

Applications of Heritage Building Information Modeling (HBIM): A Bibliometric Review and Future Trends

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Abstract—Building Information Modeling (BIM) has become the top of the agenda in the fields of Architecture, Engineering and Construction (AEC). This technology has contributed throughout the entire life cycle of construction, including the operations management phase. Under the umbrella of the BIM Legacy, the BIM approach has been able to expand to manage existing and legacy buildings. Recently, Heritage Building Information Modeling (HBIM) may have a significant potential to support the management, conservation, design, and maintenance of heritage as a consolidated technique for heritage preservation. HBIM has been prominent in several previous studies. However, there is a lack of studies that summarise the disciplinary fields that have been addressed previously. The study's aim is to perform a scientometric analysis of the existing HBIM scientific literature and to provide a picture of the research status from 2018 to March 2023. There were 248 articles extracted from the Scopus database. “VOSviewer” tool was employed to visualize the literature containing the most active scientific journals, countries, and highly used keywords. Furthermore, the recent studies on the impact of HBIM and its applications in the heritage field are reviewed. Accordingly, this paper provides a valuable reference for researchers to focus on potential areas related to HBIM.

Keywords—BIM, HBIM, Heritage, Heritage buildings, Digital heritage, Sustainability, Review, Bibliometric analysis

I. INTRODUCTION

The future of countries and communities is linked to their heritage. The conservation of heritage is constantly threatened by natural disasters or human damage. The irreplaceable character of heritage conditions the collective memory, identity, and socio-economic continuity of communities [1]. For several reasons, from the inefficiency of restoration, conservation, and reconstruction interventions [2], [3] and the weakness of the systems for carrying out studies, supervision, and recording of historical data of building structures [4], [5], to the increasing emergence of new information technologies in the fields of archaeology, Architecture, Engineering and Construction (AEC) [6]–[11], various organisations with interest in heritage assets and stakeholders have taken advantage of these new trends to develop solutions to improve the life cycle management of heritage buildings [12]. Furthermore, the management and maintenance of heritage buildings are dynamic challenges and complex tasks, and onerous processes, hence, it should be managed sustainably [13]–[18].

Building Information Modeling (BIM) is “an umbrella term describing production and management processes in which construction procedures, as well as physical and functional characteristics of buildings, are represented digitally before they are committed to physical space and usage” [19]. BIM is an intelligence tool that was used in the construction sector because of its many advantages, which include collaboration between parties, project execution visualization, better design quality, clash detection, decreased cost and rework, increased productivity, improved communications, cost estimating, shortened project execution time, and improved sustainability [20]–[29]. In this perspective, BIM is acknowledged as a multidisciplinary technology vital to lifecycle management of buildings, including the conservation, design, and maintenance of historical and heritage buildings as a consolidated technique for heritage preservation [4], [30], [31]. BIM is prominent in many aspects of facility management, including the documentation and management of existing and historic buildings under the name Heritage Building Information Modelling (HBIM) [32], [33]. This process applied to existing and historical buildings allows the generation of a geo-referenced 3D model simulating the actual building and its various properties using point cloud collection by technologies such as laser scanners, digital orthophotos, photogrammetry, and data monitoring [34]–[38].

In the past few years, because of the criticality of the subject, the commitment and launch of several programs that aim at developing a collective knowledge around heritage management, the critical evolution that the subject has undergone in terms of scientific production, the certainty of daring and deploying collaborative approaches, it is necessary to understand, visualise and summarise the main elements that suppose that HBIM is a real opportunity to preserve and manage existing building structures [39]–[44], nevertheless, no particular initiatives or clear frameworks in place for stakeholders and practitioners have been devised to improve their chances of managing the heritage buildings projects. Academics, in contrast, are progressively employing scientometric analysis to discover new subjective issues in past research [45]–[49]. In reality, in all available research publications, there has been still a lack of attempt of scientometric analysis to investigate the holistic knowledge of the current state of applications of HBIM to heritage buildings. To the best of authors' knowledge, this is unique