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Unveiling The BIM Execution Plan (BEP): A Comprehensive Review of Global Frameworks and Applications

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ABSTRACT

Building Information Modelling (BIM) has significantly transformed the construction industry by enhancing project efficiency and collaboration throughout the project lifecycle. The BIM Execution Plan (BEP) serves as a critical framework to guide construction professionals in implementing BIM effectively. However, while the BEP is intended to provide a comprehensive guideline for BIM-based construction projects, many stakeholders failed to fully leverage its benefits, often reducing it to a mere template or formality initiated at the start of a project. This study aims to review existing research related to BEP frameworks within the construction industry to guide successful BIM implementation. The findings reveal that while existing BEP frameworks outline essential elements such as project information, BIM deliverables, workflows, and quality control, only a limited number of studies provide practical guidance on their full utilisation in real-world construction projects. Furthermore, challenges such as inconsistent BEP content, lack of actionable strategies, and limited stakeholder engagement hinder its adoption and integration. This research is expected could highlight the need for a more structured and practical approach to BEP implementation, particularly in developing countries such as Malaysia, where existing frameworks remain underutilised. Hence, this research is significant for the Malaysian construction industry as it aims to bridge the gap between BEP theory and practice, enabling professionals to maximise the benefits of BIM and achieve better project outcomes.

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INTRODUCTION

The construction industry in Malaysia has undergone significant progress, becoming more modernised, efficient, and well-equipped to handle complex and large-scale infrastructure projects. This transformation is driven by the integration of advanced and innovative technologies, including Unmanned Aerial Vehicles (UAVs), Augmented Reality (AR), Virtual Reality (VR), Industrialised Building Systems (IBS), and, most notably, Building Information Modelling (BIM) (Brahim et al., 2021; Dehdasht et al., 2021; Tung et al., 2021).

BIM, as defined in the ISO 19650-1:2018, is "the use of a shared digital representation of a built asset to support design, construction and operation processes, establishing a reliable basis for decision-making" (ISO, 2018a), has emerged as a foundation of innovation in construction projects. BIM offers a wide range of benefits, including facilitating design alternatives to enable informed decision-making, enhancing rapid and accurate information exchange (Ebada et al., 2021) and promoting stakeholder integration, which significantly improves project productivity (Samimpay & Saghatforoush, 2020).

To further advance BIM adoption, Malaysia's Public Works Department (PWD) Strategic Plan 2021–2025 targets projects valued at RM 10 million and above, beginning with a 50% implementation rate, increasing annually by 10% until 2025 (Al-Ashmori et al., 2022; Othman et al., 2021). These initiatives reflect a strong commitment to advancing BIM integration in large-scale projects (PWD, 2020).

BIM in Malaysia and Others

BIM implementation in Malaysia began with three pilot projects: the Healthcare Center Type 5 in Sri Jaya Maran, Pahang; the Administration Complex Project of the Malaysian Anti-Corruption Commission (SPRM) in Shah Alam, Selangor; and two Primary Schools located in Meru Raya, Ipoh, Perak, and Tanjung Minyak 2, Melaka Tengah, Melaka. These projects were strategically selected to serve as pilot initiatives aimed at advancing BIM implementation in line with the government's objectives (Latiffi et al., 2013).

The success of these pilot projects contributed significantly to raising awareness of BIM, leading to a steady increase in its adoption. BIM adoption rates grew from 17% in 2016 to 49% in 2019, reaching 55% in 2021 (CIDB, 2022). This growth has been driven by factors such as the Construction 4.0 Strategic Plan 2021–2025, rising demand for BIM applications among construction professionals, and supportive government policies (Othman et al., 2021). As Malaysia continues to navigate Industrial Revolution 4.0 (IR 4.0), which emphasises digital technology (Aliu et al., 2023). It is crucial to ensure that the new construction workforce is well-equipped with BIM capabilities to meet the demands of an evolving industry.

Globally, BIM adoption is more advanced, with countries such as the United States, the United Kingdom, and South Korea leading the way through clear mandates and comprehensive standards (Jiang et al., 2022; Lee & Yu, 2016). For instance, the United States mandated BIM use as early as 2007 (Edirisinghe & London, 2015), while the United Kingdom introduced Level 2 Collaborative BIM for public projects in 2016 (Lea et al., 2015). Similarly, Singapore's Building and Construction Authority (BCA) made BIM submission compulsory for large-scale projects starting in 2015 (Liao et al., 2021). In the ASEAN region, countries like Vietnam and Indonesia have also developed national roadmaps and guidelines to accelerate BIM adoption (Bui et al., 2024).

However, the effective implementation of BIM implementation will require a structured BIM Execution Plan (BEP), to serve as a comprehensive framework to guide and standardise workflows across

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all project phases (Abdelalim et al., 2024; McArthur & Sun, 2015). The first BEP was developed by Penn State University in 2010 (McArthur & Sun, 2015), marking a significant milestone in the structured implementation of Building Information Modelling (BIM) for construction projects. The BEP is designed to standardise and streamline BIM workflows, this pioneering BEP provided a systematic approach for integrating BIM throughout the entire project lifecycle, from planning to operation (Hadzaman et al., 2016; Shawky et al., 2024).

Moreover, it outlined the key components such as defining BIM goals and uses of the project, developing process maps to visually represent the flow of BIM activities, establishing information exchanges, and setting up the technological infrastructure required to support seamless communication and quality control (Abbasnejad et al., 2021; Abdelalim et al., 2024). This foundational document has been widely recognised and adopted globally, becoming a benchmark for the development of subsequent BIM frameworks and guidelines, including ISO 19650 (Ashworth et al., 2023).

Following the success of the Penn State BEP, many other countries developed their own BEP guidelines to guide BIM implementation in construction projects. For instance, the success of the Penn State BEP has inspired the creation of BIM Execution Plan (BEP) guidelines in various countries to standardise and enhance BIM implementation in construction projects. The Rail Baltica Latvia BIM Manual frameworks for example are built on established standards and structured workflows, incorporating key components such as Employer's Information Requirements (EIR), BEPs aligned with ISO 19650 standards, codification and data management protocols, Level of Geometry (LoG) and Level of Information (LoI) matrices, and supporting resources like facility asset data spreadsheets and space naming guidelines.

Meanwhile, in Norway, the BEP frameworks promote interoperability by enabling stakeholders to use their preferred tools while maintaining consistency through standardised formats such as Industry Foundation Classes (IFC) and BIM Collaboration Format (BCF). Tools like the Catenda Hub platform further enhance coordination and traceability, facilitating seamless collaboration among multidisciplinary teams from conceptual design to final documentation. Collectively, these practices ensure that BIM implementation meets institutional and project-specific objectives, delivering efficient and integrated outcomes. These initiatives, along with the PWD BEP Guidelines which were introduced in Malaysia in 2014 and updated in 2021, have played a critical role in advancing BIM adoption. The Malaysian guidelines outline essential components like project information, BIM deliverables, work processes, and quality control measures, reflecting a global trend towards standardising BIM implementation practices (PWD, 2014, 2021).

Despite these pioneering BEP documents and the growing body of BIM-related standards, BIM implementation still faces significant challenges. In Malaysia particular, although BIM adoption has been steadily increasing, many constructions professionals struggle with limited technical expertise, insufficient training, and the lack of a structured framework to optimise BIM processes fully (Al-Ashmori et al., 2022; Tran et al., 2024). These issues hinder the effective use of the BEP and limit its potential to drive the success of BIM projects across all phases (Mahazir et al., 2024). Not only that, despite having comprehensive BIM frameworks, other countries also experience similar difficulties in translating the BEP guidelines into practical, actionable practices (Silva & Couto, 2021). Issues such as inconsistent training, varying levels of understanding, and the absence of proper stakeholder collaboration continue to undermine the successful implementation of BIM and BEP (Mellado, 2022; Shawky et al., 2024).

Moreover, its practical implementation is often inconsistent across regions (Abdelalim et al., 2024; Shawky et al., 2024). This inconsistency results in varying levels of BIM maturity, as translating these frameworks into actionable practices proves difficult due to insufficient understanding, skills, and coordination among construction stakeholders (Abbasnejad et al., 2021). Not only that, the utilisation of

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BEP to facilitate BIM implementation remains underutilised (Eldin et al., 2024; Shawky et al., 2024). This is because BEP is often treated as a static template rather than a dynamic tool for project success (Doukari et al., 2022). According to ISO 19650-2:2018, the BEP 'explains how the information management aspects of the appointment will be carried out by the delivery team' (ISO, 2018b). The document explained BEP into two types:

(i) Pre-contract BEP, which focuses on processes and methodologies during the design phase.

(ii) Post-contract BEP, which manages and coordinates BIM information during the construction and operational phases (Tsai, 2022).

For that reason, while the Penn State BEP and other international guidelines have set a solid foundation for BIM implementation, the construction industry globally continues to face hurdles in fully leveraging BIM's potential. These challenges highlight the need for enhanced training initiatives, clearer guidelines, and stronger collaboration among stakeholders to ensure that BIM and BEP can be effectively integrated and executed throughout the lifecycle of construction projects. As BIM adoption grows, the construction industry must focus on bridging these gaps to realise the full benefits of BIM technology.

Hence, the novelty of this study lies in its emphasis on the practical utilisation of BIM Execution Plans (BEP) within the Malaysian context, which is an area that has received limited attention in previous research. Unlike studies generalising BIM implementation or focusing on international standards, this research will provide a contextual analysis of BEP frameworks tailored to Malaysia's construction industry. Therefore, this study aims to fill this gap by critically reviewing existing BEP frameworks and evaluating their utilisation within Malaysian construction projects, thereby providing actionable insights to enhance BIM implementation strategies and support standardised practices aligned with local needs.

METHODOLOGY

This qualitative research utilises the Systematic Literature Review (SLR) method to review the existing research related to the BEP framework. The systematic review uses the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA), a set of guidelines and a checklist developed to improve the transparency and reporting quality of systematic reviews and meta-analyses in research. The adopted PRISMA approach consisted of identification, screening, eligibility, and inclusion to provide a thorough and credible overview of the research topic (Moher et al., 2010).

Initially, the Google Scholar online database was selected as the primary source for publication selection due to its accessibility to a wide range of high-quality journals. To narrow the scope, the focus was placed on publications related to Building Information Modelling (BIM) in the construction industry, specifically those published between 2015 and 2024, as the earliest research on the BIM Execution Plan (BEP) framework emerged in 2015. The initial search yielded 17,800 articles, which were subsequently refined during the screening stage to focus on studies explicitly related to BEP. This process reduced the pool to 2,310 publications, and further filtering narrowed it down to 1,770 articles that concentrated specifically on BEP frameworks.

Following this, the eligibility stage was conducted to assess the availability of full-text articles for detailed content analysis. At this stage, 1,760 publications were excluded for not meeting the inclusion criteria, leaving 10 journal articles from diverse regions available in full text for the final analysis, as depicted in Figure 1. This SLR approach offers a comprehensive evaluation of existing research on BEP

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frameworks only, providing valuable insights into BEP implementation and its role in leveraging BIM benefits throughout the project lifecycle.

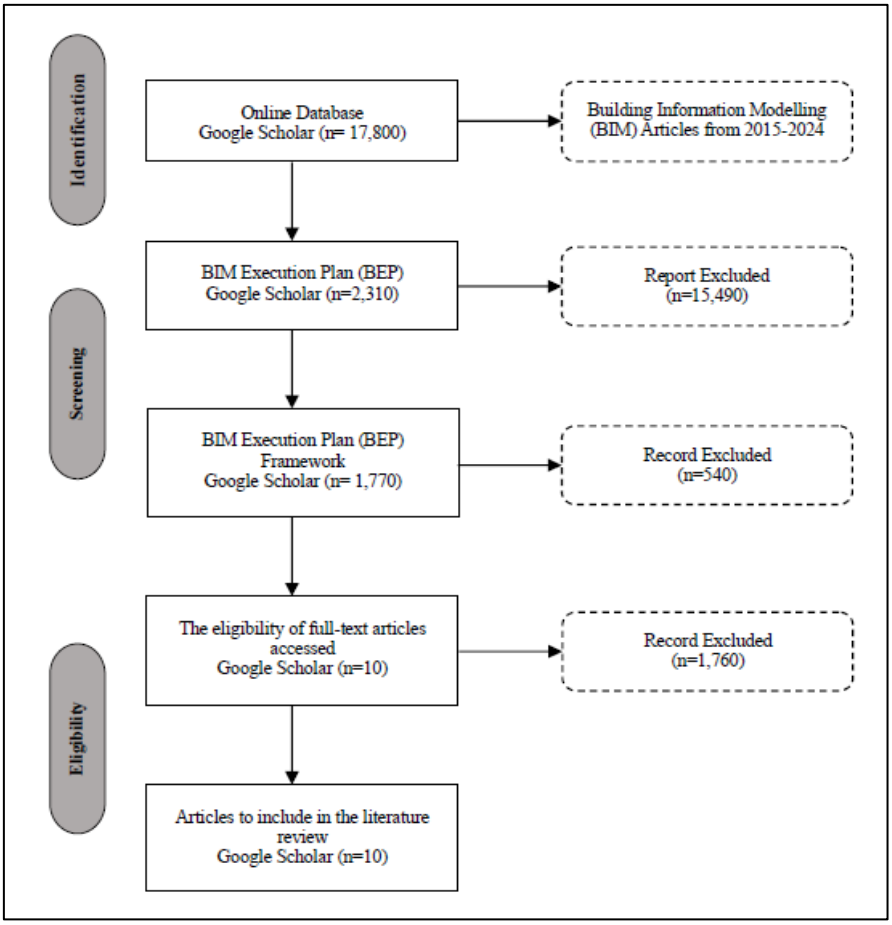

Fig. 1. The Process of Systematic Review Based on PRISMA

Source: Authors (2024)

RESULTS AND DISCUSSIONS

This discussion reviews 10 existing BEP frameworks from global studies to analyse their purpose, key elements, strengths, and limitations. The BEP serves as a structured guideline for the effective implementation of BIM in construction projects by establishing processes, roles, responsibilities, and deliverables. These studies provide insights into the development and application of BEPs in various contexts, such as Public-Private Partnerships, mega-construction projects, sustainable designs, and infrastructure developments (Hadzaman et al., 2016; McArthur & Sun, 2015; Shawky et al., 2024).

The literature review highlights the progression of BEP frameworks, starting with McArthur & Sun (2015), followed by contributions from Hadzaman et al. (2016). In 2021, notable studies emerged, including

those by Ayerra et al. (2021), Bakar et al. (2020), Rodrigues & Andrade (2021), and Silva & Couto (2021). Recent advancements are evident in the works of Gadi (2022) and Panagiotidou et al. (2022), with the latest contributions from Abdelalim et al. (2024) and Shawky et al. (2024). This body of research highlights the evolving nature of BEP frameworks and their adoption across various construction settings, as summarised in Figure 2 below:

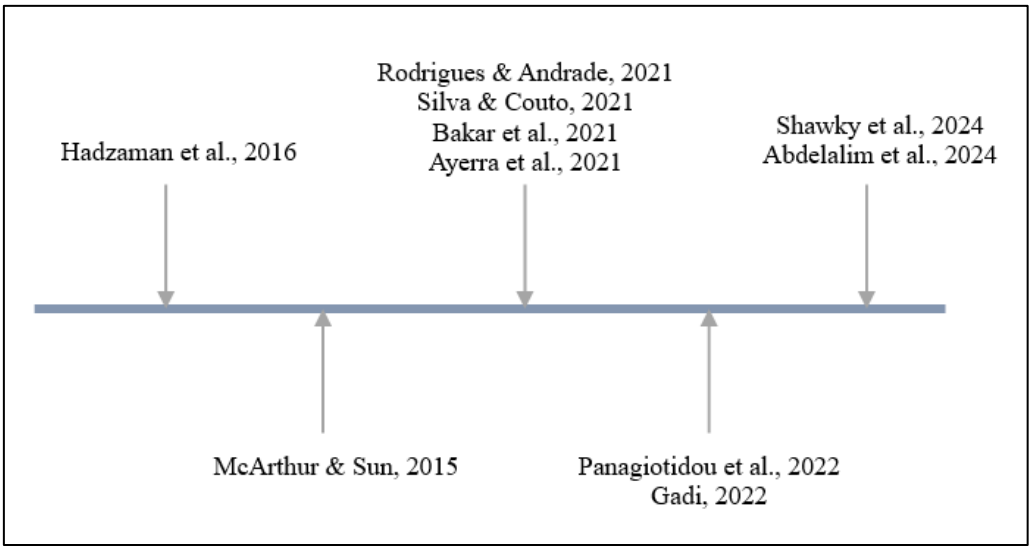

Fig. 2. Timeline of BIM Execution Plan Proposed Framework Publications

Source: Authors (2024)

The review identifies key BEP elements, including project information, BIM deliverables, work processes, quality control, and model structure, which are critical for improving coordination, information exchange, and project efficiency. It also assesses the global application of BEP frameworks, identifying notable strengths such as enhanced stakeholder collaboration, adaptability, and streamlined workflows. However, limitations persist, including inconsistencies in BEP content, insufficient standardisation, and implementation challenges.

The findings are then contextualised within Malaysia's current BEP practices. Although the Public Works Department (PWD) introduced Malaysia's first BEP guidelines in 2014 and a revised edition in 2021, significant challenges remain (Zainon & Vicky, 2021). Issues such as the lack of detailed guidelines, limited practical support, and inconsistent stakeholder compliance hinder the effective implementation of BEPs in Malaysian construction projects (Jun et al., 2024). Therefore, this discussion aims to evaluate the BEP elements, the utilisation of existing frameworks, their strengths, and limitations, while linking these findings to the ongoing challenges in Malaysia's BIM implementation practices. Details of the review are illustrated in Table 1 below.

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Table 1. Previous Research Related to the BEP Framework

No.	Title	Purpose	No. of BEP Elements
1.	Best practices for BIM Execution Plan Development for a Public–Private Partnership Design-Build-Finance-Operate-Maintain Project (McArthur & Sun, 2015)	To guide the development of Building Information Modelling (BIM) Execution Plan for the delivery of Public-Private Partnership (P3) projects	14
2.	An Exploratory Study: Building Information Modelling Execution Plan (BEP) Procedure in Mega Construction Projects (Hadzaman et al., 2016)	To investigate the processes of BEP To identify the information exchange among stakeholders To establish strategies to implement BIM in Mega construction projects	4
3.	BIM Execution Plan (BEP) to Infrastructure Superintendence of The Federal University of Pernambuco (Rodrigues & Andrade, 2021)	To present the steps used to create a BEP for the realisation of a design development phase	4
4.	BIM Execution Plan, Maturity and Diffusion Policies Applied to Sustainable Design of Structures (Silva & Couto, 2021)	To present a specific proposal for a BEP applied to structural design offices	11
5.	Building Information Modelling Execution Plan (BEP): A Comparison of Global Practice (Bakar et al., 2021)	To identify and compare the key elements in existing BEPs	12
6.	Next Steps in BIM Execution Planning: A Review of Guides in the USA (Ayerra et al., 2021)	To evaluate a small sample size of BEPs and suggest essential guidelines that must be followed when developing a BEP	9
7.	Building Information Modelling Execution Plans: A Global Review (Panagiotidou et al., 2022)	To review and analyse the literature and synthesise existing knowledge relevant to the topic	24
8.	Evaluating BIM Execution Planning Elements and Their Alignment to International Information Management Standards (Gadi, 2022)	To define and validate common BEP information categories and elements to support future BEP standards and requirements	17
9.	Standardisation of BIM Execution Plans (BEP's) for Mega Construction Projects: A Comparative and Scientometric Study (Shawky et al., 2024)	To identify and analyse the content topics of a BEP	7
10.	Developing Standard BIM Execution Plans for Complex Construction Projects (Abdelalim et al., 2024)	To track the progress of BEP standards, identify key research topics and determine influential works in the field	9

Source: Abdelalim et al. (2024)

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BIM Execution Plan (BEP) Framework: Elements, Use, Strengths, and Limitations

The BEP framework will be analysed in detail below, including its key elements, applications, strengths, limitations, and its relevance and comparisons in the Malaysian context.

BEP Elements

The literature highlights various key elements within BIM Execution Plans (BEP) that are essential for facilitating the successful implementation of Building Information Modelling (BIM) across construction projects. Studies such as McArthur & Sun (2015) and Rodrigues & Andrade (2021) outline tailored BEP structures suited to unique project delivery systems, while Hadzaman et al. (2016) and Shawky et al. (2024) delve into BEP content, exploring critical components such as processes, roles, and information exchange strategies. These studies consistently emphasise standardised BEP elements such as project phases, data management protocols, roles and responsibilities, quality control, and communication workflows as foundational to achieving project efficiency and consistent information exchange.

In Malaysia, the Public Works Department (PWD) introduced the first edition of a BEP framework in 2014, followed by a revised edition in 2021. The Malaysian BEP framework includes key elements such as project information, BIM deliverables, work processes, quality control, and model structure (PWD, 2014, 2021). However, despite its detailed structure, challenges persist regarding implementing these elements, primarily due to a lack of clear and actionable guidance. These findings align with global studies, which highlight that while BEPs are theoretically comprehensive, their practical adoption often remains inconsistent (Abdelalim et al., 2024; Shawky et al., 2024).

Use of the Framework

Globally, BEP frameworks have demonstrated significant potential in streamlining BIM adoption and improving project outcomes. Studies by Silva & Couto (2021) underscore the adaptability of BEP frameworks to address specific project needs, such as those in design offices and sustainable structural designs. Comparative analyses by Ayerra et al. (2021) and Bakar et al. (2020) further highlight how BEP frameworks align regional practices with international standards, facilitating better decision-making, enhanced stakeholder coordination, and robust information management protocols.

Despite these global advancements, Malaysia's experience with BEP framework adoption remains limited. Although the PWD's efforts represent progress, insufficient guidance and a lack of best practices continue to hinder the widespread utilisation of BEPs. Malaysian construction professionals face challenges in translating BEP theory into actionable workflows, reflecting global issues noted in Panagiotidou et al. (2022) and Gadi (2022). As a result, gaps in understanding and limited practical support restrict the full potential of BIM implementation through BEP frameworks.

Strengths of the Framework

The BEP frameworks reviewed exhibit several strengths that, if effectively leveraged, could address Malaysia's current implementation challenges. Global studies, including Panagiotidou et al. (2022) and Abdelalim et al. (2024), highlight the BEP's adaptability, allowing it to be customised for diverse project types, scales, and delivery systems. The structured approach of BEPs, includes defining roles, responsibilities, workflows, and information exchange that enhances collaboration and communication among project stakeholders. Moreover, frameworks mapped to international standards, such as ISO 19650 (as seen in Gadi, 2022), promote consistency and foster best practices across regions.

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These strengths suggest that Malaysia's BEP framework, with its established structure, has the potential to significantly benefit construction professionals. However, to realise this potential, targeted efforts are required to improve implementation strategies, provide practical training initiatives, and enhance stakeholder understanding.

Limitations of the Framework

Globally, BEP frameworks promise to streamline BIM adoption and improve outcomes by codifying standardised workflows (Ayerra et al., 2021; Silva & Couto, 2021). However, they often remain "static templates" rather than dynamic tools, offering checklists of elements without clear, context-sensitive procedures for implementation (Hadzaman et al., 2016; Shawky et al., 2024). In practice, this leads to superficial compliance: teams tick off required sections but lack the technical or institutional support to operationalise them, resulting in "BEP documents on the shelf" rather than living guides (Panagiotidou et al., 2022).

In Malaysia, these global limitations are magnified. Although the PWD's 2014 and 2021 BEP editions list comprehensive elements (project information, deliverables, quality checks), they provide minimal guidance on tailoring workflows to different project scales or procurement models. Without sector-specific case studies or exemplar processes, practitioners struggle to translate generic BEP clauses into daily routines, especially on smaller private developments that cannot afford dedicated BIM managers (Gadi, 2022).

Further, the lack of robust enforcement mechanisms means that even large public projects seldom face penalties for non-compliance, reducing the incentive to invest in the training and technology upgrades that BEP execution demands (Rodrigues & Andrade, 2021). Coupled with inconsistent BIM maturity across firms, this weakens peer pressure for best practice adoption. Stakeholders thus perceive BEP preparation as an administrative burden, not a value-adding exercise, perpetuating minimal engagement with the framework's strategic potential.

To overcome these hurdles, Malaysia needs BEP guidelines that go beyond enumerating elements by embedding step-by-step workflows, role-specific checklists, and enforcement pathways tuned to local procurement and organisational cultures. Only then do the BEP frameworks transition from theoretical blueprints into practical roadmaps for BIM success.

Framework Comparisons and Relevance to Malaysia

From the reviewed literature, most proposed BEP frameworks share a common theoretical foundation, often referencing and adapting the Pennsylvania State University (PSU) BEP to meet specific organisational or regional requirements. Studies such as Abdelalim et al. (2024), Ayerra et al. (2021), and Gadi (2022) stand out for their comprehensive analysis of BEP elements and their focus on practical implementation. For instance, Abdelalim et al. (2024) employ Pareto analysis to examine the frequency of BEP sub-elements, while Ayerra et al. (2021) propose an integrated BEP framework that spans both pre- and post-contract phases. Similarly, Gadi (2022) maps BEP frameworks to ISO 19650, enhancing their reliability and usability. These studies provide valuable insights into best practices for BEP development and implementation, offering practical recommendations for improving the adoption of BEPs in construction projects. In the Malaysian context, these global practices highlight opportunities for strengthening the current BEP framework. Table 2 outlines the elements, the use of frameworks, strengths, limitations, comparisons and gaps between the key findings of the global framework and the Malaysian context.

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Table 2. Summary of BEP Framework Analysis

Aspect	Key Findings (Global)	Malaysian Context	Key References
Elements	• Standardised elements across frameworks include project phases, data protocols, roles & responsibilities, quality control, communication workflows	• PWD BEP (2014, 2021) covers project info, deliverables, processes, quality control, and model structure • Practical guidance is still unclear, leading to inconsistent adoption	Hadzaman et al., 2016; McArthur & Sun, 2015; Rodrigues & Andrade, 2021; Shawky et al., 2024
Use of Framework	• Adaptable to project types (e.g. sustainable design, PPP, mega projects) • Aligns regional practice with international standards, improving decision-making and coordination	• The PWD efforts are a positive step. However, it lacks best practice examples and actionable workflows hinders real-world uptake • Professionals struggle to translate BEP theory into practice	Ayerra et al., 2021; Bakar et al., 2020; Gadi, 2022; Panagiotidou et al., 2022; Silva & Couto, 2021
Strengths	• Highly customisable for diverse scales and delivery systems • Structured roles, workflows, and exchanges enhance collaboration • Mapping to ISO 19650 promotes consistency	• Malaysia's structured PWD BEP could leverage these strengths • Needs targeted training and clearer stakeholder guidance to realise potential	Abdelalim et al., 2024; Gadi, 2022; Panagiotidou et al., 2022
Limitations	• Inconsistent content and stakeholder engagement • Static templates are often misused • Dependence on technological readiness and enforcement mechanisms	• PWD BEP lacks detailed, actionable instructions and robust enforcement • Variable BIM maturity across organisations exacerbates adoption challenges	Gadi, 2022; Hadzaman et al., 2016; Rodrigues & Andrade, 2021; Shawky et al., 2024
Comparisons & Gaps	• Most frameworks trace back to PSU BEP (2010) and now map to ISO 19650 • Recent studies use Pareto analysis, integrated pre/post contract models, and scientometrics	• Aligning PWD BEP more fully with ISO 19650 • Introducing clear enforcement, exemplar case studies, and stakeholder-focused workflows will bridge the practical use gap	Abdelalim et al., 2024; Ayerra et al., 2021; Gadi, 2022

Source: Abdelalim et al., 2024; Ayerra et al. (2021)

From Table 2 above, global studies have highlighted that BEP frameworks generally include standardised elements such as project phases, data protocols, quality control, and defined roles and responsibilities (Hadzaman et al., 2016; McArthur & Sun, 2015; Rodrigues & Andrade, 2021; Shawky et al., 2024). These elements are intended to support clear communication and streamlined workflows between project stakeholders. Moreover, frameworks are also adaptable to various project types and align with international standards like ISO 19650, thereby enhancing coordination and decision-making (Ayerra et al., 2021; Bakar et al., 2020; Gadi, 2022; Panagiotidou et al., 2022; Silva & Couto, 2021).

However, in the Malaysian context, the PWD BEP, while covering key aspects such as deliverables and processes, is still constrained by a lack of practical guidance and actionable workflows, which hinders its adoption in BIM construction projects (Shawky et al., 2024). Professionals often struggle to translate BEP theory into practice, despite its alignment with international principles (Ayerra et al., 2021; Bakar et al., 2020; Gadi, 2022; Panagiotidou et al., 2022; Silva & Couto, 2021), making the BEP implementation inconsistent, fragmented, and difficult to enforce across real-world project environments.

The structured PWD BEP has the potential to leverage strengths commonly identified in global frameworks, such as customisability and collaborative workflows (Abdelalim et al., 2024; Gadi, 2022;

Panagiotidou et al., 2022) to promote more effective stakeholder coordination, streamline project delivery, and enhance BIM integration across various project stages. However, the current version of PWD BEP lacks detailed guidance, enforceable instructions, and stakeholder support mechanisms (Gadi, 2022; Hadzaman et al., 2016; Rodrigues & Andrade, 2021; Shawky et al., 2024) that has led to challenges, particularly given the varying levels of BIM maturity across organisations.

Additionally, while most global BEP frameworks trace back to the PSU BEP and have since evolved to map onto ISO 19650, Malaysia's PWD BEP requires better alignment with these international standards to enhance its application within BIM construction projects in the Malaysian context (Abdelalim et al., 2024; Ayerra et al., 2021; Gadi, 2022). In conclusion, addressing this research gap may be achieved by introducing localised case studies, establishing clearer enforcement mechanisms, and developing workflows that reflect stakeholder needs. Closing these gaps is crucial to enabling Malaysian construction professionals to fully realise the benefits of BIM implementation, thereby supporting more efficient, consistent, and collaborative project delivery.

CONCLUSION

This study reviewed 10 existing BIM Execution Plan (BEP) frameworks to analyse their elements, strengths, limitations, and relevance to Malaysia's current BEP practices. The findings highlighted that key BEP elements such as project information, BIM deliverables, work processes, quality control, and model structure are critical for improving project efficiency, stakeholder collaboration, and information exchange. Global studies demonstrate the adaptability and potential of BEP frameworks when tailored to meet project-specific needs, particularly when aligned with international standards like ISO 19650.

However, the study also identified significant limitations, including inconsistencies in BEP content, lack of actionable guidance, and varying levels of BIM maturity, which hinder the effective implementation of BEPs globally and in Malaysia. Despite the PWD releasing BEP frameworks in 2014 and 2021, challenges remain in translating theoretical frameworks into practical workflows, reflecting a need for improved implementation strategies, training, and support for Malaysian BIM construction projects.

Future research will focus on developing a comprehensive BEP framework tailored to the specific needs and practices of the Malaysian construction industry. This framework is expected to offer structured yet adaptable components that can guide professionals throughout all stages of a project, from pre-contract planning to post-construction activities. Several key areas are recommended for inclusion, such as clearly defined roles and responsibilities for each stakeholder, standardised templates for BEP documentation, and a phased implementation roadmap that reflects local project delivery methods.

The inclusion of practical tools, such as checklists, progress monitoring guides, and collaboration protocols, will help support the effective application of BEP processes. To further strengthen its relevance, the framework should also incorporate training content and awareness resources to assist stakeholders who may have limited experience with BEP. These elements are intended to help address existing challenges while encouraging clearer communication, improved consistency, and stronger collaboration in BIM implementation across the Malaysian BIM construction projects.

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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.

AUTHORS' CONTRIBUTIONS

The authors confirm their contribution to the paper as follows: study conception and design: Syahirah Mat Sahizol Raduan, Juliana Brahim, Rumaizah Mohd Nordin; data collection: Syahirah Mat Sahizol Raduan; analysis and interpretation of results: Syahirah Mat Sahizol Raduan, Juliana Brahim, Suzila Mohd; draft manuscript preparation: Syahirah Mat Sahizol Raduan, Juliana Brahim, Suzila Mohd and Otto Fajarianto. All authors reviewed the results and approved the final version of the manuscript.

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