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The Missing Link: Issues in Achieving BIM Success through BEP Implementation in Malaysia

Syahirah Mat Sahizol Raduan[a], Juliana Brahim[a*], Rumaizah Mohd Nordin[a] & Zainidi Mat Yusoff[b]

[a]*Studies of Construction, Faculty of Built Environment, Universiti Teknologi MARA, Shah Alam, Selangor, Malaysia*

[b]*Binnies Singapore Pte Ltd, 2 International Business Park, #02-22 The Strategy Tower 2, 609930, Singapore*

[*]*Corresponding author: jubrahim@uitm.edu.my*

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ABSTRACT

Building Information Modelling (BIM) Execution Plan (BEP) offers numerous benefits to the Malaysian construction industry and plays a crucial role in improving communication and collaboration among project stakeholders. It clearly defines deliverables throughout the project lifecycle, offering a detailed and structured framework for construction projects that aim to successfully integrate BIM. However, many BIM practitioners face challenges in utilising BEP in BIM projects, making it difficult to fully harness the benefits of BIM. Therefore, this research was conducted to investigate issues with the current use of BEP in Malaysian construction projects. The research involved semi-structured interviews with eight respondents from the construction industry who possess experience using BEP. The findings reveal that the lack of understanding of BEP is a key issue, primarily due to the inexperience of BIM teams with BIM and BEP processes. Additionally, ambiguity in BEP process usage is another significant concern, as BEP is not initiated at the commencement of the project and lacks progressive updates. Therefore, this research is expected to advance BEP practices in construction projects, foster future studies related to BEP in Malaysia, improve BIM implementation and align with government policies to enhance BIM integration within the construction industry.

Keywords: BEP; BIM; standardisation; issues; implementation

INTRODUCTION

Building Information Modelling (BIM) is a process of creating, using, and sharing 3D models through digital technology, which contains various types of information. This information can be utilized by construction professionals to achieve project objectives throughout its implementation (PWD 2021). Due to its benefits, BIM has been highlighted in the CIDB Construction 4.0 Strategic Plan (2021-2025) as one of the 12 emerging technologies driving transformation in the Malaysian construction industry. Specifically, it falls under Cluster 1: Simulation and Modelling (CIDB 2020), where its adoption is seen as a catalyst for improving project efficiency, collaboration, and sustainability within the sector. This recognition underscores BIM's significant potential to reshape the future of construction in Malaysia. BIM benefits construction projects by facilitating easier information sharing among project stakeholders, enabling regular analysis of project designs with real-time simulations, and providing the client with a better understanding of the accurate and multi-dimensional model (Hadi 2020).

In addition, in executing BIM construction projects, a BIM Execution Plan (BEP) is essential for planning and monitoring strategies, and it functions as the main reference for project teams regarding BIM-related information related to the project, such as project goals, project characteristics, project stakeholders and infrastructure required (Bakar et al. 2020). A BEP serves to clarify roles, responsibilities, and the delivery of key project information to ensure consistency and quality across all stages of the project (CIDB 2017). Furthermore, the BEP enables effective collaboration among stakeholders by setting expectations, milestones, and deliverables while identifying potential risks and outlining strategies for mitigation. Moreover, BEP is a living document that needs to be updated progressively (Ramírez-Sáenz et al. 2018), to ensure the successful integration of BIM technology

throughout the building lifecycle (Sudakova et al. 2024). This iterative process enables project teams to stay adaptable and responsive to any changes, including design adjustments or unforeseen challenges. Consequently, the ongoing evolution of the BEP through regular updates is critical for maximizing the benefits of BIM throughout the entire lifecycle of a project, spanning from planning and design to construction, operation, and maintenance. The integration of a well-maintained BEP ensures that BIM continues to be an invaluable technology for improving project outcomes, reducing errors, enhancing communication, and driving higher efficiency in construction processes. However, most BIM practitioners face challenges in utilizing BEP in BIM projects, making it difficult to fully harness the benefits of BIM. Hence, this research is expected to answer the research question and fulfil the research objective, as illustrated in Table 1.

TABLE 1. Research question and objective

No	Research Question	Research Objective
1	Why do issues persist in the current use of BEP in Malaysian BIM construction projects?	To investigate issues with the current use of BEP in Malaysian BIM construction projects

LITERATURE REVIEW

The BIM Execution Plan (BEP) serves as a reference document for contracting parties to implement BIM projects in accordance with the International Organisation for Standardisation (ISO) 19650 standards (NIBS 2022). Other than that, the BEP is a vital process carried out by the project team to develop a strategy for effectively implementing BIM within the project (Gadi, 2022). Additionally, by establishing standardized protocols and procedures, projects in the construction industry have the potential to significantly enhance clarity, efficiency, and effectiveness in project management, while effectively overcoming challenges like miscommunication and delays, resulting in improved outcomes and reduced costs (Abdelalim et al. 2024a). To gain a deeper understanding of BEP, the next subsection will explore the BEP concept, including its definition, key aspects in its creation, relevant standards for BEP development, and the issues identified in the current BEP implementation.

BIM EXECUTION PLAN (BEP) CONCEPT

BEP, according to the Construction Industry Development Board (CIDB), is defined as "A reference document for the contracting parties to execute the BIM project. BEP embodies the process and methodology to deliver the collaborative working practices for the BIM project." (CIDB, 2017). Concurrently, the Public Works Department (PWD) through the PWD BIM Guideline, has generally states that BEP provides a detailed execution plan, including monitoring and control methods, and acts as a primary reference for data management, as well as the assignment of roles and responsibilities. Moreover, it contains essential project-related information that must be continuously updated through collaboration and cooperation among all parties (PWD 2021), ensuring that all stakeholders are aligned throughout the project lifecycle and that the project progresses according to the defined objectives. This dynamic process allows for flexibility in addressing changes while maintaining consistency and transparency in BIM construction project execution.

Furthermore, the development of a BEP requires the inclusion of key contents that form the foundation of a structured BEP template. One of the earliest structured guides for the development of BEP was introduced by Penn State University (PSU) in 2010. This guide provided a standardized framework for BEP formulation, setting a precedent for future BEP practices in the construction industry. Building upon this foundation, the National BIM Standard – United States (NIBS) BEP was developed in 2011, further refining the framework for BEP implementation (Messner et al. 2019; NIBS, 2022). These standards outline the key components essential for creating an effective BEP, offering a comprehensive reference for BIM practitioners worldwide. The development of these standards has been pivotal in standardizing BEP practices, as summarized in Table 2.

TABLE 2. Key Content of BIM Execution Plan (BEP)

No	Key Content of BIM Execution Plan
1	BIM Execution Plan Overview
2	Project Information
3	Key Project Contacts
4	Project Goals/BIM Uses
5	Organisation Roles
6	BIM Process Design
7	BIM Information Exchanges
8	BIM and Facility Data Requirements
9	Collaboration Procedures
10	Quality Control
11	Technological Infrastructure Needs

Following the earlier developments of mentioned BEPs, the British Standards Institution (BSI) has established standards to guide their implementation. Introduced in 2013, the Publicly Available Specification 1192-2 (PAS 1192-2) provided a comprehensive framework for BEP creation (BSI 2013). However, this standard was withdrawn in 2018 due to conflicting issues that could lead to confusion and inefficiency. Consequently, the International Organisation for Standardisation (ISO) 19650 has emerged as a global benchmark for efficiently managing information across the entire lifecycle of a built asset (ISO 2018a, 2018b), establishing a clear framework for information management in construction projects. Furthermore, ISO 19650 builds upon the principles of BIM and aligns closely with PAS 1192-2, effectively superseding the earlier standard, and offering a more comprehensive and adaptable approach to managing construction-related data and processes globally. This shift represents a significant advancement in standardization, ensuring consistency and improved outcomes in BIM implementation

PREVIOUS RESEARCH RELATED TO BEP

Table 3 presents the growing body of research on BEP and highlights how the focus has evolved over time. Earlier studies, particularly those conducted between 2016 and 2020, centred on exploring the structural components and key elements that form the foundation of BEPs. These initial works played an important role in shaping the industry's understanding of how BEPs should be developed and what they should include. However, in more recent years, especially between 2024 and 2025, the direction of research has gradually shifted. Newer publications are placing greater emphasis on digital transformation and the automation of BEP processes, reflecting how the construction industry is beginning to adopt more forward-looking, technology-driven approaches.

Several consistent themes emerge across the literature. Many researchers have drawn attention to the need for clearer and more standardised BEP guidelines. For example, the works of Bakar et al. (2020), Ganah and Lea (2021), and Shawky et al. (2024) underscore the importance of establishing consistent procedures to guide BEP use across different projects. Others, such as Gadi (2022) and Panagiotidou et al. (2022), have focused on the structure and content of BEPs, aiming to improve how information is organised and shared. Meanwhile, studies by Abdelalim et al. (2025) and Mahazir et al. (2024) delve into the reasons behind BEP-related challenges, such as inconsistent application and limited awareness among practitioners. These studies also stress the importance of clearly defining stakeholder roles to avoid confusion and to promote better collaboration in BIM-based construction environments.

Taken together, the findings from these studies suggest that several long-standing issues remain unresolved. There is still a lack of widely accepted standards for BEP preparation and implementation, which contributes to inconsistency in practice. Additionally, the shift towards digital platforms is gaining attention, with researchers pointing out the benefits of moving away from manual BEP development. Digital tools have the potential to streamline workflows, support regulatory compliance, and allow for more dynamic project management through real-time updates and clearer documentation. This growing interest in digital transformation signals a strong industry demand for tools that can make BEP implementation more efficient and manageable.

In the context of Malaysian construction, however, a key gap still exists. Although some studies, particularly by Bakar et al. (2020) and Mahazir et al. (2024), have explored issues with BEP application and identified areas for improvement, there is currently no comprehensive BEP framework tailored specifically for local projects. These studies have laid the groundwork, but they stop short of proposing a structured solution that fits Malaysia's unique construction landscape. This underscores the need for further research that not only builds on existing insights but also moves toward the development of a standardised BEP framework that reflects local practices, challenges, and regulatory expectations. Therefore, this research is essential to investigate issues with the current use of BEP in Malaysian BIM construction projects.

TABLE 3. Previous research related to BEP

No	Author/Year	Title	Aim/Objectives	Location/ Project	Findings	Output
1	Bakar et al. (2020)	Building Information Modelling Execution Plan (BEP): A Comparison of Global Practice	To identify and compare the key elements in existing BEPs	Malaysia	The BEP framework was a key factor in the project's BEP development.	Comparison of 20 BEPs' key project

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No	Author/Year	Title	Aim/Objectives	Location/ Project	Findings	Output
2	Hadzaman et al. (2016)	An Exploratory Study: Building Information Modelling Execution Plan (BEP) Procedure in Mega Construction Projects	1. To investigate the process of BEP 2. To identify the information exchange among stakeholders 3. To establish strategies to implement BIM in mega construction projects	Malaysia	Four main elements of BEP are BIM goals, BIM use of responsible parties that involved in the BIM projects & decision-making	Provide guidelines for managing BIM in Mega construction projects
3.	Mahazir et al. (2024b)	Construction Project failure: Investigating Causes of Ineffective Building Information Modelling Execution Plan	To investigate the causes that contribute to the development of ineffective BEPs	Malaysia	Incompetency, lack of knowledge in BIM, individual attitude, poor data management, and insufficient technology used are the causes that contribute to ineffective BEPs	Supports evaluation of the BIM process and serves as a guide for BIM practitioners
4	Panagiotidou et al. (2022)	Building information modelling execution plans: a global review	1. To identify and analyse the content topics of a BEP to identify the conditions that affect its development 2. To provide an understanding of the influential dependencies between the topics of a BEP	United Kingdom	Occurrence of more than 70% of BIM goals, roles and responsibilities, BIM deliverables, recording, LOD specification, coordination meeting, IFC, file-naming conventions	Theoretical Framework
5	Ayerra et al. (2021)	Next Steps in BIM Execution Planning: A Review of Guides in the USA	1. Evaluating a small sample size of BEPs 2. Suggest essential guidelines that must be followed when developing a BEP	USA	Lack of consistency and standard structure	A hybrid BEP structure based on PSU and international standards
6	Klusmann et al. (2020)	BIM Based Information Delivery Controlling System	1. Establish standard EIR and BEP 2. Build an online platform for execution of semi-automated checking	Germany	1. The proposed online platform generates and validates EIR files using MVD XML and IFC files 2. Expert workshops supported the development of features and checklists.	A prototype for a semi-automatic EIR/BEP validation platform
7	Gadi (2022)	Evaluating BIM Execution Planning Elements and Their Alignment to International Information Management Standards	Developing a core list of required and optional BEP content elements	USA	105 new elements considered for the BEP	BEP Section
8	Tzanakakis (2021)	A study on the customization of the BIM Execution Plan based on project characteristics	To develop a process for the customization of a BEP according to the project's needs	Netherlands	Project characteristics are the most important for the tailor-making of a BEP	BEP Outline

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No	Author/Year	Title	Aim/Objectives	Location/ Project	Findings	Output
9	Ganah and Lea (2021)	A Global Analysis of BIM Standards across the Globe: A Critical Review	1. To compare and identify BIM standards, guidelines and template from worldwide 2. To provide a central resource for BIM documentation and gaps in BIM standards	United Kingdom	1. The US and the UK have been ahead of other countries in developing BIM standards 2. BIM standards are still under development and have not yet reached full implementation and adoption in most countries	Recommendations for international coordination to close BEP and EIR documentation gaps
10	Abdelalim et al. (2024b)	Automation and Optimization of BIM Execution Plans for Mega Construction Projects	1. To automate and optimize BEP creation for mega projects. 2. To improve collaboration and compliance through a digital platform	Egypt	30%-time reduction in BEP creation, 20–25% error/rework reduction, improved collaboration, and real-time compliance that aligned with ISO 19650	Digital platform
11	Abdelalim et al. (2024a)	Developing Standard BIM Execution Plans for Complex Construction Projects	To improve digital transformation by implementing more efficient methodologies.	Egypt & Kingdom of Saudi Arabia	Identified 20+ essential BEP elements through Pareto and frequency analysis	BEP standard
12	Abdelalim et al. (2025)	Digital Transformation of BIM Execution Plans for Effective BIM Implementation in Mega Construction Projects	To explore how digital platforms support the standardisation of BIM Execution Plans	Egypt, Saudi Arabia & Greece	1. Developed a BEP platform that reduced BEP creation by up to 30% 2. A survey of 15 experts confirmed improved collaboration, compliance with ISO 19650 and data management	A platform for automating and standardising the creation of BEPs
13	Shawky et al. (2024)	Standardization of BIM Execution Plans (BEPs) for Mega Construction Projects: A Comparative and Scientometric Study	1. Identify common content topics and structures in BEPs 2. Propose a standardised BEP framework to improve efficiency and collaboration in BIM projects	Egypt	Identified inconsistencies due to lack of standardisation.	A standardised framework to guide BIM practices globally

ISSUES RELATED TO BEP

Despite the expanding body of research, there remains a notable gap in the Malaysian context. Although studies by Bakar et al. (2020) and Mahazir et al. (2024) identify key elements and challenges in BEP implementation, they do not extend to the development of a comprehensive and structured BEP framework tailored to Malaysia's specific construction practices. This gap highlights the need for further research focused on producing a standardised approach that addresses local project requirements and supports effective BIM integration within the Malaysian construction industry.

1. Lack of Standardization in BEP Creation

   The lack of standardization in BEP creation remains one of the most pressing issues in BIM implementation. The absence of a national standard for BEP preparation and execution has led to inconsistencies in project workflows, documentation, and stakeholder coordination (Kah & Qin 2021; Shawky et al. 2024). Despite the push for greater BIM adoption, the industry still lacks clear, standardized guidelines for

BEP preparation, resulting in varying document structures, content, and processes across different projects. This inconsistency affects project efficiency and disrupts the intended seamless collaboration facilitated by BIM technology. Studies suggest that without a well-defined BEP standard, project teams often develop BEPs that vary significantly in format, scope, and level of detail, leading to misinterpretation and inefficiencies (Kah & Qin 2021). The lack of a national BIM standard further exacerbates this issue, making it challenging for industry practitioners to achieve uniformity in BEP implementation (Shawky et al. 2024). The fragmented documentation and workflows ultimately hinder the potential of BIM to enhance project coordination and efficiency.

2. Ambiguity in BEP Process Usage

Another major challenge is the ambiguity in BEP process usage, which affects project coordination and execution. Ideally, BEP should be established in the early stages of a project to ensure clear objectives and alignment among all stakeholders (Messner et al. 2019). However, in practice, BEPs are often developed reactively rather than proactively, resulting in unclear guidelines and inconsistent application. A key issue is the failure to integrate BEP with other project planning documents, such as the Master Work Program (MWP), leading to misalignment between BIM processes and overall project scheduling (Abdelalim et al. 2024a). Additionally, BEPs frequently lack progressive updates, causing project stakeholders to rely on outdated information, which results in confusion and inefficiencies (Abdelalim et al. 2024b). The absence of a standardized BEP workflow and template has led to ad-hoc adaptations from previous projects, further complicating implementation (Abdelalim et al. 2024a). Without clear procedural guidelines, project teams struggle to utilize BEP effectively, reducing the intended benefits of BIM adoption.

3. Lack of Understanding of BEP Concepts

The lack of understanding of BEP concepts among construction professionals further exacerbates these challenges. BEP serves as a key document in BIM implementation, yet many industry practitioners, particularly those with limited BIM experience, struggle to interpret and utilize BEP effectively (Jamal et al. 2019). The knowledge gap between experienced BEP developers and first-time BEP users creates inconsistencies in execution and project deliverables (CIDB 2017). This issue is especially prominent in organizations where BIM is newly introduced, as different team members have varying levels of familiarity with BEP documentation. Additionally, outdated BEP information and inconsistent document formatting lead to miscommunication and rework, further affecting project efficiency (Lozinski, 2020). The lack of structured training and education on BEP preparation and execution contributes to this problem, making it difficult for industry professionals to fully leverage BEP for project success.

4. Lack of Enforcement in BEP Implementation

Despite various BIM-related initiatives in Malaysia, there remains a lack of enforcement in BEP implementation. Policies such as the PWD Strategic Plan 2021-2025, the Construction 4.0 Strategic Plan 2021-2025, and the National Construction Policy 2030 have been introduced to promote BIM adoption, yet there are no specific regulations mandating BEP compliance (Chan et al. 2019). This regulatory gap has resulted in inconsistent BEP adoption across projects, as there are no formal consequences for non-compliance. The lack of clear enforcement mechanisms allows project teams to overlook BEP implementation, diminishing the effectiveness of BIM in streamlining project workflows (Arif et al. 2021). Additionally, regulatory enforcement plays a critical role in ensuring compliance with BIM execution plans, and without it, project teams may neglect BEP requirements, leading to inefficient project execution (Jamaludin et al. 2022). Therefore, introducing regulatory mandates and enforcement mechanisms is essential to achieving consistent BEP adoption and improving BIM implementation outcomes.

5. Inadequate BEP Framework

The inadequacy of the existing BEP framework further hinders BIM implementation in Malaysia. Although government agencies have developed BEP guidelines, these documents often lack the depth and specificity needed to address practical industry challenges (Bakar et al. 2020). Current BEP frameworks focus primarily on general BIM principles rather than offering clear, step-by-step instructions on structuring, updating, and integrating BEPs into project workflows. Additionally, limited research has been conducted to evaluate the effectiveness of existing BEP frameworks, raising concerns about their applicability in real-world construction scenarios (Panagiotidou et al. 2022). The lack of practical assessment means that BEP frameworks may not fully address industry-specific challenges, reducing their effectiveness in supporting BIM adoption. To improve the existing BEP

framework, further research and industry collaboration are needed to refine guidelines, incorporate best practices, and ensure alignment with the evolving needs of the construction sector.

6. Inconsistent BEP Updates

   Another challenge in BEP implementation is the inconsistency in updating BEP documents throughout a project's lifecycle. While BEP is intended to be a dynamic document that evolves with the project, many construction teams fail to update it regularly, resulting in outdated and inaccurate information being used for decision-making (Abdelalim et al. 2024b). This inconsistency stems from a lack of clear responsibility for BEP maintenance, as different project teams may assume that updating the document is someone else's responsibility. Consequently, discrepancies in BEP documentation led to misalignment between project stakeholders, causing inefficiencies, miscommunication, and delays. Establishing a systematic process for continuous BEP updates, along with assigning clear roles and responsibilities, can help mitigate this issue and improve project outcomes.

7. Limited Stakeholder Collaboration in BEP Development

   Effective BEP implementation requires active collaboration among all project stakeholders, yet many projects suffer from limited stakeholder involvement in BEP development. In many cases, BEPs are prepared by a single team or consultant without sufficient input from other key stakeholders, such as project managers, contractors, and facility managers (Abdelalim et al. 2024a). This lack of collaboration results in BEP documents that do not fully address the needs and expectations of all project participants, reducing their effectiveness in guiding BIM processes. Encouraging a more inclusive approach to BEP development, where all stakeholders actively contribute to its creation and refinement, can enhance its usability and relevance to the project.

8. Resistance to BEP Adoption Due to Cost and Time Constraints

   Lastly, resistance to BEP adoption due to cost and time constraints remains a significant barrier in the industry. Many project teams perceive BEP preparation as an additional administrative burden that requires extra time and resources, leading to reluctance to fully implement it (Abdelalim et al. 2024a). Smaller firms and projects with tight budgets may struggle to allocate resources for BEP development, viewing it as a non-essential requirement rather than a critical project management tool. Additionally, project teams that lack prior experience with BEP may see it as an overly complex process that adds unnecessary complications to project execution. To address this challenge, greater awareness of BEP's benefits, along with simplified and cost-effective implementation strategies, should be promoted to encourage wider industry adoption.

Addressing these BEP-related challenges is essential for improving BIM implementation in Malaysian construction projects. The lack of standardization, ambiguity in BEP processes, insufficient understanding, lack of enforcement, inadequate BEP frameworks, inconsistent updates, limited stakeholder collaboration, and resistance due to cost constraints collectively hinder the effective adoption of BIM. Strengthening industry knowledge, standardizing BEP procedures, enforcing regulatory measures, and promoting cost-effective implementation strategies will contribute to a more structured and efficient BEP framework. Future research should focus on evaluating the effectiveness of existing BEP guidelines and developing practical strategies to enhance BEP adoption, ultimately improving project efficiency and collaboration in Malaysia's construction industry.

RESEARCH METHOD

This qualitative research employs content analysis to systematically examine and interpret data from semi-structured interviews. The study involves eight (8) respondents, each with more than five years of experience in Malaysian BIM construction projects. The sample size of eight respondents is considered sufficient for this type of qualitative inquiry. According to (Creswell & Creswell, 2018; Zahrizan et al. 2013), qualitative studies typically involve between five and twenty-five participants, depending on the depth of analysis and data saturation. In this study, the chosen number supports the aim of exploring

the complex realities of BEP implementation in practice.

All participants have been directly involved in government-led construction projects that implement BIM. These respondents include BIM coordinators, project managers, consultants, and government officials. Their diverse roles provide valuable insights into the challenges and practices of BEP implementation in the Malaysian construction industry. Furthermore, interviews were conducted through physical and online meetings, allowing flexibility while ensuring comprehensive engagement. In addition, this study was approved by the Research Ethics Committee of Universiti Teknologi MARA, with approval reference number REC/03/2025 (PG/MR/192), and all participants provided informed consent before the interviews. Their combined experiences contribute to a nuanced understanding of the complexities involved in integrating BEP within the context of BIM implementation in Malaysian BIM construction projects.

The content analysis process starts with data familiarization, in which interview transcripts are thoroughly reviewed to identify key themes related to the challenges of BEP implementation. Using open coding, recurring patterns, such as issues with BEP understanding, standardization, practical application, enforcement challenges, and framework limitations, are systematically categorized in the ATLAS.ti, that were selected as the coding software for this research.

Following the coding phase, thematic analysis is carried out to explore both commonalities and differences in the respondents' insights. This step helps ensure a comprehensive interpretation of the broader concerns observed across the industry. After thematic analysis, network diagrams are developed to visually map the relationships between key themes and subthemes, providing a structured representation of the findings.

Through this systematic approach, the research identifies critical areas in need of improvement and proposes targeted recommendations to strengthen BEP standardization, enforcement, and overall effectiveness within the Malaysian construction industry.

FINDINGS AND DISCUSSION

The following subsections will provide a detailed analysis of the findings and discussion related to the respondents' backgrounds in the construction industry and their involvement in BIM construction projects. Furthermore, this section will further explore the construction professional experience and familiarity with BEP implementation in Malaysian BIM construction projects. Additionally, the discussion will highlight key issues identified by the respondents that hinder the effective implementation of the BIM Execution Plan (BEP) in the construction industry. These challenges include knowledge gaps, ambiguities of process, and the lack of standardization, which collectively impact the efficiency and adoption of BEP in Malaysian BIM construction projects.

RESPONDENTS' BACKGROUND

Table 3 shows the summary of the respondents' backgrounds. The analysis of the respondents' backgrounds reveals a diverse range of experience levels in both the construction industry and BIM-related projects. The majority of respondents have extensive experience in the construction industry, with several having over 20 years of involvement. One respondent stands out with 30 years of industry experience, indicating a deep understanding of both traditional and modern construction methodologies. Others have varying levels of experience, ranging from 8 to 18 years, suggesting a mix of senior and mid-career professionals. However, there is also a case with only 5 years of experience, highlighting the presence of relatively newer professionals in the field.

TABLE 3. Summary of Respondents' Backgrounds

No	Respondent (R)	R1	R2	R3	R4	R5	R6	R7	R8
1	Involvement in the Construction Industry (Years)	>20	8	>5	30	12	9	18	18
2	Involvement in Projects using BIM (Years)	>20	5	>5	20	8	9	12	8
3	Experience in using BEP (Years)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Despite their strong construction backgrounds, their involvement in BIM projects varies. Only a few respondents have more than 20 years of BIM experience, suggesting that early adoption of BIM has been limited to certain professionals. Others have between 5 to 12 years of BIM involvement, indicating that BIM adoption is still evolving in the industry. Interestingly, one respondent with 8 years of construction experience has been involved in BIM

projects for 5 years, demonstrating early exposure to BIM and suggesting that younger professionals are integrating digital construction methods more quickly than their senior counterparts.

A significant finding is that all respondents have experience in using BEP, despite their differing levels of BIM involvement. This also shows that the selected respondents with a minimum of 5 years of experience are sufficient to provide details information on related issues in BIM (Ku & Taiebat, 2011; Olanrewaju et al. 2022). Moreover, this suggests that BEP is being consistently adopted across different project types and levels of expertise, reinforcing its role as a critical component in BIM project execution. It also indicates a growing emphasis on structured BIM workflows within the industry, ensuring that all professionals, regardless of their experience level, are familiar with BEP implementation.

ISSUES RELATED TO THE BEP

The network diagram illustrated in Figure 1 below, obtained through data analysis using ATLAS.ti, reveals several significant barriers to effective BIM Execution Plan (BEP) implementation within the construction industry. These challenges include the lack of standardization in BEP creation, ambiguity in BEP process usage, inadequate understanding of BEP, weak enforcement mechanisms, and inadequacies in the BEP framework. While these issues are well-documented in previous research, a critical examination suggests that they are not isolated problems but rather interconnected factors that collectively hinder the successful adoption of BEP. The following analysis evaluates these issues in greater depth, critically comparing them with existing literature and assessing their broader implications.

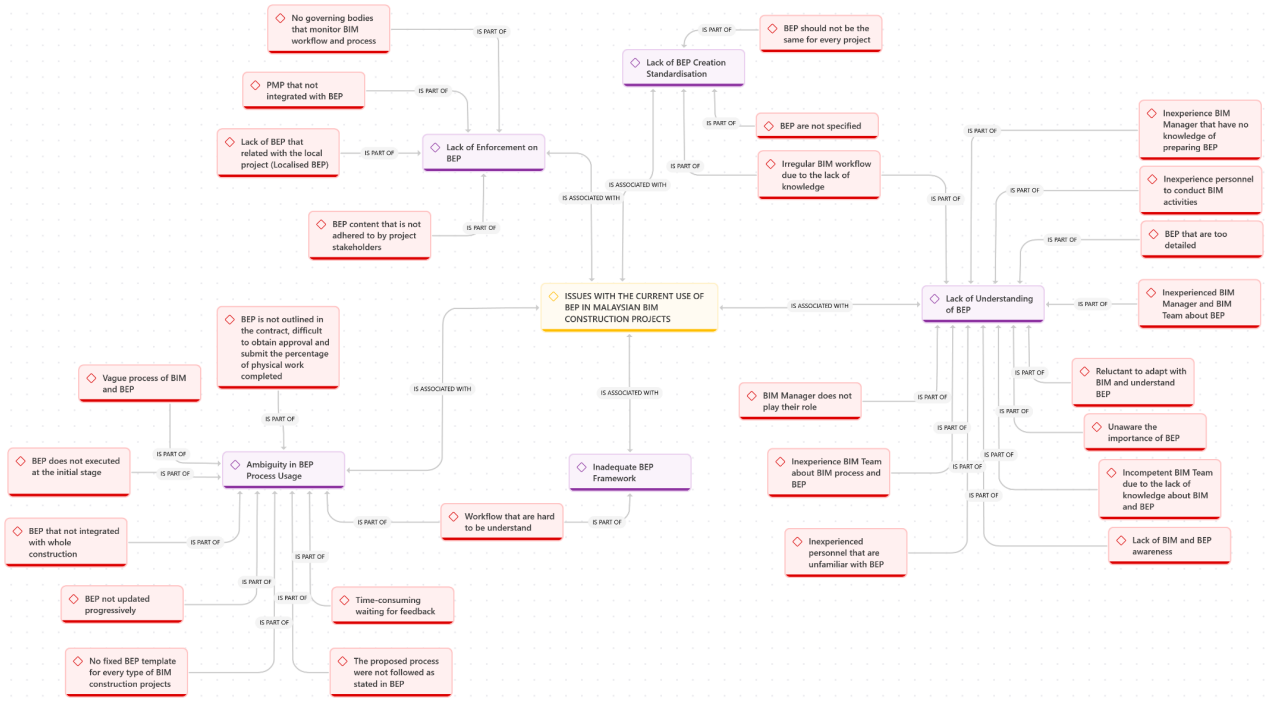

FIGURE 1. Network diagram of issues with the current use of BEP

1. Lack of BEP Creation Standardization

   One of the most fundamental barriers to BEP implementation is the absence of a uniform and structured standard for BEP development, resulting in inconsistencies across projects. R1 highlighted that there is no universally adopted BEP standard, echoing the concerns of Abdelalim et al. (2024a), who argued that the absence of a unified approach leads to discrepancies in execution, reducing efficiency and limiting interoperability among project stakeholders.

   This issue is compounded by the fact that R2 noted that BEP is sometimes not explicitly specified in project documentation, which means that some projects may proceed without a clear execution plan. This aligns with the findings of (Sacks et al. 2016; Shawky et al. 2024), who demonstrated that the absence of mandatory BEP requirements in contracts significantly weakens their implementation, leading to fragmented project execution and incomplete BIM adoption.

However, while a lack of standardisation can be a barrier, rigid standardisation without flexibility may also create inefficiencies. As explained by R3,

"The workflow is unorganized, compounded by a lack of knowledge, making the BEP not firm, which hinders a smooth BIM process."

This viewpoint is supported by (Scheffer et al. 2018), who found that while standardisation enhances clarity and enforcement, a one-size-fits-all approach can limit project-specific optimisation and innovation. Moreover, R4 raised concerns about the irregularity in BEP workflows due to varying levels of stakeholder knowledge, which is consistent with previous studies indicating that stakeholders' uneven understanding of BEP requirements leads to fragmented execution and reduced collaboration (Doan et al. 2023). This suggests that standardization alone is not a solution unless it is coupled with comprehensive industry-wide training and knowledge dissemination. While the lack of BEP standardization creates inconsistencies, rigid standardization without adaptability may also reduce effectiveness. A more dynamic standardization framework, which allows for flexibility while ensuring compliance with essential BEP principles, is needed.

AMBIGUITY IN BEP PROCESS USAGE

Another critical barrier is the unclear and inconsistent application of BEP processes, which creates confusion and delays. R1 observed that BEP is not fully integrated into the overall construction process, mirroring the findings of (Hadzaman et al. 2016), who identified that BEP is often treated as an administrative document rather than a functional part of project execution, leading to ineffective adoption. Additionally, R2 highlighted that,

"When it comes to creating processes and workflow, it is necessary to ensure that people involved understand the workflow. Often, people do not fully grasp how to apply the workflows outlined in the BEP."

This annotation highlights that BEP workflows are difficult to understand, suggesting either excessive complexity or inadequate documentation. This aligns with the study by (Mohammed & Hilal 2024), who found that technical jargon and overly detailed BEP documentation often discourage stakeholders from fully engaging with the process, leading to misinterpretations and inefficiencies.

R3 raised an equally important issue: waiting for BEP feedback from clients is time-consuming, which creates workflow bottlenecks. This issue was previously highlighted, where client-side delays in approving BEP documents can significantly impact project timelines, particularly when clients lack a deep understanding of BIM workflows. Moreover, R6 identified that BEP is not progressively updated as the construction project advances, reinforcing the findings Mahazir et al. (2024b) who emphasised that BEP should be a living document that evolves with project stages rather than remaining static. This suggests that BEP processes are not only unclear but also lack mechanisms for continuous adaptation and refinement.

The ambiguity in BEP processes stems from both a lack of clarity and poor integration within project workflows. This suggests that BEP should not be a standalone document but should instead be seamlessly embedded within broader project management practices.

1. Lack of Understanding of BEP

A critical challenge is the limited knowledge and expertise regarding BEP among BIM teams. R1 highlighted that some BIM teams are inexperienced with the BEP process, leading to execution inefficiencies. This is consistent with the findings of (Bašková et al. 2018; Mahazir et al. 2024a) Mahazir et al. (2024a), who reported that BIM teams often lack structured training in BEP, leading to errors and mismanagement. The issue is exacerbated by R3, R4 and R5, who noted that even BIM managers often lack sufficient BEP knowledge, making them ineffective in overseeing implementation. Moreover, R6 added that,

"Lack of BIM and BEP awareness is the cause of this issue. If the personnel are not well-versed with BEP, at least they should have basic BIM training to conduct BIM activities and BEP preparation for better BEP implementation in BIM projects."

This observation aligns with the research conducted by Mahazir et al. (2024b), which highlights that even senior professionals often lack formal BEP training, resulting in inconsistent enforcement across projects that contribute to fragmented BEP adoption, affecting project coordination and efficiency. Additionally, R7 & R8 further highlighted that certain professionals continue to resist the implementation of BIM and BEP, perceiving it as an added complexity rather than a beneficial tool for project efficiency. This reluctance is often driven by concerns over technological change, hesitation to adopt new workflows and a strong preference for conventional project management practices.

The challenge extends beyond individual knowledge gaps, as the lack of understanding regarding BEP represents a wider sectoral challenge. Addressing this requires a

structured approach, including comprehensive training programmes, certification processes, and continuous professional development initiatives. By bridging the gap between BEP theory and real-world application, these efforts can foster a more standardised and effective BEP implementation within the construction industry.

2. Lack of Enforcement of BEP

The findings also highlight significant weaknesses in BEP enforcement mechanisms. R1 noted that Project Management Plans (PMPs) are not integrated with BEP, which Mahazir et al. (2024b) argued is a critical flaw, as BIM execution must align with broader project management frameworks to be effective. Moreover, R4 highlighted that stakeholders do not always adhere to BEP requirements, suggesting that compliance is neither strictly monitored nor enforced. Without a proper enforcement mechanism, stakeholders often treat BEP as a formality rather than a binding project guideline. Furthermore, R6 identified that,

"No governing bodies that monitor BIM workflow and BIM process as stated in the BEP of the BIM construction projects."

In another citation, Mahazir et al. (2024a) emphasised that regulatory oversight is necessary to ensure industry-wide compliance with BEP standards. This suggests that the issue is not just about individual non-compliance but rather a structural deficiency in the enforcement framework. Weak enforcement stems not only from a lack of regulatory oversight but also from poor contractual integration of BEP requirements. Addressing this requires binding regulatory policies, stronger contractual obligations, and compliance monitoring frameworks to ensure BEP adherence.

The findings indicate that BEP implementation is hindered by systemic and interrelated challenges, including standardisation issues, process ambiguity, lack of understanding, weak enforcement, and inadequate regulatory frameworks. A critical examination suggests that these are not standalone problems but interconnected issues that reinforce each other, ultimately leading to inefficiencies in BEP execution.

CONCLUSION

To conclude, this study identifies the key challenges hindering the effective implementation of the BIM Execution Plan (BEP) in Malaysian BIM construction projects. Through qualitative insights gathered from experienced professionals, the research highlights several critical factors that contribute to BEP inefficiencies. These include limited understanding among stakeholders, inconsistent application across project phases, and the absence of standardized enforcement mechanisms and clear guidelines. This study contributes new contextual knowledge by focusing specifically on Malaysia, offering a detailed examination of BEP challenges within its local construction environment. By capturing recurring issues from industry perspectives, the research enhances understanding of the persistent barriers to seamless BEP integration.

The findings offer practical implications for policymakers, industry professionals, and academic institutions. Policymakers are encouraged to introduce a nationally recognized BEP framework that aligns with Malaysia's construction practices. For the industry, targeted training and adoption of consistent guidelines are essential for improving coordination and implementation. In academic settings, this study highlights the importance of embedding BEP-related content into BIM education to better prepare future practitioners. The research is subject to certain limitations, particularly the small sample size and its single-country scope, which may constrain the generalizability of its findings to broader contexts.

Future research should focus on the development and validation of an automated BEP framework suited to Malaysian construction projects. This includes exploring digital tools that support real-time updates, structured access control, and integration with project management platforms. Expanding the scope to include comparative studies across different countries or project types could also provide valuable insights and contribute to the formulation of adaptable BEP frameworks for varied construction environments.

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DECLARATION OF COMPETING INTEREST

None.

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