



## Article

# Adaptive Reuse in the Realm of Architecture: Global Research Trends and Gaps for the Future Studies

Berkhan Kahvecioğlu \*  and Semra Arslan Selçuk 

Department of Architecture, Faculty of Architecture, Gazi University, 06560 Ankara, Turkey; semraselcuk@gazi.edu.tr

\* Correspondence: berkankahvecioglu@gmail.com

**Abstract:** The effort to preserve historic buildings for the future has always been on the agenda of experts on local and global scales and been supported by many initiatives and strategies. Within the scope of this research, the concept of “adaptive reuse” which is often preferred as a conservation strategy for historic buildings, is discussed. The focus is on the adaptive reuse studies of historic buildings in literature that have managed to physically survive in the face of changing conditions; comprehensive and systematic research with a bibliometric analysis is presented. The study has been scanned in the Web of Science database under the heading “Title/Abstract/Keywords” and the data has been analyzed in detail with the VOSviewer program. The findings indicate the research trends in the literature and gaps for the future research. The results highlight the innovative approach for historic buildings in the context of the adaptive reuse strategy and present the field’s challenges, limitations and opportunities. It is expected this study will help researchers and policymakers to understand the evolutionary implications of conservation strategies and develop other theoretical and practical initiatives to be applied in this field.

**Keywords:** adaptive reuse; global research trend; architecture; bibliometric analysis; cultural heritage



**Citation:** Kahvecioğlu, B.; Arslan Selçuk, S. Adaptive Reuse in the Realm of Architecture: Global Research Trends and Gaps for the Future Studies. *Sustainability* **2023**, *15*, 9971. <https://doi.org/10.3390/su15139971>

Academic Editors: Wojciech Bonenberg, Beata Nowogórska and Leonard Runkiewicz

Received: 24 March 2023

Revised: 26 April 2023

Accepted: 20 June 2023

Published: 22 June 2023



**Copyright:** © 2023 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

## 1. Introduction

From past to present, cities have undergone many changes along with all developments. In addition to political, social, demographic and economic events in different periods, technological developments especially in the last century have directly affected the city’s physical change. This situation has resulted in drastic changes in its needs and demands. Among these, the discipline of architecture and engineering took first place and serious strategies were developed for the city’s sustainability, especially with existing building stock.

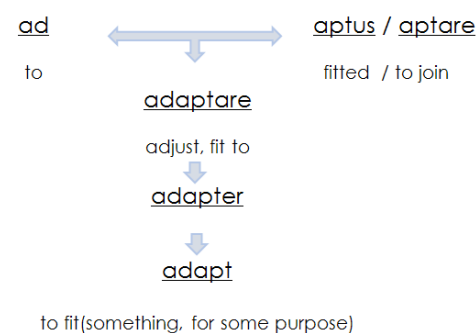
To ensure the social and economic sustainability of existing buildings, it is necessary to estimate their service life and manage and renew investment and construction activities with new strategies. For this reason, it is expected to comprehensively assess the technical condition (strengthening, infrastructure, etc.) of these buildings to meet the current and expected needs of the society, and to carry out studies such as modernization to the architectural and social environment (modernization share). Thus, it will become more possible to establish the building’s place in the lifecycle and its relationship with other parameters.

The effort to sustainably transfer cultural heritage has caused buildings of historical value to gain popularity today. Adaptive reuse (AR), considered as a strategy, is frequently used in the revitalization of heritage buildings. As a result of these correct, rational and effectively coordinated strategic decisions, the historic buildings that have been physically renovated and modernized have also enabled the collective memory, values and history of society to be kept alive.

With global change, applied to historic buildings economic, political, social etc. the pressure has strengthened strategies for preserving architectural and historical values.

Global perspective was gained by moving away from a single building scale. Therefore, based on their historical value, all heritage buildings on a global scale represent a universal set. The General Conference of the United Nations Educational, Scientific and Cultural Organization meeting in Paris from October 17 to 21 November, 1972, at its seventeenth session supported this universality: “Some parts of the cultural or natural heritage is of extraordinary importance, and therefore should be protected as part of the world heritage of mankind as a whole ...” and “Given the magnitude and seriousness of the new dangers that threaten them, it is the duty of the international community as a whole to participate in the protection of cultural and natural heritage of outstanding universal value by providing collective assistance ...” [1].

The fact is the historic physical elements, which continue to stratify, are under the threat of degradation and extinction in the process, which is directly linked to loss of local culture and collective memory. To prevent this situation, changes have been made in conservation policies, and many strategies and policies have been developed on global and local scales. One of these policies—AR—is preferred. The word adaptive is based on the French and Latin languages by origin (Figure 1). Old French has the word “adapt”, which means to fit (something, for some purpose), and Latin has the word “adaptare”, which means to adjust/fit to [2].



**Figure 1.** Word origin development [2].

Many institutions and organizations have conducted studies to implement the AR perspective of heritage buildings with convenient strategies and taken the same approach with similar items. One of them, the International Charter for the Conservation and Restoration of Monuments and Sites [Venice Charter 1964], states in Article 5: “The protection of monuments, always use them for socially useful purpose is facilitated. Therefore, this type of use is desirable, but it should not change the layout or decoration of the building. Only within these limits can the changes required by a change of function be foreseen and allowed.” Within the framework of this understanding, it is observed that reuse is allowed and the points to be considered are conveyed in a general framework [3].

The value and meaning of historical buildings from the time they existed to the present day are revealed thanks to their concrete representation today. But apart from the physical meaning and value of these buildings, one important situation is that these buildings constitute a critical component in sustainable development. While listing the advantages of reuse, Merlino [4] points out that the consumption of energy, electricity and materials during the construction process of a new building is higher, and also the amount of waste generated during the demolition of historical buildings can cause an environmental crisis and climate change. Therefore, no matter how far the developments in the construction industry have progressed, AR is an important strategy that can benefit in the face of environmental problems. Like Merlino [4], Stone [5] approaches the subject in a concrete way by considering examples of architectural interventions performed on existing buildings. While Stone [5] focuses on current issues that support reuse, Jacobs [6] also makes many criticisms by depicting the reconstruction of modern cities in the 20th century. According to Jacobs [6], especially the new project applications in the planning of cities are

attributed not as the reconstruction of the city, but as the plundering of the city and refute the city.

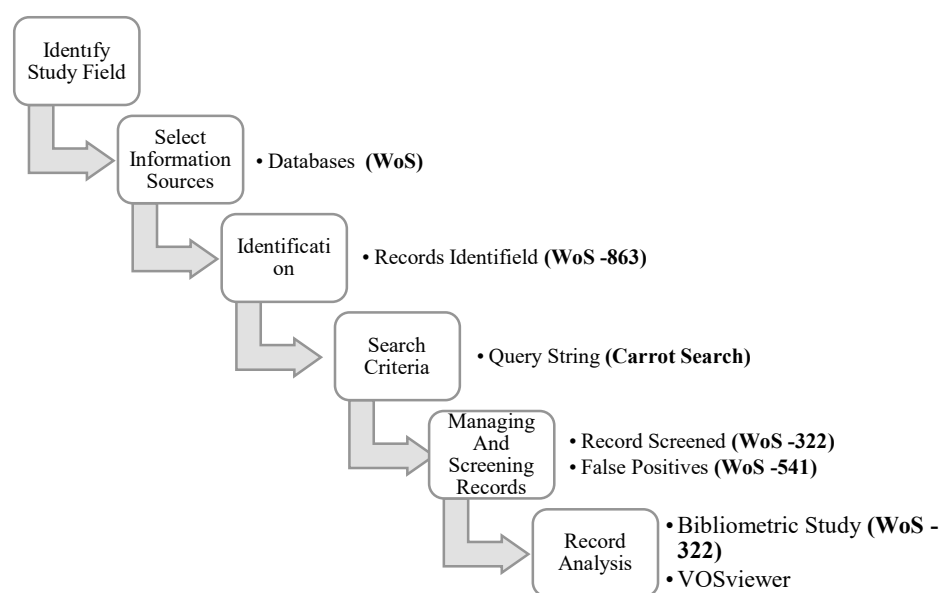
This study attempts to reveal the latest status of the AR strategy in current literature (in the cultural heritage), the development process and trends in research from the past to present by means of bibliometric literature analysis. Therefore, the research topic aims to provide an overview of strategic approaches to the reuse of heritage buildings with different analyses and to create an important reference source for other scientific studies.

## 2. Research Methodology

While bibliometry deals with analysis of literature using mathematical or statistical methods, it measures and evaluates scientific productions with different methods and extracts objective data. Nowadays, due to many scientific/technical journals and research areas, the bibliometric technique has gained importance and research trends in the discipline have become traceable [7]. Therefore, bibliometric analysis studies are of great importance in analyzing the scientific activities of researchers, institutions, regions and countries then determining research trends.

### 2.1. Data Collection Strategy (Database, Keywords, and Inclusion Criteria)

Before starting a comprehensive bibliometric analysis, it is necessary to correctly take screening process steps. For this purpose, a step map has been determined in which the research approach—that is, the framework—is summarized (Figure 2).



**Figure 2.** Research framework/approach.

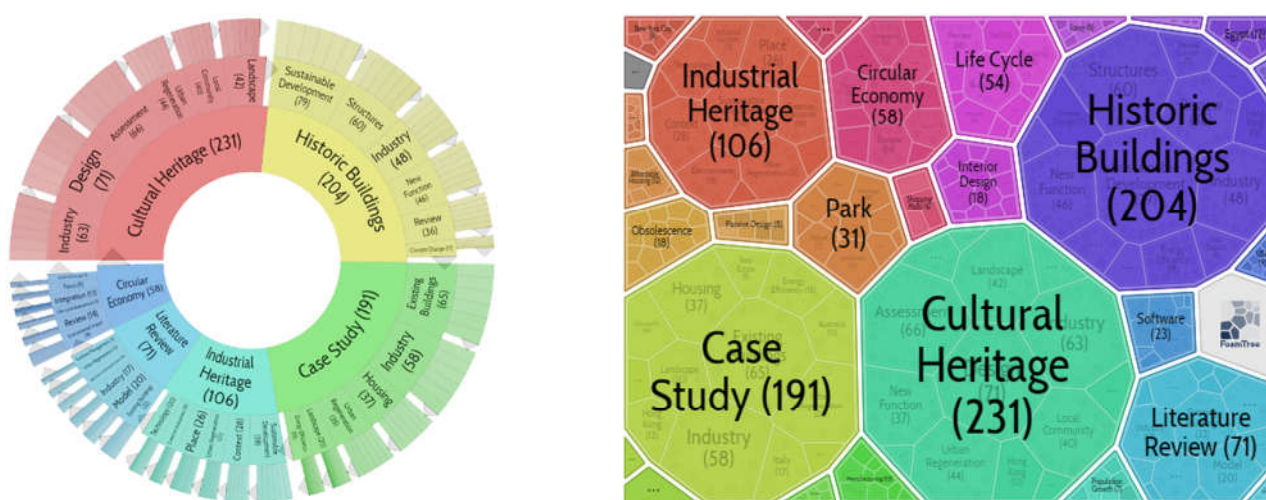
There are several well-known databases in the research world. For example, while Web of Science (WoS) and Scopus databases handle multidisciplinary research, databases such as MEDLINE, AGRICOLA, ERIC and PubMed keep the subject more private. The scientific literature within the framework of the AR concept, which is available in the WoS multidisciplinary database and accessible through the Gazi University (Ankara) library, has been analyzed by a bibliometric study. The study is not an assessment of the qualities of the studies contained in the database but reveals the descriptive and qualitative data on the flow of the AR concept from yesterday to today.

Determining the keywords that form the research topic and grouping the results into clusters by analyzing the literature is an important approach. Therefore, to reveal the connection of the AR concept, which is the research subject, with the key concepts in the literature and to identify the key concepts within the scope of the research, the Carrot

Search web interface (<https://search.carrotsearch.com>, accessed on 15 November 2022) was used.

Carrot Search is an analysis program that allows clustering (categorization or grouping) of research documents or information taken from web content depending on their similarities. This preliminary analysis increases the accuracy of the research. In this way, the researcher can analyze dynamic and more specific topics through a general topic [8].

A preliminary review of the phrase “adaptive reuse” or “adaptive re-use” was made under the “Title/Abstract/Keywords” heading via the selected database, the WoS. No restrictions were imposed during the interrogation to determine with which disciplines and keywords the subject was studied together in the international literature. As a result of the scan, 863 documents were reached. The documents were printed out in Excel and clustering analysis was performed with Carrot Search. The results are shown in the visual information map (Figure 3). The size and angles of the bubbles in the figure represent the relationship with the subject and number of documents.



**Figure 3.** Auxiliary concepts discussed with the concept of AR in the WoS.

According to Figure 3, there are 29 bubble themes (clusters). The different distribution and size of bubbles are easily observed and the focus is on specific concepts. AR is another result of the analysis in which the research content is widely used with the concepts of Cultural Heritage, Historic Buildings, Case Study and Industrial Heritage.

In research areas (Figure 4), the discipline of architecture (199 documents—23.09%) is in the foreground. The other research areas in the top five are Environmental Sciences Ecology (185 documents—21.46%), Science Technology Other Topics (156 documents—18.10%), Engineering (153 documents—17.759%) and Construction Building Technology (135 documents—15.66%). The fact there are several studies in engineering, economics and ecological fields apart from the discipline of architecture, indicate the subject has been widely covered and gained an important place numerically.

The search query was scanned in the “Title/Abstract/Keywords” headers of the WoS core collection. The interrogation was conducted on 15 November 2022. The scanned words were carried out in parallel with the preliminary analysis result (Carrot Search). A query strategy based on keywords was determined: (“adaptive reuse” or “adaptive re-use”) and (“cultural heritage” or “historic building” or “historic buildings” or “historical building” or “historical buildings” or “industrial heritage” or “heritage building” or “heritage buildings” or “architectural heritage”). The 863 documents scanned and obtained in the preliminary analysis were re-examined in the Title/Abstract/Keywords headings with the identified keywords. As a result of the search, 414 documents were flagged. After that, scanning was completed with 322 documents by limiting them under the ‘article’ heading from the ‘document type’ option (Figures 5 and 6).

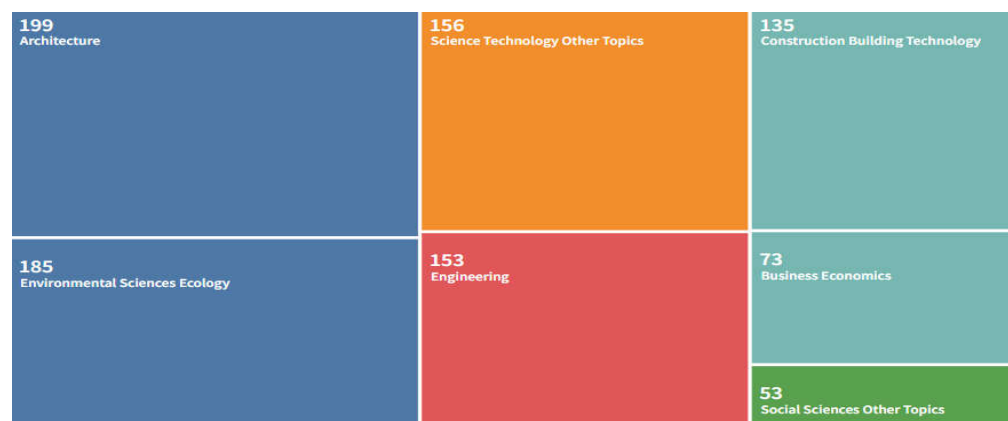


Figure 4. Research areas where the concept of AR is discussed in the WoS.

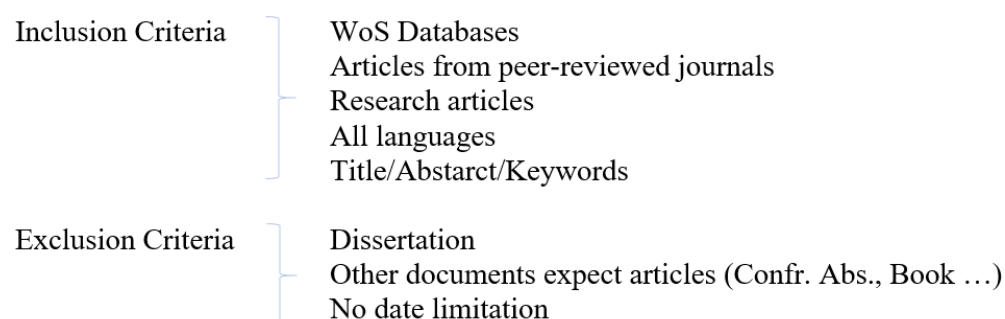


Figure 5. Inclusion and exclusion criteria.



Figure 6. AR analysis search strategy.

## 2.2. Data Analysis

Many programs perform data analysis for bibliometric mapping and graphical representations (VOSviewer, Pajek, Cite-Space, Biblioshiny, Gephi, Bibliometric, ScientoPy, Hite-Space, SankeyMATIC and Bib-Excel). Although the data results of bibliometric maps stand out the most in bibliometric studies, graphical representations are just as valuable in terms of the studies' comprehensibility and readability. While this situation is unobtrusive in small-scale analyses, graphical mapping is insufficient in big data analyses. For this reason, VOSviewer, which focuses on better understanding and graphical representation by analyzing statistical data within the scope of the study [9], was preferred. VOSviewer, popularly used recently and frequently preferred with its free access and convenient interface, has a functionality that can easily bibliometrically map clusters containing large data. VOSviewer offers three types of visualizations: network, year and density analyses. According to the analyzed title, different sizes and colors indicate popularity, similarity or relational network association.

The primary documents obtained as a result of preliminary analysis and scanning (322), respectively: year/publication periodic distribution, publication/author number re-



relationships, co-authorship relationships, distribution by country, keyword analysis, citation analysis of publications, preferred sources and citation analysis to these sources, analysis of attribution to countries and examined the 23 most preferred AR articles. In addition, the 10 most cited articles among the documents discussed within the scope of the study were comprehensively analyzed and the important documents discussed in the sensitivity of the subject were examined in detail.

### 3. Findings

The number of publications dealing with the keywords determined by the adaptive reuse concept according to year is shown in Figure 7. According to the research analysis results, publications between 1992 and 2022 were considered. Although the first article was published in 1992, it was found there was no research on the scanned feature until 2007. While it was observed the research continued decisively and demand was low until 2007 to 2011, interest increased between 2012 and 2018. It reached the highest quantitative level in research in 2021 with a consistently high publication graph. However, while the highest number of publications was reached with 76 documents (23.602%) in 2021, the publication of 46 documents (14.286%) until 15 November 2022 indicated a decrease of 9.316% in all publications, while there was a significant decrease of 39.473% between 2021 and 2022. This decrease in research trend reveals an important situation. Although research suggests adaptive reuse is an expected increase in the circular economy and the building and construction industry [10], this prediction is not realized based on the data put forward depending on the research topic.

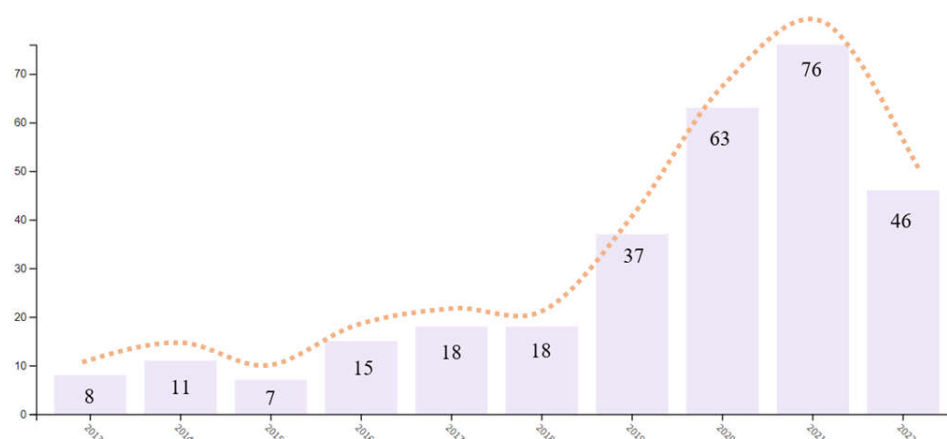


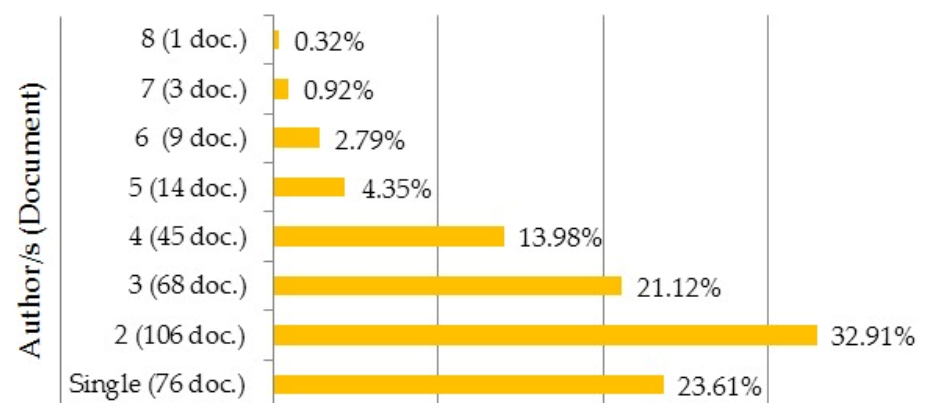
Figure 7. Distribution of publications by year.

The analyses of researchers who dealt with the keywords determined by the adaptive reuse concept are shown in Figure 8. To reveal more detailed data before the analysis performed in VOSviewer, the minimum number of documents and citations for an author is limited to two. It is seen that the 322 documents was reached after the scan was prepared in partnership with 703 authors; after the limitation, it was reduced to 76 authors. However, when the connections between the authors were analyzed, it was seen that three groups out of the 76 authors were at the forefront and publications intensified. As a result of the analysis, it was revealed the groups were formed with the cooperation of six or seven authors. It is expected the fact the author groups are scattered and have little cooperation may constitute a limiting factor in developing a different perspective on the research topic.

When the research is handled with author collaborations (Figure 9), the degree of cooperation is observed at 76.39%. In this high researcher collaboration, 32.90% have two authors. For this reason, it seems that works are mostly handled by two authors.



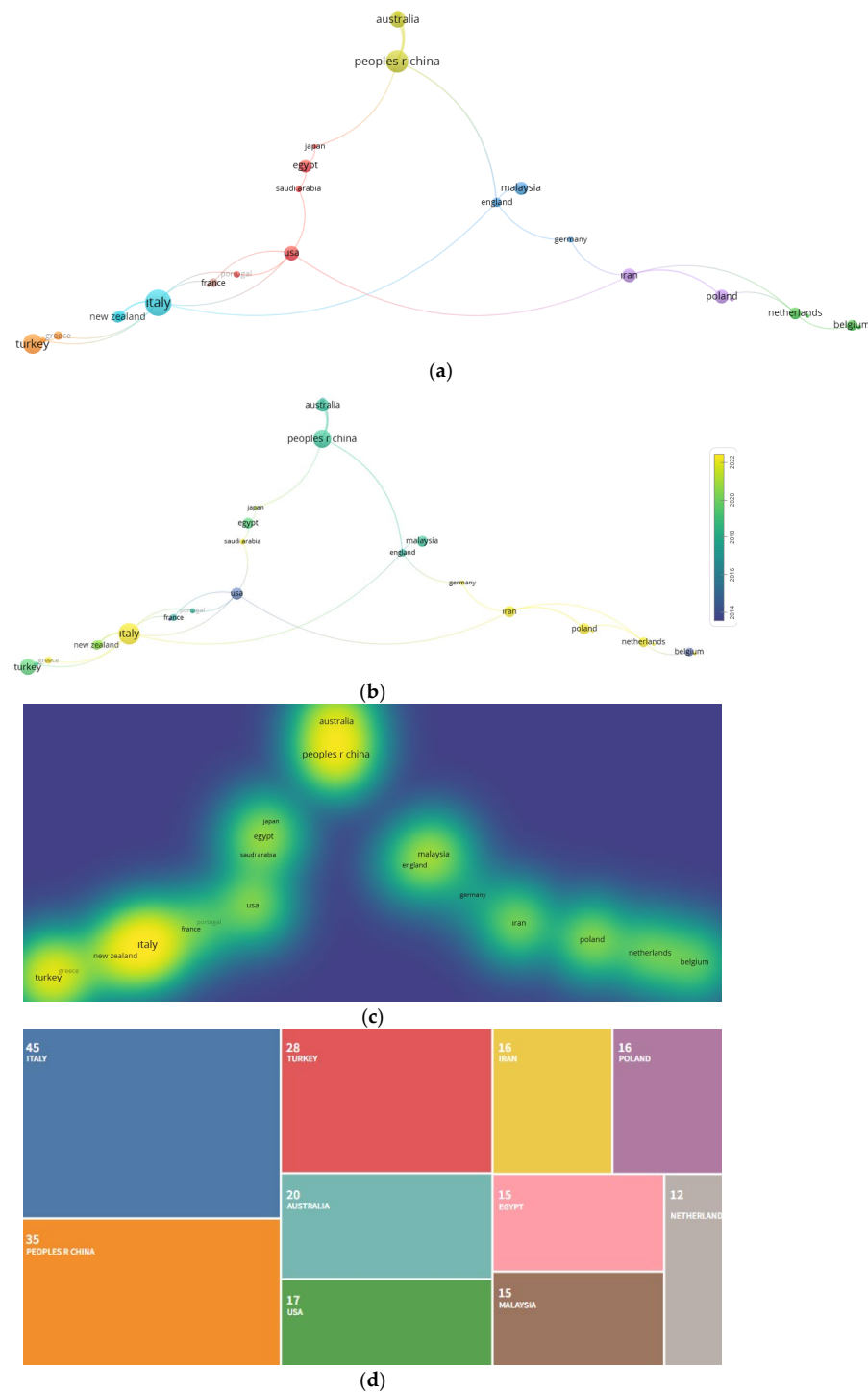
**Figure 8.** Analysis of the 76 co-authors of 322 documents obtained from the WoS: (a) Author relations and the density cloud in the field of study, (b) Cooperation and periodic analysis of two groups.



**Figure 9.** Document-author number analysis (322 documents).

To determine the most effective countries discussing the research topic and cooperation between them, a “country network analysis” was created (Figure 10). The distribution of the studies by countries in number, the relationship of the countries with each other, of periodic publications and the density cloud in the study area are shown. To provide more detailed data before the analysis is performed in VOSviewer, the minimum number of documents and citations for a country is limited to two. While it is seen that the 322 documents reached after the screening were prepared in partnership with 58 countries, this was reduced to

39 countries after the limitation. However, when the connections between the countries were examined, it was seen that 27 countries were interacting more with each other. At this point, the field of research should be expanded to more countries, explored and brought into the literature. The size of the circular clusters formed in the analysis refers to the numerical magnitude of the studies carried out on the research. The curvilinear lines between them analyzes the countries' cooperation in the field of research.

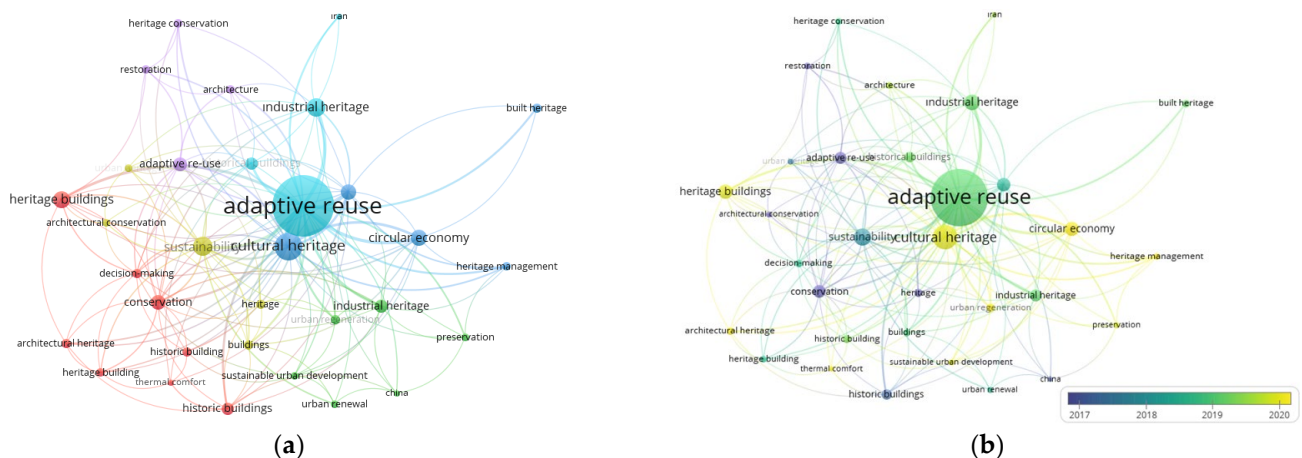


**Figure 10.** The number of publications and density clouds of 27 countries belonging to the 322 documents obtained from the WoS: (a) The countries' relationships with each other, (b) Periodic publications by the countries, (c) The density cloud in the area of the countries, (d) The number of publications from the countries.



The fact that large circular clusters are seen in countries such as Italy, China and Turkey can be understood as historical heritage and sustainable studies are more intense and being discussed more actively. It is important that scientific awareness between the countries is strong and gives an encouraging quality to the other business associations.

Analysis of the most preferred keywords in the documents dealing with the research topic is shown in Figure 11. Before the analysis was performed in VOSviewer, the minimum number of occurrences of a keyword was limited to five to provide more detailed data. While it was seen there were 1107 keywords in the 322 documents reached after the scan, 32 keywords were preferred more frequently after the restriction. The analysis shows, as of 2017, the potential relationships between keywords and interest in the research topic increased. The most used topics supporting the concept were cultural heritage, sustainability, heritage buildings and industrial heritage, respectively. The size of the node expresses the power and frequency of using a keyword, while the proximity between two nodes indicates the relevance of concepts between each other. The gradient colors in the analysis map, which turn from dark blue to yellow, represent the years. Blue-colored nodes highlight keywords that appeared early, while yellow-colored nodes highlight keywords that appeared recently. Although the yellow nodes focus on the concepts of cultural heritage and heritage buildings, there is a correct approach to the concepts of circular economy, urban regeneration, heritage management and urban development. This analysis is important in terms of revealing the changing trends of the research subject.

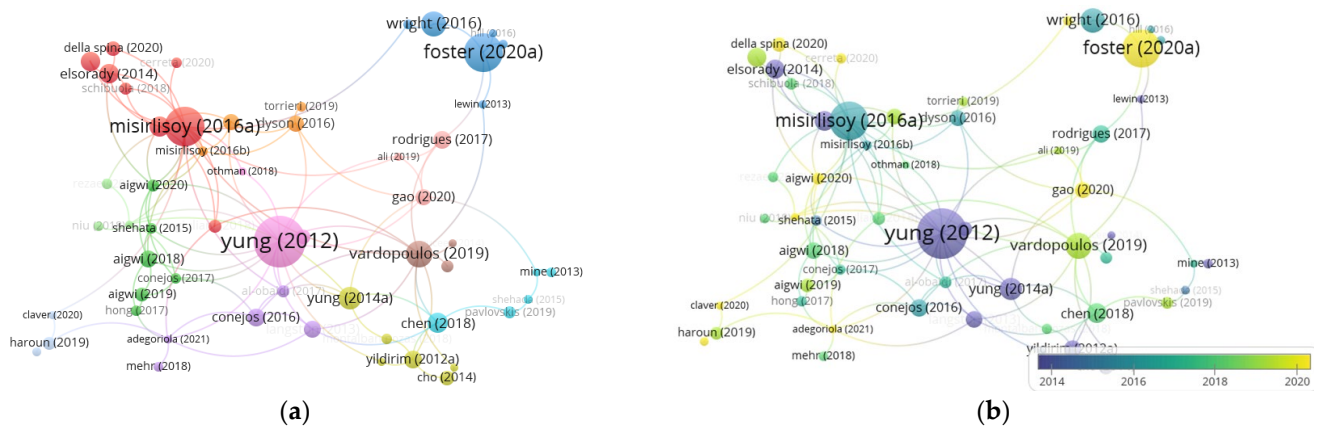


**Figure 11.** Keyword analysis of the 322 documents obtained from the WoS: (a) Keyword analysis, (b) Periodic use of keywords.

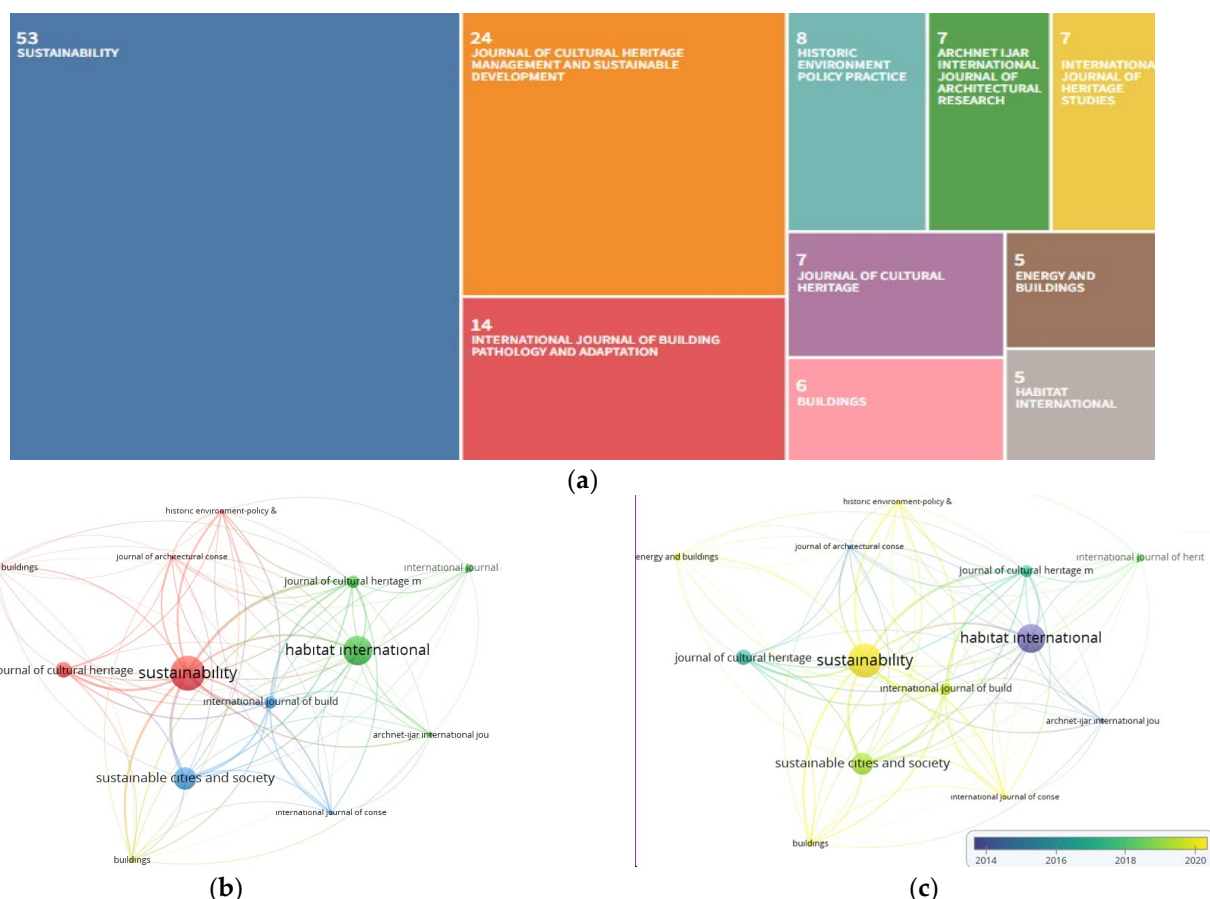
The analysis of references to the documents dealing with the research topic is shown in Figure 12. To reveal more detailed data before the analysis performed in VOSviewer, the minimum number of citations to a document is limited to 10. As a result of the limitation, 74 studies received the most citations. Among these 74 studies, it was found that 55 documents have more relational connections. Research articles by Yung [11], Misirlisoy [12] and Foster [13] have been cited over 100 times and are preferred references.

The citation analyses of the organizations (publishers) that accept the articles dealing with the research topic as publications and those publishers are shown in Figure 13, respectively. To reveal more detailed data before performing the analysis in VOSviewer, the minimum number of documents and citations of an organization is limited to five. While it was seen that the 322 documents reached after the scan were published by 139 different organizations, it was reduced to 13 organizations after the restriction. The sources accepting the most publications on research are *Sustainability* (53 articles) and the *Journal of Cultural Heritage Management and Sustainable Development* (24 articles). These sources have received 360 and 102 citations, respectively. The *Journal of Cultural Heritage*, with seven articles, received 131 citations, while *Sustainable Cities and Society* and *Habitat International*, with five

articles, received 209 and 289 citations, respectively; these two sources are remarkable in terms of statistical value.



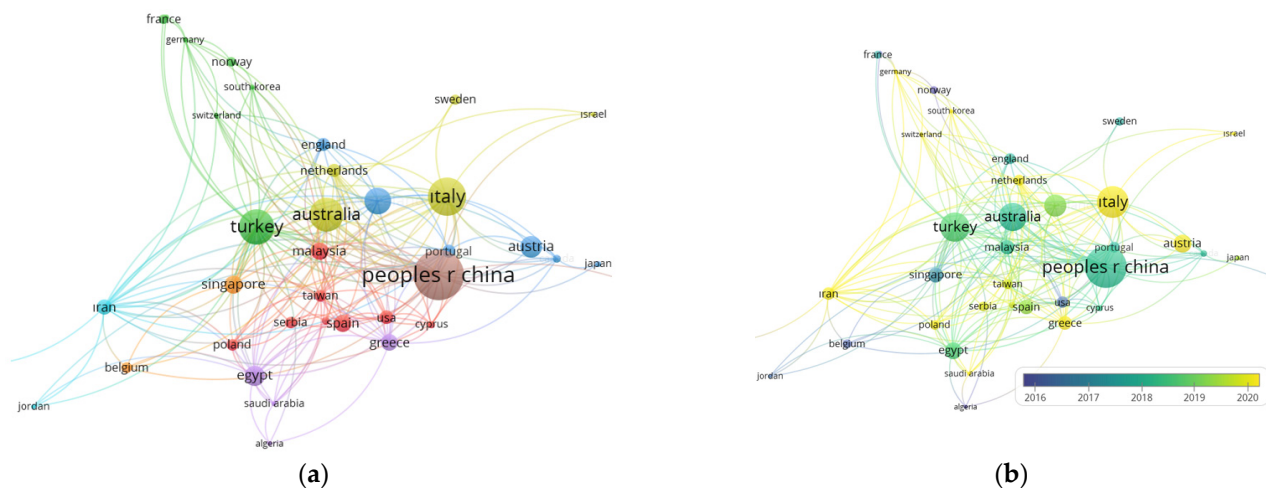
**Figure 12.** Citation analysis of the 322 documents obtained from the WoS; (a) Analysis of citations to a document, (b) Periodic analysis of the documents.



**Figure 13.** Organizations (publishers) analysis of the 322 documents obtained from the WoS; (a) Organizations (publishers), (b) Analysis of references to the organizations (publishers), (c) Periodic analysis of references to the organizations (publishers).

The citation analyses made to the countries that covered the research topic are shown in Figure 14. To provide more detailed data before the analysis is performed in VOSviewer, the minimum number of documents and citations of a country was limited to two. While it is seen that the 322 documents reached after the screening were prepared in partnership

with 58 countries, this was reduced to 39 countries after the limitation. However, when the connections between the countries were analyzed, it was seen that the citation networks of 37 countries interacted with each other. The countries with the most publications are Italy (45), China (35) and Turkey (28), respectively (Figure 10). It was found the first three countries that received the most citations did not change over time and received 307, 481 and 270 citations, respectively. In addition, another point that draws attention in the country citation analysis is that Austria received 122 citations with three articles and Singapore received 90 citations with five articles. It is seen that research publications in these two countries have an important position in the issue's sensitivity.



**Figure 14.** Citation analysis results of the 322 documents obtained from WoS; (a) Analysis of citation to country, (b) Periodic analysis of citation to country.

The top 10 reference sources most used by the authors dealing with the research topic are shown in Table 1. The minimum number of citations of a source is limited to 20 to reveal more detailed data before the analysis is performed in VOSviewer. It was found the 322 documents reached after scanning were supported by 12,602 sources, while 23 sources were used more frequently after the limitation.

The 10 articles that received the most citations from the articles reached through the bibliometric analysis are shown in Table 2. To reveal more detailed data before the analysis is performed in VOSviewer, the minimum number of citations is limited to 20. It was found that 30 sources were cited and more than 20 of the 322 documents were reached after the scan.

As a result of the analysis carried out in VOSviewer, the content analysis of the 10 most commonly used articles as references are shown in Table 3. For the documents to be examined in the content analysis to reflect the accurate and meaningful results of the research and for the method to be more successful, they are divided into categories. Although the categories classify the works individually, they can be defined with a holistic impression in terms of providing a broad perspective. In this direction, according to the citation number ranking of the articles, the content of the studies was evaluated as the purpose/status of the problem, its importance/contribution, the method or methods used, the findings and conclusion/discussion, and the development related to the field and the strategies desired to be put forward.

**Table 1.** The top 10 used sources in the 322 documents.

N.	Title	Author	Year	Type	Org./Publ.
1	Adaptive Reuse of Heritage Buildings [14]	Bullen, PA; Love, PED	2011	Article	Structural Survey
2	Adaptive Reuse Strategies for Heritage Buildings: A Holistic Approach [12]	Misirlisoy, D; Gunce, K	2016	Article	Sustainable Cities and Society
3	Building Adaptation [15]	Douglas, J	2006	Book	Butterworth-Heinemann
4	Adaptive Reuse and Sustainability of Commercial Buildings [16]	Bullen, PA	2007	Article	Facilities
5	Implementation Challenges to the Adaptive Reuse of Heritage Buildings: Towards the Goals of Sustainable, Low Carbon Cities [11]	Yung, EHK; Chan, EHW	2012	Article	Habitat International
6	Strategic Assessment of Building Adaptive Reuse Opportunities in Hong Kong [17]	Langston, C; Wong, FKW; Hui, ECM; Shen, LY	2008	Article	Building and Environment
7	The Rhetoric of Adaptive Reuse or Reality of Demolition: Views from the Field [18]	Bullen, PA; Love, PED	2010	Article	Cities
8	Does Adaptive Reuse Pay? A Study of the Business of Building Renovation in Ontario, Canada [19]	Shipley, R; Utz, S; Parsons, M	2006	Article	International Journal of Heritage Studies
9	A Multi-Objective Decision-Making Process for Reuse Selection of Historic Buildings [20]	Wang, HJ; Zeng, ZT	2010	Article	Expert Systems with Applications
10	A New Future for the Past: A Model for Adaptive Reuse Decision Making [21]	Bullen, PA; Love, PED	2011	Article	Built Environment Project and Asset Management

**Table 2.** The top 10 cited in the 322 documents.

N.	Title	Author	Year	Org./Publ.	Citations
1	Implementation Challenges to the Adaptive Reuse of Heritage Buildings: Towards the Goals of Sustainable, Low Carbon Cities [11]	Yung, EHK; Chan, EHW	2012	Habitat International	163
2	Adaptive Reuse Strategies for Heritage Buildings: A Holistic Approach [12]	Misirlisoy, D; Gunce, K	2016	Sustainable Cities and Society	110
3	Circular Economy Strategies for Adaptive Reuse of Cultural Heritage Buildings to Reduce Environmental Impacts [13]	Foster, G	2020	Resources Conservation and Recycling	107
4	Critical Sustainable Development Factors in the Adaptive Reuse of Urban Industrial Buildings. A Fuzzy DEMATEL Approach [22]	Vardopoulos, I	2019	Sustainable Cities and Society	61
5	Drivers of Heritage Value: A Meta-analysis of Monetary Valuation Studies of Cultural Heritage [23]	Wright, WCC; Eppink, FV	2016	Ecological Economics	56
6	Adaptive Reuse of Traditional Chinese Shophouses in Government-led Urban Renewal Projects in Hong Kong [24]	Yung, EHK; Langston, C; Chan, EHW	2014	Cities	48
7	Assessment of the Decision-making Process for Re-use of a Historical Asset: The Example of Diyarbakir Hasan Pasha Khan, Turkey [25]	Yildirim, M	2012	Journal of Cultural Heritage	41
8	Evaluating the Adaptive Reuse of Historic Buildings through Multicriteria Decision-making [26]	Chen, CS; Chiu, YH; Tsai, LC	2018	Habitat International	39
9	Ranking of Adaptive Reuse Strategies for Abandoned Industrial Heritage in Vulnerable Contexts: A Multiple Criteria Decision Aiding Approach [27]	Bottero, M; D'Alpaos, C; Oppio, A	2019	Sustainability	38
10	Assessment of the Compatibility of New Uses for Heritage Buildings: The Example of Alexandria National Museum, Alexandria, Egypt [28]	Elsorady, DA	2014	Journal of Cultural Heritage	38



**Table 3.** Content analysis of the top 10 cited in the 322 documents.

N.	Article	Purpose/Status of Problem	Importance/Contribution	Method/s	Findings	Concl./Discussion
1	Implementation Challenges to the Adaptive Reuse of Heritage Buildings: Towards the Goals of Sustainable, Low Carbon Cities [11]	The debate about which sustainability factors are of key importance for the adaptive reuse of existing heritage and how to address them in practice has not yet been resolved.	Identifies the main factors of the sustainability framework for the adaptive reuse of existing heritage.	-Literature review -Face-to-face meetings with critical people involved in the selected 7 projects (45–90 min)	-15 sustainable factors -Difficulties in the implementation of these factors -Recommendations for adaptive reuse in a low-carbon city	It is emphasized that the framework for achieving sustainable, low-carbon compliant reuse should be addressed more holistically.
2	Adaptive Reuse Strategies for Heritage Buildings: A Holistic Approach [12]	Provides a comprehensive review of the factors affecting the adaptive reuse decision-making process and develops a holistic model for adaptive reuse strategies for historic buildings.	All the factors affecting adaptive reuse decision making are considered as a holistic model.	-Literature review -16 buildings selected from different countries -Structure observation and meeting with decision-makers	-Factors affecting decision-making -Adaptive reuse strategies -A developing model	A holistic perspective has been emphasized by proposing a model to develop adaptive reuse strategies for historical buildings.
3	Circular Economy Strategies for Adaptive Reuse of Cultural Heritage Buildings to Reduce Environmental Impacts [13]	Decision-makers do not have the knowledge for the adaptive reuse of cultural heritage buildings and lack the tools to implement these projects.	It integrates the methods and techniques in building/construction literature by reducing the environmental impact of buildings' lifecycle with a new and comprehensive circular economy framework.	-Literature review -Synthesis work	-Identification of the building lifecycle -Participants and users in the building life cycle -Circular economy strategies for adaptive reuse	A comprehensive circular economy framework for the adaptive reuse of cultural heritage buildings is presented based on a synthesis of the literature.
4	Critical Sustainable Development Factors in the Adaptive Reuse of Urban Industrial Buildings. A Fuzzy DEMATEL Approach [22]	The factors affecting local sustainable development through adaptive reuse projects and the interaction between them have rarely been studied.	The analysis identifies the critical factors affecting local sustainable development through adaptive reuse projects, as well as evaluate it as a tool for future decision-making.	-Literature review -Fuzzy–DEMATEL analysis -Case study	-Local sustainable development is directly influenced by adaptive reuse projects by seven critical factors -The emerging critical factors should be given special attention in future strategies and action plans.	Land conservation and cultural heritage protection are the two most critical factors in the adaptive reuse of urban industrial buildings, followed by community action and involvement empowerment.
5	Drivers of Heritage Value: A Meta-analysis of Monetary Valuation Studies of Cultural Heritage [23]	By conducting meta-analysis of heritage valuation studies, determines the common factors of the economic value of cultural and historical heritage.	Improved insight into the economic benefits from conservation can be gained through better understanding of the underlying economics. In response to this challenge, the economic value of heritage sites is being estimated.	-Literature review -Meta-analysis	-Geographical distribution of the studies used for meta-analysis -Statistical characteristics of the dependent variable -Authorship effects; transcontinental valuation method	Heritage sites in areas with higher population density have higher value and conservation that supports adaptive reuse of areas produces higher values compared to passive conservation.
6	Adaptive Reuse of Traditional Chinese Shophouses in Government-led Urban Renewal Projects in Hong Kong [24]	The reconstruction pressure is intense in the urban transformation zones in the historical cities in Southeast Asia and there are many challenges in terms of sustainability.	The sustainability issues identified in the case studies are not unique to the Hong Kong context only. It can be handled on a global scale.	-Literature review -ARP model -8 selected examples -Meeting with participants	-Tension between economic viability and heritage value -Redevelopment pressure, land acquisition and property rights -The problem of social inclusion, continuity of lives and sense of place -Rigidity of spatial planning and environmental considerations	With this study, the importance of the sustainability framework is emphasized by considering future adaptive reuse.
7	Assessment of the Decision-making Process for Re-use of a Historical Asset: The Example of Diyarbakır Hasan Pasha Khan, Turkey [25]	Proposes a methodology for the appropriate reuse of historical patterns that have lost their original functions and discusses the consequences of such reuse.	A simple technique is proposed to help decision-makers who are having difficulty making a new usage decision for a historical pattern.	-Literature review -Case study -6-step methodology	-Advantages and disadvantages of reuse decisions	To prevent historical depreciation, it is necessary to create adaptive reuse for historical patterns.



Table 3. Cont.

N.	Article	Purpose/Status of Problem	Importance/Contribution	Method/s	Findings	Concl./Discussion
8	Evaluating the Adaptive Reuse of Historic Buildings through Multicriteria Decision-making [26]	The factors influencing the choice of reuse alternatives are becoming increasingly complex. The consideration of only specific factors has led to frequent conflicts between the chosen alternatives and overlooked conservation values of historic buildings.	An integrated decision-making model has been established to resolve differences of opinion regarding the ideal reuse alternatives of historical buildings and to contribute to the evaluation of the feasibility of alternatives.	-Literature review -Analytic network process -Fuzzy Delphi method -Case study -Expert opinion	-The priority order for the alternatives within each criterion -Sensitivity analysis according to economic, social, ecological, architectural and historical orientations	The possibility of the transition of the historic building to commercial use should be maintained through future space use planning to adapt to possible changes in the urban environment.
9	Ranking of Adaptive Reuse Strategies for Abandoned Industrial Heritage in Vulnerable Contexts: A Multiple Criteria Decision Aiding Approach [27]	Proposes a multi-criteria auxiliary approach for sorting adaptive reuse strategies of cultural heritage. Industrial sites are frequently left to deteriorate, as their preservation is not considered as important as other kinds of heritage buildings.	The article presents a novel application of the Preference Ranking Organization Method for Enrichment of Evaluations (PROMETHEE) to support the design and implementation of adaptive reuse strategies of abandoned industrial heritage in vulnerable contexts, and evaluate relative tangible and intangible effects.	-PROMETHEE -Case study -GAIA (Geometrical Analysis for Interactive Aid) plane	-Ranking comparison for the different decision scenarios. -GAIA plane for the decision scenarios under investigation.	The developed application has confirmed the advantages of using PROMETHEE to support complex decisions, since it compares alternative scenarios, taking into account the opinions of different experts involved in the problem.
10	Assessment of the Compatibility of New Uses for Heritage Buildings: The example of Alexandria National Museum, Alexandria, Egypt [28]	Assesses the compatibility of adaptive reuse of historical buildings in Egypt, given the growing number of projects involving innovative building reuse throughout the country.	Based on the analysis of stakeholders' perspectives, public and expert, this research identifies important issues and establishes guidelines for use during the study of the adaptive reuse process of historic buildings.	-Literature review -Case study -Expert and non-expert opinions	-Indicators and measurements of heritage-adaptive reuse related to the results of laypeople and experts.	The case study serves as a guide while the interviewees demonstrate the process preserves the architectural integrity of the building and agree that its new cultural function represents the optimal building reuse.

#### 4. Conclusions

The theme of sustainability has been one of the most discussed topics by all disciplines in the last decade. In particular, the disciplines of architecture and engineering, which are physically held and can overlap with many topics, are closely related to the theme. The concept of adaptive reuse also has similar meanings to the theme of sustainability as a goal and approach style. The AR of historic buildings on a minor scale reveals the importance of the concept in terms of different disciplines with titles that can be derived, such as sustainable environment, architecture and economy. It is anticipated that consideration of the concept as a single piece in different disciplines will be the most important tool in process management.

AR involves difficult processes and changes. For this reason, important issues such as the existing texture, city, identity of the place, cultural meaning and relational connection, and tourism-oriented economy should be considered when planning to revive the historic building. Although the concept of AR seems to have been realized in a singular building and put into action to extend its physical life, it should not escape attention that it is part of the whole picture due to the building's originality. Although originality is dedicated as a singular value of the building, the integrity concept consists of singular originality.

This article comprehensively reviews the bibliometric analysis of research on the AR of historic buildings. The research evaluated by taking into account the WoS database is also a possible situation where different results may arise if another database is preferred. However, this research article is expected to be a reference to other field and non-field bibliometric studies and to shed light on future research in terms of its evaluation by association or comparison. In addition, the article is expected to be an important reference in analyzing and examining real case studies that have been or will be handled with AR in the current situation.

One of the most apparent results revealed within the scope of the analysis is the portfolio of participants who impact historic buildings. It turns out it has as important a point to pay attention to social participation as it is a subject dominated by people who are experts in the field. For this reason, institutions and organizations that have a say in management with a participatory approach, heritage owners, construction companies, experts related to the field (architect, engineer, economist, social scientist, etc.) and decisions should be made and implemented with an approach in which local people participate. In this way, the AR strategy will be more likely to be applied correctly, allowing the historic building, structure, culture and memory to be carried sustainably into the future.

Another consequence is that the building character is analyzed well in advance, and the determinations are made correctly. The current state of the building, spatial building, mechanical and static analysis; the value of aesthetic, historic, social, local materials and craftsmanship; the value of the attribute in the whole region in conjunction with the reflection of subjectivity in the process; the structural changes and transformations; the use of objectives; and the economic dimension of the repairs made during the process are among the topics that should be analyzed first. Then, determining requirements such as the budget required for the proposed reuse, relevant regulations, existing material, construction technique, new material and construction technique required for reuse are also important issues. However, it should be evaluated whether the structure, environment and society require the proposed reuse function. A function made up and not kept alive will not make the historical building sustainable or keep it alive. In addition, before and after the project construction, the economic and social perspectives should be considered by all disciplines and feasibility studies should be carried out. The society's accessibility to the structure and function, the region's strategic planning approaches and the buildings for the coming years, its place in the local plans and its policy in the process will also allow the historic buildings to be handled correctly.

Throughout this study, it has been revealed which strategies should be considered and which should be rethought in the face of historic building with different perspectives and development stages for research that will be studied specifically on the subject in the future.

Therefore, this study has a guiding value for researchers and policy developers in terms of understanding the developmental relationships in conservation strategy and developing other theoretical and practical initiatives to be made in the field.

**Author Contributions:** Conceptualization, B.K. and S.A.S.; methodology, B.K. and S.A.S.; validation, B.K. and S.A.S.; formal analysis, B.K. and S.A.S.; investigation, B.K. and S.A.S.; resources, B.K. and S.A.S.; data curation, B.K. and S.A.S.; writing—original draft preparation, B.K. and S.A.S.; writing—review and editing, B.K. and S.A.S.; visualization, B.K. and S.A.S.; supervision, B.K. and S.A.S. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research received no external funding.

**Institutional Review Board Statement:** Not applicable.

**Informed Consent Statement:** Not applicable.

**Data Availability Statement:** Data sharing not applicable.

**Conflicts of Interest:** The authors declare no conflict of interest.

## References

1. UNESCO. *Convention Concerning the Protection of the World Cultural and Natural Heritage*; Edward Elgar Publishing: Cheltenham, UK, 1972; Available online: <https://whc.unesco.org/en/conventiontext/> (accessed on 7 January 2023).
2. Harper, D. Etymology of Adaptation, Online Etymology Dictionary. Available online: <https://www.etymonline.com/word/adaptation> (accessed on 7 January 2023).
3. Venice Charter. *International Charter for the Conservation and Restoration of Monuments and Sites*; Venice Charter: Venice, Italy, 1964.
4. Merlino, K.R. *Building Reuse: Sustainability, Preservation, and the Value of Design*; University of Washington Press: Seattle, WA, USA, 2018.
5. Stone, S. *UnDoing Buildings: Adaptive Reuse and Cultural Memory*; Routledge: Oxfordshire, UK, 2019.
6. Jacobs, J. *The Death and Life of Great American Cities*; Vintage: New York, NY, USA, 2016.
7. Chandrashekarai, M.; Mulla, K.R.; Harinarayana, N.S. Bibliometric Analysis of Literature Published in Emerald Publications on Digital Libraries. *Int. J. Libr. Sci.* **2010**, *1*, 20–29.
8. Gonzales-Aguilar, A.; Ramírez-Posada, M. Carrot2: Búsqueda y Visualización de la Información. *El Prof. De La Inf.* **2012**, *21*, 105–112. [CrossRef]
9. Van Eck, N.; Waltman, L. Software Survey: VOSviewer, a Computer Program for Bibliometric Mapping. *Scientometrics* **2010**, *84*, 523–538. [CrossRef] [PubMed]
10. Owajori, O.M.; Okoro, C.S.; Chileshe, N. Current Status and Emerging Trends on the Adaptive Reuse of Buildings: A Bibliometric Analysis. *Sustainability* **2021**, *13*, 11646. [CrossRef]
11. Yung, E.H.; Chan, E.H. Implementation Challenges to the Adaptive Reuse of Heritage Buildings: Towards the Goals of Sustainable, Low Carbon Cities. *Habitat Int.* **2012**, *36*, 352–361. [CrossRef]
12. Misirlisoy, D.; Gunce, K. Adaptive Reuse Strategies for Heritage Buildings: A Holistic Approach. *Sustain. Cities Soc.* **2016**, *26*, 91–98. [CrossRef]
13. Foster, G. Circular Economy Strategies for Adaptive Reuse of Cultural Heritage Buildings to Reduce Environmental Impacts. *Resour. Conserv. Recycl.* **2020**, *152*, 104507. [CrossRef]
14. Bullen, P.A.; Love, P.E.D. Adaptive Reuse of Heritage Buildings. *Struct. Surv.* **2011**, *29*, 411–421. [CrossRef]
15. Douglas, J. *Building Adaptation*; Routledge: New York, NY, USA, 2006.
16. Bullen, P.A. Adaptive Reuse and Sustainability of Commercial Buildings. *Facilities* **2007**, *25*, 20–31. [CrossRef]
17. Langston, C.; Wong, F.K.; Hui, E.C.; Shen, L.Y. Strategic Assessment of Building Adaptive Reuse Opportunities in Hong Kong. *Build. Environ.* **2008**, *43*, 1709–1718. [CrossRef]
18. Bullen, P.A.; Love, P.E. The Rhetoric of Adaptive Reuse or Reality of Demolition: Views from the Field. *Cities* **2010**, *27*, 215–224. [CrossRef]
19. Shipley, R.; Utz, S.; Parsons, M. Does Adaptive Reuse Pay? A Study of the Business of Building Renovation in Ontario, Canada. *Int. J. Herit. Stud.* **2006**, *12*, 505–520. [CrossRef]
20. Wang, H.J.; Zeng, Z.T. A Multi-objective Decision-making Process for Reuse Selection of Historic Buildings. *Expert Syst. Appl.* **2010**, *37*, 1241–1249. [CrossRef]
21. Bullen, P.; Love, P. A New Future for the Past: A Model for Adaptive Reuse Decision-making. *Built Environ. Proj. Asset Manag.* **2011**, *1*, 32–44. [CrossRef]
22. Vardopoulos, I. Critical Sustainable Development Factors in the Adaptive Reuse of Urban Industrial Buildings. *A Fuzzy DEMATEL Approach. Sustain. Cities Soc.* **2019**, *50*, 101684. [CrossRef]
23. Wright, W.C.; Eppink, F.V. Drivers of Heritage Value: A Meta-analysis of Monetary Valuation Studies of Cultural Heritage. *Ecol. Econ.* **2016**, *130*, 277–284. [CrossRef]

24. Yung, E.H.; Langston, C.; Chan, E.H. Adaptive Reuse of Traditional Chinese Shophouses in Government-led Urban Renewal Projects in Hong Kong. *Cities* **2014**, *39*, 87–98. [\[CrossRef\]](#)
25. Yildirim, M. Assessment of the Decision-making Process for Re-use of a Historical Asset: The Example of Diyarbakir Hasan Pasha Khan, Turkey. *J. Cult. Herit.* **2012**, *13*, 379–388. [\[CrossRef\]](#)
26. Chen, C.S.; Chiu, Y.H.; Tsai, L. Evaluating the Adaptive Reuse of Historic Buildings through Multicriteria Decision-making. *Habitat Int.* **2018**, *81*, 12–23. [\[CrossRef\]](#)
27. Bottero, M.; D’Alpaos, C.; Oppio, A. Ranking of Adaptive Reuse Strategies for Abandoned Industrial Heritage in Vulnerable Contexts: A Multiple Criteria Decision Aiding Approach. *Sustainability* **2019**, *11*, 785. [\[CrossRef\]](#)
28. Elsorady, D.A. Assessment of the Compatibility of New Uses for Heritage Buildings: The Example of Alexandria National Museum, Alexandria, Egypt. *J. Cult. Herit.* **2014**, *15*, 511–521. [\[CrossRef\]](#)

**Disclaimer/Publisher’s Note:** The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.