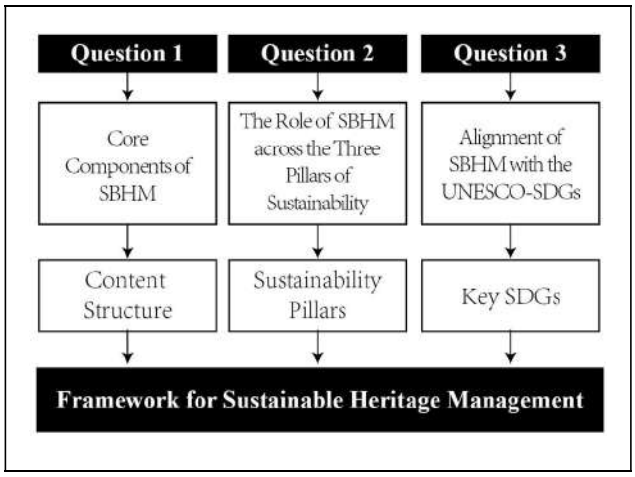

Figure 4. Formation pathway of the SBHM framework.

Control," although limited in total frequency, was still addressed nine times, underscoring its relevance to practical management. These focal issues will be further elaborated in subsequent sections of this study.

Discussion

This chapter structures the discussion around the three central research questions proposed in the study and elaborates on them in light of the results of the systematic analysis. On this basis, it further explores the key dimensions of SBHM, its methodological contributions, and the implications for practical applications (Figure 4).

Core Components of SBHM

A comprehensive analysis of the research findings indicates that eleven first-level categories have been identified in relation to SBHM. Among these, Technology and Methods, Resource Integration, Stakeholder Engagement, Strategic Planning, Monitoring and Evaluation, and Identification and Value Analysis are most widely regarded as its core components. This finding directly responds to **RQ1** ("What constitutes Sustainable Built Heritage Management?") and provides robust empirical support for the construction of a systematic SBHM framework.

Within the 11 systematic management steps of SBHM, Technology and Methods stands out as the most prominent theme and is broadly recognized as the fundamental basis for life-cycle management. Current studies consistently highlight the significant contributions of tools such as Geographic Information Systems (GIS), Building Information Modeling (BIM) and its derivative Historic Building Information Modeling (HBIM), and Life Cycle Cost Analysis (LCCA) in areas such as spatial cataloging, restoration planning, energy efficiency enhancement, and carbon emission control (Castellano-Román & Pinto-Puerto, 2019; Hull & Ewart, 2020; Murphy et al., 2009; Oostwegel et al., 2022). At the same time, the introduction of emerging technologies such as Digital Twin (DT), Virtual Reality (VR), Augmented Reality (AR), the Internet of Things (IoT), and Artificial Intelligence (AI) is driving a transition of heritage management toward greater digitalization, intelligence, and interactivity (Bertolin & Berto, 2024; Massafra et al., 2022). The second prominent element is Resource Integration, which constitutes both the institutional and practical foundation of SBHM. It primarily manifests at three levels: heritage tourism, cross-sector collaboration, and interdisciplinary cooperation. The development of heritage tourism not only enhances the economic potential and social influence of heritage sites but also strengthens community identity and public participation (Afrić Rakitovac et al., 2019; Folgado-Fernández et al., 2025). Cross-sectoral and transnational collaborations expand knowledge sharing and governance capacities, while interdisciplinary cooperation builds methodological bridges across architecture, environmental sciences, and information technology (Giliberto & Labadi, 2023; Hassan et al., 2024). The third critical dimension is Stakeholder Engagement, which is universally recognized as the social safeguard for the long-term sustainability of SBHM. Studies consistently emphasize the participation of diverse actors, including governments, developers, construction teams, residents, and visitors, with community participation regarded as a key factor in ensuring conservation, financial sustainability, and knowledge feedback (Chen & Wan, 2023; Wang et al., 2019). However, most research remains limited to identifying stakeholder intentions and lacks institutionalized and multi-tiered participatory mechanisms (Dormaels, 2016; Freeman, 2010; Jones & Wicks, 1999). The fourth essential element is Strategic Planning, which provides the overarching framework for SBHM implementation. Existing studies stress the importance of priority setting and risk assessment, and they propose a range of supporting instruments including adaptive reuse tools, digital management and dynamic monitoring platforms, and value assessment frameworks (Nieto-Julián et al., 2021). These instruments play a vital role in improving the transparency and scientific basis of management practices, but their level of integration remains limited, requiring a more dynamic balance between value conservation, energy optimization, and social functionality (Cassalia, 2014). The fifth element, Monitoring and Evaluation, is regarded as a fundamental support mechanism for SBHM, together forming a life-cycle safeguard. Tools such as Heritage Impact Assessment (HIA), multi-dimensional value assessment models, and

non-invasive monitoring techniques provide scientific evidence for authenticity, integrity, and risk control. However, there is still a lack of a fully integrated closed-loop mechanism strongly coupled with decision-making processes (Judson & Iyer-Raniga, 2010; Kayan et al., 2021; Naramski et al., 2023). Finally, the discussion of Identification and Value Analysis highlights the cultural dimension of SBHM. The multi-dimensional values of built heritage, including historical, artistic, social, economic, esthetic, and landscape aspects, must be systematically identified and dynamically updated to ensure their continued relevance in rapidly changing social and environmental contexts. Nevertheless, existing research remains insufficient in developing systematic and adaptive value frameworks (De Gregorio et al., 2023; Judson & Iyer-Raniga, 2010; Liao & Tung, 2024; Yasien & Kebede, 2022). Other themes, while less prominently represented in current research, nonetheless play critical roles throughout the overall process and collectively contribute to reinforcing the cyclical and sustainable nature of heritage management.

From a practical perspective, the utility of SBHM lies in its capacity to be transformed into a stepwise and operational pathway, consisting of 11 stages. First, as the starting point of heritage conservation, Identification and Value Analysis should involve systematically identifying the historical, social, environmental, and economic values embedded in built heritage through Heritage Impact Assessment and multi-dimensional value frameworks. Second, Strategic Planning provides an overarching framework that defines priorities and adaptive reuse strategies through comprehensive management plans, thereby improving the transparency and operability of the management system. In terms of Stakeholder Identification and Engagement, it is necessary to establish multi-level governance structures that incorporate governments, experts, construction teams, and community representatives into decision-making and feedback mechanisms to ensure legitimacy and social acceptance.

The stage of Resource Integration and Development emphasizes the combined use of financial resources, tourism revenues, academic expertise, and community strength, while institutionalized networks are built through cross-sectoral, interdisciplinary, and international collaborations. Community Well-being Enhancement can be promoted through legal frameworks, tax incentives, and financial subsidies, ensuring that heritage protection delivers positive effects on community development, social equity, and the improvement of public services. Moreover, Policy and Financial Management provides the prerequisite for implementing the framework by offering fiscal support, tax incentives, and funding mechanisms that sustain the long-term viability of SBHM. At the same time, Technology and Methods, through BIM or HBIM, GIS, LCA, and

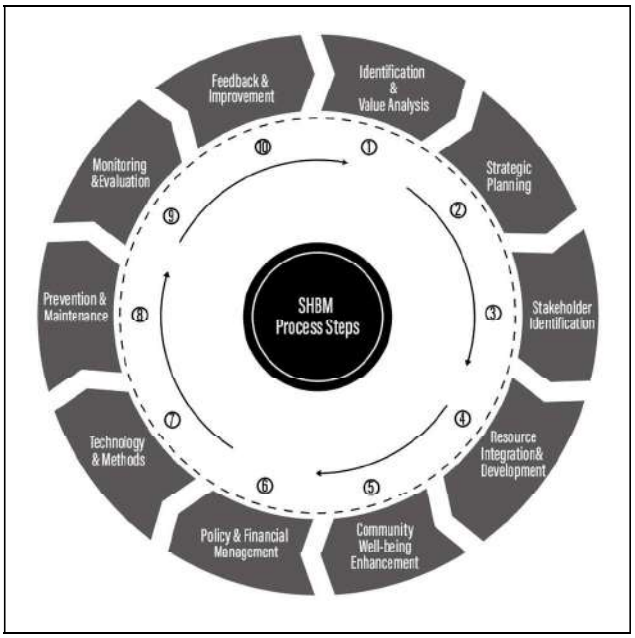

Figure 5. Implementation pathway and operational process of SBHM.

related tools, provide scientific support for data collection and physical documentation of heritage assets. Prevention and Maintenance emphasizes routine management and periodic protective measures, supported by facility renewal and risk early-warning mechanisms that effectively reduce the rate of deterioration and mitigate sudden threats to heritage integrity. Meanwhile, Monitoring and Evaluation should be developed as a closed-loop mechanism aligned with decision-making processes, employing non-invasive sensors and IoT-based technologies for long-term dynamic monitoring, with continuous feedback into strategic planning and implementation. Finally, Feedback and Improvement serves as the closing stage of the cycle, ensuring that management practices are iteratively refined through reflection on outcomes and reanalysis of monitoring data. This process guarantees iterative renewal of the system and provides institutional assurance for the long-term sustainability of SBHM.

Overall, the practical significance of SBHM lies in its transformation of fragmented theoretical concepts into a systematic and operational tool through a closed-loop, stepwise pathway. This approach not only safeguards the authenticity and integrity of heritage but, more importantly, enhances active collaboration among diverse actors, governments, communities, and markets through deliberate institutional design. By integrating environmental performance, social acceptance, and economic feasibility, it facilitates the sustainable management and value enhancement of built heritage (Figure 5).