

The Role of SBHM Under the Three Pillars of Sustainability

Sustainable Built Heritage Management (SBHM) demonstrates distinctive characteristics compared to general sustainable heritage management in both its pathways and methodologies. Its core contribution lies not only in advancing environmental sustainability but also in producing comprehensive effects across the economic and social dimensions. This tripartite framework directly addresses **RQ2**, namely “How does built heritage management function under the three pillars of sustainability?”

From an environmental perspective, SBHM establishes environmental sustainability principles as central to built heritage management, emphasizing comprehensive life-cycle oversight supported by the values of equity, continuity, and common good. By integrating appropriate technological tools, formulating eco-friendly strategies, and prioritizing reversible and minimal intervention measures, SBHM reduces the environmental burden associated with restoration and adaptive reuse while fostering healthy, comfortable, and safe heritage environments. In addition, SBHM relies on advanced building monitoring and risk assessment methods that effectively mitigate potential threats to heritage assets. Environmental monitoring and energy optimization, supported by digital tools, offer greater precision and long-term applicability. Preventive maintenance and the establishment of environmental monitoring systems further strengthen the ecological resilience of heritage sites and their surrounding areas. In this sense, SBHM not only improves the environmental performance of built heritage but also contributes to the health and stability of the ecosystems in which heritage is embedded.

The economic benefits of SBHM are equally direct and significant. These benefits primarily manifest through the cultural value embedded in built heritage, which generates capital assets in both stock forms, such as inheritance, sale, and management tied to ownership, and flow forms, such as entrance fees paid by visitors. Such mechanisms substantially increase economic returns. Furthermore, the sustainable development and management of built heritage generate large numbers of employment opportunities and actively stimulate the growth of related industries, particularly tourism and the cultural and creative sectors. These spillover effects further drive economic development in heritage sites and their surrounding communities, ensuring that management activities create value for multiple stakeholders and achieve shared benefits. In the process of sustainable management, life-cycle cost analysis (LCCA) supports the formulation of more economically efficient maintenance plans, significantly reducing resource consumption and waste generation. This not only improves

management efficiency but also strengthens economic sustainability. Thus, SBHM supports sustainable economic development while advancing the conservation of built heritage.

From a social perspective, SBHM empowers stakeholders with the ability to provide feedback, participate, and engage in decision-making processes, thereby reflecting social needs more authentically. As immovable material carriers of local culture and history-built heritage sites provide tangible, interactive spaces that enhance community vitality and strengthen social cohesion. Their embedded sense of place and identity is particularly significant, and effective management reinforces local distinctiveness, deepens community attachment to heritage, and even enables heritage sites to function as places of collective memory. Compared to other forms of heritage, SBHM benefits from more mature technologies and methodologies that have been validated in architectural development and management practices. By selecting and integrating appropriate tools, SBHM not only has safeguards-built structures but also establishes collaborative platforms for heritage management, promoting information exchange, experience sharing, and the dissemination of global knowledge, thereby enhancing the preservation and transmission of built heritage sites.

SBHM and the Sustainable Development Goals

The third core issue concerns the ways in which SBHM contributes to the realization of the United Nations Sustainable Development Goals (SDGs). Although the 17 goals of the 2030 Agenda do not explicitly dedicate a target to cultural heritage, SDG 11.4 clearly calls for strengthening the protection of the world’s cultural and natural heritage. The UNESCO (2015) Policy Document for the Integration of a Sustainable Development Perspective into the Processes of the World Heritage Convention explicitly emphasizes the need to integrate sustainability principles systematically into heritage management processes (Committee, 2015). Subsequently, the ICOMOS (2019) report *Futures of Our Pasts: Engaging Cultural Heritage in Climate Action* highlighted the pivotal role of cultural heritage in addressing climate change and advancing sustainability (Downes, 2019). Collectively, relevant studies and policy documents underscore the strategic importance of cultural heritage in sustainable development, particularly in advancing SDG 11 (Sustainable Cities and Communities), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action). SBHM, through life-cycle management, digital monitoring, and adaptive reuse, demonstrates unique advantages in reducing resource consumption, enhancing climate resilience, and promoting social equity, thereby making a direct contribution to

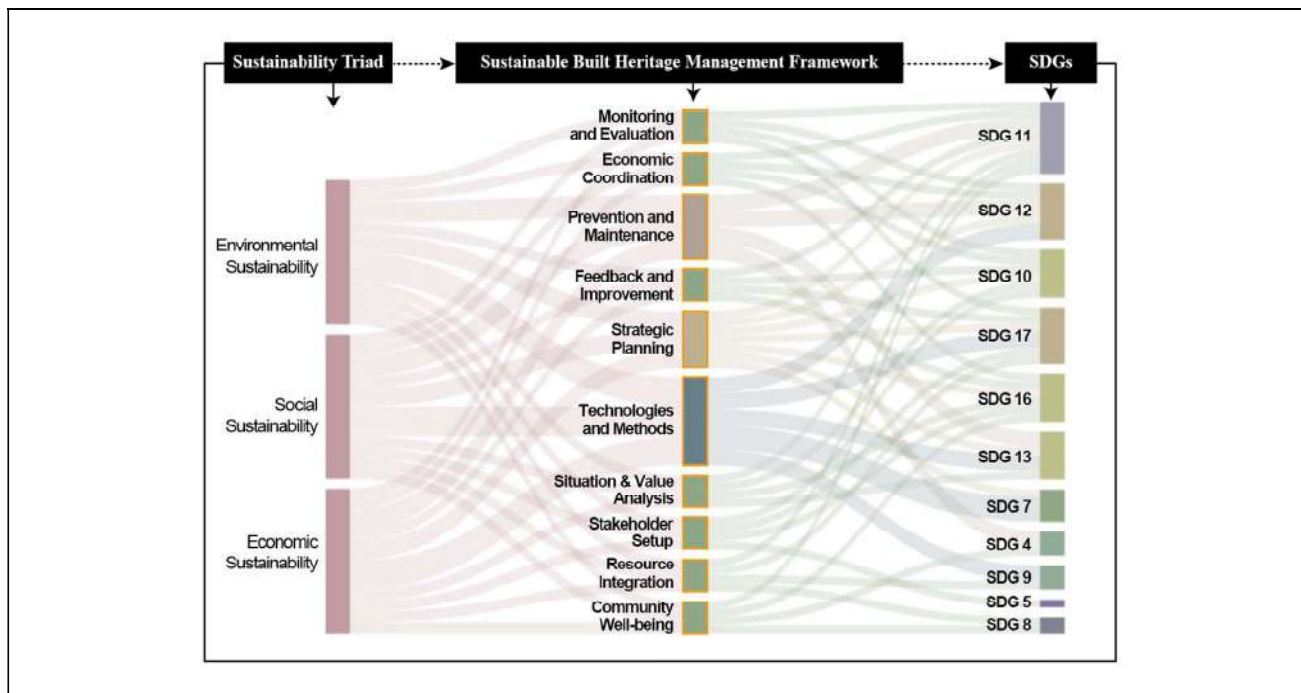


Figure 6. The relationship between SBHM and the United Nations Sustainable Development Goals (SDGs).

the broader global sustainability agenda. Unlike traditional heritage conservation approaches that primarily emphasize environmental concerns, the distinctive value of SBHM lies in systematically embedding social and economic dimensions into the management framework, thus responding to the multifaceted objectives of the SDGs in a more integrated manner (Figure 6).

More specifically, the protection and maintenance of cultural heritage represent a central component of achieving SDG 11.4. Through scientific identification and value assessment, SBHM not only strengthens the long-term stability of heritage assets but also improves living environments and revitalizes surrounding areas, thereby directly contributing to SDG 11 (Sustainable Cities and Communities). The incorporation of life-cycle assessment (LCA) enables systematic evaluation of resource and energy consumption in interventions, promoting SDG 12 (Responsible Consumption and Production), while simultaneously reducing environmental burdens and enhancing economic viability (Judson & Iyer-Raniga, 2010; Kayan et al., 2021). The maintenance and optimization of built heritage improve energy efficiency, extend building lifespans, and reduce carbon emissions, while strengthening resilience to climate change and natural hazards, aligning with SDG 7 (Affordable and Clean Energy) and SDG 13 (Climate Action; Dos Santos Gonçalves et al., 2025). Adaptive reuse further reduces reliance on new construction,

effectively lowering resource consumption and ecological disturbance.

At the social and economic levels, SBHM also demonstrates significant impacts. As a high-quality platform for education and training, built heritage promotes public knowledge dissemination and capacity building, enhancing awareness and appreciation of heritage and thus supporting SDG 4 (Quality Education; El-belkasy & Wahieb, 2022; Lerario, 2022). The development of heritage tourism and cultural and creative industries fosters regional economic growth and job creation, advancing SDG 8 (Decent Work and Economic Growth) and SDG 9 (Industry, Innovation, and Infrastructure; Hampton, 2005). Circular economy models and efficient resource use further reinforce the implementation of SDG 12 (Afric Rakitovac et al., 2019; Folgado-Fernández et al., 2025).

Moreover, the multi-stakeholder collaboration inherent in SBHM—through stakeholder identification, resource integration, and knowledge sharing—enhances governance transparency and inclusivity, thereby supporting SDG 16 (Peace, Justice, and Strong Institutions) and SDG 17 (Partnerships for the Goals). By addressing the needs of vulnerable groups, SBHM also contributes to SDG 5 (Gender Equality) and SDG 10 (Reduced Inequalities; Dormaels, 2016; Freeman, 2010; Jones & Wicks, 1999). In addition, preventive maintenance and proactive conservation reduce the risks of sudden

damage, while digital monitoring and tools such as H-BIM improve energy efficiency and data-driven governance, further advancing SDG 9 (Industry, Innovation, and Infrastructure) and SDG 13 (Climate Action; Judson & Iyer-Raniga, 2010; Kayan et al., 2021).

Taken together, these findings show that SBHM, in contrast to traditional heritage management approaches, contributes not only at the environmental level but also strategically integrates social, economic, and ecological dimensions. In doing so, SBHM demonstrates its unique advantages and strategic value in advancing the global sustainable development agenda.

The three research questions discussed above, when integrated, ultimately converge into a systematic framework that provides a more operational and logically coherent pathway for heritage management. This framework not only enhances the overall sustainability of heritage management but also offers a stepwise and replicable model that can guide diverse types of heritage conservation practices.

In the context of built heritage practice, this framework can be directly applied as a practical tool. When managers are confronted with tasks of conservation and management, the initial step should be comprehensive Identification and Value Analysis. This process should not be limited to assessing the physical characteristics and environmental conditions of the heritage asset but must also include an evaluation of its economic potential, an analysis of community attitudes and differences in public perception, and the identification of diverse socio-cultural values. Such an approach ensures a holistic understanding of the heritage context.

More importantly, the framework's objective extends beyond integrated heritage management. It emphasizes the alignment of heritage management with the Sustainable Development Goals (SDGs) from a medium- and long-term perspective. By addressing stakeholder interests and perceptual differences during the identification and value assessment stage, the framework can effectively reduce social inequalities and disparities in resource allocation, thereby advancing SDG 10 (Reduced Inequalities) and SDG 11 (Sustainable Cities and Communities). Similarly, by embedding environmental risk assessment and climate adaptation planning, the framework aligns heritage protection with SDG 13 (Climate Action). Incorporating institutional development and multi-stakeholder participation mechanisms into the management process further responds to the objectives of SDG 16 (Peace, Justice, and Strong Institutions).

At each subsequent step, the framework ensures that management practices address not only the heritage asset itself but also broader environmental, social, and

economic dimensions while maintaining responsiveness to medium- and long-term sustainability objectives. Through the systematic interlinking of these stages, a closed-loop management process can be progressively established.

Nevertheless, these methods are not static but dynamic and adaptive. At the final stages of project evaluation and feedback, the framework allows for a re-examination and re-implementation of earlier steps, enabling iterative optimization of management pathways and enhancement of heritage value. The specific operational framework is illustrated below (Table 1).

Conclusion

Although some heritage professionals have shared successful experiences, built heritage management continues to face the pressing challenge of knowledge fragmentation. Existing case studies remain scattered and fragmented, making it difficult to integrate them into a systematic theoretical framework capable of effectively guiding practice. Consequently, there is an urgent need to construct a framework that can consolidate and integrate dispersed resources, thereby facilitating the implementation of effective management practices and promoting cross-regional knowledge sharing (Darlow et al., 2012; Fyall & Garrod, 1998; Loulanski & Loulanski, 2011).

Through a systematic review of 115 relevant publications, this study proposes a conceptual framework of Sustainable Built Heritage Management (SBHM), structured around a life-cycle perspective that integrates identification, planning, implementation, monitoring, and feedback into a closed-loop process. The results demonstrate that SBHM effectively responds to the complex demands of built heritage management across the environmental, social, and economic dimensions, while simultaneously aligning with the United Nations Sustainable Development Goals (SDGs). This finding not only provides structured theoretical support for built heritage management but also lays a methodological foundation for its practical application across diverse contexts.

Compared with traditional heritage management approaches, the core contribution of SBHM lies in its systematicity and adaptability. On the one hand, it embeds sustainability principles throughout the entire management process, expanding beyond physical restoration or single-phase interventions to cover multiple stages, including identification, conservation, adaptive reuse, and dynamic monitoring. On the other hand, it emphasizes the integration of interdisciplinary tools and the establishment of multi-stakeholder collaboration mechanisms, highlighting the multiple functions of built heritage in promoting social equity, economic