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MAPPING AND DECODING THE TRAJECTORY OF HERITAGE-CENTERED URBAN TRANSFORMATION ASSESSMENTS

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Abstract

In recent decades, the assessment of urban development activities has gained prominence, with a growing focus on their impact on historic urban areas. While numerous urban transformation assessment frameworks have been explored and applied, there is a notable gap in documented studies summarizing the literature specifically on heritage-led urban development assessments. Using bibliometric analysis and the PRISMA technique, this study extracts relevant articles from the Web of Science core database and offers insights into annual publication trends, scientific production by countries, author affiliations, citation frequency, relevant journals, and keywords. Network mapping reveals co-citations, keyword co-occurrences, author and country collaborations, and historiography. This research provides a valuable reference for future trends in heritage-led urban development assessment frameworks, benefiting researchers, practitioners, and policy-makers.

Keywords

Bibliometrix, literature review, urban heritage, urban transformation, assessment, framework.

1. *Introduction*

Heritage is often disregarded as a barrier to modern urban development (Manuela et al., 2017), seldom conceptualizing the liaison of heritage in the urban realm, where urban heritage can be understood as tools to understand the city and its morphology (Abdurahiman, Kasthurba, & Nuzhat, 2022). The concept of urban heritage has expanded from single entities to part of a historic cultural and natural landscape which comprises the tangible and intangible aspects (Labadi & Logan, 2016). Urban heritage is also referred to as the "unity of the city" which had monuments as the cores. Though the idea was monument-centric, he implied that it included the context too (Dao, 2017). Nijkamp and Riganti discuss the concept of urban cultural heritage as a physical manifestation and expression of the community identity which has to carry forward for the generations ahead along with its cultural and symbolic values (Riganti & Nijkamp, 2004). Dupagne has categorized urban heritage into three categories: The first category comprises the monumental heritage of cultural value; the second category comprises the non-exceptional heritage elements but present in a coherent way with a relative abundance; and the third category is the new urban elements that have formed the urban fabric such as the built form, open spaces, streets and infrastructure (Dupagne, A; Ruelle, C; Teller, 2004). In recent years, the notion of urban heritage has been explored by many researchers and authors (Abdurahiman & Kasthurba, 2022; Manuela et al., 2017; Veldpaus et al., 2013). Further international doctrines and articles began to give attention to the idea of the urban landscape; historic urban centres and ensembles and capturing heritage as a part of a broader canvas (Jokilehto, 2007). Hence, there forth, the notion of urban heritage within the urban realm is a paradigm shift in the urban development process and policy-making.

In recent years, there has been a significant multidisciplinary trend in terms of literature that focuses on keyword sets such as urban heritage and urban development or transformation, going beyond the subset of 'cultural urban heritage'. The current study aims to trace an overall picture of the research domain with such keywords and understand the various sub-domains in which scientific production is taking place.

Furthermore, although there are many studies conducted in developing assessment frameworks and models for urban development (Abdurahiman, Kasthurba, Arlikatti, et al., 2022), there is a lack of study on the trend of research focusing on heritage-led urban development assessment. By deriving a macro outlook of the overall trend within the academic research community, a clear depiction of the existing literature for the same can be attained. The study aims to identify research trends and predict the productivity of publishers, individual authors, organizations, and countries.

1.1 Research questions

The study also aims to identify journals with the greatest impact in the study domain and identify potential research collaboration opportunities. The current study is motivated to conduct a bibliometric analysis, based on published articles, to analyze the following research questions:
(a) What is the research trend in terms of annual publication frequency?
(b) What are the various sub-domains?
(c) Which are the prominent articles with the highest citation count?
(d) Who are the key contributing authors?
(e) Which are the prominent journals in the study domain?
(f) What are the keywords frequently used?
(g) What is the trend pattern in author, country, and institution collaboration?

These questions provide a fundamental basis for the current study, where the results create an overall perspective in the research domain of heritage-led urban development assessment. Hence, there is an apt scope for reviewing and exploring the existing literature through bibliometric analysis. This analysis would yield relevant articles, authors, and sources, and further discover the existing gaps, future possibilities, innovative thinking, and redefined concepts within the study domain of urban heritage. The study aids in the research community as a reference to opt and explore new research directions and methodologies.

2. Literature review

Based on an intensive search on the Web of Science database, it was found that there is a significant quantity of research conducted in the study domain of heritage-led urban development assessment, there are only very few that have conducted a review study.

A total of 45 documents published in 33 journals were identified as review articles from 2006-2021, out of which only six documents focused on a bibliometric analysis, which was published from 2019 onwards. An overview of the identified six documents is shown in Tab.1.

Liu et al (2019) performed a bibliometric analysis of the literature from the China National Knowledge Infrastructure (CNKI) database focusing on gentrification in China. The bibliometric analysis was performed using four software. Statistical Analysis Toolkit for Informetrics (SATI) software was used to mine and extract literature, and provide an overview of document information. University of California at Irvine NETwork (UCINET) software was used to analyze social networks. Statistical Product and Service Solutions (SPSS) was used to perform multivariate statistical analysis. Lastly, CiteSpace software was used to trace thematic trends. The paper identified 121 articles and the analysis showed that the study on gentrification focused mainly on two disciplines – geography and urban & rural planning. The paper identified 121 articles and the analysis showed that the study on gentrification focused mainly on two disciplines – geography and urban & rural planning (Liu et al., 2019). Zhang et al (2020) conducted a bibliometric study on the research trend of study on industrial heritage in Western countries (127 articles) and China (72 articles). The analysis was done using the CiteSpace software (Zhang et al., 2020). Nadkarni and Puthuvayi (2020) focused on presenting a comprehensive literature review of 42 articles identified from the WoS database on the various applications of MCDM techniques adopted in heritage buildings. The study included a bibliometric analysis using Bibliometrix (Nadkarni & Puthuvayi, 2020). Wang et al (2021) conducted a bibliometric study on 151 articles identified from the WoS database to understand the relationship and reveal the association between urban renewal and the built environment (Wang et al., 2021). Owojori et al (2021) conducted a bibliometric study on 227 documents identified from the Scopus database, focusing on the adaptive reuse of buildings, with the aid of VOSviewer software for data visualizations (Owojori et al., 2021). Zheng et al (2021) carried

out a bibliometric study on 3971 articles identified from the SCIE (Science Citation Index Expanded) and SSCI (Social Sciences Citation Index) databases of WoS, focusing on the domain of sustainable urban renewal by understanding the scientific production within the domain (Zheng et al., 2021). The analysis was conducted with the aid of VOSviewer software. However, a study focusing on exploring the trend in heritage-led urban development assessments is still deficient. The current study helps to bridge this gap, trace the trend, and understand the various sub-domains within the study of heritage-led urban development assessments.

Tab. 1: List of bibliometric articles in the domain

Authors	Article	Journal
(Liu et al., 2019)	Progress of Gentrification Research in China: A Bibliometric Review	Sustainability
(Zhang et al., 2020)	Recent Evolution of Research on Industrial Heritage in Western Europe and China Based on Bibliometric Analysis	Sustainability
(Nadkarni & Puthuvayi, 2020)	A comprehensive literature review of Multi-Criteria Decision Making methods in heritage buildings	Journal of Building Engineering
(Wang et al., 2021)	The Relationship Between Urban Renewal and the Built Environment: A Systematic Review and Bibliometric Analysis	Journal of Planning Literature
(Owojori et al., 2021)	Current Status and Emerging Trends on the Adaptive Reuse of Buildings: A Bibliometric Analysis	Sustainability
(Zheng et al., 2021)	Progress in Research on Sustainable Urban Renewal Since 2000: Library and Visual Analyses	Sustainability

3. Methodology

For understanding and analyzing a research domain, with its research trends, popularity, and scope of further research, a bibliometric analysis is desirable (Bhargavan et al., 2023; Binoy et al., 2021; Lazar & Chithra, 2021; Nadkarni & Puthuvayi, 2020; Viswalekshmi et al., 2022). The methodology adopted for the study is divided into two phases based on the tasks performed to pursue the answers to the mentioned research questions and achieve the desired objectives: (1) PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) and (2) bibliometric analysis. The first phase is the identification of articles and refinement by adopting the universally accepted PRISMA technique (Page et al., 2021). This step starts by establishing the Boolean combination of the identified keywords that address the research focus domain (Fig. 1). The second phase is the procedure of conducting bibliometric analysis with the aid of "bibliometrix", an open-source R-package tool. This phase is instrumental in quantitatively evaluating and dissecting the gathered literature, enabling the extraction of valuable insights into research trends, influential authors, key concepts, and more. To visualize and communicate the extracted data effectively, the study further utilized tools such as Biblioshiny and VoSViewer, which facilitated the creation of informative data visualizations.

3.1 PRISMA- Identification of articles

The first step of the data collection involved the extraction of the articles from the online bibliometric database. The identification of articles was limited to the Web of Science (WoS) core database. Existing literature reveals that the WoS database yields profound results. Relevant keywords were identified to initiate the search. To produce a refined preliminary search result, the search criteria directed the string search within the 'Topic' criteria only. The keywords mentioned below were presumed to be found in the topics of the relevant articles with similar objectives of the study. The Boolean combination of 3 search string sets was constructed to streamline the focus and refine the relevant articles accordingly.

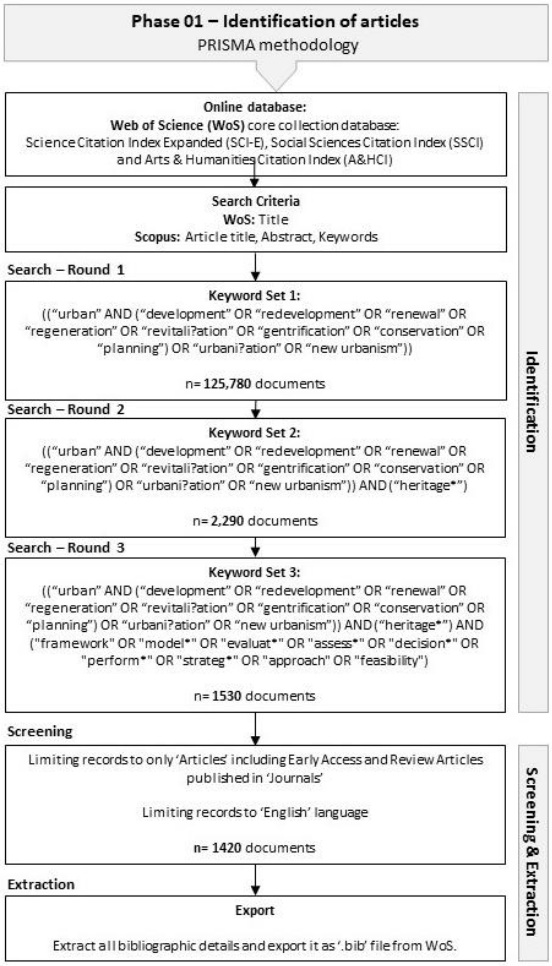

Fig. 1: PRISMA methodology

String set 1: (urban development/ urban redevelopment/ urban renewal/ urban regeneration/ urban revitalization/ urban gentrification/ urban conservation/ urban planning/ new urbanism); Intent: the application of these keywords extracts articles on the broader spectrum of the types of urban processes that occur and brings change within an urban area.

String set 2: (heritage); Intent: the application of these keywords streamlines the articles to those that focus on urban development processes that are related to heritage or heritage-driven

String set 3: (framework/ model/ evaluation/ assessment/ decision-making/ decision-aid/ decision support system/ performance/ strategy /approach/ feasibility); Intent: the application of these keywords streamlines the articles to those that focus on frameworks or models of heritage driven urban development processes.

The article search was limited to the Science Citation Index Expanded (SCI-E), Social Sciences Citation Index (SSCI), and Arts & Humanities Citation Index (A&HCI) from the Web of Science Core Collection. The first-string set yielded a total of 125,780 documents. With the inclusion of ‘heritage’ in the initial string search, the document results count was narrowed down to a total of 2,290 documents. The inclusion of the third string of keywords into the search streamlined the results to a total of 1530 documents. Subsequently, a screening was performed to limit the documents to Articles including Early Access and Review Articles; and language criteria to ‘English’, which yielded a total of 1420 documents. Tab. 2 shows the search criteria carried out to identify and screen relevant articles. The documents were extracted and exported in bibtex (.bib) format.

Tab. 2: Search criteria

Items	Criteria
Keywords	Search 1 - ((“urban” AND (“development” OR “redevelopment” OR “renewal” OR “regeneration” OR “revitali?ation” OR “gentrification” OR “conservation” OR “planning”) OR “urbani?ation” OR “new urbanism”)) Search 2 – ((“urban” AND (“development” OR “redevelopment” OR “renewal” OR “regeneration” OR “revitali?ation” OR “gentrification” OR “conservation” OR “planning”) OR “urbani?ation” OR “new urbanism”)) AND (“heritage*”) Search 3 – ((“urban” AND (“development” OR “redevelopment” OR “renewal” OR “regeneration” OR “revitali?ation” OR “gentrification” OR “conservation” OR “planning”) OR “urbani?ation” OR “new urbanism”)) AND (“heritage*”) AND ("framework" OR "model*" OR "evaluat*" OR "assess*" OR "decision*" OR "perform*" OR "strateg*" OR "approach" OR "feasibility")
Time period	No chronological filter criteria
Language	English
Document	Articles, Early Access, Review Articles
WoS Index	SCI-E, SSCI, A&HCI

3.2 Bibliometric analysis- Bibliometrix

With the growing demand for comprehensive integration and analysis of published literature, bibliometric analysis has become a pivotal step in conducting a time-efficient and productive systematic literature review. R is a free software that facilitates as a programming language. Rstudio includes tools for data code execution and plotting of data. RStudio helps to import and combine various forms of bibliographic data. Bibliometrix is an open-source R-Tool for comprehensive science mapping analysis of scientific literature(http://www.bibliometrix.org) (Aria & Cuccurullo, 2017). Biblioshiny is a web-based interface application included in the bibliometrix package, through which data was extracted. The following steps are performed for software initiation and data extraction.

- Execute and open the RStudio application
- Enter the following command within the console window to install the "Bibliometrix" package in R Studio: >*install.packages ("bibliometrix")*
- Enter the following command to load the "Bibliometrix" library to activate the package: >*library(bibliometrix)*
- Enter the following command to load the "Biblioshiny" package: >*biblioshiny()*
- With the input of the last command, the biblioshiny for the bibliometrix domain will open up in the web explorer.
- Load the Bibtex (.bib) file into the biblioshiny for the bibliometrix domain

The research publication trends and performance of various attributes such as keywords, authors, journals, institutions, and countries are evaluated in the form of data tables and data visualizations. Further network mapping was extracted from VOSViewer for analysis.

4. Results

4.1 Main information

The overall information of all the identified documents from the WoS database during 2002-2022 is presented in Tab. 3. A total of 1420 documents have been published in 410 journals with a total number of 65395 references. The collaborative index was found to be 2.99 indicating a noteworthy collaboration among researchers within the study domain. The average number of citations received per document was 13.13.

Tab. 3: Overview of extracted database

Description	Results
Main Information About Data	
Timespan	2002:2022
Sources (Journals, Books, etc)	410
Documents	1420
Average years from publication	5.14
Average citations per document	13.13
Average citations per year per doc	1.934
References	65395
Document Types	
article	1336
article; early access	39
review	44
review; early access	1
Document Contents	
Keywords Plus (ID)	2334
Author's Keywords (DE)	4914
Authors	
Authors	3645
Author Appearances	4332
Authors of single-authored documents	264
Authors of multi-authored documents	3381
Authors Collaboration	
Single-authored documents	290
Documents per Author	0.39
Authors per Document	2.57
Co-Authors per Documents	3.05
Collaboration Index	2.99

4.2 Annual scientific production

The annual growth rate of publications showed an increasing trend from 2002 to 2021 with a growth rate of 11.4% (Fig. 2). At present, the number of annual publications was found to be highest in 2021. The trend suggests a linear growth in research productivity within the domain of heritage-led development frameworks, with its research diversity and scope ranging from cultural to natural heritage. It was found that there is no significant decline in terms of annual production suggesting the research interest and demand in the domain. The average citations per year were found to vary through the years with the highest being 3.6 in the year 2007 (Fig. 3). The highest average total citations per article was 53.4 in the same year i.e. 2007 (Fig. 4).

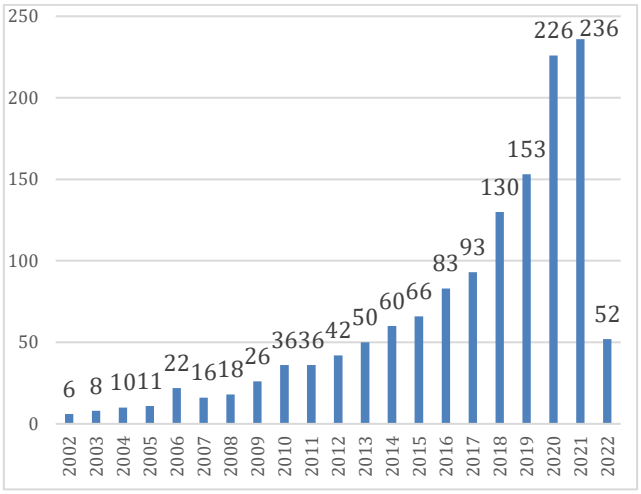

Fig. 2: Annual publication trend

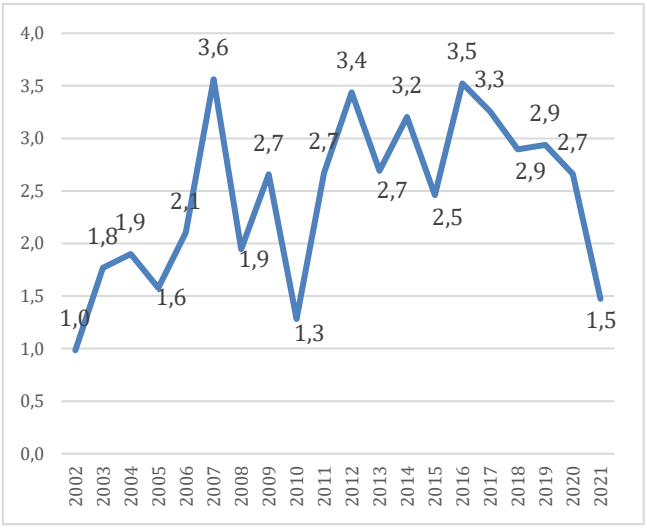

Fig. 3: Average citations per year

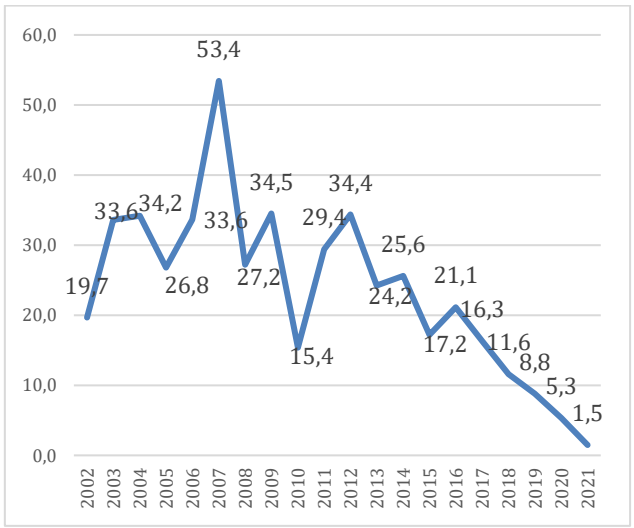

Fig. 4: Average citations per year

4.3 Research domain outreach

To understand the research outreach across various domains, the articles extracted from the WoS collection were not limited to a particular Web of Science category. From Tab. 4, it was found that the research stretches across 124 various categories, in which most of the articles were published within Environmental Studies (31%) and Environmental Sciences (25%).

Tab. 4: Article distribution

Web of Science category	Article count
Environmental Studies	442
Environmental Sciences	350
Green Sustainable Science Technology	244
Urban Studies	227
Regional Urban Planning	143
Geosciences Multidisciplinary	136
Geography	132
Architecture	108
Humanities Multidisciplinary	90
Construction Building Technology	78
Archaeology	77
Civil Engineering	68
Analytical Chemistry	64
Materials Science Multidisciplinary	63
Hospitality | Leisure | Sport | Tourism	60
Physical Geography	56
Social Sciences Interdisciplinary	54
Spectroscopy	54
Art	49
Ecology	48
Water Resources	46
Development Studies	42
Energy Fuels	36
Remote Sensing	34
Biodiversity Conservation	31

4.4 Journal impact and productivity

In the current study, we have limited the article source to only 'journals'. In our conducted systematic review, the 1420 identified articles have been published in 410 journals from various disciplines. The Bradford's Law charting technique was also used to view article source clustering (Goffman & Morris, 1970) and identify "core" journals in the discipline. The source clustering is shown in Fig. 5 with their respective frequencies represented in Tab. 5. The first zone, which lies in

the core, is where sources particularly devoted to the subject will be concentrated graphically. In the collection, there are 10 sources with a total of 483 articles that fall in the core zone. The top ten impactful journals with their respective h-index (Schreiber, 2008) values are represented in Tab. 6. The analysis suggests that even though 'Sustainability' has a higher number of published articles of 199, the articles published in 'Cities' has a more impact (H index: 21). The source dynamics i.e. their productivity over the years has been depicted in Fig. 6. It clearly shows a rapid upsurge in the number of article publications in the journal 'Sustainability' post-2017.

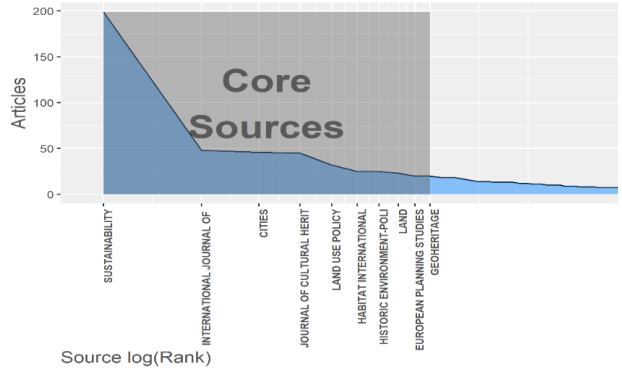

Fig. 5: Source clustering

Tab. 5: Frequent sources

Source (Journal)	Freq.
Sustainability	199
International Journal of Heritage Studies	48
Cities	46
Journal Of Cultural Heritage	45
Land Use Policy	32
Habitat International	25
Historic Environment-Policy & Practice	25
Land	23
European Planning Studies	20
Geoheritage	20

Tab. 6: Source Impact

Source (Journal)	H-index
Cities	21
Journal Of Cultural Heritage	18
Sustainability	15
Habitat International	13
Landscape And Urban Planning	12
International Journal of Heritage Studies	11
Land Use Policy	11
Tourism Management	10
European Planning Studies	9
Science Of The Total Environment	9

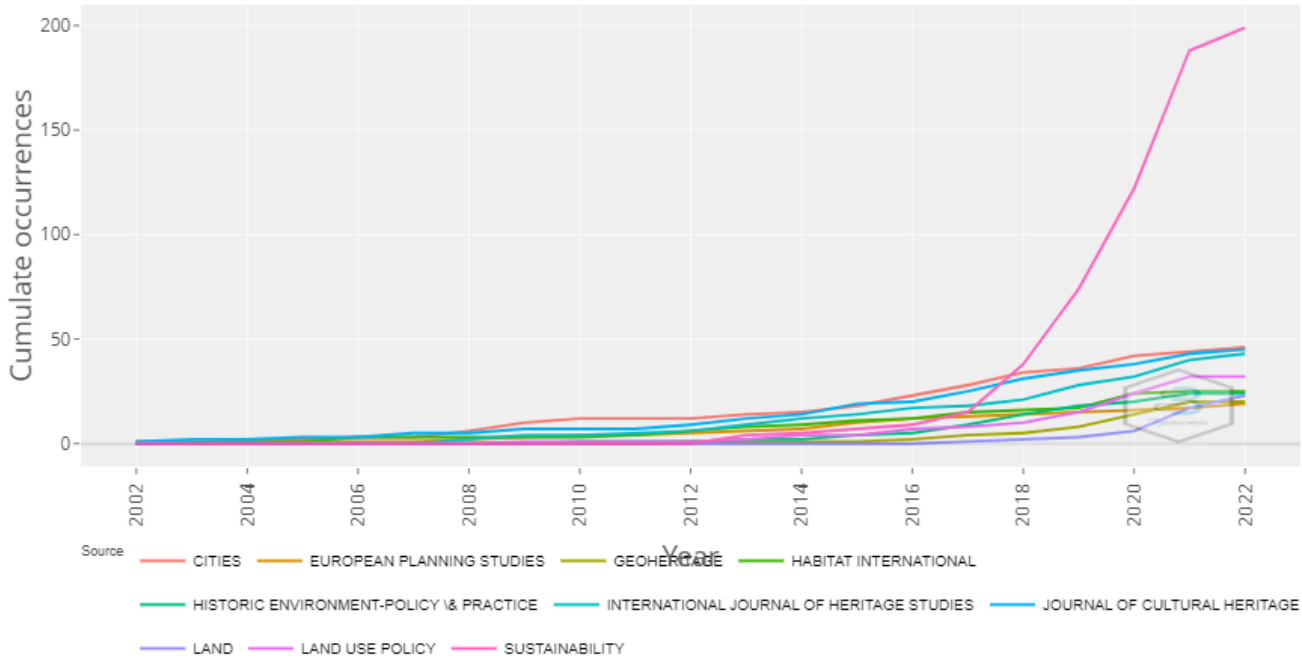

Fig. 6: Source growth dynamics

4.5 Top cited articles

Article citation count gives a comprehensive understanding of the most impactful articles in the research domain. In the current study, the top 10 articles from the extracted bibliometric data were ranked based on their total citation count (Tab. 7). The most cited paper which was published in Tourism Management focuses on a review of research on urban tourism and the various sub-domains associated with it.

Tab. 7: Most article citations

Paper	Author, Year	Journal	Total citation
Urban tourism research: Recent progress and current paradoxes	(Ashworth & Page, 2011)	Tourism Management	420
CityGML – Interoperable semantic 3D city models	(Gröger & Plümer, 2012)	ISPRS Journal of Photogrammetry and Remote Sensing	296
Built cultural heritage and sustainable urban development	(Tweed & Sutherland, 2007)	Landscape and Urban Planning	252
Global ecological, social, and economic impacts of marine plastic	(Beaumont et al., 2019)	Marine Pollution Bulletin	190
Indicators and ratings for the compatibility assessment of conservation actions	(Rodrigues & Grossi, 2007)	Journal of Cultural Heritage	185
Does demolition or refurbishment of old and inefficient homes help to increase our environmental, social, and economic viability?	Power, Anne; 2008 (Power, 2008)	Energy Policy	180
Energy efficiency and thermal comfort in historic buildings: A review	(Martínez-Molina et al., 2016)	Renewable and Sustainable Energy Reviews	175
Cultural tourism: A review of recent research and trends	(Richards, 2018)	Journal of Hospitality and Tourism Management	171
Urban vs. rural destinations: Residents' perceptions, community participation and support for tourism development	(Rasoolimanesh et al., 2017)	Tourism Management	162
Implementation challenges to the adaptive reuse of heritage buildings: Towards the goals of sustainable, low carbon cities	(Yung & Chan, 2012)	Habitat International	152

4.6 Authors' Productivity

The number of authored articles published by the authors gives an understanding of the most relevant authors in the extracted collection. The top 10 most relevant authors and their publication count have been shown in Tab. 8. Fig. 7 shows the top authors' productivity over time. The size of the circle depicts the number of articles published and the shade intensity of the circle depicts the number of citations per year for the corresponding year by that author. It can be seen that the contributing authors came into evidence in the domain from the year 2011 onwards, except for Jim C Y, who authored articles from 2004 onwards. Tab. 9 shows the number of citations attained by the authors thus giving an understanding of the most local cited authors in the collection.

Tab. 8: Relevant authors

Authors	Articles	Fractionalized
Jim CY	17	12.67
Zhang Y	16	4.43
Ferreira TM	11	3.69
Chan EHW	10	3.67
Li J	9	1.98
Wang Y	9	2.30
Yung EHK	9	3.50
Wang X	8	2.75
La Russa MF	7	0.95
Lasaponara R	7	2.02

Tab. 9: Local-cited authors

Authors	Local citations
Chan EHW	85
Yung EHK	73
Jim CY	32
While A	21
Ferreira TM	20
Nasser N	20
Colenbrander BJF	19
Guzman PC	19
Roders ARP	19
Langston C	18

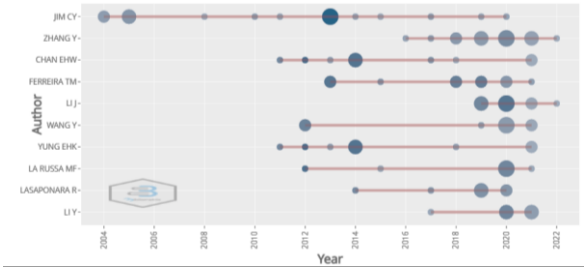

Fig. 7: Author productivity

4.7 Keyword analysis

The occurrence frequency of the top twenty keywords is represented in Tab. 10. The word 'heritage' has been seen in terms such as 'built heritage', 'urban heritage', 'heritage conservation', and 'cultural heritage'. The most frequently used keyword was found to be 'cultural heritage', followed by 'heritage', 'conservation', 'urban', 'sustainability' etc. The keyword 'China' has a frequency occurrence of 48, being the seventh most used keyword, hence indirectly showcasing the frequency of study conducted within the country. Fig. 8 shows a generated Word Cloud of the top fifty most frequent author keywords.

Fig. 8: Author keywords- word cloud

Tab. 10: Keyword frequency

Words	Occurrences
cultural heritage	147
heritage	123
conservation	89
urban	58
sustainability	55
sustainable development	49
china	48
urban planning	44
tourism	41
urban regeneration	41
adaptive reuse	38
development	32
landscape	31
cultural	29
GIS	27
planning	27
urban heritage	27
management	25
built heritage	23
heritage conservation	23

4.8 Three-fields plot

The three-field Sankey plot mapping was performed to analyze and get an overview of the main journals, main authors, and the keywords used, as shown in Fig. 9. The criteria were set to plot the top 20 of the respective fields. The sources have been represented in the left field, whereas the authors and keywords are shown in the middle and right field respectively. The size of the node determines its respective rank. Most of the articles from the top authors have been published in the 'Sustainability' journal, followed by 'Habitat International'. Another notable fact is that the key authors are concentrated in China. This is also reflected in the most used keywords. Apart from 'china', 'cultural heritage' has been mostly used as a keyword by the key authors.

4.9 Co-occurrence network analysis

To understand the overall conceptual structure between various concepts within the extracted literature, a co-occurrence network map was generated based on author keywords (Fig. 10). Six core clusters were identified, as represented in Tab. 11.

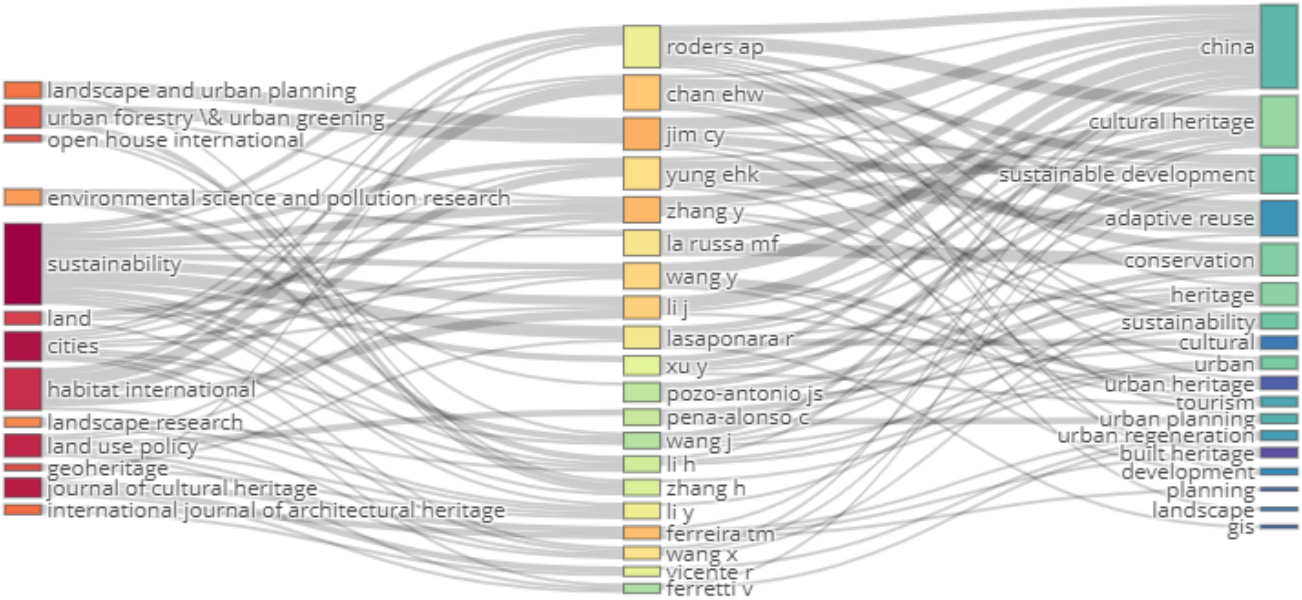

Fig. 9: Three-field plot

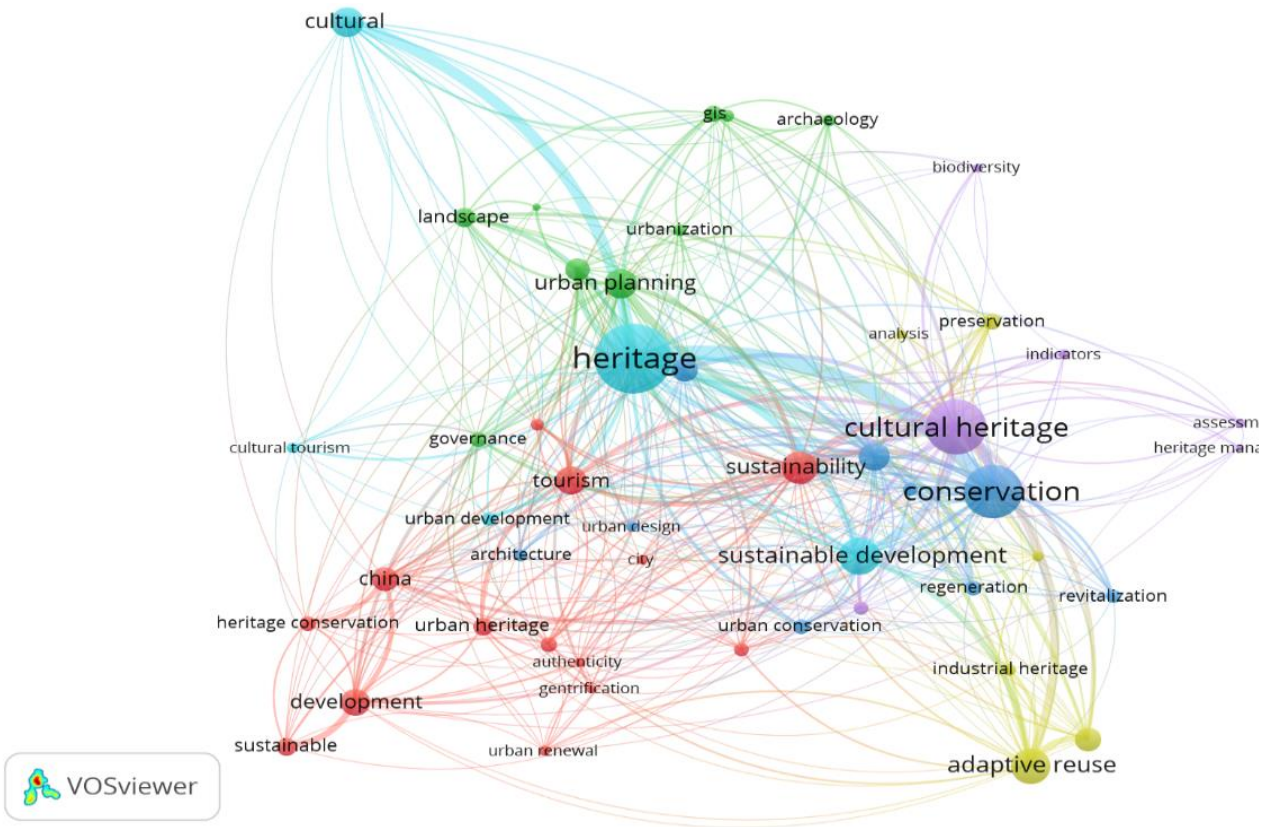

Fig. 10: Co-occurrence network

Tab. 11: Author keyword clusters

Cluster 01	Cluster 02	Cluster 03
Authenticity	Archaeology	Architecture
China	Ecosystem Services	Built Heritage
City	GIS	Conservation
Community	Governance	Management
Culture	Landscape	Regeneration
Development	Planning	Revitalization
Gentrification	Remote Sensing	Urban
Heritage Conservation	Urban Planning	Urban Conservation
Heritage Urban Landscape	Urbanization	Urban Design
Sustainability		
Sustainable		
Tourism		
Urban Heritage		
Urban Renewal		
Cluster 04	**Cluster 05**	**Cluster 06**
Adaptive Reuse	Assessment	Cultural
Analysis	Biodiversity	Cultural Tourism
Historic buildings	Cultural Heritage	Heritage
Industrial Heritage	Heritage Management	Sustainable Development
Preservation	Indicators	Urban Development
Urban Regeneration	Sustainable Urban Development	

Cluster 01 primarily focuses on the cultural and developmental aspects of heritage-led urban development. It includes keywords related to urban development, cultural heritage preservation, and sustainable approaches to heritage conservation. Cluster 02 encompasses keywords related to the technical and environmental aspects of heritage-led urban development. It includes topics like geographical information systems (GIS), governance, and urban planning in the context of heritage preservation. Cluster 03 revolves around architectural and design-related aspects of heritage-led urban development. It includes keywords related to architectural heritage, conservation, and urban design for heritage preservation. Cluster 04 focuses on the adaptive reuse of historic and industrial buildings, emphasizing the importance of preserving historical structures and revitalizing urban areas. Cluster 05 encompasses keywords related to the assessment of heritage-led urban development, including indicators for measuring progress and sustainability. It also touches upon biodiversity and cultural heritage management. Cluster 06 combines cultural aspects with sustainable development and urban development, indicating the intersection of cultural heritage and sustainability in urban planning and development.

4.10 Countries scientific production

The most productive countries in terms of article publication frequency and country citation have been represented in Tab. 12 and Tab. 13 respectively. As per the table, it was found that China has published almost 50% i.e. a total of 729 articles out of the 1420 identified articles, followed by Italy, Spain, the UK, and the USA. Italy was observed to be the most cited country, followed by China, the UK, Spain, and the Netherlands.

Tab. 12: Country productivity

Country	Frequency
China	729
Italy	668
Spain	330
UK	315
USA	269
Australia	166
Netherlands	142
Portugal	142
Germany	123
Turkey	117

Tab. 13: Country-wise citations

Country	Total citations	Average article citations
Italy	3117	14.63
China	2365	10.80
United Kingdom	2231	22.31
Spain	1182	11.94
Netherlands	1092	27.30
USA	1010	12.95
Germany	817	25.53
Portugal	810	20.77
Australia	554	11.08
Greece	450	15.52

5. Discussion

The study conducted captures and presents the evolutionary trend of the inclusion of the urban heritage domain within urban transformational assessment studies. The published bibliometric papers focusing on the current set of keywords have also been presented and summarized, hence suggesting the need for a bibliometric study with the identified keywords, due to the lack of proper focus on the current objectives. To conduct the bibliometric study, the bibliometric R-package was an effective and user-friendly tool for descriptive and graphical analysis. The bibliometric analysis is solely based on the articles that are available in the Web of Science database that justifies its impact in the research field. Published articles except for conference proceedings, book chapters, and book reviews were the prime criteria for shortlisting the documents from the database. A total of 1420 documents were identified from the WoS database, considering all the categories, and after necessary criteria refinement. The bibliometric study focused not only on identifying the literature trend but also on understanding the diversification of studies related to urban heritage along with development. Although articles were found to be published within domains such as environmental sciences/studies, urban planning/studies, and architecture, we find there is a noteworthy article count within domains such as geography, chemistry, ecology, energy, biodiversity, and social sciences. The literature search with the defined keyset yielded documents that went beyond the idea of urban heritage within the cultural heritage context and showed a significant multidisciplinary outreach. This shows the multi-disciplinary nature of the research domain.

The relevant papers began to emerge in 2002 and showed remarkable progress in scientific productivity. The number of published literature increased from 6 to 236 yielding a remarkable 11.4% linear growth rate within nearly two decades i.e. from 2002 to 2021. The year 2007 was seen to be most productive year in terms of average citations, which was 3.6 citations per year and 53.4 citations per article. Another key point observed was that although the journals with the majority of articles published and those with the highest h-index were different, both journals appeared among the top 3 in both categories. There is a 50 percent difference in the number of articles published between the highest and second-highest article-count journals, which indicates the scientific proficiency of the top most frequent journal. Despite the publication spread into other sub-domains, most of the articles with top citations revolve around the domain matrix of cultural heritage, tourism, and urban development. The highly cited articles collectively inform the academic discourse and practical applications within the field, offering valuable insights into the complexities of heritage-led urban development. The most cited article falls under the sub-domain of urban tourism.

Jim CY stands out as the most prolific author with 17 articles, indicating their substantial contributions to the field. Their high fractionalized score of 12.67 reflects the significant impact of their work. Following closely is Zhang Y with 16 articles, demonstrating a consistent presence in the research literature. Ferreira TM, Chan EHW, and Yung EHK each have authored 11, 10, and 9 articles, respectively, showcasing their considerable contributions to the field. Wang Y, Yung EHK, and Wang X have also made notable contributions, with 9, 9, and 8 articles, respectively. The fractionalized scores reveal the relative impact of each author's work, with Jim CY and Yung EHK leading in terms of influence. La Russa MF and Lasaponara R, while having fewer articles to their name, have contributed significantly, as indicated by their fractionalized scores, emphasizing the value of their research contributions in the field. These findings shed light on the key authors who have played instrumental roles in advancing the discourse on heritage-led urban development assessment frameworks. Notably, Chan EHW emerges as the most cited author with 85 local citations, underscoring their significant contributions to the literature in this area. Yung EHK also demonstrates a strong presence with 73 local citations. These authors likely play pivotal roles in shaping the discourse around heritage-led urban development, possibly through their research, publications, or expertise. The remaining authors, including Jim CY, While A, Ferreira TM, Nasser N, Colenbrander BJF, Guzman PC, Roders ARP, and Langston C, contribute substantially with citation counts ranging from 18 to 32, signifying their valuable contributions to the local scholarly community. These findings illuminate the key voices driving research and discussions in heritage-led urban development

assessment frameworks within the specified locality.

The keyword frequency analysis reveals several prominent themes within research on heritage-led urban development assessment frameworks. "Cultural heritage" and "heritage" emerge as the most frequently mentioned keywords, underscoring the central role of cultural preservation in urban planning. "Conservation" emphasises the safeguarding of heritage assets, while "sustainability" and "sustainable development" signify a growing commitment to environmentally and socially responsible practices. Notably, "China" is a significant keyword, reflecting extensive research on heritage-led urban development in the context of China's rapid urbanization and cultural heritage. The presence of "urban," "urban planning," "tourism," and "urban regeneration" highlights the focus on urban areas, with a consideration of tourism as an economic and cultural driver. "Adaptive reuse" emphasizes the repurposing of historical structures, and "development" encompasses the broader context of urban development in which heritage is integrated. "Landscape" signifies the importance of the urban environment, while "GIS" points to geospatial technologies' role in managing heritage assets. These keywords collectively represent the multidisciplinary nature of heritage-led urban development research, integrating cultural, environmental, architectural, and planning aspects to balance heritage preservation with urban growth and sustainability.

After analyzing the author's keywords co-occurrence network map, articles that were mainly published could be categorized within six keyword clusters. The keyword clusters provide an overview of the diverse themes and topics within heritage-led urban development assessment frameworks. Researchers in this field may use these clusters to guide their studies, focusing on specific themes or exploring interdisciplinary approaches to address the complex challenges of preserving cultural and environmental heritage in urban areas. All over the study, China has been predominantly popping in various fields. The study reveals that China is the most productive country in terms of scientific publications and second in terms of citations. The varying levels of productivity among countries could be influenced by factors such as cultural heritage significance, urbanization rates, and academic research funding. These findings can provide insights into the global landscape of research in this field and may guide future collaboration and research efforts. The high average article citation counts for the Netherlands, Germany, and the UK suggest that research from these countries tends to have a more substantial influence on the academic community. China has also been used as a keyword in multiple articles. the results indicate a global interest in heritage-led urban development assessment frameworks, with several countries actively contributing to the scholarly literature. The top relevant author Jim C.Y. who also hails from China has 17 published articles focusing on the study area of urban ecology followed by other key authors who also are from China. This significantly indicates the scientific productivity from within the country.

6. Conclusion

The study provides potential direction for future research to assess urban transformations with a perspective of urban heritage from various subdomains, which can be taken into research interest by the researchers in their respective disciplines. The current study opens the scope for conducting a detailed literature review of the core articles in various sub-domains, thus showcasing the multidisciplinary relevance of the research domain. Various methodologies and applications adopted in assessing urban transformations in historic urban areas can be identified, extracted, and studied comprehensively.

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