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Integrated value–based project management in the Malaysian construction industry

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ABSTRACT

Value Management (VM) is a structured approach to maximising a project's value by analysing its functions, materials, and costs to meet objectives at the lowest cost without compromising quality, performance, or functionality. In Malaysia's construction industry, VM has significantly enhanced project outcomes. However, VM faces challenges despite its benefits due to limited awareness, knowledge barriers, and a gap between theory and practice. Although many practitioners recognise VM's advantages, there remains a need for a deeper understanding of the VM process and how to apply necessary project management (PM) activities for project success. This study addresses the gap in understanding how PM activities can be integrated with VM to enhance project performance in the Malaysian construction industry. PM involves planning, organising, and controlling resources to achieve specific goals within set constraints, using knowledge, skills, tools, and techniques to successfully execute projects and deliver desired outcomes. The study employed a qualitative method, including interviews with eleven professionals and practitioners in Malaysia's construction industry, to identify PM activities that can be incorporated into the VM process. Thematic analysis using Atlas.ti revealed that PM and VM share similar objectives in ensuring project performance. The study illustrates the benefits of incorporating PM operations into VM by highlighting the relationships between PM and VM, such as better collaboration, better resource management, and improved project outcomes. By providing practitioners with a framework to apply PM techniques within the VM process, our findings contribute to the innovation of VM concepts, enhancing project performance, and bridging the theory-practice gap in the Malaysian construction sector.

1. INTRODUCTION

Value Management (VM), also referred to as Value Engineering (VE), is a methodical and organised approach that is intended to guarantee that a project achieves its performance and quality objectives while

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simultaneously maximising the value for money [1]. The concept of VM offers a structured methodology for identifying opportunities for value enhancement and cost-effective solutions. Nevertheless, the full potential of VM has yet to be realised due to the numerous challenges and obstacles it encounters in practice. VM encompasses collaborative methods that assist project teams in identifying, evaluating, and optimising possibilities to enhance project performance, minimise costs, and increase value. Numerous researchers, including [2-7], contend that the core premise of VM transcends mere cost reduction, focusing instead on enhancing value through the alignment of project objectives with stakeholder expectations and project constrains. In the present-day construction industry, studies such as [3], [8-9] underscore that the importance of project success transcends merely on completed constructions is within budget and on schedule only. Further, the sector faces mounting pressure to execute projects that adhere to high-quality standards and optimise stakeholder value as it progresses [10-11]. Consequently, VM has become a potent tool for enhancing project outcomes, increasing efficiency, and attaining sustainable development in this pursuit [5], [12].

The use of VM in the construction sector has steadily increased owing to the necessity for effective resource utilisation and enhanced project outcomes. [13] examined the adoption of VM in the Egyptian residential construction sector and determined that VM activities substantially enhance project success in terms of cost, quality, and schedule, with a 55.5% cost-saving influence on overall project success. Similarly, [14] explored bridging the theory-practice gap in VM within Sri Lanka's construction industry, concludes that VM ensures value for money in construction projects while benefitting the country's economic, social, and environmental aspects through efficient resource use [15]. VM allows multidisciplinary professionals and stakeholders to address social and environmental issues. However, VM implementation poses challenges, such as additional time and costs for sustainability goals. Historically, in Malaysia, VM was first introduced in 1986 [16], and the potential of VM application gained interest among Malaysian practitioners in 2006 [5]. Nevertheless, recent findings by [17] and [18] show that the application of VM still requires improvement. For instance, findings supported by [14] The construction industry mainly uses traditional PM methodologies to achieve project performance. This demonstrates that the VM application is still lagging despite its significant contribution to enhancing project outcomes and increasing project values

Although VM adoption has become more prevalent, its theoretical foundations, which advocate for a structured and collaborative approach to enhancing value, face several challenges. [19] investigated VM implementation in small and medium construction projects in Malaysia, and the findings show that most construction industry practitioners who conduct VM studies generally focus on building and large-scale projects. [20] reviewed VM practices in Malaysia, noting the unclear descriptions of current VM applications and the need for more research on the behavioural aspects of VM workshops. [14] criticised these findings, highlighting that many researchers address VM conceptually rather than practically, which, in turn, leads to insufficient implementation in the construction industry. Additionally, there is a lack of understanding of the VM concept, an absence of formal guidelines, and significant resistance to change within the industry, where traditional project management (PM) practices dominate. Therefore, integrating PM activities into the VM methodology requires a synergistic approach that aligns the structured principles of both disciplines.

The fundamental resemblances between PM and VM enable their seamless integration [14]. Both disciplines are centred on achieving efficient and successful outcomes. PM's emphasis on defining objectives, setting timelines, and allocating resources aligns closely with VM's goal of optimising value while controlling costs [21]. The structured planning and execution phases of PM correspond to the systematic analysis and evaluation stages of VM, which facilitate the identification of enhancement opportunities [22]. Furthermore, risk assessment in PM complements VM's focus on identifying potential improvements, fostering a proactive approach to value creation. The collaborative nature of VM resonates with PM's need for effective communication and stakeholder engagement, allowing project teams to brainstorm innovative solutions collaboratively and mirroring the cross-functional teamwork promoted by PM. The alignment of project monitoring and review processes with VM's continuous assessment ensures

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ongoing value enhancement [1]. This paper intends to establish a cohesive framework integrating PM activities into the VM methodology to enhance project efficiency, quality, and value. By recognising the commonalities between PM and VM, the research explores how these disciplines can be combined to create a unified approach that maximises project outcomes.

2. LITERATURE REVIEW

2.1 Value management

VM is a systematic and planned strategy designed to maximise the value of projects, goods, or processes while minimising costs [1]. The concept centres on the notion that the relationship between function and cost determines value. Its objective is to optimise value by analysing subjects into their fundamental components and identifying opportunities for overall enhancement [23-25]. The process involves understanding objectives, examining functions, generating innovative ideas, evaluating proposals, implementing selected ideas, and conducting ongoing reviews [8], [26-27]. This method encourages active participation between colleagues, fosters the generation of new and innovative ideas, and optimises resource utilisation. Industries such as construction and manufacturing benefit from VM by focusing on value enhancement rather than merely reducing costs and promoting innovation and collaboration across different functions. VM is a dynamic process that consistently enhances value while maintaining cost efficiency to provide a comprehensive framework for achieving objectives in various sectors [5], [12].

Globally, VM has gained widespread recognition in the construction industry as an essential tool for achieving project success. It has been adopted in various regions, including Europe, North America, and Asia [1], to optimise project outcomes through systematic analysis and collaborative decision-making. In these regions, VM is increasingly integrated into project planning and execution phases, contributing to improved project efficiency, cost control, and innovation. However, the global application of VM faces challenges such as varying levels of awareness, inconsistent implementation practices, and the need for continuous training and development [23].

In Malaysia, the adoption of VM in the construction industry is still developing. Although VM is recognised for its potential to enhance project outcomes, its application is often limited by practitioners' need for more awareness and understanding [18]. Furthermore, even though the Malaysian government has promoted VM through policy initiatives and guidelines, its implementation still needs to be consistent across projects. The gap between theory and practice, along with knowledge barriers, continues to hinder the full integration of VM in the Malaysian construction industry [18-19].

2.2 Impact on value management

VM offers many compelling benefits that apply to a wide range of industries. It commences by cultivating a comprehensive perspective that goes beyond cost reduction by prioritising the optimisation of value across projects, products, or processes. It stimulates innovative problem-solving by deconstructing subjects into their fundamental functions and evaluating the extent to which these functions contribute to the overarching objectives [3], [5]. Additionally, the application of VM harbour and assists in the advancement of innovation and progress [18]. It also encourages collaboration among project teams from various fields, enabling them to combine their knowledge to generate and evaluate concepts [14].

Moreover, this systematic approach guarantees a thorough and detailed examination of functions and their cost-relationships, evaluating ideas based on their potential impact, feasibility, and cost-effectiveness. VM also aids in pinpointing inefficiencies or redundancies and well-informed decision-making concerning which proposed enhancements merit pursuit. Furthermore, it empowers organisations to align strategic decisions with their goals and resources [12]. VM also brings flexibility to project development and the enhancement of processes. Through continuous monitoring and review, timely modifications are made possible, ensuring that expected improvements are achieved and any discrepancies or obstacles are quickly

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addressed. Such flexibility enhances the nimbleness of projects and procedures, enabling organisations to proactively adapt to changing conditions [8].

The implementation of VM offers significant benefits to financial prudence. The main objective is to increase value, yet a thorough analysis of functions often reveals opportunities for cost reduction without sacrificing quality and performance [5], [12]. The combined benefits of value optimisation and cost control significantly enhance organisational efficiency and profitability. VM ensures that the construction industry adheres to budgetary and temporal limitations while optimising project requirements and objectives. In the construction industry, the VM application can result in product enhancements that more effectively satisfy customer requirements and strengthen competitive positioning in the market. The methodology's effectiveness in PM is evident by its ability to reduce risks and increase project success rates through targeted value enhancements. In short, VM is a powerful strategy that can significantly influence various sectors by combining innovation, collaboration, adaptability, and fiscal prudence [12].

2.3 Project management

PM systematically uses knowledge, expertise, tools, and methods to effectively organise, execute, oversee, regulate, and complete a temporary undertaking with clear goals, such as developing a product, delivering a service, or achieving specific outcomes. It entails meticulously coordinating resources, such as time, cost, scope, quality, human resources, communication, and risk, to accomplish objectives within set constraints. Commonly, the process is led by a project manager who ensures clear objectives, stakeholder alignment, and good communication while adjusting to changes and challenges. PM ensures project completion by overseeing every stage, including initiation, planning, execution, monitoring, and closure. This allows organisations to deliver results on schedule, within the allocated budget, and with the desired level of quality. As a result, PM allows organisations to promote innovation, improve efficiency, and attain strategic goals [21].

2.4 Project management knowledge areas

The Project Management Body of Knowledge (PMBOK) is an comprehensive foundation for project management and covers the ten (10) distinct knowledge areas that are essential for efficient project management. Together, these areas represent the core knowledge of PM, serving as a framework for project managers to navigate through the complexities of their projects. Each knowledge area is a separate discipline that contains different processes, techniques and methods to cover key aspects of project planning, execution, monitoring and completion [28-29]. These controllable knowledge domains, combined with project management tools and techniques and interpersonal skills, provide the basis for a successful method to organise and direct project activities to achieve defined objectives across time boundaries that will result in satisfied stakeholders, meet the standard quality assurance and quality control processes, in such a way that the project team met the project objectives. Further, project managers applying the PM knowledge can effectively coordinate work that would allow more accurate and flexible systems, increasing the likelihood of successful project delivery that meets stakeholders' expectations [21].

Project integration management

Project Integration Management in construction projects is related to project integration management, which coordinates processes, tasks, and technologies within the PM framework [30]. It covers organising, structuring and scheming project elements and processes to lead to a specific task. It is also essential when it comes to the implementation of construction projects, as it helps in effective stakeholder collaboration and coordination. Integration management can assist in enhancing overall project performance by integrating information, resources and activities among these various processes [30].

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Successful integration management allows the tasks of a project to be harmoniously carried out. Project managers deploying this approach effectively implement, comprehend, combine, coordinate and align discrete construction processes that must be undertaken to complete projects [30-31]. Further, it ensures that a project's various components work well together and enables consistent and repeatable performance in terms of time, cost, quality, safety, and client satisfaction. Also, it adds to project accomplishment and knowledge by creating an organised management framework, such as a project integration management plan, and discussing tools and techniques that can be used to make the process effective in the project scope [30]. When project managers assess the factors influencing construction work by using the integrating framework within PM knowledge, they enable professionals to evaluate project performance and develop strategies to manage complex tasks effectively [31].

Project scope management

Project scope management includes processes needed to ensure that a project contains all the tasks necessary to complete it while excluding those that are unintended in the realisation of the project. It also focuses on project-oriented ways to record and identify tasks that must be taken to achieve the project's objectives, keeping its essentials focused. It requires defining the goals, results, and boundaries and ensuring that a strategy can address all changes in or adjustments of the scope before it is manifested [21]. The objective of project scope management is to enable effective communication and mutual understanding among stakeholders of the limitations and specifications of a given project [32]. Scope management is another critical element in PM because any changes or modifications to the project scope may cause additional costs and decrease project efficiency [33].

Project schedule management

Project schedule management refers to the systematic and organised methods and techniques used to effectively organise, create, allocate, and monitor a project’s time frame. It involves coordinating and sequencing activities, resources, and milestones, such that the project is completed within the pre-determined time. The primary goal of project schedule management is to develop a realistic project schedule, predict risks and delays, effectively allocate resources, monitor, and adjust as needed to keep the project on track [21]. In addition, it encompasses other facets such as predicting the time frame of each activity, creating a project schedule, determining the relationship among activities, allocating resources and tracking and adjusting the entire programme as the project progresses. When time is effectively managed, project managers can best allocate resources, adhere to pre-determined deadlines, and achieve project goals [34-35].

Project cost management

Project cost management involves planning, estimating, budgeting, and controlling costs so project stakeholders can complete projects practically within the approved budget. It is a systematic process of administering the project costs that can enhance the possibility. This includes defining project objectives, scheduling project activities in a specific order, making detailed estimates of costs and plans, monitoring the progress of the project to identify deviations from planned timelines and costs, and analysing data collected to verify that ongoing or completed process have followed expected paths or arrived at desired goals as described by [21], as well as measuring the amount and impacts of these deviations. Project Cost Management is a part of Project Management in general, which influences and ensures the profitability and success of construction projects [36-37].

Project quality management

Project quality management involves processes and activities that ensure a project adheres to all required standards and fulfils stakeholder requirements. This systematic approach is applied throughout the project's lifecycle, incorporating quality control techniques to guarantee that work products and deliverables conform to standards and meet stakeholder expectations. Further, it is a complete set of processes to ensure

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that the project conforms to established quality standards and meets stakeholders' expectations. The fundamental methodology follows uniformly throughout the project life cycle while incorporating quality control practices. The procedures manage the project outputs and outcomes to meet the specified requirements and demands put in place by stakeholders. This includes setting quality goals, developing quality strategies, implementing quality assurance efforts, and conducting quality control evaluations. Together, these efforts analyse and scrutinise the project well enough to determine its quality and performance. The ground aim of project quality management is to find out and prevent potential pitfalls, imperfections or disparities that could reduce the quality of the project. Indeed, this approach aims to ensure successful project completion within the spefiedtime and budget while realising business and product values. [21].

Project resource management

Project resource management is about getting the available resources expended, monitored, and used in a way that ensures a successful project. This, in turn, involves identifying and procuring important human, mechanical, materials or fiscal resources and the constant upkeep of these resources until the project completion [21]. The primary goal of project resource management is to use resources efficiently, limit costs and time, and ensure that the right resources are available in the right quantities at the right time to complete project goals successfully. Effective project resource management makes sound quality judgements to allocate resources most appropriately to the project elements required within limitations and available resources [21], [38-39].

Project procurement management

Procurement management is the practice of strategic planning, buying and, in some cases, the efficient management of goods and services required for a project or organisation. It involves identifying needs, selecting an appropriate procurement method, market research, assessing suppliers, negotiating agreements, and controlling purchases to ensure that goods or services purchased meet the required quality, quantity, timing and price [21]. One of the important facets aforementioned in PM is Procurement, which deals with the acquisition of required resources at optimal cost and timing to meet project objectives, thereby adding value [21], [40].

Project risk management

Project risk management is a systematic process that identifies, assesses, and responds to project risks. This consists of identifying, assessing and evaluating hazards and controlling methods to mitigate or lessen them to applicable levels. The main idea is to take opportunities as far as they can go and reduce risks, at least in the construction field, where risk management is one of the paramount issues in project success [21]. Risk management is a proactive process in preventing and anticipating future risks [41]. This approach is proactive in that it tries to anticipate and mitigate risks before they happen, employing several techniques over the project's life cycle [21]. In this way, project managers can obtain alarm information that affects the achievement of ambitious project objectives in aspects such as time, cost and desired quality [42]. In the construction industry, effective project management is crucial as most projects are very complex and require substaintial budgets. Project managers, therefore, need to minimise the risks associated with these uncertainties for the project to succeed. While it is no guarantee of success, risk management can enhance the possibility that the project objectives are met [21], [41].

Project communication management

Project communications management includes the processes and activities that enable the collection, dissemination, storage and ultimate disposition of project information. It comproses a collection of the activities necessary for delivering satisfactory communication among project team members, stakeholders, and other parties involved in the project life cycle [21]. It should also include developing a communication plan that identifies the approaches, tools, and channels for communication to meet stakeholder requirements

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[21], [43]. This aspect greatly impacts the delivery of successful projects by fostering collaboration, ensuring timely and secure information sharing, and avoiding potential miscommunications or misunderstandings. The Project Management Institute (PMI) sees communication management as one of the most significant aspects of PM. The communication planning process should be integrated into the project plan. It involves activities such as developing communication strategies, disseminating project-related information, and monitoring and maintaining communication throughout the project [44].

Project stakeholder management

Project stakeholder management is the process of identifying, analysing, and effectively interacting with individuals or organisations who are interested in or can influence a project's achievement [45-48]. While [46] have emphasised that it can be defined as the effective management of stakeholders' relationships, expectations, and needs from the beginning through the end of the project. This method ensures their support and cancels potential adverse impacts that they can have on the project, thus creating a positive and collaborative environment and enhancing decision-making, communication, and other processes. Furthermore, in the context of stakeholder management, [45] specified that it is crucial to understand the stakeholders' interests, priorities, and concerns, follow their feedback, and treat their needs appropriately from the project's planning phase through its implementation to evaluation. Therefore, ongoing project stakeholder management is indispensable for reaching reciprocity, identifying stakeholders, considering their interests properly, managing their conflict behaviour, and ensuring that the diversity of their needs and expectations is met. As a result, continuous monitoring, adaptation, and engagement are needed to build favourable relationships and ensure stakeholders' satisfaction, and they may also vary in terms of goals, methods, and outcomes [21].

2.5 Critical project management activities

The successful completion of any project is contingent upon the implementation of an effective project management system. A few critical activities are included. The first phase is the "Initiation" phase, in which the high-level project's objectives, scope, and key stakeholders are determined and identified. Detailed planning is contingent upon identifying initial objectives, which serve as the foundation for all subsequent endeavours. This is followed by the "Planning" phase, which anticipates all potential details. Planning is an essential phase that necessitates thorough attention to detail. In the absence of this, it is impossible to forecast budgets and identify contingencies in a timely manner. The subsequent phase is "Execution", during which the planning process is completed. Integration between the 10 PM knowledge and the plans' performance are critical factors that could determine the success of the project's outcome. This phase is conducted by coordinating personnel and resources.

Leadership and communication are essential components that would facilitate the comprehension of whether the project management team is achieving its objectives. The continuous flow of processes is primarily characterised by the "Monitoring and controlling" phase. It is executed throughout the entire project lifecycle, encompassing the phases of inception, planning, execution, and closure, and it involves monitoring project performance in accordance with the plan, adjusting and controlling changes to the plan, and analysing variances. Finally, the last phase ensues, the "Closing" phase, which guarantees that all activities are finally concluded and wrap up the whole project. The project's deliverables are finally transferred to its customers.

Additionally, this is the period during which the customer may either approve or disapprove of the project and its outcomes. An initial evaluation is conducted to ascertain the best practices and potential lessons learnt. The project's success is contingent upon each activity. Table 1 illustrates several critical PM activities.

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Table 1. Critical project management activities

Knowledge areas	Critical project management activities	Authors
Integration (INTE)	• Incorporates all the aspects of projects and provides a roadmap toward their success. • Coordinate, govern, schedule, budget, manage, and document for efficient projects. • Monitor, integrate, control, close, and reduce uncertainty for improved project outcomes.	[30], [31], [49]
Scope (SCOP)	• Develop a management plan defining and describing project scope and outlining validation and control. • Gather, document, and manage stakeholder requirements to meet project objectives and specifications. • Clearly describe the project, deliverables, and limitations to establish achievable project boundaries. • Divide project components into hierarchical elements, curbing scope creep and linking deliverables, cost, time, and resources. • Verify project outputs match the defined scope, aiming for formal stakeholder approval of deliverables. • Monitor changes against baseline and assess new owner requests to ensure scope control.	[33], [50], [51]
Schedule (SCHE)	• Assessing the interrelationship between schedule delay risk factors. • Evaluating the impact of project traits, organisational factors, and implementation on schedule delays. • Conducting focus groups of experienced managers to validate findings and delve deeper into schedule delay causes. • Set policies, procedures, and docs for the project schedule from planning to execution. • Identify and document specific actions required to create project deliverables. • Identify and document relationships between project activities within this task. • Estimate work periods for activities based on resources and requirements within this task. • Analyse sequences, durations, resources, and constraints to build a project schedule model for execution. • Continuously monitor project status to update schedule and handle changes to the baseline. • Visual representation of project tasks, dependencies, critical path, and sequential order. • Assessing the duration using history, expert insights, and relevant factors for individual tasks.	[34], [35]
Cost (COST)	• Set objectives, sequence tasks, and generate estimates and strategies in cost planning. • Monitor cost by tracking project progress and identifying variations in time and cost plans. • Reporting by sharing monitored data as agreed, forwarding to relevant teams for necessary steps • Evaluate project performance, compare to predictions, and assess the size and impact of discrepancies.	[21], [37]
Quality (QUAL)	• Identify project quality standards and document how compliance will be shown for requirements. • Implement the plan, aligning the project with the organisation's quality policies and fulfilling requirements from planning. • Monitor and record quality activity results, assess performance and ensure outputs meet customer expectations by comparing requirements.	[21]
Procurement (PROC)	• Create a plan detailing procurement activities, timelines, budgets, and responsibilities for procurement management. • Identify the project's required goods or services, specifying quantity, quality, and specifications.	[21], [40]

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	• Assess and choose suppliers or contractors based on expertise, experience, capacity, and cost. • Draft binding agreements outlining terms, conditions, and expectations between the project owner and selected suppliers. • Negotiate with suppliers to establish favourable terms, encompassing pricing, delivery, and performance criteria. • Monitor execution, enforce terms, handle changes, and resolve disputes to ensure compliance. • Monitor performance, evaluate progress, and address issues to ensure project success and collaboration.	
Communication (COMM)	• Develop communication strategies, direct processes, and manage project information dissemination. • Enhance knowledge exchange by assessing project and stakeholder information requirements. • Update team on rules and operational norms. • Give performance feedback, share news, and offer support on time.	[43], [44], [52], [53]
Risk (RISK)	• Risk identification by determining the potential risks that may affect the project. • Risk evaluation: Analysing the identified risks. • Risk response: Developing and implementing strategies • Monitoring and control: Continuous monitoring of the identified risks and their impact on the project.	[41], [42]
Resource (RESO)	• Evaluating resource availability and capacity for project requirement fulfilment. • Estimating the resource requirements for each project task or sub-task. • Allocating resources to specific tasks based on availability, skillsets, and project priorities. • Manage resource usage for efficiency and effectiveness. • Handle resource conflicts when tasks/projects vie for limited resources. • Optimise projects by adjusting resources to address constraints and enhance performance. • Review resource use to improve allocation and optimise strategies.	[38], [39], [54]
Stakeholders (STKH)	• Identify stakeholders by gathering information about the relevant parties involved. • Analyse and evaluate stakeholder involvement. • Secure higher authority support and set stakeholder management approach.	[48]

3. METHODOLOGIES

This research aims to identify any areas of improvement for VM applications through PM in the Malaysian construction industry. It also seeks to propose a comprehensive framework for evaluating the adoption of PM activities into the VM methodology. Given the exploratory nature of the research objectives, a qualitative research methodology was adopted.

The research began with a systematic review of relevant literature from various sources, including journal articles, conference papers, research reports, and Internet information. This process aims to understand the current landscape of PM knowledge and activities in the construction industry to ensure the project meets its objective and performance targets. Based on the PMBOK, 10 PM knowledge areas were examined to extract key themes and topics related to implementing PM activities into VM methodology.

Subsequently, to obtain the input and views of the construction industry practitioners, semi-structured interviews were conducted. The objective of this process was to find critical PM knowledge, processes, and activities that would enable beneficial PM activities to be integrated into the VM methodology. The choice of interviews as the primary research method was based on two reasons. On the one hand, it is possible to note that the interviews are compelling when the researcher wishes to obtain comprehensive and detailed

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information from the respondents. Since, in the current study, the respondents have considerable knowledge and experience in the area and are likely to possess the information that is important for the researcher, the interviews appeared to be the most appropriate method [55]. On the other hand, semi-structured interviews were chosen to identify the reasons that motivated, underpinned, and explained the phenomena under study with specific regard to the contexts in which the subjects are studied and their interrelations [56].

A purposive sample was taken to identify the respondents for the interviews. It was organized so that only the individuals who possessed the information needed to conduct a full-fledged analysis were included in the sample. The respondents were chosen according to their experience in managing construction projects, their awareness of PM knowledge processes and activities, and their occupations and roles in the specific firms. More detailed information on the respondents is provided in Table 2.

Table 2. Respondent profiling

No.	Respondent Code	Position in the Organisation	Type of the organisation	Years of professional experience
1	P1	Project Manager	Private construction firm	15-20
2	P2	Project Manager	Private construction firm	5-10
3	P3	Architect	Private consultant firm	10-15
4	P4	Architect	Private consultant firm	20 - Over
5	P5	Design Engineer	Private consultant firm	15-20
6	P6	Project Engineer	Government agency	15-20
7	P7	Project Engineer	Government agency	15-20
8	P8	Project Engineer	Government Agency	15-20
9	P9	Quantity Surveyor	Private construction firm	15-20
10	P10	Quantity Surveyor	Private consultant firm	15-20
11	P11	Academician	Local university	15-20

A total of eleven interviews were conducted for this investigation. This sampling approach was adopted to guarantee the credibility and legitimacy of the study by involving individuals capable of delivering significant insights. The number selected was considered satisfactory as it produced substantial information for meaningful endings, meeting the usually approved sampling standard in qualitative examination referred to as "reaching theoretical saturation" [58]. Both face-to-face and online meetings were led. Moreover, trial interviews were held prior to the formal interviews, where people were offered the chance to reiterate and elucidate their points during the discussions to improve the examination legitimacy and trustworthiness [59-60]. On average, the interviews lasted from one to one and a half hours. Each of the interviews was recorded, transcribed, and analysed.

Content analysis was employed to analyse the qualitative data, as it provides a systematic and objective means of deriving inferences from data, describing and quantifying specific phenomena with minimal loss of information [61]. This method suited the research's data collection protocol, which involved documents and open-ended survey responses [62]. The analysis was guided by the critical PM activities and the PMBOK guidelines, which served as essential references for evaluating current practices. Insights and comments from the semi-structured interviews also contributed to the content analysis. Atlas.ti, a qualitative data analysis software, facilitated the development of emerging themes from the interviews and the reviewed PM activities.

4. RESULT AND DISCUSSION

Fig. 1 shows the relationship between critical PM and VM where analysis of the PM activities, project performance attributes and VM objectives in the Malaysian construction industry (MCI), coupled with

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insights from semi-structured interviews, has unveiled critical PM activities that can help the VM application. These essentials can be classified into ten distinct PM knowledge : (1) Project Integration Management (INTE), (2) Project Scope Management (SCOP), (3) Project Schedule Management (SCHE), (4) Project Cost Management (COST), (5) Project Quality Management (QUAL), (6) Project Resource Management (RESO), (7) Project Procurement Management (PROC), (8) Project Risk Management (RISK), (9) Project Communication Management (COMM), and (10) Project Stakeholder Management (STKH). The ensuing sections will elaborate on and discuss these ten PM knowledge areas.

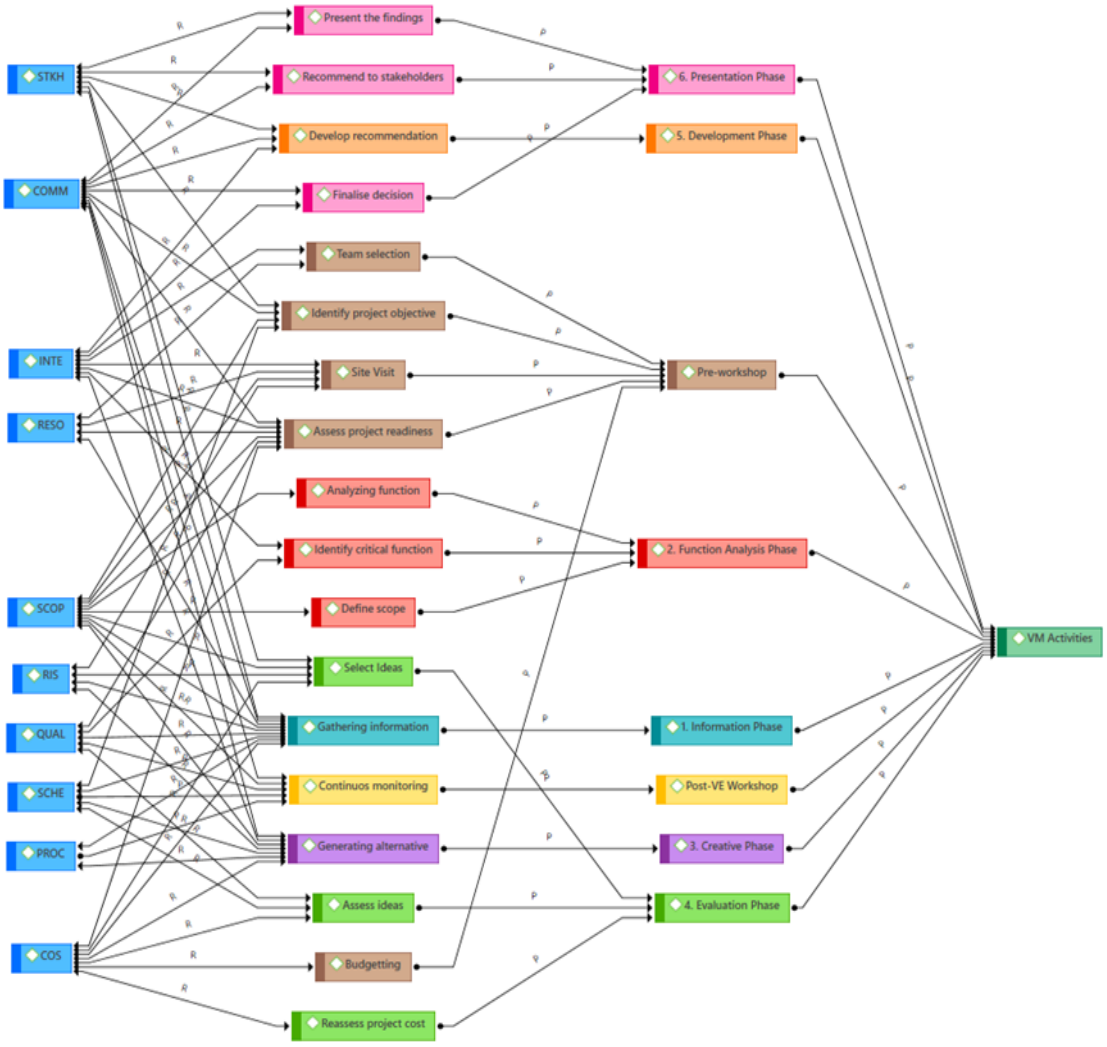

Fig. 1. Relationship between project management knowledge areas and VM activities

4.1 Current status of VM applications

The analysis performed in this study showed that some organisations employed structured and formalised VM methodologies while others relied on PM practices. In particular, the majority of respondents, such as Respondent P4, P6, P7, and P11, offered relatively high levels of detail and mentioned the presence of structured approaches to value management. Specifically, Respondent P4 took the EPU

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approach, which consists of the following steps: defining objectives, generating alternatives and assessing such options. Respondent 6 detailed the process of scoping projects, estimating budgets, and driving procurements through discussions and approvals. Respondent P7 mentioned that the government requires value management on large projects involving site visits, a pre-workshop conference and a workshop co-chaired by a VE specialist. All of them mentioned the crucial importance of the multidisciplinary team in the seven-stage process, which involved a high degree of interaction across various disciplines. Meanwhile, Respondent 11 detailed a comprehensive 7-phase VM process, including preparation, information gathering, function analysis, creativity, evaluation, development, and presentation phases.

The predominant theme is the reliance on PM methodologies over formal VM studies. Most respondents, such as Respondents P1, P2, P3, P8, P9, and P10, have yet to conduct VM. This indicates a reliance on PM, where prioritising is given to the methodologies to meet project objectives and performance. This also shows that most construction companies currently rely on PM methodologies, which reflect a well-established practice that emphasises project success by meeting deadlines, staying within budget, and providing quality. Based on the analysis. Notably, Respondent P1 focuses on PM practices without structured VM processes when managing and supervising the construction project. Similarly, Respondent P3 relies on established PM practices to ensure project efficiency and client satisfaction.

4.2 Value-based project management

Project Integration Management (INTE) - Respondent P4, P5 and P11 emphasised the importance of implementing INTE within the VM methodology to achieve successful delivery. Unifying INTE into VM entails harmonising the procedures and actions of project integration with the overarching objective of optimising value for the organisation. According to Interview P11, incorporating INTE throughout the VM process requires aligning VM activities with each stage of the project life cycle, from initiation to closeout. In addition, during the initiation phase, the project team must clearly define the roles, responsibilities, and deliverables associated with VM in the PM plan. Furthermore, [31] proposed that the activities related to INTE can be incorporated into the VM methodology by integrating the principles and processes of project integration into the existing VM framework. The authors also proposed that INTE ensure the appropriate coordination and synchronisation of project activities, which is crucial for success. For instance, it was emphasised that the project team must create a project integration plan grounded in value analysis (VA) and delineate how various project activities will be organised, unified, and harmonised. This plan must also consider the interdependencies, logical connections, and order of project activities [21].

Project Scope Management (SCOP) - In interviews, Respondents P1, P2, P3, and P6, it was stressed that the systematic approach of VM must be consistent with the structured definition and controlling practices for work packages of PM if SCOP activities are to be fully incorporated into a VM system. Respondent P1 emphasised that the SCOP must be comprehensively defined in the "Information" phase of VM, where all the project parameters, such as project constraint and limitation, project deliverables and risk, are all clearly set out. This step is crucial to ensuring that the project scope conforms to its intended goals and lays the groundwork for optimising value. In addition, Respondents P3 and P6 noted the importance of adopting SCOP activities with VA within the VM methods, which required a match on one hand between VM's logical path and predetermined scope boundaries, and similarly on the other between PM's planned scope control and completed scope control practices. Considering scope considerations at every stage of the VM project process, an incremental value greater than expected initially can be achieved without going beyond established scope boundaries.

SCOP activities can be integrated into the VM methodology by adhering to specific procedures. For starters, the project manager needs to develop a scope management plan based on expert judgment or consultation with building professionals who have experience with similar projects. This initial step identifies and defines the essential tasks and responsibilities for those involved. Secondly, the work breakdown structure (WBS) should be revised in response to any modifications to the project scope. The WBS assists in identifying activities, allocating appropriate resources, and assessing risks and cost

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implications associated with the actions [51]. The project manager should also engage in activities such as the following: the collection of project requirements, the definition of the project scope, the creation of the WBS, the verification of the scope, and the control of the scope [63]. These activities are a component of standard SCOP and are essential for the successful completion of the project as intended [51], [63]. In other words, this integration facilitates the efficient attainment of the desired results by optimising the project's scope [33].

Project Schedule Management (SCHE) – Respondents P2, P3, P4, P7 and P9 agreed that project targets should be closely aligned with the time constraints and milestones of the project as specified during VM's "Information" phase. Respondents P2 and P7 emphasise adopting schedule management strategies into VM, especially during the VA phase, as to ensure value-added projects are completed on time. P4 and P7 also suggested that the project team illustrated the importance of integrating SCHE during the work breakdown activities, and their temporal relationships and durations should be considered in the "Creative Idea Generation" and "Function Analysis" phases. This includes looking for opportunities to shorten the project schedule and increase efficiency, which can be achieved by understanding the temporal relationships among functions. Ideas must also consider not only functional improvements but methods to shorten the project timeline as well.

SCHE activities can help improve the VM methodology through Earned Value Management (EVM) techniques, as suggested by Respondent P11. EVM is a PMI technique for evaluating the quality of a project by comparing what it actually costs with its estimated value. For instance, [35] emphasise that EVM should use performance data, including the estimated earned value and the actual cost of work performed, to conclude how far along a project is at any given date. Additonally, activities can be adjusted in light of project milestones to meet the timeline [35].

Project Cost Management (COST) – At the Information Phase, P1, P10 and P11 pointed out that the project objective must clearly state its budget constraints. This is to ensure that whatever efforts are made must be within the financial constraints of the project economic feasibility. In particular, understanding the cost contribution of each function will make it easier to find ways to reduce costs without decreasing value. Respondent P2 suggested that the emphasis of ideas is not limited to functional reform but should also focus on cutting expenses. This can mean developing new methods for improving processes, acquiring materials, or organising work. Further, Respondent P10 suggested a series of approaches which can be applied to integrating project cost management with the VM method process. For example, the respondent highlighted that the project manager, with the assistance of the procurement team, should consider the best options and best value for money approach when selecting a supplier. This approach can directly reduce the project cost without compromising the quality and the project's scope. Further, Respondent P11 specifically explained that this begins in the planning phase by defining what functions or activities are necessary to achieve objectives for a project. During this phase of work, techniques for cost estimation from the standpoint of each function or activity may be introduced [21].

Project Quality Management (QUAL) – Based on the respondents' opinions, Respondents P2, P3, P5 and P8 it can be agreed that during the "Information" phase of VM, the desired quality standards and benchmarks should be explicitly highlighted, which should be linked to the project's broader goals. In contrast, the opinions of P2 and P3 suggest that functions should be evaluated based on their value and qualities; hence, understanding the quality implications of each function would eventually enable the identification of opportunities to enhance quality and value. Thus, the suggested ideas should entail impacts for improving the function and ideas on how the project's quality could be enhanced. For example, Respondent P8 would suggest the impact and ideas for the novel means for ensuring the project's high quality, namely, the new ways of control, testing, or validation. Incorporating the QUAL activities into VM provides a broader approach, which may enhance the project outcomes. Therefore, synergy delivers value while keeping the quality levels high, meeting the customer's expectations. The described advances required the following actions and steps, which were also linked with quality management and value optimisation. Thus, to ensure successful integration, it is necessary to establish quality determination and

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achieve the objectives that outline how they should be for the project [21] . Hence, specific, measurable quality requirements for each project element need to be defined to identify and lay the foundations for the implementation of a rigorous quality control approach throughout the project.

Project Resource Management (RESO) – Respondents P1, P3, and P4 asserted that project resource requisites should be clearly defined during the value survey and paved with the project's overall goals. This allows the value-enhancing efforts to be treated with adequate resources. Every function should be assessable in terms of its resource requirements. By understanding every function's resource demands, opportunities for efficiency enhancement and increasing value can be attained. Therefore, the project team should consider how proposed improvements impact project resources. Besides, value-enhancing principles should pervasively interact with ideas that increase value with the most efficient resource utilization [39]. The researchers previously proposed several avenues for integrating RESO activities into the VM, such as dynamic resource allocation. The study has shown that managing resources, including assigning them exactly when needed, can save costs and schedules [38]. This way, resources are optimised, maximising efficiency and the objectives and value that can be achieved. In addition, integrating RESO into VM methodologies can provide graduates with strengths in engine performance, value creation, and an emphasis on PM's features as desirable trends. Integrating RESO involves making resource distribution decisions compatible with goals, ensuring that resources are applied efficiently and leveraging PM's characteristics as competitive benefits [38-39], [54].

Project Procurement Management (PROC) – Respondents P1, P3 and P4 commented that project procurement must be addressed during the value study and concurrently with the project's objectives. This can ensure that effective procurement strategies will support value creation. In addition, both P5 and P11 commented that functions need to be evaluated for procurement implication at the Function Analysis stage of VM. Therefore, it can be important to understand the procurement needs of each function to identify issues and know where value can be procured. Ideas should include both functional enhancements and innovative procurement strategies. This could include proposing novel approaches to supplier selection, contract negotiation, or sourcing that contribute to value creation. In contrast, the "Evaluation and Selection" step should consider the impact of proposed enhancements on project procurement. Value optimisation principles should prioritise ideas that increase value while optimising procurement processes.

According to [40], integrating PROC activities into the VM methodology entails aligning the procurement process to deliver the required project functions at an optimal whole-life cost while maintaining quality, performance, and reliability. The authors propose that, during the design phase, early involvement of key stakeholders, including the main contractor, is crucial to benefit from their expertise and input in reducing waste, improving buildability, and better understanding the project requirements. They also emphasised collaboration and teamwork by encouraging cooperation and effective communication while moving away from the fragmented approach of traditional procurement methods. The implementation of integrated procurement methods, such as management contracting and partnering, promotes collaboration and increases project value. Furthermore, the authors suggested that the project team should conduct several value engineering workshops throughout the project to ensure active participation by all project stakeholders. The stakeholders and project personnel concur that change is unavoidable in the construction industry. Thus, the paradigm shift affects relationships to promote collaboration, innovation, enhanced constructability, superior communication through the construction supply chain, and the need to integrate sustainable construction practices. Additionally, the construction industry and its stakeholders need to embrace change and support innovative procurement strategies to tackle the managerial, technical, and economic challenges. Importantly, the change should depend on the client's needs and be implemented by the project team.

Project Risk Management (RISK) – Respondents P1, P3, and P4 stated that considering potential risks is vital and should be weighed against the project's goals. This means that all the ideas to enhance value should consider possible risks to the project's success. Moreover, functions must also be assessed with risks in mind. The rationale is that considering risks associated with each function helps identify opportunities

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to add value while minimising the risks of negative developments. Thus, ideas must refer to project functions and ways to increase value while considering risks. Moreover, the ideas must include means for supporting value and mitigating risks. For instance, ideas may propose new ways to minimise risks, present contingencies, or use alternative solutions to enhance the value of the target project while lowering the associated risks. Finally, ideas should address how the proposed changes affect the project's risks. According to the principles of value optimisation, ideas that lead to value increases while minimising risks are given priority. Integrating RISK activities into VM means continually controlling risks throughout the project. At this stage, all the proposed changes are tested to identify how they affect project risks, and the necessary modifications are made to ensure the effectiveness of risk management [41]. The author further suggested that RISK activities are incorporated into the VM methodology by integrating risk management processes and techniques in every phase. This ensures that risks are identified, evaluated, and managed throughout the VM process, thus enhancing overall project outcomes. The authors noted that risk management can be integrated into the VM methodology by conceptually including risk management as part of the VM process from the project briefing stage to the implementation stage. This will facilitate assessing and managing risks and uncertainties associated with different value options and improve project outcomes. The project team can also create a synergistic relationship between risk management and value management by aligning risk management objectives with VM objectives to ensure that risk management measures do not compromise the project's overall value. Incorporating risk management processes into the VM methodology enables the project team to optimise value and risk trade-offs, thus ensuring the best project results.

Project Communication Management (COMM) - Integrating COMM activities into VM requires aligning structured project communication with a collaborative and cross-functional approach. Interview P3, P5, P6, P7, P8, and P11 advised creating clear communication plans to inform stakeholders about value optimisation efforts and objectives during the value study. P7 added that functions should be evaluated for value and impact on communication. Understanding how functions affect stakeholders and communication channels can help identify value-enhancing communication strategies. Ideas should include functional improvements and creative ways to communicate value-enhancing efforts. This could involve engaging stakeholders, sharing progress, and gathering insights. According to [64], several COMM activities can be integrated into VM by following a systematic approach to ensure effective and efficient communication throughout the entire project. Based on the findings, the author advised the project team to identify communication objectives and goals using VM. This includes project updates, feedback, and problem-solving. In addition, the project leader should create a communication management plan that outlines strategies, channels, and methods for communication during the planning phase to ensure that the plan addresses both project and stakeholder needs. Finally, the study suggests that communication frequency, format, and content should be considered. It also advises the project team to find the best communication channels and tools and involve all stakeholders throughout the project.

Project Stakeholder Management (STKH) - Respondents P10 and P12 advised identifying stakeholder needs and expectations during VM's "Understanding Objectives" phase to ensure that value-enhancing efforts consider relevant stakeholders' perspectives and interests. Most respondents suggest that the functions should be assessed for value and stakeholder impact. Further, P6 and P12 emphasised that understanding how functions affect stakeholders can help identify ways to add value and address concerns. Ideas should include functional improvements and stakeholder engagement and management. This could involve proposing novel stakeholder engagement, communication, and satisfaction methods. On top of that, P11 recommended that the project team consider the stakeholder impacts of proposed enhancements. It is anticipated that the project can achieve better performance by prioritising value optimisation and improving stakeholder engagement.

[21] suggested that the integration process should begin at the initiation stage with stakeholder identification. This process involves rigorously identifying and gathering stakeholder information based on their relevance to the project, potential impact, and value; stakeholders must be identified when using VM. This proactive identification prepares the project team for a thorough understanding of key players and their

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contributions to project goals. [21] also suggested that stakeholder assessment refines integration by thoroughly examining the complex dynamics of stakeholders' interests, influences, and behaviours. This is because VM requires stakeholders' interests and results to align with the project goals. By considering these factors, project teams can make informed decisions that satisfy stakeholders and meet the project's targets [48].

5. CONCLUSION

The primary challenge in implementing VM in the Malaysian construction industry is successfully integrating VM principles with PM practices successfully. Although the individual significance of both disciplines has been widely recognised, further research and implementation efforts are required to effectively incorporate them and enhance the benefits of applications and technology in construction projects. It is expected that once these issues have been addressed, it has the potential to substantially improve the progress in project implementation, cost efficiency, and creativity within the field. Similarly, incorporating PM activities into the VM methodology requires a collaborative approach that aligns the organised principles of both fields. Firstly, the activities involved in PM, such as setting objectives, developing schedules, and assigning resources, should be closely integrated with the overall goals of VM. This is to guarantee that project milestones and deliverables are strategically placed within the value optimisation process. Furthermore, the systematic examination of functions and their correlation with costs conducted by VM can be incorporated into project planning by evaluating the contribution of different project components to value and identifying opportunities for improvement. Additionally, project risk assessment may be tied to VM's focus on identifying potential enhancements so that the risks are actively transformed into value creation opportunities. Moreover, the collaborative aspect of VM must be consistent with PM's emphasis on efficient communication and the involvement of stakeholders. Indeed, teams may convene meetings to propose creative solutions and test them for feasibility, thus fostering interdisciplinary teamwork. Finally, project monitoring and review may support VM's continuous evaluation, allowing value to be constantly improved and judged throughout the project's duration. Ultimately, by weaving these activities together, one may conclude that PM is integral to VM. As a result, these processes, both in the short and long term, are beneficial for making the construction of Malaysian projects cheaper, delivering better results, and ensuring that a comprehensive approach is maximising value. In this way, it can be asserted that the successful application of VM provides a revolutionary opportunity for the Malaysian construction industry. The sector, Malaysian constrction industry, can become more efficient, creative, and constantly improved by overcoming the roadblocks associated with integration and augmenting traditional strategies with the establishment of integrated value-based project management. Indeed, due to the benefits of cost and creativity, not to mention the promising prospects, VM may be considered as the main approach to construction projects. Therefore, while the qualitative methodology allowed the authors to provide comprehensive insights into incorporating PM activities into VM, it also had limitations. For example, the data may not cover the entire spectrum of phenomena if qualitative data are used, and the sample is too small to be extrapolated to the entirety of the Malaysian Construction Industry. This is the case since the data is subjective by nature and relies not on replicable figures but on the participants' comments and the researcher's interpretations of them. If future research aims to make the results more valid and generalisable, it may use the mixed-methods approach, where the qualitative data are paired with the quantitative data. Using larger and more varied samples, employing longitudinal studies will result in a deeper understanding of incorporating PM activities into the VM methodology.

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7. CONFLICT OF INTEREST STATEMENT

The authors agree that this research was conducted in the absence of any self-benefits, commercial or financial conflicts and declare the absence of conflicting interests with the funders.

8. AUTHORS' CONTRIBUTION

Mohd Hilmi Malek: Conceptualisation, methodology, formal analysis, investigation and writing-original draft, writing- review and editing; **Che Maznah Mat Isa**: Conceptualisation, methodology, and formal analysis, supervision, writing- review and editing, and validation.

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