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ARTICLE

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Heritage in a Circular Economy: Integrating Conservation, Resource Management, and Community Engagement

Johannes Warda [1], Georg Schiller [2], and Robert Knippschild [2,3]

[1] Institute for Archaeology, Heritage Conservation Studies and Art History, University of Bamberg, Germany
[2] Leibniz Institute of Ecological Urban and Regional Development (IÖR), Germany
[3] International Institute Zittau of Technische Universität Dresden, Germany

Correspondence: Johannes Warda (johannes.warda@uni-bamberg.de)

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Abstract

The building industry is one of the most resource-intensive sectors globally, accounting for significant environmental impacts through material extraction, processing, and waste generation. In the quest to mitigate climate change and preserve natural resources, the integration of circular economy (CE) principles into various sectors, including heritage conservation (HC), has gained notable attention. The CE framework corresponds with the general intention of HC efforts to preserve buildings of high cultural value. However, the intersection of CE with HC strategies to prolong the use of buildings often remains underexplored. This article seeks to address this gap by discussing an integrated perspective of CE and HC approaches, building on an expanded definition of CE. By looking at diverse stakeholders and forms of organisation within the HC community, including heritage practitioners in citizen initiatives and local communities, we explore how their practice can be regarded as implementation of CE strategies. Discussing the results, the article advocates for a shift in perspective to consider the various actors involved in HC and their capacities to adopt and promote circular practices. Through this integrated approach, the article aims at contributing to a deeper understanding of the synergies between CE and HC.

Keywords

adaptive reuse; circular economy; community engagement; heritage conservation; heritage values; resource management

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1. Introduction

The building industry is one of the most resource-intensive sectors globally, accounting for significant environmental impacts through material extraction, processing, and waste generation. In the quest to mitigate climate change and preserve natural resources, the integration of circular economy (CE) principles into various sectors, including heritage conservation (HC), has gained notable attention (Foster, 2020; Gravagnuolo et al., 2021; Huuhka & Vestergaard, 2020). CE aims to redefine traditional linear economic models by promoting the sustainable use of resources through regeneration, reuse, and recycling. By extending the lifespan of buildings through maintaining, repairing, refurbishing, revitalising, and reusing, the environmental footprint associated with new construction can be significantly reduced. This CE framework corresponds with the general intention of HC efforts to preserve buildings of high cultural value. However, the intersection of CE with HC strategies to prolong the use of buildings often remains underexplored. This article seeks to address this gap by discussing an integrated perspective of CE and HC approaches, drawing on an expanded definition of CE that encompasses the strategic prolongation of building life cycles and the transformation of existing spaces (section 2). This perspective aligns with the overall goals of CE, which emphasise minimising material inputs and maximising the utility of existing resources (section 3). Conventional approaches often overlook the importance of agency—how individuals and organisations interact in their care efforts for built heritage. In the sense of "open heritage" (Oevermann & Szemző, 2023), we understand heritage not only to mean the objects deemed worthy of protection, but also a broad network of different actors and the political and institutional mechanisms to which they are subject in their conservation efforts. This article looks at diverse stakeholders and forms of organisation within the HC community (section 4), including heritage practitioners in citizen initiatives and local communities, and explores how their practice can be regarded as implementation of CE strategies.

Methodologically, this study relies on a literature review of the discourse on CE and HC strategies, supported by case studies that exemplify the integration of CE and HC principles. The focus of the case studies will be on heritage networks and citizens' associations and thus on the level of local and intermediate actors who are often overlooked. The case studies are all located in Germany. The country's long-standing tradition of citizen-led action for HC has led to a vital landscape of initiatives in the field which operate next to heritage protection authorities. These initiatives appear to bring in more integrated perspectives on future issues of HC and thereby push the authorities to act. In the light of key findings in the field on the difficulties of applying CE strategies for HC, the results of this article advocate for a shift in perspective in order to gain a deeper understanding of the synergies between CE and HC. The concluding remarks suggest looking at the various actors involved in HC and their capacities to adopt and promote circular practices, and to strengthen their cross-sectional cooperation (section 5).

2. Material Flows in the Built Environment and Their Environmental Impact

2.1. The Global Flow of Materials

The construction industry is one of the most resource-intensive sectors worldwide, exerting enormous environmental impacts. It alone is responsible for 35–45% of global material flows and generates 30–40% of global waste (Hertwich et al., 2020; Mhatre et al., 2021). Projections indicate that these pressures will intensify: Deetman et al. (2020) expect the global demand for building materials to double within

the next three decades, driven by the continuous expansion of the global building stock. At present, the anthropogenic material stock embedded in existing building infrastructure already amounts to 318.7 gigatons worldwide (Deetman et al., 2020).

Importantly, the consumption of construction resources is highly uneven across regions. Contrary to widespread assumptions, the highest per capita consumption of building materials does not occur in the rapidly urbanizing countries of the Global South. Instead, it is concentrated in the wealthy societies of the Global North, which—despite their relatively modest growth in new building stock—contribute disproportionately to global material demand (Schiller & Roscher, 2023). While in 2022, the rate of new building in developing and emerging countries was nearly 1.8 times higher than in the Global North (International Energy Agency, 2023), the latter continued to sustain excessive material throughput within existing building stock. This paradox can be explained by lifestyle factors rather than growth dynamics. High material consumption in affluent societies is largely driven by the maintenance, renewal, and upgrading of already well-equipped building stocks.

2.2. Impact

The immediate climate impacts of building materials arise from grey emissions, caused by the energy used in the processing of materials and during transportation. Their share, measured against global GHG emissions as a whole, is constantly increasing. According to a study by the United Nations, the share of emissions from material production in global GHG emissions rose from 15% in 1995 to 23% in 2015 (Hertwich et al., 2020). Nearly half of that comes from construction. The increasing significance of embodied emissions becomes even more apparent when considering buildings with different energy performance standards. While emissions decrease with the optimization of the operational energy performance of buildings, the material-related embodied emissions, from the production of the building materials used, continue to increase. In energy retrofitted buildings, embodied emissions are at the level of operational emissions or even above (Mahler et al., 2019). The enormous flows of resources and the associated environmental impacts are partly a result of the fact that material flows in the built environment have predominantly been organised linearly (López Ruiz et al., 2020).

3. Promoting the Continued Use of Buildings: The CE Perspective

3.1. Concepts and Definitions

To reduce the use of resources, the European Union is taking active measures to transform the construction industry towards circular systems (European Commission, 2020). Based on comprehensive research on existing CE definitions, Kirchherr et al. (2017) identify key characteristics of this concept. They refer to the so-called “4R framework” (Reduce, Reuse, Recycle, Recover) and highlight its inherent system perspective, the consideration of different levels (object, region, national, global), as well as the significance of new business models and consumption patterns for the implementation of circular concepts. Meanwhile, the “R” approach has been further expanded to what is now the widely recognized “9R framework” (Potting et al., 2017). “9R” makes a clear distinction between different approaches, aiming at the avoidance of resource flows, the more efficient provision of resources, the more intelligent and sufficient use of products, and finally the fundamental questioning of their necessity. Subsequently, the longer use of products, their

production using resources that are already within the anthropogenic material stocks and their energetic utilisation are also considered. The "9R framework" is organised along a scale from strategies of highest ("R0") to lowest grade of circularity ("R9"), the latter being a totally linearly organised economy (Potting et al., 2017, p. 15). Strategy R0 demands the refusal of any production activity.

3.1.1. Diversification of CE Strategies

Bocken et al. (2016) summarize these approaches into three overarching groups: the smart use and production of products (narrowing), the extension of the lifespans of products and their parts (slowing), and the beneficial use of materials at the end of the lifespan of products and their parts (closing). Later, a fourth strategy was added, "regenerate" (Konietzko et al., 2020, p. 2). The application of these terms to the construction sector can be outlined as follows:

The term "closing" specifically refers to the closing of material loops, particularly in the field of construction material recycling. It may also encompass approaches that facilitate recycling by considering the separability of building materials during the design stage of buildings. This strategy is oriented towards the "end of life" phase of buildings and components, that is, the management of materials released after demolition. "Slowing" encompasses a broader field which can be summarised under the concept of "preserving the existing stock." This involves utilising entire buildings or components for a longer time, effectively slowing down the material flow. The distinction between "slowing" and "closing" is not always clear-cut. Potting et al. (2017) clearly associate "closing" in the context of "useful applications of materials" with the material level, while "slowing" pertains to the product level and its components. In contrast, Konietzko et al. (2020) include in their definition of "closing" not only the reuse of materials through recycling but also the reuse of components. The attribution one follows should primarily be justified on a content basis.

In the construction industry, questions concerning material cycles focus heavily on technical issues related to material qualities and requirements stipulated in standards and regulations. Conversely, the field of component reuse is notably more complex and comprehensive. In addition to technical inquiries, this includes legal issues regarding, e.g., warranties, design and planning considerations for integrating used components into new buildings, and so forth. Hence, component reuse is closer to the complex questions related to preservation of existing stock and is more accurately assigned to this overarching strategy. This addresses the usage phase, which must be extended by repairing, refurbishing, revitalising, or repurposing buildings and components. "Narrowing," or the streamlining of materials, signifies "less": buildings and components are constructed more efficiently with a reduced material input. However, the social components of "narrowing" also involve questioning consumption patterns in the context of sufficiency approaches (e.g., less living space per capita) as well as considering new uses for buildings (e.g., shared spaces). "Regenerating," mentioned as a fourth strategy, is underscored by the notion of making clean. It addresses the issue of pollutants, the use of renewable energy, and regenerating natural ecosystems. Again, there are numerous references to construction. This spans the discussion on appropriate limit values and suitable proofs regarding the handling of pollutants, through various possibilities of using and harnessing renewable energies, to the reframing of buildings from consumers of ecological services to producers, e.g., as energy providers (plus energy houses) or as elements in nature-based systems managing heat islands (green facades, etc.).

The description of the sub-strategies of circular construction highlights their breadth, which can be compared to the sustainable construction concept that has been on social and political agendas since the 1990s. Significant differences lie in the stronger emphasis on necessary systemic changes rather than primarily focusing on efficiency improvements, and a distinctly greater emphasis on intent of action—particularly reinforced by the demanded business models.

3.1.2. Challenges in Classification of CE Strategies and Their Effects

How can the presented strategies be classified in terms of their effects? Given the complexity of the strategies, this is not straightforward. However, the following trend statements can be hypothetically formulated based on plausible considerations and conceptual references in the literature on the strategies: Potting et al. (2017) see the highest potential for minimising resource use and avoiding waste generally in "narrowing strategies," followed by "slowing" and "closing." For the construction sector, this must be scrutinised further: Technical innovations aimed at increasing efficiency theoretically possess a very high potential for resource conservation and emissions reduction. For instance, Zhang et al. (2024) calculate a resource conservation potential of around 65% achievable through the combination of innovative technologies concerning the construction material concrete. They do not, however, consider the necessary socio-institutional change required to anchor new technologies in society and to promote market penetration. Additionally, technical innovations are predominantly oriented towards the construction of new buildings. Sufficiency approaches also hold great potential, although these mostly rely on theoretical models. Hertwich et al. (2020) identify resource conservation and emissions reduction potentials that extend far beyond the technical potentials—such as through drastic reductions in living space requirements. Achieving broad societal acceptance for this requires a profound transformation of values. Circular management of the existing building stock has a direct effect on reducing resource consumption and avoiding grey emissions if new construction is avoided by using existing buildings for longer. In this case, the material input required for maintenance and revitalisation is hardly significant (Knippschild et al., 2025). "Closing" favours the use of secondary resources and conserves natural raw materials. It can also help to reduce grey emissions if process energies for recycling are low and transport is kept short (Gruhler & Schiller, 2023). Regenerative strategies are associated with the aforementioned strategies and may reinforce or mitigate them.

4. Prolonging the Life of Buildings: HC and Agency

4.1. The HC Framework—Buildings as a Resource

The designation of heritage objects is fundamentally based on values and processes of valuation (Avrami et al., 2019). HC theory from as far back as 1900 highlighted the dual character of monuments, recognizing them as both materially present entities and historical testimonies. This raises essential questions about the features conveyed by their materiality and the cultural values attributed to them. In recent years, Critical Heritage Studies have placed significant emphasis on the constructed nature of heritage, arguing that heritage is not merely a reflection of intrinsic values but is also shaped by contemporary societal contexts, "a production of the past in the present," as Harrison (2012, p. 32) puts it.

Conversely, both classical modern and current HC theory retain a strong material-oriented perspective, heavily influenced by 19th-century preservationists such as John Ruskin and Alois Riegl. Their contributions

help explain why materiality continues to play a central role in the discourse surrounding heritage, despite the growing recognition of the importance of cultural narratives and constructions in understanding heritage objects. Ruskin, for instance, contends that the unique value of historic buildings arises from their materiality, which reflects the passage of time and experiences they have endured and reminds the observer of the people who built them (Ruskin, 1849/1903, p. 245). Riegl's theory of values presented in *Der moderne Denkmalkultus* (1903) proves to be a highly elaborative reflection on the intentions of art works and the becoming of monuments. According to Riegl, monuments bear the capacity to give insight into the cycle of life and death (Riegl, 1903, p. 24). He conceives this aspect as a universal category that can be experienced equally by all people.

It is important to highlight, in the thoughts of Ruskin and Riegl, that when addressing the issue of materiality and the heritage values it embodies, the concept of the original as a specific, unaltered state is not significant. Instead, both Ruskin and Riegl recognise the inevitability of change over time and value it highly, finding the greatest worth or quality of a monument precisely in this characteristic. In Riegl's theory of values, this refers to the memory values, particularly the age value, which he clearly distinguishes from contemporary values, such as the novelty value of experiencing an unaltered work of art (Riegl, 1903, pp. 40–41; see also Augustiniok et al., 2023, on Riegl's contemporary values and adaptive reuse). Ruskin's and Riegl's contributions to the concept of HC can be summarized as follows: The embodied historical value of heritage buildings does not rest primarily in their architectural forms and features, but rather in their materiality, which serves as a testament to the passage of time. Initially aimed at opposing the completion and restoration of Gothic cathedrals, this understanding gave rise to the preservationist principle of prioritizing conservation over restoration.

The material values attributed to a building intersect with the broader concept of resource value within the building stock (Hauser, 2001; Petzet & Hassler, 1996). This change of perspective was decisive for the rediscovery, and the eventual boom, of adaptive reuse as a conservation strategy (Wong, 2017). The Venice Charter of 1964 is frequently acknowledged as the first set of universal guidelines informing adaptive reuse (The Venice Charter, 1964/2012, p. 46; Wong, 2017, p. 10). Today, reuse as a key element of building conservation has become a broadly discussed architectural design and urban planning strategy (Lenz & Pendlebury, 2022). Under the motto of "as found," the reuse of buildings is even referred to as an architectural style of its own (Braae & Riesto, 2011).

4.1.1. Keeping It in a Good State: The Interplay of Maintenance, Repair, and Reuse

To conserve rather than to reconstruct also implies that historic buildings should be maintained in the state in which they present themselves once they are attributed heritage value. "Take proper care of your monuments, and you will not need to restore them," is the famous quotation from Ruskin (1849/1903, p. 244). Consequently, all efforts should be directed at maintaining and repairing them in a state-of-the-art craftsmanship manner. The conservationist concept of repair is exclusively dedicated to preserving existing structures and not to be mixed up with measures directed only at the restoration of the outer appearance (Mader, 1999, p. 151). In its modernist form, this ideal is also laid down in The Venice Charter (1964/2012).

In the context of modern architecture, where regular maintenance and building upkeep is not a major concern, practical examples of a preventive strategy can primarily be found in the HC sector. The "Monumentenwacht," or Monument Watch initiatives, conceive of the maintenance of historic buildings as a common challenge that should be met with a communal organisation form. Originally founded in the

Netherlands in the 1970s, the idea spread to Flanders, Denmark, Portugal, and other European countries (Wu & van Laar, 2021). In Germany, the "Moumentenwacht" has gained some attention over the past decade. The Bavarian State Preservation recommended to introduce similar initiatives to implement an integrated structure for the "facility management" of historic monuments (Bayerisches Landesamt für Denkmalpflege, 2016, p. 35). The only similar initiative so far which is clearly inspired by the Dutch example is the "Monumentendienst" in the Rhine-Weser region (Monumentendienst, n.d.).

4.1.2. The Ideal of Craftsmanship and HC Education

HC theory and practice have long been based on the ideal of proper craftsmanship, which includes necessary maintenance work, repairing building components, and partially replacing them. In the aftermath of the European Architectural Heritage Year 1975, which aimed primarily at changing the demolition politics of urban renewal during that time, craftsmanship became a new focal topic of the heritage community at the European level. For example, a recommendation adopted by the Council of Europe (CoE) in 1986 aimed at "the promotion of craft trades involved in the conservation of the architectural heritage" (CoE, 1986). While the Council efforts focused on training, international exchange of skills, and contracting, the aspect of material integrity of heritage objects as well as the practice of using reclaimed materials were also acknowledged (CoE, 1986, p. 3). Currently, on the level of built heritage research and teaching, we observe a shift towards an integrative approach of heritage and architectural reuse practices in a broader sense. At RWTH Aachen University, a tenured assistant professorship will be established in 2025/26 with a specialisation in HC and building stock maintenance. Prospective candidates are expected to demonstrate practical experience in what could be called CE strategies both applied to listed and non-listed buildings, including the management of modern materials such as concrete and plastics. The new professorship will follow up on the current chair who has a more classical HC profile (Academics, 2025). Also, initiatives such as the study programme "Handwerk und Bauerhalt" (Crafts and Building Preservation) at Coburg University of Applied Sciences build on the attempts to strengthen the ties between HC, the craft trades, and architectural design (Hochschule Coburg, 2024).

4.2. Who Cares? Heritage Actors and Agency at the Intermediate Level and Bottom-Up

After discussing strategies in the previous section that are rooted in the classical HC approach, the following section will focus on examples where the preservation of buildings occurs under different conditions and in the context of the emergence of new institutional structures and groups of actors. The perspective taken here is informed, as mentioned above, by the open heritage concept. Oevermann and Szemző (2023, p. 159) define open heritage as a framework for addressing the various ways in which heritage is preserved, including the interplay between different local, institutional, and community constellations. Open heritage appears as a type of holistic planning tool that resolves the contradictions and obstacles that normally accompany HC projects by acknowledging them as normal parts of the process. The case studies presented below can be broadly divided into two distinct categories. The first category includes initiatives on the regional level that contribute to building awareness networks and critically engage with planning processes related to heritage sites, particularly when it comes to the demolition of buildings (4.2.1). The second category comprises actors and initiatives that view the building stock as a resource at the local level and actively manage it. This involves combating vacancy or salvaging building elements or materials in the spirit of urban mining when a building cannot be preserved in situ (4.2.2).

4.2.1. Heritage Networks and Citizens' Associations

Heritage networks and citizens' initiatives in the field of HC have played an ambivalent role in the past decades. Bottom-up initiatives can be credited with having put HC back on the agenda and helped to re-position it as a community-oriented framework during the waves of urban renewal in the 1960s and 70s. More recently, initiatives to reconstruct from scratch buildings destroyed in World War II or its aftermath, as in Dresden and Potsdam, have gained increasing attention. Concurrently, heritage activism aimed at strengthening efforts to prevent demolition, preserve the existing building stock, and put it back in use can also be observed. The first example discussed here is the Denkmalnetz Bayern, or Bavarian Heritage Network (DNB). As an umbrella organisation, it represents more than 220 initiatives and associations at the local and regional level and about 450 individuals. Since its foundation in 2012, the DNB has developed into a strong advocacy organisation for the preservation of monuments. In 2021, it was granted the status of an association with legal standing in Bavaria. This entitles the DNB to appeal planning laws affecting the built heritage as an official advocacy institution, comparable to environmental protection organisations. The focal point of its educational and public relations work is the website with its highlighted section titled "historic monuments & buildings" (DNB, n.d.). Designed as a kind of citizen science mapping, this section now features around 330 buildings classified into the four categories of "noteworthy," "endangered," "lost" (Figure 1), and "saved." The data not only highlights impending heritage losses but also brings together materials such as concepts presenting alternatives to demolition, statements, and media reports. In this way, an object- and case-based panopticon of heritage-informed and resource-sensitive urban planning is created. The DNB also facilitates community efforts to nominate buildings for the Bavarian list of historic monuments.

Figure 1. Remains of the demolition of the Kulmbach freight depot, a listed building (2023). The case was closely monitored by DNB and is now filed under the category "lost" in the database. Source: Courtesy of Dietmar Popp/Hans-Joachim Zeitler.

A similar database is provided by the Denkmalverein Hamburg, or Hamburg Society for Architectural Heritage. The Denkmalverein, focusing on the city state of Hamburg, describes itself as the "most important independent voice for monument protection in Hamburg" (Denkmalverein Hamburg, n.d.-a). The website features all types of buildings and civil engineering structures under the categories "endangered," "saved," and "lost" (Figure 2). The entries range from the small farmer's cottage in the Hamburg suburbs to brutalist office and department stores' buildings and even the Köhlbrand Elbe bridge. As with the DNB, the entries here also provide background information on the history of the buildings, numerous photos, and a press review. In many cases, it is only through the Denkmalverein's research work that a building is deemed worthy of preservation and recognised by the monument authority. For example, a vocational school building by the renowned architecture office von Gerkan, Marg & Partner from 1990 was listed through an intervention by the Denkmalverein and nevertheless demolished in 2020 (Denkmalverein Hamburg, n.d.-b).

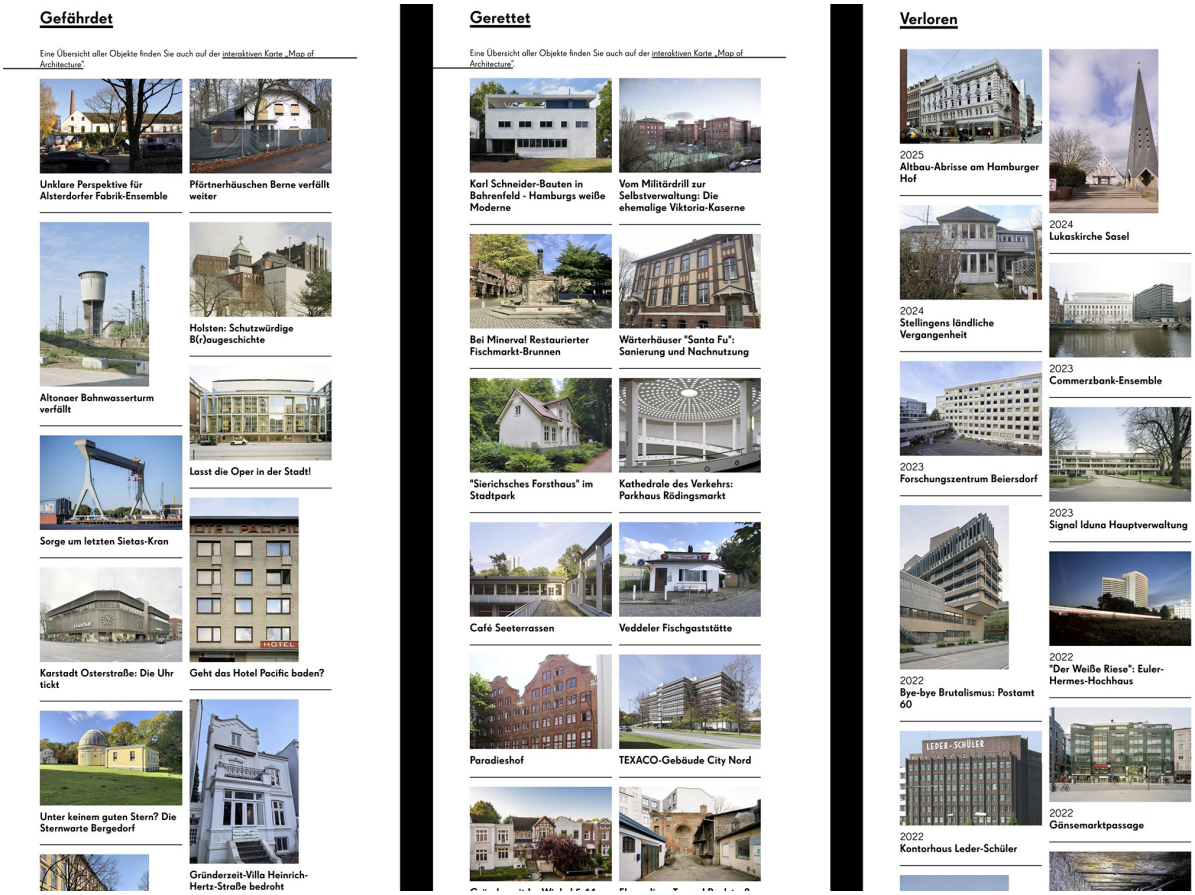

Figure 2. Database of buildings by Denkmalverein Hamburg (website screenshots, 2025). Source: Own.

4.2.2. Managing Vacancy and Building Components

In recent decades, many regions in Europe have been affected by the phenomenon of shrinkage due to demographic and economic changes. The resulting vacancy of historical buildings poses a significant challenge for municipalities, not only in the preservation of monuments but also in urban development (Knippschild et al., 2025; Veldpaus et al., 2019). Vacancies and vacant lots affect the cityscape and the subjective quality of life. It is not uncommon for demolitions to occur, encompassing both post-war housing estates and inner-city historic buildings, as seen in cities like Leipzig and Chemnitz (Nelle et al., 2017).

To counter the fatal logic of shrinkage and demolition with a perspective of preservation, representatives from HC and urban planning have called for a paradigm shift from "shrinking cities" to "waiting cities" (Sulzer, 2007, p. 23). The focus here is on the approach of understanding temporarily vacant buildings not as candidates for demolition, but as quiet resources for future revitalising urban development. These buildings should be actively preserved and structurally secured through appropriate measures.

Another instrument for the maintenance and activation of existing structures that has primarily developed over the past decade is known as vacancy management (Reichenbach-Behnisch et al., 2012). In this context, municipalities, particularly smaller and medium-sized towns, seek to establish a database on the available building stock to convey this information to potential users. Again, the aim is to interpret the vacancy of buildings not as an endpoint, but as a starting point for possible future development and to keep essential resources in reserve for this purpose. Evidence that vacancy management is not only effective in urban areas can be seen in examples from rural Franconia. Here, a state programme to promote inner urban development created incentives to actively manage building vacancies and infill development, thereby conserving resources and reducing land consumption (Bayerische Verwaltung für Ländliche Entwicklung, 2023). This has led to the emergence of a number of so-called municipal alliances, which actively integrate the tools of vacancy management and infill development into their local development strategies for a collective partnership of several municipalities. Founded in the early 2010s in particular, online research shows that many of the alliances are still active and continue to provide funding opportunities for individual and community-based development of vacant buildings (e.g., Hausnummer frei, n.d.; Innenentwicklungs-Immobilienportal des Landkreises Rhön-Grabfeld, n.d.-a; Rhönallianz, n.d.). The alliances, such as the Röhn-Grabfeld region, have set up a real estate marketplace on their web platform and present good practice examples for the restoration of historically valuable buildings. In Röhn-Grabfeld, these are primarily impressive examples of revitalised historic timber-framed buildings (Innenentwicklungs-Immobilienportal des Landkreises Rhön-Grabfeld, n.d.-b). Nevertheless, there is a considerable proportion of building plots for new construction projects in newly designated development areas on the web-based marketplaces—a practice that actually contradicts the aims of inner development (Innenentwicklungs-Immobilienportal des Landkreises Rhön-Grabfeld, n.d.-c).

Since 2022, the Denkmalnetz Sachsen (DNS) has been addressing the issue of vacant monuments, particularly in smaller towns and rural areas in Saxony, with the aim of bringing these monuments back into use. The focus of its work is on networking initiatives, supporting individual owners and heritage activists, and, in particular, offerings for widely accessible vocational training in the crafts. DNS sees its work as a contribution to the construction transition ("Bauwende"). In 2024, it launched the project "Bauteilbörse," which aims to create a platform for circular building in the field of monument preservation and to reconnect with the now-disappeared structures of component recovery and distribution (Wilson & Ditze, 2024). The DNS initiative aims to establish a framework for the procurement of already salvaged components. However, it is also important to consider how the salvage of components and materials can be carried out where they are generated—on the construction site and the building itself. Despite the many trades that have already specialised (again) in the technique of selective dismantling, in the view of many stakeholders, there are still numerous obstacles to the reuse of salvaged building components (Rudolph-Cleff, 2023, p. 147). The case of the Upper Palatinate city of Amberg illustrates which stakeholders and structural conditions can promote component management. This small urban community holds a significant ensemble of historic buildings with a characteristic roofscape (Stadt Amberg, 2014, p. 20). The proportion of roof

coverings made with historical, handmade tiles from the period between the 15th and 19th centuries is now only about 8.9% (Scherm, 2023, p. 36). To maintain this overall impression, and increasingly for reasons of resource economy and sustainability efforts, the local heritage protection authority regularly mandates the preservation of roof coverings during construction work. This means that the tiles must be salvaged, examined, and stored until they can be reused (Figure 3). The city of Amberg works closely with property owners and the State Office for the Preservation of Monuments, and utilises a local network of experts, including a tile specialist. In some projects, the city administration also supported the logistics of transporting and storing the salvaged tiles for its own buildings or arranging for their use on other construction sites (Scherm, 2023, pp. 39–40). However, due to technical reasons, such as the conversion of historical attics or high leakage requirements when insulating the roof, the reuse of roof tiles is often not feasible (Scherm, 2023, p. 54).

Figure 3. Salvaged tiles stacked on the roof of Georgenstraße 53b, Amberg, ready to be transported into storage (2023). Source: Courtesy of Jana Scherm.

5. Discussion and Conclusion

As introduced above, a central focus of the extended CE approaches, which are purported to have the strongest impact on local climate protection, is the preservation of material resources within the existing building stock. Strategies which promote this are, e.g., maintenance and an extended use of current buildings. Unlike the strategies of material-efficient new construction or the expansion of the recycling industry—both of which involve significant material transformations, energy-intensive processes, and consequently material-induced GHG emissions—maintaining the existing building stock has direct effects on resource conservation and GHG emission reduction.

It can be stated that modern HC strategies are closely linked to circular regimes of used building component management (Arlotta, 2019). However, the notion of HC and its principles as a strategy to generally prolong the life of buildings is still not the main focus of climate-related preservation research and political measures.

As a review by Foster and Saleh (2021) has shown, strategies for the adaptive reuse of cultural heritage buildings are hardly to be found in local efforts to build up CE structures. Instead, approaches and recommendations that aim to improve the energy performance of buildings as a contribution to climate protection still dominate (Burbat et al., 2024; Haas et al., 2021). Some in the HC community warn of the risks of a direct entanglement of both concepts, pointing out the importance of maintaining the cultural values of heritage objects. Roblee and Minner (2022, p. 52), for example, fear the loss of a sense of place and predict an even greater level of ecological costs. They compare the impact of CE on the built environment to the devastation of post-mining landscapes. With regard to the general concept, some researchers argue that CE approaches might overshoot the mark, due to their high theoretical differentiation and high number of participants (Weber & Jaeger-Erben, 2023, pp. 187–188). Huuhka and Vestergaard (2020, p. 6) suggest that the reluctance in HC towards the CE approach originates in the discipline's historic struggle for concepts such as authenticity and material integrity.

But is this the only reason? Our inquiry into the interplay of the HC and CE approaches leads us to conclude that there is a misperception of the different levels of consideration on which CE strategies are based and might be seen as relevant for HC. On the one hand, CE strategies are concerned with the entire building stock, claiming that every adaptive reuse project is a win. On the other hand, at the level of the individual building, CE strategies deal with building components, either for new construction or reuse. The reluctance to impose a strict CE policy on heritage buildings comes from the latter. To solve these issues, it might be helpful to change perspectives: CE and HC should not be viewed as two different and sometimes conflicting strategies next to each other. Rather, the focus should be on the similarities of both concepts at all scales and on overlapping strategies on the practical level. To address and actively resolve possible conflicts, it might be helpful to stick to the fundamental position of HC that the right strategy for transformation projects must always be determined on an individual object level. In this way, cultural values and the significance for the local and social context, among other aspects, can also be integrated into the project. Our case studies, focusing on various stakeholders, particularly at the mid and micro-levels and from bottom-up initiatives, have shown that there are ample opportunities to work towards the implementation of CE strategies. This does not mean that there is always a clearly defined framework for this. Rather, individual measures contribute to the CE strategies, especially in the sense of "closing" and "narrowing." To practically implement CE strategies in this manner, we suggest focusing on three areas of action:

1. *Networking of key stakeholders and actors*: Regardless of the need to adjust legal frameworks, enhanced networking and collaboration among various state and civil society actors holds significant potential. This pertains to the revision and monitoring of the inventory, the pooling of personnel and material resources for conservation, and the extensive field of vocational training. While this approach is shared and widespread in most of the heritage community, it is socially under-supported in general and suffers from the disappearance of locally established circular structures that once existed (Warda et al., 2024). Especially in the case of the new municipal alliances formed to implement vacancy management and to coordinate infill development, stronger ties with HC actors could increase the effectiveness of the approach. As HC is supposedly associated with a limited economic or industrial dynamism, it is important for all stakeholders to point out the shift in value creation from industrially driven processes towards artisanal structures on the local level.
2. *Build on resource value*: The greatest potential in the integration of HC and CE concepts lies in the recognition of a material resource value. HC with a focus on material values can provide a

well-established set of strategies to prolong the life of buildings. For example, preserving the existing building stock, applying minimal interventions for maintenance, repair, and reuse, and using materials from within existing circles (this may include salvaged building components or materials from heritage buildings which could not have been maintained in place). Also, focusing on the longevity of buildings avoids lengthy construction sites and thus has a direct effect on the urban fabric and quality of life. The mapping of the building stock by bottom-up initiatives, as we have shown, might bring in a fresh take on the resource issue. It illustrates the fate of the building stock and can help to raise awareness, almost in the manner of an architecture guide, of how fast the built environment changes and what mass of high-quality built space is being demolished every day. In turn, the databases bear eloquent witness to the potential of the CE approach, but at the same time point to the continuing lack of effective ways of protecting existing building stock resources in order to revitalise them. The databases that are created from an HC perspective could complement the approach of the so-called material cadastres which aim to collect building material indicators for the building stock in order to calculate their global warming potential (Schinke et al., 2025).

3. Finally, a regional policy and spatial planning perspective is required: These include approaches to increase the attractiveness of cities and regions for newcomers, such as improved interregional accessibility, a stable educational and cultural infrastructure, and an open and tolerant urban society (Zöllter et al., 2024). If the dynamics of economic and demographic development, purchasing power, and demand for residential space to be converted are lacking, the above considerations will be difficult to apply in practice. At the moment, rental income in shrinking or shrunken regions, and in municipalities with significant vacancies, often does not cover the costs of refurbishments that are in line with the protection of listed buildings and, e.g., energy efficiency. This is why funding is needed for the integrated consideration of CE and HC for local authorities, owners, and other stakeholders in order to close the gap between the necessary investments and the revenue to be generated. In addition to the financial strain, the complexity of revitalising vacant, historical, and listed buildings is often an obstacle to their reuse (Ghoz, 2025). This requires approaches to providing information and reducing complexity, such as tools for standardisation or consulting services for professionalisation.

While the findings of the article predominantly pertain to the German landscape of HC actors, it remains uncertain how they might manifest on a European scale. This warrants further investigation in subsequent project-based research.

Conflict of Interests

The authors have previously published research articles in collaboration with employees of the Denkmalnetz Sachsen (DNS), a case study discussed above.

LLMs Disclosure

LLM tool HAWKI (an inter-university application programming interface to OpenAI; complies with academic data protection regulation and does not use data for LLM training) was used to improve grammar and style.

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About the Authors

Johannes Warda is senior lecturer in Historic Preservation at the University of Bamberg. Before, he has held research and teaching positions in Weimar, Dresden, at Akademie der bildenden Künste Wien, and FH Erfurt. His research focuses on the history and theory of architecture and preservation, sustainability, and building materials and resources.

Georg Schiller is head of the Anthropogenic and Natural Resources research group at the Leibniz Institute of Ecological Urban and Regional Development (IOER). He received his doctorate from the Brandenburg University of Technology Cottbus-Senftenberg with a focus on urban development and infrastructure adaptation.

Robert Knippschild has been the head of the Interdisciplinary Centre for Transformative Urban Regeneration (IZS) at the Leibniz Institute of Ecological Urban and Regional Development (IOER) since 2016. He is a university professor at the International Institute (IHI Zittau) of Technische Universität Dresden.