

SUSTAINABILITY-ORIENTED ARCHITECTURE: ADAPTIVE REUSE OF RELIGIOUS HERITAGE

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Abstract. *The growing demand for sustainable practices in all domains and the need for change in how we use resources, have been reflected recently in a larger body of research dedicated to sustainability. The construction sector is often perceived as one of the most important raw materials and waste generators consumers. Today, when reflecting on what makes a culture sustainability-oriented, we need to consider what activities the decision-makers and other stakeholders are developing into a community. Architects are among the most important stakeholders in building sustainable communities and cultures. Sustainable architecture seeks to minimize the negative impact of buildings on the environment through efficiency and low-carbon footprint materials, energy sources, and at large, all the elements of the ecosystem necessary for building development. Nowadays, many architects and constructors integrated sustainable practices into their processes, and adaptive reuse of existing buildings is such a practice, embodying some circular economy practices. The conservation of such buildings has multiple economic and environmental benefits. Within this context, religious heritage buildings hold a unique advantage for positive impact on communities when it comes to building a sustainability-oriented culture through preservation works and adaptive reuse. However, specific recommendations for the sustainable repurposing heritage religious sites derived from adaptive reuse have not yet been formulated. This study outlines positive adaptive reuse practices and opportunities for sustainable development of communities hosting old religious buildings. Currently, the literature dedicated to repurposing religious sites is scarce and does not clearly present positive circular economy practices when it comes to adaptive reuse. Through a mixed methods study of 23 papers, studies, and dissertations related to repurposing religious sites, published in the past thirty years, the research identified multiple adaptive reuse practices, positively impacting the environment and communities, and opportunities to develop sustainability-oriented communities. The findings can serve as a guide to creating a framework for the sustainable development of communities with old religious sites. This research is part of a two-stage study dedicated to opportunities and challenges in the adaptive reuse of religious heritage buildings within the context of the circular economy.*

Keywords: *adaptive reuse, heritage buildings, religious buildings, repurposing, sustainability-oriented culture, sustainable development, sustainability-oriented architecture.*

Introduction

Today, we seek to reduce the number of resources extracted and waste through sustainability-oriented strategies which we employ in various domains. The architecture and construction sectors are often seen as some of the most important raw materials and waste generators consumers. In this context, heritage religious buildings are uniquely positioned in the urban and rural landscape by embodying cultural and historic features that define communities. Preservation works to conserve such sites hold economic and environmental advantages and benefits (Arlotta, 2018).

When reflecting on what makes a culture sustainability-oriented, we need to consider what activities the decision-makers and other stakeholders are developing in the community. Architects are among the most important stakeholders in building sustainable communities and cultures. Sustainable architecture seeks to minimize the negative impact of buildings on the environment through efficiency and low-carbon footprint materials, energy sources, and all the elements of the ecosystem necessary for building development. Nowadays, many architects and constructors integrated sustainable practices into their processes, and adaptive reuse of existing buildings is such a practice, highly appreciated for embodying circular economy practices. Within this context, religious heritage buildings hold a unique advantage for positive impact on communities regarding preservation works and adaptive reuse.

This study aims to understand the practices and opportunities for sustainability-oriented architecture arising from the adaptive reuse of heritage religious sites. Romania has about 5,700 protected religious sites, under which 24 are UNESCO flagships (Future for Religious Heritage, 2021). We know that at least 150 religious heritage buildings based in the south-east Transylvania region, in Romania, are five hundred years old, and are waiting for a new purpose. We seek to validate the hypothesis that adaptive reuse techniques for religious sites employ multiple environment-beneficial practices and therefore present opportunities for growing sustainability-oriented communities, and cultures that we should study and promote. The results aim to prove that is possible to positively associate preservation and efficient waste management, opposite to preservation and waste generation, most often associated with architecture projects. No previous research has compiled a list of positive-impact practices when repurposing religious buildings and has not formulated potential opportunities to develop sustainability-oriented communities.

To serve this purpose, the authors performed a literature review of what is done in religious sites revival with adaptive reuse. Through a review of 23 papers, studies, and dissertations published in the past 30 years, the authors seek to present a picture of the opportunities for building sustainable-oriented cultures in those communities where religious sites are being repurposed. The study will also emphasize which environmentally positive practices embody circular economy practices.

The research was organized into four parts: first, the literature review establishes for the reader the status quo of research related to the adaptive reuse of religious heritage buildings. Second, the authors present the methodology employed to identify the practices and opportunities of adaptive reuse, focusing on what is being said and done, how much is being said and done, and who is part of the adaptive reuse process. Third, the authors analyze the data collected by dividing the positive-impact practices

identified into six categories and diving into each. A series of positive environmental and community impact opportunities were further identified. Last, recommendations for developing sustainability-oriented architecture repurposing projects related to religious sites were formulated.

Literature review

Resource consumption and waste generation in architecture and construction were stimulated by globalization, a linear consumption-based model. Both domains need innovative and sustainability-oriented practices, as they consume raw resources and contribute to waste creation (Arlotta, 2018; Davey, 2021). Rethinking what value is and how to seek it, and encouraging reuse is vital for waste reduction and resource depletion. To adapt to the circular economy environmental-economic factors, stakeholders such as policymakers, investors, architects, and others explore the circular economy processes and redesign buildings within a circular framework for materials use and reuse (Rose, 2019; Haroun et al., 2019).

The heritage buildings are rich in waste reduction efforts. When engaging with heritage places revival, there are a few directions to follow: preservation, which is rehabilitation to maintain a building and all the changes incurred during its lifetime, opposite restoration, which returns a building to its form at a certain time. Apart from these two directions, conservation is another practice that involves an intervention into a building's design to ensure structural integrity related to new foundations, brick repointing, and the reassembly of scattered or fractured pieces. Adaptive reuse is a process of using an old building for a new, different purpose, by changing interior design plans and new construction, and as a result, a new form and function will be integrated into the community. For example, an important characteristic is maximizing the reuse and retention of existing materials and structures (Foster, 2021; Shahi et al. 2020; Arlotta, 2018; Plevoets & Van Cleempoel, 2011). Based on these premises, adaptive reuse could support the development of more sustainable material supply chains: local renewable materials, and recirculation of existing materials (Rose, 2019; Arlotta, 2018).

In architecture, the sustainability-oriented concepts associated with the adaptive reuse approach encourage the reuse of architectural elements and materials in site preservation. However, the relationship between the concept of a sustainability-oriented economy and the reuse of architectural elements can be further developed by examining the literature connected to the existing practices in the field, and its advantages and challenges. Adaptive reuse faces multiple challenges: first, limited engagement in heritage and preservation literature has been noticed with topics connected to the circular economy (Haroun et al., 2019). Second, decision-makers lack knowledge of adaptive reuse environmental and economic benefits and are not equipped with the tools to implement these projects. Third, the recent European Union Green Deal strategy asserts the need for architecture, engineering, and construction to develop more sustainable practices to address economic and environmental challenges through better building material reuse. Fourth, designing or redesigning for the circular economy encounters multiple challenges: lack of innovative features of architectural solutions, absence of adequate standards, ineffective new business models, longer design phases, and additional costs (Kozminska, 2020). Even though the conservation of such buildings has multiple economic and environmental benefits, recommendations

for the sustainable development of heritage religious sites derived from adaptive reuse have not yet been formulated.

Methodology

The research draws from a comparative approach. The paper reviews the literature on the architectural preservation of religious heritage buildings where the adaptive reuse technique has been employed. To identify relevant literature, the researchers have collected papers and studies identified through extensive research of papers and studies where topics such as: adaptive reuse, repurposing of old buildings, religious sites, heritage sacred places, and repurposing were discussed. The inquiry was done in Web of Science, ScienceDirect, Directory of Open Access Journals, and JSTOR, Sustainability - An Open Access Journal from MDPI. The search for relevant publications was initialized with no period limits. However, after entering the keywords, the search results produced literature from 1991 to 2022. Therefore, to get insight in the scholarly literature on the adaptive reuse of religious and cultural buildings, we reviewed contemporary literature published in the past thirty years (figure 1).

As can be seen in figure 1, the most important body of literature was published within the past eight years, which may coincide with the development of the circular economy concepts and practices.

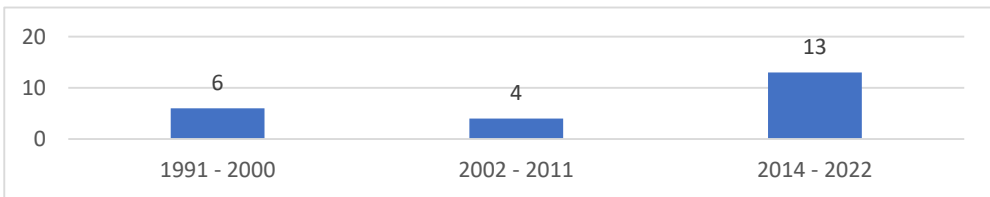


Figure 1. The body of literature related to architectural preservation of religious heritage: number of works and publishing timeline (Authors' own research)

Additional title screening, abstract, and keywords were conducted in the body of literature selected, and studies relevant to this study and objectives were selected. After the screening, a total of 23 publications met the criteria. Moreover, we made this inventory, where we characterized the literature by country of origin of the university where the researchers are affiliated, and the publishing year, to identify who is treating the subject and in which areas of the globe (table 1).

Table 1. Literature related to adaptive reuse of religious heritage (Source: Authors' own research)

Author(s)	Paper, dissertation, report title	Country of researcher(s)'s university	Year of publication
The European Network for historic places of worship	Adaptive Reuse of Fortified Churches in Transylvania: Challenges and Opportunities	Belgium	2022

Vaida, E.	Report on the restoration of historic roofs of church monuments Saxon fortifications from Transylvania	Romania	2022
Interreg Europe	Adaptive reuse of religious heritage	Europe	2021
Gholami, G., Heidari, S., Hanachi, P.	Conservation and reuse of architectural heritage, an approach based on energy efficiency	Iran	2021
Foster, G. and Saleh, R.	The Adaptive Reuse of Cultural Heritage in European Circular City Plans: A Systematic Review	Austria, Belgium	2021
Dongez, N., Manisa, H., Basdogan, S.	Tendency to Circular Economy: Reuse of Architectural Elements	Turkey	2021
Akande, O.	Improving Environmental Sustainability in Reuse of Some of England's Churches: Challenges and Options for Sustainable Practices	Nigeria	2021
Huuhka, S. and Vestergaard, I.	Building conservation and the circular economy: a theoretical consideration	Finland, Denmark	2020
Iodice, S., De Toro, P., Bosone, M.	Circular Economy and adaptive reuse of historical buildings: an analysis of the dynamics between real estate and accommodation facilities in the city of Naples (Italy)	Italy	2020
Lo Faro, A. and Miceli, A.	Sustainable Strategies for the Adaptive Reuse of Religious Heritage: A Social Opportunity	Italy	2019
Haroun, H., Bakr, A., Hasan, A.	Multi-criteria decision making for adaptive reuse of heritage buildings: Aziza Fahmy Palace, Alexandria, Egypt	Egypt	2019
Rose, C.	Systems for reuse, repurposing, and upcycling of existing building components	United Kingdom	2019
Arlotta, A.	Locating Heritage Value in the Reciprocal Relationship Between Preservation and Waste Management	United States of America	2018
Amayu, E.	New Uses for Old Churches: An Examination of the Effects of Planning Regulations on the Adaptive Reuse of Church Buildings	Canada	2014
Lueg, R.	Approaches to the Adaptive Reuse of Churches in Germany and the United States	United States of America	2011
Ahn, Y.	Adaptive reuse of abandoned historic churches: building type and public perception	United States of America	2007
Park, SC.	Respecting Significance and Keeping Integrity: Approaches to Rehabilitation	United States of America	2006
Douglas, D.	Building Adaptation	United Kingdom	2002
Latham, D.	Creative Re-use of Buildings	United Kingdom	2000

Sharp, D.	Modern Architecture's Place in the City: Divergent Approaches to the Historical Core	United Kingdom	1998
Byard, PS.	The Architecture of Additions	United States of America	1998
Murtaugh, W.	Keeping Time: The History and Theory of Preservation in America	United States of America	1997
Denslagen, W.	Architectural Restoration in Western Europe: Controversy and Continuity	the Netherlands	1994
Robert, P.	Adaptations: New Uses for Old Buildings	United States of America	1991

Most of the literature resources have origin in Europe, followed by the United States and the United Kingdom, Egypt, Iran, and Canada. Moreover, this characterization points out the geographical areas where adaptive reuse is not being discussed yet: Latin America, Australia, and Asia. Each source in table 1 was read by both researchers, followed by a classification of the data from each source, mainly the researchers retained the positive practices of adaptive reuse related to the impact on the environment and people considered as opportunities for sustainable growth. The data was roughly introduced in an excel file, as it was presented in each piece of the body of literature selected. After a second reading of the data collected, sub-categories emerged, and the researchers continued to rearrange the data into sub-categories according to what was specifically said.

In terms of positive practices, six sub-categories were identified (figure 2) and further analyzed.



Figure 2. Practices identified for adaptive reuse of heritage buildings: division into sub-categories (Authors' own research)

Results and discussion

When looking into positive practices related to adaptive reuse, the choice of location for the religious site where adaptive reuse was done, was given to buildings located in popular, safe, tourists-preferred areas. So, in areas perceived as travel destinations, repurposing the religious site for a new function to serve the tourists (table 2) was a clear choice. Moreover, functional infrastructure is an important factor when making the choice to repurpose an old religious site.

Table 2. Adaptive reuse of religious heritage practices: location, function and form, standards
(Source: Authors' own research)

Areas of concern	Practices	Literature
Choice of location	monuments located in popular and safe travel destinations for foreign and domestic tourists;	The European Network for historic places to worship (2022);
	infrastructure in place (roads, electricity, gas, water, sewage, healthcare services, schools, telephone reception and internet);	The European Network for historic places to worship (2022);
Function and form	community centre, charitable uses - most preferable, civic roles, recreational uses, commercial uses, and residential use; university campus; order defined by the extent of a church's association with the public as well as its original spatial characteristic; mountaineering facilities and restaurants;	Latham (2000); Douglas (2002); Lueg (2011); Interreg Europe (2021); Ahn (2007);
Standards for rehabilitation	minimal alteration and compatible use as ways to keep the integrity; architectural integrity: style, workmanship, setting or location, materials, building type or function, and continuity; the original integrity should not be impaired when new additions;	Ahn (2007); Murtagh (1997);
	preservation of the building's distinctive architectural styles;	Ahn (2007);
	the examination of historic properties (e.g. significant materials, cultural characters, time periods, and physical features and conditions) is part of the decision-making process;	Park (2006);

When readapting the function of a religious site, it has noted in the literature that the new functions preferred are community center, charitable enterprise, a civic function,

or recreational use, commercial use, residential use, university campus, or mountaineering facilities and restaurants (table 2).

In terms of standards for rehabilitation, the literature sources have mentioned several opportunities concerning the development of standards so these can support minimal changes so that the integrity and originality of the building should not be altered (table 2): preserving the architectural integrity of the site, of the building's style. Some recommendations are as follows: original integrity should not be impaired with new additions, and the examination of historic properties should be part of the decision-making process.

Stakeholders are key for generating opportunities for the adaptive reuse of religious heritage buildings. The literature review related to stakeholders connected to the topic, allowed us to conclude that stakeholders want, within the process of adaptive reuse, to minimize the material use and energy waste, to employ old techniques with the support of local manufacturers with positive effects on the local economy (table 3).

Table 3. Adaptive reuse of religious heritage practices: stakeholders and incentives (Source: Authors' own research)

Areas of concern	Practices	Literature
Stakeholders	the minimization of material use and energy waste; produce missing materials using the old techniques with local manufacturers, support the local economy;	The European Network for historic places to worship (2022); Interreg Europe (2021); Vaida (2022);
	common collaborative living and working; engaging local entrepreneurs in the design of the new uses of the fortified churches (using local and regional craftspeople for the furnishings, amenities and décor of the apartments;	The European Network for historic places to worship (2022); Arlotta (2018);
	municipality influence and support adaptive reuse (Responsibility for changing the buildings' function in the zoning plan, keeping a digital database of heritage sites, providing financial support;	Interreg Europe (2021);
Incentives	Tax reductions;	Lueg (2011); Arlotta (2018);

Moreover, we have observed that there are opportunities of involving local entrepreneurs in rethinking and design of the new scope through adaptive reuse. It is important to include the municipalities in the process since they have the responsibility and means to change the zoning plan and even provide financial support (table 3). As for incentive opportunities, it has been mentioned that tax cuts can contribute to adaptive reuse.

With the adaptive reuse concept, preserving religious heritage buildings is pulling the circular economy practices to light (table 4). The opportunity to align to circular economy practices is given by reusing various materials and natural processes adapted to serve the new building scope. Minimal interventions and efficient, green processes are recommended: natural ventilation solutions, environmentally friendly wastewater management, energy-saving solutions, and campaigns targeting the building users (table 4).

Table 4. Adaptive reuse of religious heritage practices: circular economy practices (Source: Authors' own research)

Areas of concern	Opportunities	Literature
Design: circular economy practices	designing a non-conflicting and non-invasive use;	The European Network for historic places to worship (2022);
	the use of traditional materials, reused materials, natural ventilation solutions, environmentally friendly wastewater management, minimal intervention on the natural landscape, etc;	The European Network for historic places to worship (2022); Interreg Europe (2021); Lo Faro and Miceli (2019); Arlotta (2018);
	actively engage users and visitors in an energy saving campaign, introduce energy management systems and making building services such as heating and lighting more efficient;	Akande (2019);
	Integrating building management systems into any proposed retrofitting projects (monitoring and controlling the heating, cooling and lighting systems as well as ventilation systems); movement or occupancy sensors as part of a wider building management system; behavioral change of the users should be targeted by making real time information about energy use available; employees energy behavior change (training); on-site energy from renewable (e.g. air-source heat pumps, ground source heat pumps, biomass boilers, etc.); the professionals involved in heritage buildings retrofitting projects, such as architects, installation engineers, building surveyors etc., should include services such as analysis of whole life costs and carbon savings in services they provide to support the justification of the investment	Akande (2019);

	keep old materials in use and produce the needed materials with local manufacturers who ancient techniques	Vaida (2022);
	all types of approach require a respect for the existing fabric and a “cautious approach of changing as much as necessary but as little as possible”	Lueg. (2011);
	reusing existing buildings is already becoming economically attractive due to the optimization	Lo Faro and Miceli (2019);

An important focus is put on developing solutions for efficient building management solutions. To conclude, reusing existing buildings is part of circular economy practices (Lo Faro and Miceli, 2019). Nowadays, the acceleration of urbanization and the increase in building production and utilization, has accelerated gas emissions which have increased by 45% in the past thirty years (Ahmed Ali et al., 2020).

Last, a list of opportunities (figure 3) for sustainability-oriented activities can be derived from positive practices in adaptive reuse.

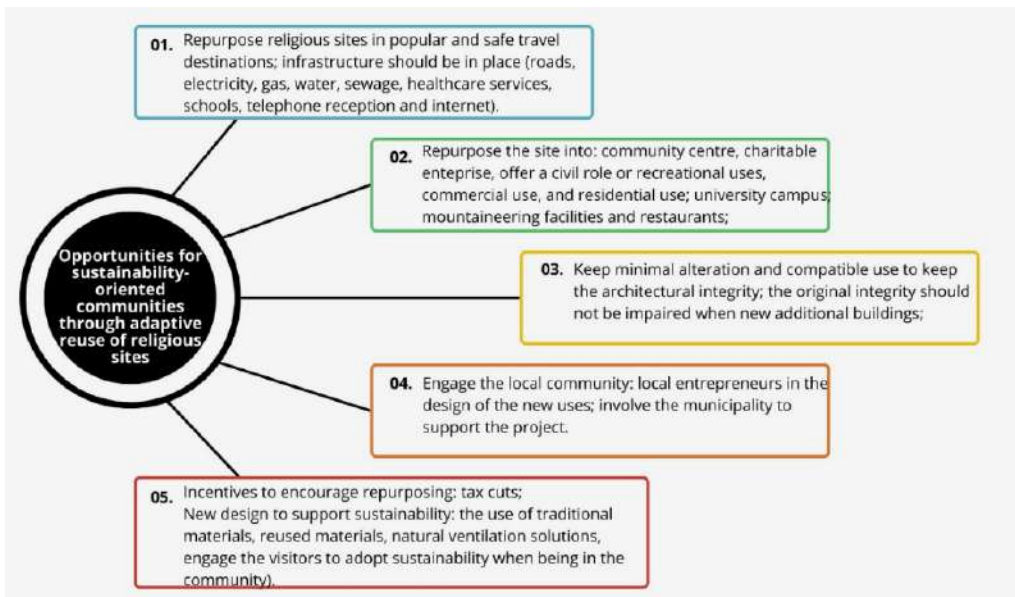


Figure 3. Opportunities for sustainability-oriented communities through adaptive reuse of religious sites (Authors' own research)

The authors conclude that in practice, we have already validated activities from adaptive reuse which positively impact the environment and, therefore, within the communities where these projects are hosted.

Conclusions and recommendations

Many papers recognize that adaptive reuse of religious heritage presents challenges and opportunities. In this paper, we discuss only the environmentally positive practices with adaptive reuse, with the aim to formulate a list of opportunities related to repurposing heritage buildings, which should be followed to stimulate the creation of sustainability-oriented communities. To sum up, stakeholders from a community hosting a heritage religious site should pay attention to a few subjects when repurposing old religious buildings: the choice of location, what the new function given through repurposing, how is new design corroborated with the new function, and architectural features, how to engage stakeholders to benefit the project and what incentives to offer to stimulate sustainability-oriented results.

This study is not without limitations; thus, the limitations concern the number of papers and studies analyzed, and the databases investigated for data collection. Second, 22 of the 23 documents analyzed were published in English, and one in Romanian. There might exist some publications in the field of adaptive reuse outside the English language which, if identified and considered, could contribute to the research's perspective.

Future research directions should investigate circular economy policy instruments set out in the European Green Deal, the European Union's framework for a circular economy for religious site preservation. The authors recommend expanding the body of knowledge for further analysis by including all literature on adaptive reuse, not only adaptive reuse for religious sites, to identify an expanded list of positive practices related to sustainability-oriented buildings and communities. However, the study presents a detailed methodology for the selected documents.

Developing a framework for sustainability-oriented communities based on sustainability-oriented architecture is necessary for this age where efficiency and reuse are key for developing sustainability-oriented communities and cultures.

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