PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 22 ISSUE 3 (2024), Page 47 – 62

CONSTRUCTION PROJECT FAILURE: INVESTIGATING CAUSES OF INEFFECTIVE BUILDING INFORMATION MODELLING EXECUTION PLANS

Mashanim Mahazir[1], Rahimi A. Rahman[2], Nurhaizan Mohd Zainudin[3], Salmaliza Salleh[4]

[1,2] *Faculty of Civil Engineering Technology*,
UNIVERSITI MALAYSIA PAHANG AL-SULTAN ABDULLAH,
KUANTAN, MALAYSIA
[2]*Faculty of Graduate Studies,*
DAFFODIL INTERNATIONAL UNIVERSITY, DHAKA, BANGLADESH
[3] *Faculty of Industrial Management*,
UNIVERSITI MALAYSIA PAHANG AL-SULTAN ABDULLAH,
KUANTAN, MALAYSIA
[4] *Faculty of Engineering,*
UNIVERSITI TEKNOLOGI PETRONAS, SERI ISKANDAR MALAYSIA

Abstract

The successful implementation of Building Information Modelling (BIM) is contingent upon effectively executing BIM Execution Plans (BEPs). This study aims to investigate the causes that contribute to the development of ineffective BEPs that ultimately result in construction project failures. Interview data with twenty BIM professionals were collected on causes contributing to the development of ineffective BEPs. The collected data was analyzed using thematic analysis. The analysis revealed three categories contributing to ineffective BEPs: people, process, and technology. There are 11, 6, and 1 causes related to people, process, and technology, respectively. The finding suggests that incompetency, lack of knowledge in BIM, individual attitude, poor data management, and insufficient technology used are the causes that contribute to ineffective BEPs. The outcomes of this study offer substantial insights into the Architecture, Engineering, and Construction (AEC) industry in developing effective BEPs, thereby ensuring the successful delivery of BIM-based construction projects.

Keywords: Building Information Modelling, BIM Execution Plan, BEP failure, construction project, thematic analysis

[1] Corresponding Author. Email: anim.mahazir@gmail.com

INTRODUCTION

Building Information Modelling (BIM) is an adoption of modelling technology and its related set of processes to generate, convey, examine, and employ digital information models over the entirety of a construction project's life cycle. Before integrating BIM into a project, the successful implementation of BIM is contingent upon the effective execution of the BEPs (Panagiotidou et al., 2023). BEP is an essential document within the Architecture, Engineering and Construction (AEC) industry (Ventura, 2021). It outlines the strategic approach and operational procedures for integrating and using BIM on a designated project. During the COVID-19 pandemic, many projects encompass risks that can be categorized as unpleasant risks and positive risks (Zamani et al., 2021; Ahmad et al., 2023; Tung et al., 2021) . The pandemic has inevitably resulted in catastrophic consequences for various industries of the world economy (Tan & Abdul-Samad, 2022). Additionally, it has been shown that a significant proportion of construction firms exhibit a strong desire to expand into global markets in order to optimize their revenue and capitalize on potential advantages (Ogunnusi et al., 2020). Most international AEC industries implemented BIM. The decision of a construction firm to enter global markets relies on good knowledge and understanding of BIM. Hence, a comprehensive BEP in implementing BIM projects becomes compulsory for most local and international projects. Most research focuses on identifying the elements that should be included in BEPs, but there is a scarcity of research investigating how to create effective BEPs. The development of an effective BEP will help to address the unpredictability of performance of BIM projects (Ayerra et al., 2021 and).

A lack of sufficient information impedes the development of an effective BEP. Due to the scarcity of competent BIM specialists, implementing BEPs appears to be more challenging (Hadzaman et al., 2016). In other words, a thorough identification of the underlying factors contributing to the ineffectiveness of BEP is necessary to develop viable intervention strategies. There are issues related to the slow execution of BIM projects. Not having a clear BIM workflow and poor understanding of the BIM process is due to the ineffective BEP developed. The identification of causes is crucial to ensure that the BEP developed includes all the necessary information required for the successful implementation of a BIM project. The developer of BEP must develop an intervening strategy that ensures the successful completion of the BIM project by executing an effective BEP. Therefore, it is crucial to establish a proper model that may serve as a framework for identifying the underlying factors contributing to the ineffectiveness of BEP, which ultimately leads to construction project failures.

This study investigates the causes that contribute to the development of ineffective BEPs that ultimately result in construction project failures. The aim

was established based on a research question: What are the causes contributing to the ineffectiveness of BEP that result in construction project failures? This is the first paper that analyses the causes that contribute to the development of ineffective BEPs. The outcomes of this study offer substantial insights into the AEC industry in developing effective BEPs, thereby ensuring the successful delivery of BIM-based projects.

LITERATURE REVIEW

Silva and Andrade (2020) mentioned that BEP encompasses a comprehensive document that delineates the framework for the successful integration and adoption of BIM systematic practices within AEC organizations. Meanwhile, according to Teles and Lima (2023), the most comprehensive BEP document proves to be an effective reference for establishing a well-defined BEP structure to guide a new project. Panagiotidou, N. (2023) mentioned, BEP serves as an outstanding example of a mechanism that effectively mitigates waste by fostering responsibilities and deliverables, hence facilitating the establishment of a shared understanding within teams regarding the use of BIM in projects. The usage of BIM to its maximum capacity optimizes project outcomes, mitigates errors, and enhances decision-making capabilities across the entire project lifecycle.

Farah et al. (2019) mentioned that BEP is a preliminary document that must be prepared during the initial phase to improve the probability of a successful project. In order to facilitate the optimal use of BIM during the operation phase, owners must develop effective BEP during the pre-operation phase (Lin et al., 2016). The first phase in the development of the BEP entails the inclusion of the Employer Information Requirement (EIR), Organization Information Requirement (OIR), and Asset Information Requirement (AIR) (CIDB, 2017). The phase is followed by the validation of the outcomes of BIM implementation process to find out if the supply chain effectively fulfils the requirements and capacity of clients to play a leadership role in the BIM implementation process. Abu Bakar et al. (2021) emphasized that the following six elements are essential for formulating a BEP: strategy, process, information, infrastructure, personnel, and standard.

Based on the research conducted by Abbas et al., (2022) and Hadzaman et al., (2016), the primary reason for the ineffective BEP is the need for more detailed guidance for BIM implementers in developing BEPs. Lack of clarity about process coordination also become one of the causes of ineffective BEPs as according to Fosse et al., (2016) and Ayerra et al., (2021). An extensive EIR framework is necessary to ensure effective BEPs, as mentioned by Mayer et al., (2021).

Prior research has identified the challenges of implementing BIM in AEC industry, including coordination of works, understanding the project and the

need for software, keeping the BEP updated and ensuring the BEP is properly used. However, limited research has addressed the need to develop an effective BEP as a way of overcoming these challenges. Despite the development of a thorough BEP framework, Perera et al. (2021) have found certain difficulties within the AEC industry that contribute to construction project failures, even after the implementation of the BEP. The difficulties include the integration of information from all disciplines and clear direction from client. In other words, there is a need to investigate the causes that lead to ineffective BEPs, which subsequently lead to construction project failures. This study will, thus, address this knowledge gap by identifying the causes of ineffective BEPs.

METHODOLOGY

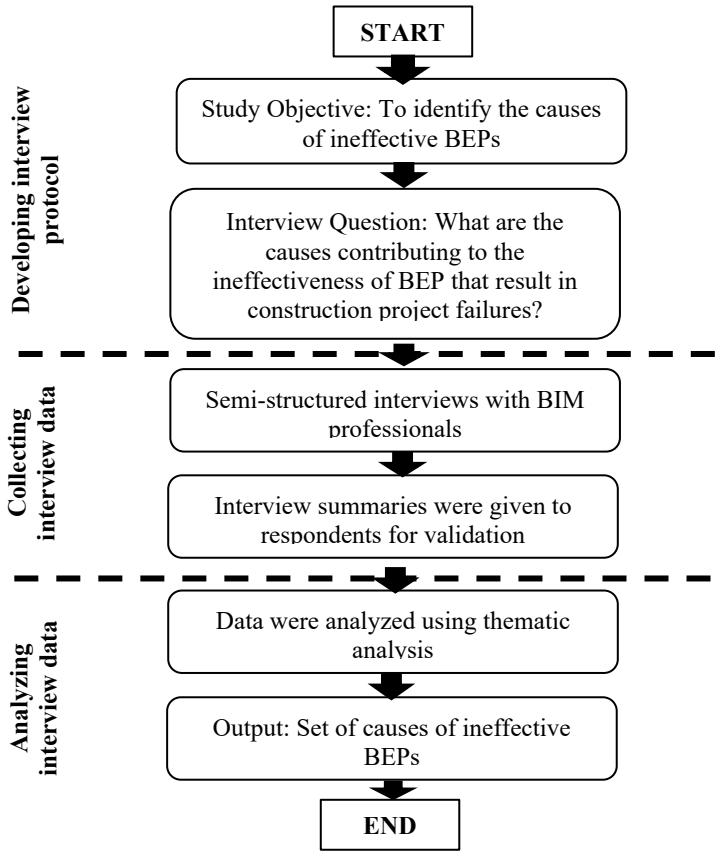

Figure 1: Research design flow
Source from: author's own creation

The research design follows the sequential process illustrated in Figure 1. Qualitative research method was chosen as it enables the elucidation, enhanced comprehension, and thorough exploration of the perspectives, behaviours, experiences, and phenomena related to the study. Therefore, to achieve the study aim, the data was collected and analyzed. The objective was to identify the causes of ineffective BEPs and analyze thematic patterns within the collected data using a coding process. The thematic analysis was the foundation for various qualitative data analysis methodologies.

Data Collection

Semi-structured interview data were collected from 20 BIM professionals in Malaysia. The interviews were conducted in person and via video conferencing. Bekele & Ago (2022) recommended to have sample size of at least 20 interviews. The purposeful sampling method was chosen in finding participants that could offer comprehensive and in-depth details on the subject matter (Cavana et al. 2001). The sampling method was chosen as the respondents possess specific criteria required for the study purpose. A sample of 20 respondents were chosen from varying work experience and professional backgrounds, including BIM managers and project directors. Table 1 shows the respondent profile of the interviewees. The interviewees were selected for having the ability to provide essential information on the subject matter based on their involvement in BIM projects, years of work experience, and expertise in BIM (Farouk et al., 2023).

During the interview, the main question was: What are the causes that contribute to the development of ineffective BEPs? Then follow-up questions were provided with the intention to gather detailed data pertaining to the causes that contribute to the development of ineffective BEPs. A summary of the interview was drafted and sent out to ensure the validity of the data, and validation was obtained from each participant (Zamani et al., 2023; Tan et al. 2022).

Data Analysis

Under the qualitative data analysis, thematic analysis was used to analyze the collected data. The method was derived from Braun & Clarke, (2006) and involves six steps in the process of thematic analysis. The steps are illustrated in Table 2.

The analysis comprised a coding technique that incorporated open coding, and selective coding. The first step is open coding, where the data is thoroughly analyzed on a line-by-line basis, using comprehensive interview summaries (Man et al., 2017). The final step involved selective coding, which entailed a thorough analysis of the qualitative data to identify the core category. (Dillon, 2012).

Table 1: Respondent profile

ID	Gender	Education		Designation	Experience in construction industry (years)	Experience in BIM (years)
		Field	Certification			
R1	M	Architecture	Degree	BIM Manager	10	8
R2	M	Construction Management	Degree	BIM Manager	25	17
R3	M	Architecture	Degree	Construction Lead	21	14
R4	M	Architecture	Degree	BIM Designer	7	7
R5	M	Civil Engineering	Master	Director & Project Lead	20	12
R6	M	Civil Engineering	Degree	BIM Solution Engineer	7	7
R7	M	Architecture	Diploma	BIM Manager	15	8
R8	M	Architecture	Certificate	Regional Sales Specialist (BIM)	12	8
R9	F	Architecture	Degree	BIM Development Senior Manager	22	13
R10	M	Electrical & Electronic	Degree	BIM Manager	10	10
R11	M	Civil Engineering	Degree	BIM Director	27	24
R12	M	Manufacturing	Diploma	BIM Operations Manager	10	7
R13	M	Civil Engineering	Degree	BIM Lead (Policy Maker)	23	13
R14	M	Mechanical Engineering	Diploma	BIM Consultant	16	16
R15	M	Architecture	Degree	BIM Manager	8	5
R16	M	Architecture	Degree	BIM Strategist	10	10
R17	M	Architecture	Degree	Managing Director & BIM Lead	24	15
R18	M	Architecture	Degree	Lead, Group of Technology	15	7
R18	M	Civil Engineering	Degree	BIM Manager	23	15
R20	M	Architecture	PhD	Academician	21	4

Source from: author's own creation

Table 2: Six steps of thematic analysis adopted from Braun & Clarke, (2006)

Step	Description
1. Familiarise the data	The interview data is reviewed and converted into textual form.
2. Create initial codes	The interview data is examined to create preliminary codes.
3. Identify themes	The first themes are reassessed in order to confirm the final themes.
4. Analyse themes	The initial codes and raw data were evaluated to ensure that the themes are consistent with the aims.
5. Establish themes	The themes have been determined and thoroughly reviewed. Adjustment is necessary when the theme's breadth and content are indeterminable.
6. Document the themes	The identified themes were found to be in line with the study's aims.

RESULT AND DISCUSSION

THEMATIC ANALYSIS RESULTS

The study shows findings derived from interviews conducted with 20 BIM professionals in effort to identify the causes leading to the ineffectiveness of BEP. Table 3 depicts the thematic analysis result with the supporting statement of causes leading to the inefficiency of BEP, resulting in construction project failures. There are 3 categories identified under themes and 20 elements are identified as sub-themes.

The themes were categorized under three categories, which are causes related to people, process, and technology, adopted from the People, Process and Technology (PPT) improvement model (Rocha et al., 2015). PPT improvement model was referred as it's integrate people, process, and technology by identifying causes that lead to ineffective BEP hence, improving the performance and outcomes of BIM projects. This comprehensive approach will also assists BIM managers in pinpointing areas for enhancement, prioritising efforts, and aligning resources efficiently.

Elements That Cause Ineffective BEP

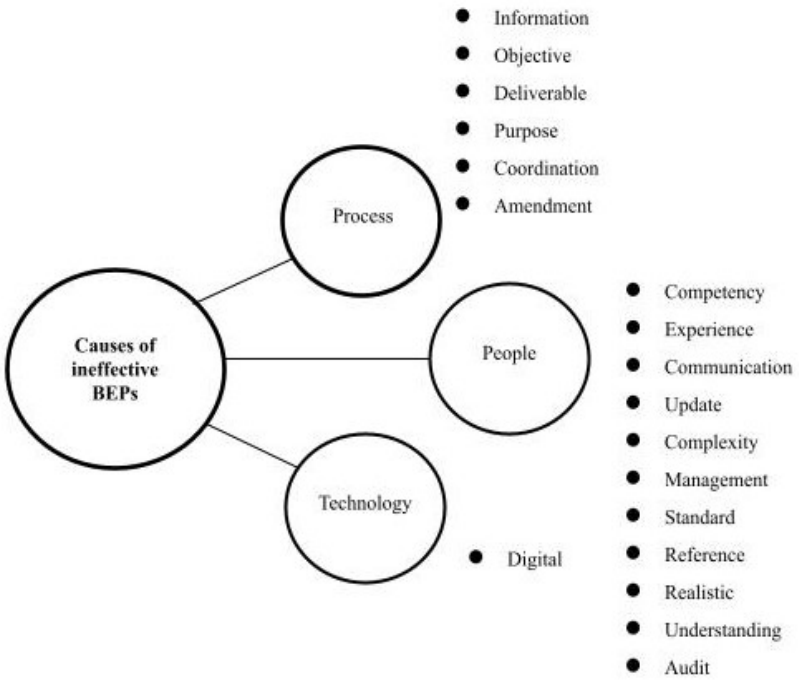

Figure 2: Causes of ineffective BEPs
Source from: author's own creation

Figure 2 depicts the elements responsible for the ineffective BEP in BIM projects. There were eleven, six, and one causes associated with people, process and technology, respectively.

Table 3: Thematic analysis results

Theme		Sub-Theme	Description	Respondents	Supporting Statement	Frequencies
People	1	Experience	Inadequeate experience	R1, R5, R15,R19	From the beginning of project brief, Employment Information Requirement (EIR) right until as built phase or hand over completed model will lead to obstacle to the entire construction process due to lack of experience. (R1)	4
	2	Manager's Competency	Incompetent BIM manager	R1, R9, R12, R13, R14, R15, R16, R19, R20	BIM manager was very good in theory but not practically. Practical knowledge is important too besides theory so that BIM manager know exact roles of BIM modeler and BIM coordinator and what should be delivered. (R14)	9
	3	Consultant's competency	Incompetent BIM consultant	R5, R11, R16	BEP mostly written by consultant but most consultant didn't refer to BEP. Consultant prefer to use traditional method in design and drawing rather than BIM. (R11)	3
	4	Communication	Lack of communication	R10, R13	BIM manager supposed to guide all team member to follow the BEP. BEP doesn't address everybody's concern due to poor or lack of communication. (R13)	2
	5	Update	BEP not up to date	R6, R13, R14	BEP stagnates during the procurement stage only. BEP should be developed once the project is awarded, but it became stagnant at the procurement stage. When a project is progressing, parameters will change; hence, BEP needs to be updated. (R6)	3
	6	Complexity	BEP too complex	R18	People always presume BEP is like a contract document where people lost interest to refer hence complex. BEP should be dynamic where it becomes main reference for all the implementer. (R18)	1

Theme		Sub-Theme	Description	Respondents	Supporting Statement	Frequencies
	7	Management	Poor information management	R4, R7, R10, R11, R14, R15	Poor information management where some of the subcontractors didn't know how to name the file or name the Revit family and where to store the file due to insuffiecient interface to share the information. (R4)	6
	8	Standard	No specific standard referred	R1, R4, R7, R16, R17	BEP is supposed to be prepared using specific standards. Not referring to specific standards makes the BEP less effective due to lack of understanding of ISO. (R16)	5
	9	Reference	BEP not referred	R9, R11, R13, R14, R16, R17	BEP was just prepared to fulfil BIM project requirements but not as the main reference to execute the whole project. (R9)	6
	10	Client's competency	Incompetent client	R3, R6, R14, R19	The client didn't properly define what to include in the BEP example, type of software, type of data storage, level of development (LOD) or detail. During the kick-off meeting, no detailed job description was provided to the contractor and consultant. (R3)	4
	11	Realistic	Unrealistic BEP	R14	BEP developed was unrealistic making it hard to deliver. Poor milestones set for each stage. (R14)	1
	12	Understanding	Fail to understand the BEP	R2, R4, R8, R10, R12, R16, R17, R19, R20	BEP was developed but poorly understand by the BIM implementer due to lack of awareness and knowledge in BIM. (R19)	11
	13	Audit	No audit done	R2	Audit on the BEP should be done at every task's milestone or annually. When the audit is done on the BEP, most of the task team will refer to the BEP to make sure the deliverable is in order. The audit is not just for the appointed party but also the task team to ensure successful project deliverable based on the BEP developed. (R2)	1

Theme		Sub-Theme	Description	Respondents	Supporting Statement	Frequencies
Process	14	Information	Information not detail	R2, R3, R6, R10, R12, R14, R19, R20	Lack of information in the diagram makes other people don't understand certain information in BEP. BEP must supported with detail wording and illustration. (R12)	8
	15	Objective	Client don't understand objective	R3, R8, R16	The client was unaware of the project requirements; hence, the BEP developed was based on the incomplete EIR. The EIR is not being amended accordingly. The design model is not taken into account until the Facility Management stage. (R8)	3
	16	Deliverable	Different BEP different deliverables	R3, R7, R16	Consultant develops own BEP same goes to contractor. BEP should be standardised using the same format for both parties, contractor and consultant. (R7)	3
	17	Purpose	BEP is developed not for main purpose	R3, R6, R16	Some clients demanded that the contractor create the BEP in order to be awarded the project. The client wanted to integrate BIM in order to stay contemporary. BEP was developed know to fulfil the real purpose. (R3)	3
	18	Coordination	BEP fails to integrate & coordinate	R5, R10, R13, R18	For instance, a consultant might just concentrate on their area of expertise, failing to consider or make design and modelling compatible with other disciplines. The BEP developed fails to coordinate and integrate with other disciplines. (R5)	4
	19	Amendment	EIR not amended accordingly	R7, R17	EIR, OIR and AIR were incomplete and it affect the Project Information Model and Asset Information Model. EIR not amended accordingly. (R17)	2
Technology	20	Digital	BEP not in digital form	R6, R7, R13	Only a few referred to hardcopy BEP, such as BIM Manager and BIM Team. Even for consultants like C&S and MEP engineers, only those involved in project deliverables will refer to BEP. (R6)	3

Source from: author's own creation

People

Competency took precedence as many BIM managers excellent in theory but lacked practical skills. Incompetent consultants often develop the BEP but fail to refer to it. Clients may also be incompetent if it do not clearly specify what should be included in the BEP, such as the software type, data storage method, and level of development (LOD) detail. This occurred as a result of inadequate experience and a lack of understanding of BEP and BIM projects. BEP should be created according to the precise guidelines outlined in ISO 19650. Once a project is execute, as it progresses, parameters will change. Therefore, BEP must be revised and audited at each milestone or annually. The developed, updated, and audited BEP fails to be referred by the implementer because of inadequate communication. It is also ineffective due its complexity, unrealistic milestones and poor information management, causing a loss of interest among people.

Process

Process is the sequence of procedures or actions taken to accomplish a particular objective or target. It includes workflows, procedures, methods, and regulations that dictate how tasks are carried out. Effective processes are essential for maintaining uniformity, excellence, and efficiency in projects. The BEP was ineffectively because the client was unaware of the purpose and objective of the BIM project. The client had little knowledge of the project needs, hence the BEP was created using insufficient information or an incomplete EIR. The client also failed to revise the incomplete EIR as required. The lack of a standardised format for contractors and consultants, as well as different deliverables, makes the developed BEP ineffective. Different deliverables may hinder the coordination and integration with others.

Technology

Technology encompasses the tools, systems, and infrastructure that facilitate activities. It encompasses hardware, software, networks, and other technological assets needed in BIM projects. Technology plays a significant role in automating tasks, enhancing communication and cooperation, and enabling data-driven decision-making. Most of the developed BEP is not available in digital format. Only a small number of individuals referred to the BEP, specifically the BIM Manager and BIM implementer. Only consultants who were involved in project deliverables will refer to BEP. Unavailability of BEP in digital format will hinder the effectiveness of the BEP developed.

CONCLUSION

In conclusion, this study aimed to identify the causes of ineffective BEPs, which subsequently lead to construction project failures. The study adopted a qualitative methodology and applied thematic analysis on interview data collected from twenty BIM professionals. As a result, three crucial elements that require significant attention contributing to developing ineffective BEPs have been identified. The potential factors that can render the development of ineffective BEPs include people, process, and technology. People bring significant causes that lead to ineffective BEP developed. The four most frequent causes mentioned are: 1. Incompetence BIM manager, 2: Failure to understand the BEP, 3: Poor information management and 4. BEP is not referred to. Regarding the process, the interviewee's responses indicate that information lacking in detail has contributed the highest frequency. The lack of detailed information provided by the client was identified as the primary factor contributing to unsuccessful development of BEPs. Technology has become the least cause of ineffective BEPs. One of the contributing causes is the lack of the BEP in a digital format. The printed version of the BEP is the least frequently used by project stakeholders, resulting in it being the least referred document.

The study findings indicate that BEP developers and BIM implementers must possess sufficient knowledge, competency, and understanding in the development and execution of BEPs. However, to ensure the efficacy of BEPs, the implementers must demonstrate a solid commitment to adhering to and consulting the guidelines indicated in the development. The perspective that views BEPs as an insignificant document that does not require reference needs to be changed. The efficient usage of technology is influencing the effectiveness of BEPs. Ensuring accessibility for all is a crucial aspect of the development of effective BEPs. The identified causes provide a fundamental basis for developing effective BEP that can lead to successful outcomes in BIM projects.

The study outcomes have substantial theoretical and practical implications. For theoretical implications, this study supports researchers in the evaluation of the BIM process through the development of effective BEPs and the examination of their impact on the outcomes of BIM projects. This can lead to increased knowledge and the development of more effective BEPs in construction practices by using the developed model as a reference. For practical implications, this study could be established as the definitive reference for BIM practitioners seeking guidance in developing BEPs. This is crucial for achieving successful BIM execution in the AEC industry. Furthermore, this study aids BIM practitioners in examining the crucial elements that should be incorporated into BEPs. Consequently, it enables them to develop effective strategies to mitigate the risk of construction project failures.

ACKNOWLEDGEMENT

The authors would like to thank Universiti Malaysia Pahang Al-Sultan Abdullah for the financial support under RDU223415. The authors are also grateful to the editors and anonymous reviewers for their insightful comments, which improved this paper's quality. The authors are also thankful to the industry practitioners that participated in this work.

REFERENCE

Abbas, M. A., Ajayi, S. O., Oyegoke, A. S., & Alaka, H. (2022). A cloud-based collaborative ecosystem for the automation of BIM execution plan (BEP). *Journal of Engineering, Design and Technology*, *24421*. https://doi.org/10.1108/JEDT-02-2022-0128

Abu Bakar, A. R., Haron, A. T., & Rahman, R. A. (2021). Building Information Modelling Execution Plan (BEP): A Comparison of Global Practice. *International Journal of Engineering Technology and Sciences*, *7*(2), 63–73. https://doi.org/10.15282/ijets.7.2.2020.1005

Ahmad, Y., Mustapha, S. Z., Ali, S. S. M., Hamid, S. N. F. A., Aziz, N. A., Tahir, N. S., Azman, U. N. N., Zamri, N. E. M. M., Jamil, A. A. A., Ayob, N. A., Aziz, M. N., Hanafiah, M. H., Arsat, A. R., & Hassan, M. S. N. A. (2023). From Crisis To Recovery: Malaysia'S Policy Responses To Covid-19 and Its Implications. *Planning Malaysia*, *21*(6), 526–546. https://doi.org/10.21837/PM.V21I30.1418

Ayerra, I., Castronovo, F., Ventura, S. M., & Nikolic, D. (2021). Next Steps in Bim Execution Planning: a Review of Guides in the Usa. *Proceedings of the European Conference on Computing in Construction*, 277–284. https://doi.org/10.35490/EC3.2021.150

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

CIDB. (2017). BIM Guide 4: BIM Execution Plan (BEP). In *Construction Industry Development Board Malaysia*. http://www.designingbuildings.co.uk/wiki/BIM_execution_plan_BEP

Dillon, D. R. (2012). *Qualitative Research*. 1–8.

Farah, S. I., Nur, D. S., Muneera, E., & Rahimi, A. R. (2019). the Barriers Factors and Driving Forces for Bim Implementation in Malaysian Aec Companies. *Journal of Advanced Research in Dynamical and Control Systems*, *11*(3), 275–281.

Farouk, A. M., Zulhisham, A. Z., Lee, Y. S., Rajabi, M. S., & Rahman, R. A. (2023). Factors, Challenges and Strategies of Trust in BIM-Based Construction Projects: A Case Study in Malaysia. *Infrastructures*, *8*(1). https://doi.org/10.3390/infrastructures8010013

Fosse, R., Spitler, L., & Alves, T. (2016). Deploying BIM in a heavy civil project. *IGLC 2016 - 24th Annual Conference of the International Group for Lean Construction*, 43–52.

Hadzaman, N. A. H., Takim, R., & Mohammad, A. H. N. M. F. (2016). An exploratory study: Building information modelling execution plan (BEP) procedure in mega

construction projects. *Malaysian Construction Research Journal*, *18*(1), 29–40.

Lin, Y. C., Chen, Y. P., Huang, W. T., & Hong, C. C. (2016). Development of BIM execution plan for BIM model management during the pre-operation phase: A case study. *Buildings*, *6*(1). https://doi.org/10.3390/buildings6010008

Man, S. S., Chan, A. H. S., & Wong, H. M. (2017). Risk-taking behaviors of Hong Kong construction workers – A thematic study. *Safety Science*, *98*, 25–36. https://doi.org/10.1016/j.ssci.2017.05.004

Mayer, P., Funtík, T., Erdélyi, J., Honti, R., & Cerovšek, T. (2021). Assessing the duration of the lead appointed party coordination tasks and evaluating the appropriate team composition on bim projects. *Buildings*, *11*(12). https://doi.org/10.3390/buildings11120664

Ogunnusi, M., Hamma-adama, M., Salman, H., & Kouider, T. (2020). Covid-19 Pandemic the Effects and Prospects in the Construction Industry. *International Journal of Real Estate Studies*, *4*(2), 120–128. https://rgu-repository.worktribe.com/preview/1001756/OGUNNUSI 2020 Covid-19 pandemic %28VOR%29.pdf

Panagiotidou, N., Pitt, M., & Lu, Q. (2023). Building information modelling execution plans: a global review. *Proceedings of the Institution of Civil Engineers - Smart Infrastructure and Construction*, *176*(3), 126–147. https://doi.org/10.1680/jsmic.22.00012

Perera, G., Nilupulee, M., Kalpani, W., Dissanayake, Y., & Bandara, K. (2021). *Barrier Analysis to Implement Building Information Modeling (BIM) Execution Plan in Sri Lankan Construction Industry*. 1–8.

Rocha, Á., Correia, A. M., Costanzo, S., & Reis, L. P. (2015). New Contributions in Information Systems and Technologies. *Advances in Intelligent Systems and Computing*, *353*(March), III–IV. https://doi.org/10.1007/978-3-319-16486-1

Silva, I. R. O. da, & Andrade, M. L. V. X. de. (2020). *BIM Project Execution Plan for Infrastructure Superintendence (SINFRA) of the Federal University of Pernambuco: presentation of a case study*. 522–527. https://doi.org/10.5151/sigradi2020-72

Tan, C. K. L., & Abdul-Samad, Z. (2022). A study of the impact of COVID-19 on construction workforce productivity in Malaysia. *International Journal of Productivity and Performance Management*. https://doi.org/10.1108/IJPPM-07-2021-0421

Teles, A. R. V., & Lima, M. M. X. de. (2023). *The development of a BIM Execution Plan for contracting public work projects*. 777–786. https://doi.org/10.5151/sigradi2022-sigradi2022_67

Tung, Y. H., Chia, F. C., & Yan-Yan, F. Y. (2021). EXPLORING the USAGE of DIGITAL TECHNOLOGIES for CONSTRUCTION PROJECT MANAGEMENT. *Planning Malaysia*, *19*(3), 13–22. https://doi.org/10.21837/PM.V19I17.983

Ventura, M. (2021). *review of guides in the USA Conference or Workshop Item*.

Wasihun Bezabih Bekele, & Fikire Yohanes Ago. (2022). *View of Sample Size for Interview in Qualitative Research in Social Sciences: A Guide to Novice Researchers | Research in Educational Policy and Management*. *20*, 42–50. https://repamjournal.org/index.php/REPAM/article/view/51/30

Zamani, S. H., Rahman, R. A., Fauzi, M. A., & Yusof, L. M. (2021). Effect of COVID-19 on building construction projects: Impact and response mechanisms. *IOP Conference Series: Earth and Environmental Science*, *682*(1). https://doi.org/10.1088/1755-1315/682/1/012049

Zamani, S. H., Rahman, R. A., & Yusof, L. M. (2023). WELL Building: Criteria for Residential Buildings in a Developing Country. *Journal of Engineering, Project, and Production Management*, *13*(3), 1–14. https://doi.org/10.32738/JEPPM-2023-0018

Received: 18th Mar 2024. Accepted: 6th July 2024

