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Building Information Modelling for Heritage Project Management: A Systematic Literature Review

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ABSTRACT

Heritage buildings represent valuable cultural, historical, and architectural assets that require effective management to ensure their preservation and sustainability. However, managing heritage projects presents numerous challenges, including incomplete documentation, complex geometries, conservation constraints, and multidisciplinary stakeholder involvement. In recent years, Building Information Modelling (BIM), particularly Heritage Building Information Modelling (HBIM), has emerged as a promising digital approach for improving the documentation, management, and conservation of historic structures. Despite the growing body of research on BIM applications in heritage contexts, the extent to which BIM contributes to heritage project management remains fragmented across the literature. This study aims to systematically review the existing research on BIM for heritage project management to identify major research trends, applications, and gaps. A systematic literature review (SLR) was conducted following the PRISMA 2020 guidelines. Relevant publications were retrieved from the Scopus database using predefined search strings related to Building Information Modelling, heritage buildings, and management practices. The search covered publications between 2010 and 2020. This study provides a foundational analysis of the formative decade of HBIM development (2010–2020), representing the period during which the core concepts, workflows, and methodological structures of HBIM were established. The initial search identified 389 records. After removing duplicates and applying screening and eligibility criteria, 28 studies were included in the final qualitative synthesis. The selected articles were analysed using thematic analysis to identify key application areas and management implications of BIM in heritage projects. The results indicate that BIM plays an increasingly important role in heritage project management by facilitating heritage documentation, conservation planning, information integration, and lifecycle management. Six major themes emerged from the analysis: heritage documentation and digital reconstruction, HBIM-based information integration, conservation and restoration planning, lifecycle and facility management, collaborative project coordination, decision support for heritage project management. The findings also highlight BIM's potential to improve project coordination, information transparency, and long-term heritage asset management. Inconclusion, this paper contributes to the understanding of BIM-enabled heritage project management and identifies future research directions for integrating digital technologies into heritage conservation practices.

Keywords: *Building Information Modelling (BIM), heritage, management, HBIM, literature review*

1.0 INTRODUCTION

Heritage buildings represent an important component of cultural identity and historical continuity. These structures embody architectural, social, and cultural values that must be preserved for future generations (Bruno & Fatiguso, 2018). However, the management of heritage projects is often complex due to ageing structures, incomplete historical documentation, conservation restrictions, and the involvement of multiple stakeholders such as architects, engineers, and government authorities. Effective management strategies are therefore essential to ensure the successful preservation and sustainable use of heritage assets.

In recent years, Building Information Modelling (BIM) has gained significant attention within the architecture, engineering, and construction (AEC) industry as a digital platform capable of improving project coordination, information integration, and lifecycle management (Zhou, 2024). BIM enables the creation of digital representations of buildings that integrate geometric information with relevant project data, facilitating better decision-making throughout the project lifecycle. When applied to historic structures, BIM evolves into Heritage Building Information Modelling (HBIM), which focuses on capturing, modelling, and managing heritage information (Raitviir & Lill, 2024; Murphy, McGovern, & Pavia, 2013).

The application of BIM to heritage buildings has been increasingly explored in academic research, particularly in areas such as three-dimensional documentation, laser scanning integration, conservation planning, and heritage asset management (Banfi & Liu, 2026; López et al., 2017). These studies suggest that BIM can support improved heritage documentation, enable collaborative conservation workflows, and enhance the management of heritage projects. Nevertheless, much of the existing literature focuses primarily on technical modelling techniques rather than on the broader project management implications of BIM adoption.

Despite recent technological advances in artificial intelligence and digital twin applications for heritage management, many contemporary approaches continue to build upon concepts and workflows that emerged during the early evolution of Heritage Building Information Modelling (HBIM). Therefore, this study systematically reviews the application of Building Information Modelling (BIM) in heritage project management between 2010 and 2020, a period recognised as the formative decade of HBIM development. This period marked the emergence of fundamental concepts, workflows, and methodological structures that shaped subsequent research and practice in the field. Accordingly, a structured literature review is conducted to synthesise existing knowledge and identify key applications, benefits, and research gaps associated with BIM implementation within heritage contexts.

2.0 LITERATURE REVIEW

2.1 Building Information Modelling in Construction Project Management

Building Information Modelling (BIM) has emerged as a transformative digital approach that enhances the planning, design, construction, and management of built assets. BIM enables the integration of multidisciplinary project information within a shared digital environment, facilitating improved collaboration and coordination among project stakeholders throughout the project lifecycle (Zhou, 2024; Eastman et al., 2011). Unlike conventional two-dimensional documentation methods, BIM allows project participants to access a centralised digital model that contains both geometric and non-geometric information related to building components, materials, and performance characteristics.

Within the context of construction project management, BIM provides several functional capabilities that improve project performance. These include design coordination, clash detection, construction sequencing, cost estimation, and lifecycle information management (Succar, 2009; Bryde, Broquetas, & Volm, 2013). The integration of information within a three-dimensional modelling environment allows project teams to visualise complex design details, identify conflicts between building systems, and evaluate alternative design solutions before construction begins. As a result, BIM has been widely associated with improved project outcomes, including enhanced scheduling accuracy, better cost control, and reduced project risks (Raitviir & Lill, 2024; Azhar, 2011; Bryde et al., 2013).

Furthermore, BIM supports the concept of integrated project delivery by enabling real-time data sharing and collaborative decision-making among architects, engineers, contractors, and facility managers (Eastman et al., 2011). Through the extension of BIM dimensions such as 4D scheduling, 5D cost estimation, and 6D sustainability analysis, the technology contributes to more comprehensive project planning and management practices across the entire building lifecycle (López et al., 2017). Consequently, BIM has become a key digital technology supporting innovation and productivity improvements within the construction industry.

2.2 Heritage Building Information Modelling (HBIM)

The concept of Heritage Building Information Modelling (HBIM) was introduced to extend BIM methodologies to the documentation and management of historic buildings and cultural heritage assets. Murphy, McGovern, and Pavia (2013) first proposed HBIM as a framework for generating parametric models of historic structures by integrating digital survey data with BIM platforms. Unlike conventional BIM applications that focus primarily on new construction, HBIM addresses the unique characteristics of heritage buildings, including irregular geometries, historical construction methods, and complex material conditions.

HBIM development typically involves the integration of advanced data acquisition technologies such as terrestrial laser scanning and digital photogrammetry to capture accurate three-dimensional representations of heritage structures (Zerafat, et al., 2023; Logothetis et al., 2017; López et al., 2017). These techniques generate dense point cloud datasets that serve as the basis for constructing parametric digital models within BIM environments. The resulting models incorporate both geometric information and semantic attributes related to architectural elements, historical materials, and construction phases.

Previous studies have demonstrated that HBIM provides a valuable platform for documenting cultural heritage assets and supporting digital reconstruction of historic buildings (Biagini et al., 2016; Rocha, Mateus, & Fernández, 2020). Through the creation of detailed digital models, HBIM enables researchers and conservation practitioners to record architectural details, structural characteristics, and historical transformations of heritage structures. Such digital representations serve as comprehensive information repositories that can support heritage documentation, conservation analysis, and knowledge preservation.

2.3 BIM for Heritage Asset Management

Beyond documentation purposes, BIM has increasingly been recognised for its potential to support the long-term management of heritage assets. Digital heritage models developed through HBIM can function as integrated information systems that store historical records, maintenance documentation, structural assessments, and conservation interventions (Woodward & Heesom, 2021). By centralising building information within a digital platform, HBIM facilitates improved monitoring and management of heritage buildings across their lifecycle.

HBIM-based asset management systems enable stakeholders to analyse structural conditions, assess deterioration patterns, and plan conservation strategies more systematically. For example, BIM-enabled heritage models can incorporate information related to material degradation, structural performance, and environmental exposure, allowing conservation professionals to evaluate appropriate restoration interventions (Tsilimantou et al., 2020). The integration of digital documentation and maintenance records also supports preventive conservation strategies and long-term heritage management planning.

Despite the growing body of research on HBIM applications, the practical integration of BIM within heritage project management remains relatively limited. Several studies have identified challenges associated with the implementation of HBIM, including difficulties in modelling complex historical geometries, limited interoperability between survey data and BIM platforms, and the absence of standardised HBIM workflows and modelling guidelines (Ba et al, 2023; Logothetis et al., 2017; Rocha et al., 2020). Furthermore, heritage conservation projects often involve unique historical and cultural constraints that require specialised modelling approaches and interdisciplinary collaboration among architects, historians, and conservation experts.

These limitations indicate that further research is required to develop systematic frameworks that support the effective integration of BIM technologies within heritage conservation and management practices.

3.0 METHODOLOGY

This study adopts a Systematic Literature Review (SLR) approach to identify, evaluate, and synthesise relevant research on BIM applications in heritage project management. The review process follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines, which provide a structured framework for transparent literature selection and analysis.

3.1 Database Selection

The literature search for this study was conducted using the Scopus database, which is widely recognised as one of the most comprehensive sources of peer-reviewed academic publications in the fields of engineering, construction management, and architecture. A structured search strategy was developed to identify relevant studies related to Building Information Modelling (BIM) and its application in heritage buildings. The search query used was: ("building information modelling" OR "building information modeling" OR BIM OR HBIM) AND ("heritage building*" OR "historic building*" OR "cultural heritage" OR "heritage conservation"). The search was restricted to publications published between 2010 and 2020 to capture developments in BIM applications within the heritage context. The review period (2010–2020) was selected to capture the foundational stage of HBIM development. This period represents the emergence and maturation of key HBIM concepts, including parametric modelling approaches, laser scanning integration, semantic enrichment, and heritage documentation workflows. The objective was not to provide a continuously updated review, but rather to identify the underlying patterns and developmental trajectories that shaped subsequent HBIM research.

The study selection process followed a systematic screening procedure consisting of four stages: identification, screening, eligibility, and inclusion as shown in Figure 1. The initial search retrieved a total of 389 publications from the Scopus database. During the screening stage, duplicate records were removed, and the remaining studies were reviewed based on their titles and abstracts to exclude articles that were not relevant to BIM applications in heritage buildings. Subsequently, the remaining articles underwent full-text assessment to determine their relevance to the research scope, particularly focusing on studies that addressed BIM or HBIM applications in heritage documentation, conservation, or management. After applying these screening and eligibility criteria, a total of 28 studies were selected and included in the final analysis for the systematic literature review.

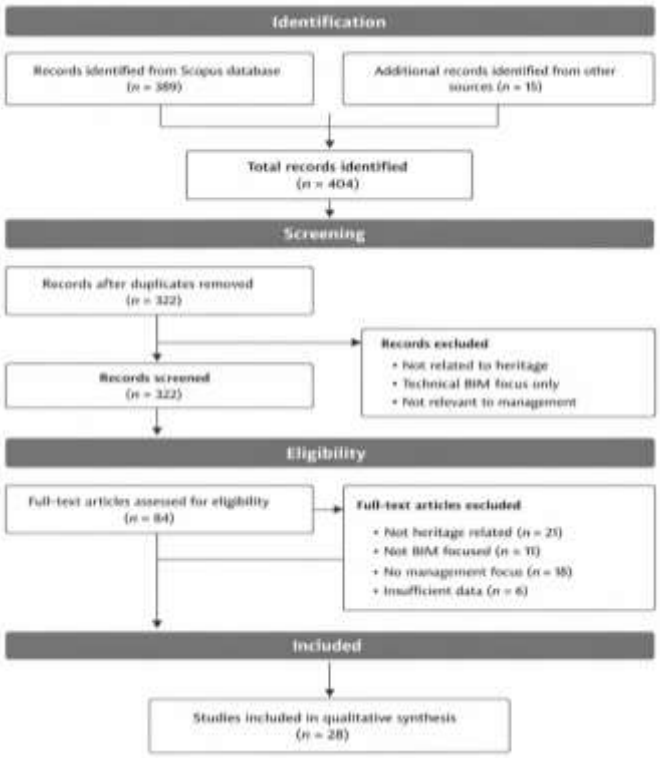

Figure 1. PRISMA Workflow

3.2 Data Collection and Analysis

Data extraction was conducted using a structured review template to ensure consistency and systematic analysis across all selected studies. Each of the 28 included articles was carefully reviewed and relevant information was extracted based on predefined variables. The extracted information included the author(s) of the study, publication year, study objective, research methodology, BIM application area, and the key findings related to BIM or Heritage Building Information Modelling (HBIM) implementation in heritage buildings. This structured approach enabled the researchers to organise and compare findings across multiple studies in a consistent manner.

The extracted data were subsequently compiled into Table 1 to facilitate comparative analysis of the selected literature. The table allowed the identification of patterns in terms of research focus, methodological approaches, and the different application areas of BIM within heritage contexts, such as documentation, digital reconstruction, conservation planning, and asset management. In addition, the analysis examined the methodological trends used in the literature, including case studies, framework development, technological applications, and conceptual studies.

Table 1. Data Extraction Table for Included Studies (n = 28)

No	Author(s)	Year	Study Focus	Methodology	Heritage Application	Key Findings
1	Murphy et al.	2013	Historic BIM modelling	Case study	Heritage documentation	Introduced HBIM concept integrating laser scanning with BIM for historic structures.
2	Volk et al.	2014	BIM for existing buildings	Literature review	Heritage asset management	Identified BIM potential for lifecycle management of existing buildings.
3	Oreni et al.	2013	HBIM for conservation	Case study	Conservation management	Demonstrated HBIM for documentation and conservation planning.
4	Brumana et al.	2013	Survey to HBIM workflow	Case study	Heritage documentation and management	Integrated laser scanning, photogrammetry, and HBIM workflows for heritage documentation and digital management.
5	Dore & Murphy	2012	HBIM and 3D GIS integration	Conceptual and methodological study	Cultural heritage recording and management	Proposed a two-stage approach integrating HBIM and 3D GIS for recording, modelling, and managing cultural heritage sites.
6	Dore et al.	2015	Structural simulation in HBIM	Case study	Heritage analysis	Integrated structural simulation within HBIM environment.

7	López et al.	2017	Point cloud integration for HBIM	Framework development	Heritage documentation and modelling	Proposed a framework integrating point cloud data into BIM environments for accurate heritage building modelling and documentation.
8	Mansir et al.	2016	HBIM adoption	Review	Heritage conservation	Identified need for HBIM in Malaysian heritage conservation projects.
9	Quattrini et al.	2017	Knowledge-based HBIM	Case study	Cultural heritage conservation	Demonstrated HBIM database integration for heritage preservation.
10	Brumana et al.	2019	HBIM survey accuracy and modelling	Methodological study	Architectural preservation	Proposed advanced survey and HBIM modelling approaches to improve geometric accuracy and preservation analysis of heritage structures.
11	Dore & Murphy	2017	State-of-the-art HBIM	Review	Heritage management	Summarized HBIM research trends and applications.
12	Bruno et al.	2018	Diagnostic HBIM modelling	Case study	Heritage management	HBIM supports building diagnosis and conservation planning.
13	Jordan-Palomar et al.	2018	HBIM intervention protocol	Framework development	Heritage project management	Proposed HBIM protocol for managing heritage interventions.
14	Biagini et al.	2016	Digital heritage and HBIM research trends	Case Study	Digital heritage management	Discussing construction management of historical building interventions
15	López et al.	2018	HBIM literature review	Review	Heritage documentation	Identified major research directions in HBIM.
16	Brumana et al.	2017	HBIM for complex heritage preservation	Case study	Heritage restoration and management	Applied advanced HBIM workflows integrating surveying, preservation, and lifecycle management for complex heritage restoration projects.
17	Malinverni et al.	2019	HBIM material decay mapping	Case study	Conservation monitoring	Used HBIM to monitor material deterioration.

18	Elsaid et al.	2019	Scan-to-BIM vs HBIM	Comparative study	Heritage documentation	Compared modelling approaches for heritage documentation.
19	Pepe et al.	2020	UAV photogrammetry for HBIM generation	Case study	Heritage digital reconstruction	Integrated UAV photogrammetry and scan-to-BIM workflows for accurate HBIM reconstruction of historic structures.
20	Diara & Rinaudo	2019	Parametric HBIM modelling for cultural heritage	Methodological study	Cultural heritage digital modelling	Proposed integration of NURBS-based modelling and BIM workflows for accurate parametric representation of complex heritage geometries.
21	Piselli et al.	2020	HBIM-based energy retrofit simulation	Case study	Heritage energy retrofit and sustainability	Integrated HBIM and energy simulation approaches to support retrofit planning and energy performance assessment of historic buildings.
22	Quattrini et al.	2017	Digital heritage conservation	Case study	Heritage asset management	HBIM supports conservation decision-making.
23	Banfi	2019	HBIM geometric modelling	Methodological study	Heritage modelling	Extended BIM tools for heritage structure modelling.
24	Piselli et al.	2020	HBIM energy retrofit	Case study	Heritage facility management	HBIM assists low-carbon retrofit planning.
25	Al-Muqdadi	2020	HBIM reconstruction	Case study	Damaged heritage reconstruction	Demonstrated HBIM reconstruction approach.
26	Martínez-Carricondo et al.	2019	UAV photogrammetry + HBIM	Case study	Cultural heritage reconstruction	Combined UAV imaging and HBIM modelling.
27	Malinverni et al.	2019	HBIM-based deterioration mapping	Case study	Cultural heritage management	Applied HBIM workflows and thematic mapping techniques to document material decay and support heritage conservation management.
28	Fai et al.	2011	BIM heritage documentation	Case study	Heritage documentation	Demonstrated BIM for heritage recording and management.

Following the data extraction process, a thematic analysis was conducted to synthesise the findings from the selected studies and tabulated into Table 2. The purpose of this analysis was to identify recurring themes and key research trends related to BIM applications in heritage project management. Through iterative categorisation of the extracted findings, several dominant themes were identified across the literature. This thematic synthesis enabled the study to provide a structured understanding of how BIM technologies have been applied within heritage conservation and management practices between 2010 and 2020. The analysis of the 28 studies revealed six major themes.

The results of the thematic analysis were then discussed and used to identify gaps and emerging directions for future research, particularly regarding the integration of BIM technologies within broader heritage project management and digital transformation frameworks.

Table 1. Thematic Analysis of BIM Applications in Heritage Project Management

Theme	Description	Key Supporting Studies	Project Management Implications
Heritage Documentation and Digital Reconstruction	BIM is widely used to digitally capture and reconstruct heritage structures using technologies such as laser scanning, photogrammetry, and scan-to-BIM workflows.	Murphy et al. (2013); Fai et al. (2011); López et al. (2017); Martínez-Carricondo et al. (2019); Brumana et al. (2013)	Provides accurate digital records of heritage buildings, enabling better documentation, visualization, and knowledge preservation for future conservation projects.
HBIM-Based Information Integration	HBIM integrates geometric, historical, structural, and material data into a centralized digital platform.	Quattrini et al. (2017); Oreni et al. (2013); Bruno et al. (2018); Volk et al. (2014)	Improves information management and coordination among project stakeholders by providing a unified data environment for heritage projects.
Conservation and Restoration Planning	BIM models are used to simulate conservation interventions, evaluate restoration strategies, and support structural analysis.	Dore & Murphy (2015); Jordan-Palomar et al. (2018); Banfi (2019); Malinverni et al. (2019); Al-Muqdadi (2020)	Enhances planning accuracy for restoration projects and supports decision-making regarding conservation strategies.
Lifecycle and Facility Management	BIM is applied to support long-term maintenance, monitoring, and performance management of heritage buildings.	Piselli et al. (2020); Banfi (2019); Quattrini et al. (2017)	Enables lifecycle management of heritage assets, including maintenance scheduling, monitoring deterioration, and managing building performance.
Collaborative Project Coordination	BIM platforms facilitate collaboration among multidisciplinary stakeholders involved in heritage conservation projects.	Brumana et al. (2017, 2019); Jordan-Palomar et al. (2018); Bruno et al. (2018)	Improves communication and coordination between architects, engineers, conservation experts, and project managers.
Decision Support for Heritage Project Management	BIM models support data-driven decision-making by integrating historical data, structural analysis, and conservation strategies.	Jordan-Palomar et al. (2018); Banfi (2019); Quattrini et al. (2017)	Supports project managers in evaluating intervention options and making informed decisions regarding heritage conservation.

4.0 RESULTS AND DISCUSSION

The findings of the systematic literature review demonstrate that BIM has evolved beyond its initial role as a documentation tool and is increasingly being explored as a comprehensive digital platform for heritage management. However, despite these technological capabilities, the integration of HBIM into practical heritage project management frameworks remains limited, highlighting the need for further research on governance structures, implementation guidelines, and policy integration for HBIM adoption.

a. Theme 1: Heritage Documentation and Digital Reconstruction

One of the most widely discussed applications of HBIM in the literature relates to heritage documentation and digital reconstruction. Many studies emphasise the use of digital survey technologies such as terrestrial laser scanning and photogrammetry to capture accurate three-dimensional representations of heritage structures. These datasets are subsequently converted into HBIM models that digitally represent both the geometry and historical attributes of heritage buildings. Researchers highlight that this approach enables the preservation of detailed architectural information and facilitates the digital archiving of cultural heritage assets (Raitviir & Lill, 2024; Murphy et al., 2013; López et al., 2017).

HBIM-based digital reconstruction is particularly valuable for heritage buildings that have undergone deterioration, structural damage, or partial loss over time. By reconstructing architectural elements within a parametric modelling environment, conservation professionals can analyse historical construction techniques and understand the evolution of building structures. Furthermore, digital heritage models provide a reliable reference for future conservation and restoration activities. As such, HBIM is increasingly recognised as an effective tool for long-term cultural heritage documentation and knowledge preservation.

b. Theme 2: HBIM-Based Information Integration

Another significant theme identified in the literature is the role of HBIM as an integrated information management platform for heritage buildings. Traditional heritage documentation practices often involve fragmented data sources, including historical archives, drawings, photographs, and survey reports. HBIM enables the integration of these heterogeneous data sources within a centralised digital model that contains both geometric and semantic information related to building elements.

Through the integration of spatial data, historical documentation, and technical information, HBIM allows stakeholders to access comprehensive building information within a single digital environment. This integrated approach improves the organisation and accessibility of heritage data, enabling more efficient information retrieval and analysis (Zerafat et al., 2023; Jordan-Palomar et al., 2018). In addition, the ability to link historical records and conservation documentation directly to model components enhances the transparency and traceability of heritage interventions. Consequently, HBIM has the potential to function as a digital knowledge repository that supports informed decision-making in heritage management.

c. Theme 3: Conservation and Restoration Planning

The literature also highlights the importance of HBIM in supporting conservation and restoration planning. Heritage conservation projects often involve complex decision-making processes that require careful assessment of building conditions, historical significance, and appropriate intervention strategies. HBIM models provide a digital environment in which conservation professionals can analyse structural conditions, identify areas of deterioration, and simulate restoration interventions.

Several studies indicate that HBIM can support conservation planning by enabling the visualisation of structural conditions and the evaluation of different restoration scenarios before implementation. This capability allows conservation teams to assess the potential impacts of proposed interventions while preserving the historical integrity of the building. Additionally, HBIM facilitates the documentation of conservation activities, ensuring that restoration interventions are systematically recorded and integrated into the digital building model (Biagini et al., 2016). As a result, HBIM contributes to more informed and transparent conservation decision-making processes.

d. Theme 4: Lifecycle and Facility Management

Beyond the documentation and restoration phases, the literature suggests that BIM technologies have significant potential to support the lifecycle management of heritage buildings. Heritage assets require continuous monitoring, maintenance, and conservation to ensure their long-term preservation. HBIM models can serve as digital asset management platforms that store information related to maintenance schedules, material conditions, and previous restoration interventions.

The integration of lifecycle information within HBIM models enables heritage managers to monitor building performance and plan preventive maintenance strategies more effectively. For example, digital models can incorporate information related to structural health monitoring, environmental exposure, and material degradation. This information allows stakeholders to anticipate potential deterioration and implement timely maintenance interventions (Tsilimantou et al., 2020). Consequently, HBIM supports a proactive approach to heritage asset management, moving beyond reactive restoration practices toward long-term preservation planning.

e. Theme 5: Collaborative Project Coordination

Another important theme emerging from the literature is the role of BIM in enhancing collaboration among stakeholders involved in heritage projects. Heritage conservation typically requires the participation of multidisciplinary teams, including architects, engineers, historians, archaeologists, and conservation specialists. The collaborative nature of BIM platforms enables these stakeholders to access shared project information and contribute to decision-making processes within a common digital environment.

BIM-based collaboration improves communication and coordination among project participants by providing visual representations of building elements and project information. This shared environment facilitates interdisciplinary dialogue and reduces the likelihood of information fragmentation during heritage projects. Furthermore, BIM platforms allow multiple stakeholders to contribute expertise during different project phases, improving the overall coordination and efficiency of heritage conservation initiatives.

f. Theme 6: Decision Support for Heritage Project Management

The final theme identified in the literature relates to the role of HBIM as a decision-support tool for heritage project management. Heritage conservation projects often involve complex planning processes that require balancing preservation objectives, technical constraints, and resource limitations. HBIM models provide a structured platform for analysing building conditions, evaluating intervention alternatives, and assessing potential risks associated with conservation activities.

By integrating technical, historical, and management information within a digital environment, HBIM supports evidence-based decision-making in heritage project management. Project managers can utilise HBIM models to evaluate project schedules, assess cost implications, and coordinate conservation activities more effectively. In addition, visual simulations and digital scenario modelling enable stakeholders to better understand project impacts before implementation. This capability enhances strategic planning and contributes to more effective management of heritage conservation projects.

While these studies identify the potential themes of BIM in supporting heritage conservation and management activities, the analysis also reveals several limitations in the current body of literature. Most studies emphasise technical modelling applications rather than the broader integration of HBIM within heritage project management frameworks. Based on these observations, the key research gaps identified from the reviewed literature are summarised in Table 3. The gaps reflect areas where existing literature is limited and where future research can contribute meaningful advances.

Table 3. Research Gap Table: BIM for Heritage Project Management

No.	Research Gap	Evidence from Literature	Implications for Heritage Project Management	Future Research Directions
1	Limited integration of BIM with heritage project management frameworks	Many studies focus on HBIM modelling and documentation rather than linking BIM with project management processes such as planning, scheduling, and cost management (Murphy et al., 2013; López et al., 2018; Bruno et al., 2018).	Without integration with formal project management frameworks, BIM remains underutilised as a decision-support tool for heritage projects.	Develop frameworks integrating BIM with project management standards such as PMBOK or construction project lifecycle models.
2	Lack of standardized HBIM modelling protocols for heritage conservation	Several studies highlight the absence of consistent modelling standards for historic structures due to complex geometries and irregular construction techniques (Dore & Murphy, 2015; Banfi, 2019).	Inconsistent modelling practices reduce interoperability and hinder collaboration among project stakeholders.	Develop standardized HBIM guidelines and modelling protocols specifically for heritage conservation projects.
3	Limited lifecycle management applications of BIM in heritage contexts	Most studies focus on documentation and restoration planning, while few explore BIM applications for long-term monitoring and maintenance (Piselli et al., 2020; Quattrini et al., 2017).	Heritage buildings require long-term lifecycle management strategies, which BIM could support through digital asset management.	Investigate BIM-enabled heritage facility management and integration with digital twin technologies for long-term monitoring.
4	Insufficient integration of BIM with heritage conservation policies and governance frameworks	Existing studies rarely address how BIM aligns with national heritage policies or conservation regulations (Jordan-Palomar et al., 2018; Mansir et al., 2016).	Lack of policy integration limits BIM adoption in heritage conservation projects managed by government agencies.	Explore how BIM frameworks can align with heritage conservation policies and regulatory frameworks.
5	Limited multidisciplinary collaboration frameworks in HBIM implementation	Heritage projects involve architects, historians, engineers, and conservation experts, but existing BIM studies rarely address collaborative governance structures (Brumana et al., 2017; Oreni et al., 201).	Ineffective collaboration can lead to fragmented project decision-making in heritage conservation projects.	Develop collaborative BIM platforms and governance models that support multidisciplinary heritage project teams.

The analysis reveals that current HBIM research is heavily focused on technical modelling and documentation, while management-oriented applications remain comparatively underdeveloped. Major gaps exist in the integration of BIM with project management frameworks, heritage conservation governance, lifecycle management systems, and collaborative decision-making processes. Addressing these gaps would enable BIM to evolve from primarily a documentation tool into a comprehensive management platform capable of supporting the planning, coordination, and long-term management of heritage conservation projects.

Finally, this study has managed to identify several critical research gaps in the current literature. The review shows that while BIM has been widely adopted for heritage documentation, its integration into formal project management frameworks remains limited. In addition, the lack of standardized HBIM modelling protocols, insufficient application of BIM for lifecycle asset management, and the limited alignment between BIM systems and heritage conservation policies represent important areas for future investigation. Addressing these issues will be essential for advancing the role of BIM as an integrated digital platform for heritage project management.

5.0 CONCLUSION

This study systematically reviewed the literature on the application of Building Information Modelling (BIM) and Heritage Building Information Modelling (HBIM) in heritage project management between 2010 and 2020. While the review intentionally focuses on the foundational decade of HBIM development, subsequent technological advances such as AI-assisted modelling, digital twins, and cloud-based collaborative systems may have introduced new research directions that warrant dedicated investigation.

The findings demonstrate that BIM technologies have been increasingly explored for heritage documentation, digital reconstruction, information integration, conservation planning, lifecycle management, and collaborative coordination. These applications highlight the potential of BIM to enhance information transparency, improve interdisciplinary collaboration, and support more effective management of heritage conservation projects.

However, the review also reveals that existing research remains predominantly focused on technical modelling aspects such as scan-to-BIM workflows and digital documentation of historic buildings. Comparatively limited attention has been given to the integration of BIM within broader heritage project management frameworks, governance structures, and lifecycle management systems. In addition, the absence of standardized HBIM modelling protocols and the limited alignment between BIM environments and heritage conservation policies present significant challenges for wider implementation.

Overall, the study underscores the need for future research to develop structured HBIM frameworks that integrate technical modelling with project management practices. Such developments would enable BIM to evolve from a documentation tool into a comprehensive digital platform supporting strategic planning and management of heritage conservation projects. Additionally, further studies are recommended to explore the integration of emerging technologies such as digital twins, artificial intelligence, and blockchain with heritage BIM systems.

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7.0 AUTHOR CONTRIBUTIONS

Muhammad Hadi Mustafa is the corresponding author who developed and led this study; Choy Poh Keong is the co-author who contributed to the literature review, data organisation, and manuscript preparation; and Nuratiqah Aisyah Awang is the co-author who contributed to the review and refinement of the manuscript.

8.0 CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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