verifying the effectiveness, and validating the applicability.

3.3 Framework Development

This phase is carried out to develop an enhanced theoretical framework to improve the progress monitoring task of Agile Kanban method. To do so, the proposed framework has been constructed based upon three theories, which are TETPM, PMT, and TPT, along with improving three elements, which are progress tracking (PT), limiting work-in-progress WIP (LWIP), and progress visualization (PV). In addition, this study enhances the theoretical framework by adding evaluation dimensions to its design as shown in Fig. 2.

As demonstrated above, Fig. 2 shows the enhanced theoretical framework, which is developed to be a strong scientific research base, for improving software project progress monitoring task. It is enhanced by contributing additional dimensions for evaluating such proposed approaches. Mainly, its effectiveness should be verified and then its applicability must be validated.

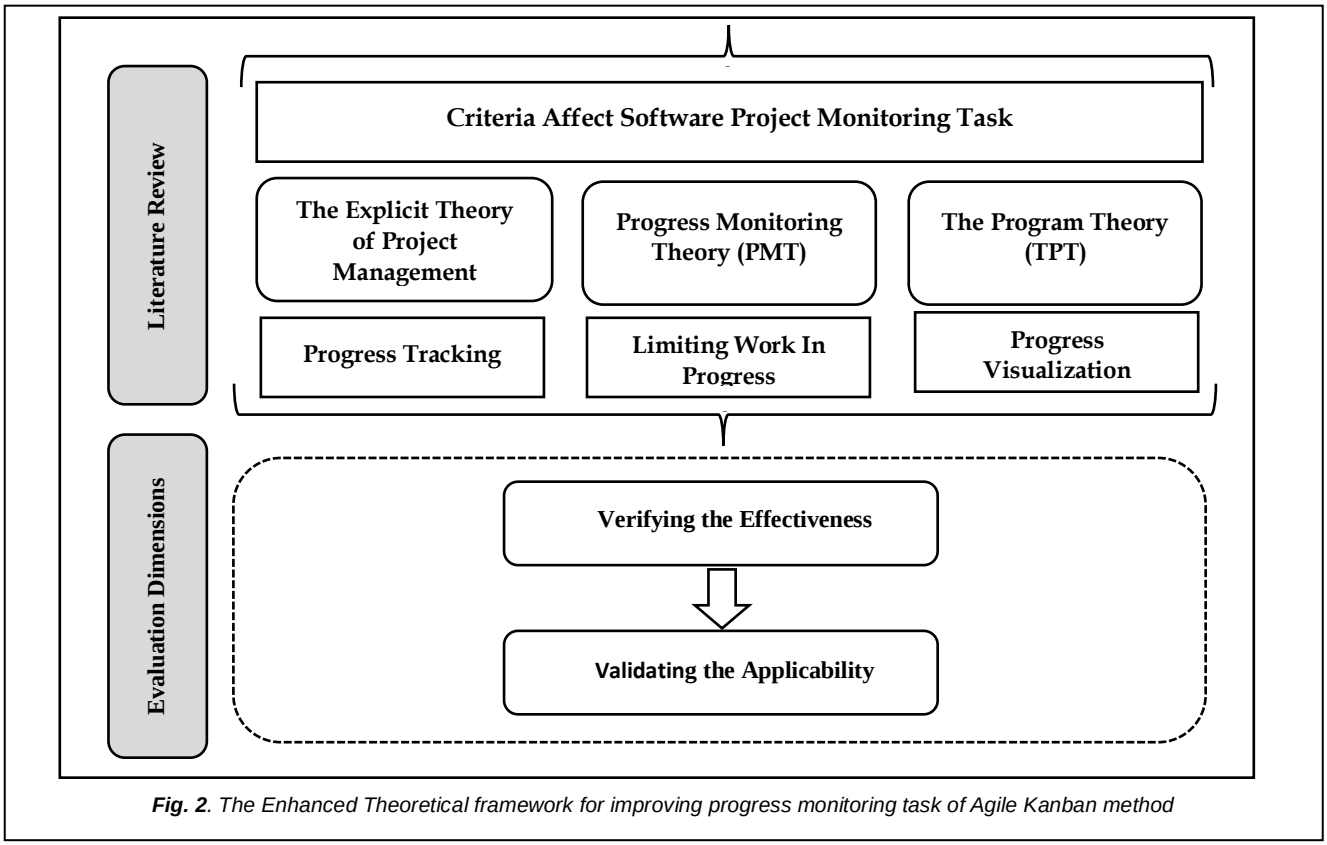

***Fig. 2**. The Enhanced Theoretical framework for improving progress monitoring task of Agile Kanban method*

4 STUDY FINDINGS AND IMPLICATION

This section highlights the finding and implication of this study. It maps and compares the features of the developed theoretical framework with the characteristics of the existing tools which are recently used in SPM. Presently, there are several tools in the market for managing and developing software projects. Some of these tools are general tools such as Primavera, MS Project, Jira, and so on, while others tools were developed based on Kanban concept, such as Leankit, KanbanTool, Kanbanery Tool, and so on. Although some of these tools still poses many benefits in managing software projects; however, they still have drawbacks and challenges in

terms of tracking the progress, controlling the WIP limits, and visualizing the vital facts and for the project workflow. From that perspective, Table I maps the features of the proposed theoretical framework with the above-mentioned tools used in SPM. Each tool receives (√) mark whenever corresponding feature is provided, (/) mark when the feature is partially provided, or (X) mark in case of that feature is not provided.

It is clearly shown in Table I that there is a significant implication of the theoretical framework over the existing tools, in which the half of its proposed features (50%) is totally not provided. While the majority features of the second half (42.80%) are partially provided, and only three features (7.20%) are provided. Particularly, it is noticeable that general tools do not possess the majority of the theoretical framework features, while some of them are partially provided. As such, tools, MS project and Jira can assess the rate of progress. Nevertheless, MS project seeks to an alternative plan to hinder the occurring of delay, while Jira makes team members focusing as much headway as possible towards the goal.

Regarding to Kanban based tools, the majority of features are provided because of these tools have been developed based on Kanban method. Even though these tools utilize Kanban board to visualize their workflow and control WIP limits; however, they have not only different settings for WIP limits, but still need project manager or team members to manually determine the WIP limits. So far, a bad estimate for preliminary WIP limits may be painful and impact the project progress, which consequently will lead to delay the development scheduling failing in delivery products on the prescribed time. Moreover, these tools are only limited to visualize the workflow, instead of provide useful insights and target information that may help in improving progress tracking.

TABLE 1

MAPPING THE FEATURES OF THEORETICAL FRAMEWORK WITH SOME TOOLS USED IN SPM

Features of the Theory	General Tools			Kanban Based Tools		
	Primavera	MS Project	Jira	Leankit	Kanban Tool	Kanbanery Tool
Providing directions for analyzing the further progress	X	X	X	X	/	/
Helping to develop tools for analyzing, designing, and monitoring	X	X	X	X	X	X
Making decisions to be as much progress as possible towards the aim	X	X	√	/	/	/
Assessing the progress' rate	/	√	√	X	/	/
Seeking to find an alternative plan to avoid the delay	/	X	X	X	X	X
Focusing on creating a logical model	X	X	X	/	/	/
Visualizing the main features of monitoring and evaluation	/	/	/	/	/	/

Overall, the main implication of this study is the enhanced theoretical framework, which has a major feature in which tools for analyzing, designing, and monitoring software projects can be developed. Nevertheless, only KanbanTool and Kanbanery can partially provide directions for analyzing the further progress. Besides that, although the feature of focusing on creating a logical model does not provide by the general tools, it is partially provided by Kanban based tools. Furthermore, all tools partially provide the feature of visualizing the main features of monitoring and evaluation, whereby they only focus on visualizing the basics and general criteria.

5 CONCLUSION

Although the adoption of Agile Kanban method in SPM is continuously on the rise, several studies claimed that Kanban method still having significant deficiencies in its software project monitoring task. Consequently, this problem impacts on the progress scheduling and hinders the realizing software products successfully within the prescribe time. In this context, a theoretical framework was proposed to establish a strong base focuses in solving that problem. However, this framework is still in its initial phases as well as needs to be enhanced. Therefore, this paper utilized the exploratory research design to review the literature and enhanced the proposed theoretical framework which developed to improve the progress monitoring task of Agile Kanban method. The contribution of this study is an enhanced theoretical framework focuses in examining the evaluation dimensions of the proposed approaches. The results revealed that there are two evaluation stages, which are verifying the effectiveness of the proposed approach, and then validating its applicability. In addition, the implication of this study has been highlighted in which the enhanced theoretical framework can be used to design alternative models or tools for of monitoring and managing the development process of software project. Nevertheless, this study also proved that existing tools used in SPM domain still have shortcoming and need to be improved.

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