

Analysis of Domestic Research Trends in Industrial Heritage Conservation and Reuse Based on Citespace

Shanshan Shen¹, Rui Zhu¹, Yiqun Liao², Qian Zhang^{3*}

¹ School of Art and Design, Zhengzhou University of Light Industry, Zhengzhou, China

² Rocket Force Engineering Project Management Office of the People's Liberation Army, Senior Engineer, Architectural Design, China

³ Cultural Heritage Conservation, School of Art and Design, Zhengzhou University of Light Industry, Zhengzhou, China

Email Address

3051526051@qq.com (Shanshan Shen), 2007017@zzuli.edu.cn (Qian Zhang)

*Correspondence: 2007017@zzuli.edu.cn

Received: 10 October 2025; **Accepted:** 17 November 2025; **Published:** 24 November 2025

Abstract:

In response to the policy direction outlined in China's 14th Five-Year Plan for Cultural Development, which explicitly advocates "strengthening the conservation and utilization of industrial heritage while promoting the inheritance and innovation of industrial culture", this study employs Citespace software to conduct a visual analysis of CNKI literature spanning 2005 to 2025. The research systematically examines hotspots and trends in the field, revealing a policy-driven surge in overall research activity. Key focuses include the preservation, adaptive reuse, and value assessment of industrial heritage, with research efforts predominantly concentrated in regions such as Beijing and Tianjin. Current studies exhibit limitations in perspective, insufficient depth of content, and inadequate recognition of intangible values. Future research should integrate multidisciplinary efforts and deepen the exploration of intangible values to facilitate the transition of industrial heritage from "static preservation" to "dynamic evolution," thereby providing theoretical and practical support for sustainable conservation and innovative inheritance.

Keywords:

Industrial Heritage, Conservation and Adaptive Reuse, Citespace, Visual Analysis

1. Introduction

National industrial heritage core items refer to the tangible and intangible remains that represent the primary characteristics of national industrial heritage [1]. The International Committee for the Conservation of the Industrial Heritage (TICCIH) stated in the 2003 Nizhny Tagil Charter: Industrial heritage comprises industrial cultural relics of historical, technical, social, architectural, or scientific value, which record the evolution of production systems and constitute core evidence of the progression of industrial civilization. Although this field is increasingly emphasized within cultural heritage, systematic reviews remain relatively scarce, particularly

those employing visual quantitative analysis using Citespace software, resulting in insufficient revelation of the knowledge structure and intrinsic connections within the literature.

Therefore, this study utilizes Citespace software to investigate domestic literature in the industrial heritage field from 2005 to 2025. By examining aspects such as literature distribution, core authors, research institutions, and thematic evolution, it delineates the developmental trajectory and methodological trends, thereby laying a foundation for improving the conservation and reuse system of China's industrial heritage.

2. Data Sources and Research Methods

2.1. Data Sources

Journal articles from the China National Knowledge Infrastructure (CNKI) database published between 2005 and 2025 were searched using “industrial heritage protection” and “industrial heritage reuse” as themes. Searches were conducted in titles, keywords, and abstracts, initially yielding 789 articles. After relevance assessment, 290 non-core articles were excluded. The remaining articles were then comprehensively ranked based on relevance and citation count, with 499 valid articles ultimately retained as the data source for visualization analysis. As some scholars have noted, weakly relevant literature can result in redundant clustering and irrelevant branches in knowledge graphs. Therefore, systematic retrieval and data cleaning strategies were employed to eliminate interference from irrelevant literature. The literature was exported in Refworks format, and CiteSpace6.1.R3 software was utilized to perform keyword co-occurrence, clustering, and burst analysis, revealing the evolutionary paths of research hotspots.

2.2. Research Methods

CiteSpace, as a core tool for scientific knowledge mapping, is primarily employed to construct keyword co-occurrence networks, cluster structures, and timeline evolution within the industrial heritage discipline. This methodology facilitates the analysis of citation patterns, keyword distributions, and research trends in scholarly literature, thereby revealing cluster characteristics and evolutionary patterns of the knowledge domain. Furthermore, through the integration of word frequency statistics and cluster analysis algorithms, the approach enables quantitative identification and visualization of the field, ultimately establishing a comprehensive knowledge mapping system for industrial heritage conservation and utilization.

3. Analysis of Research Results

3.1. Analysis of Annual Publication Volume

Based on the statistical analysis of CNKI literature, China's industrial heritage research can be divided into three stages. The first stage, from 2005 to 2009, was a period of slow growth, with only 44 articles published in five years. It was not until 2010 that the special international symposium on “Industrial Heritage Reuse,” jointly initiated by The International Committee for the Conservation of the Industrial Heritage (TICCIH), the International Committee for the History of Technology (ICOHTEC), and the International Association of Labour Museums (WORKLAB), was held in Finland. This conference systematically constructed the theoretical framework for industrial heritage conservation and discussed renewal strategies and

evaluation systems, propelling the research into a stage of fluctuating growth. The second stage, from 2010 to 2018, was a period of fluctuating growth, with the number of publications increasing to 250 articles over nine years and the average annual growth rate significantly improving. With the successive promulgation of national policies for the preservation and identification of industrial heritage, General Secretary Xi Jinping emphasized that “historical culture is the soul of the city, and we should protect urban historical and cultural heritage as we cherish our own lives.” The key to safeguarding this “urban soul” lies in effectively balancing the relationship between urban construction development and the preservation and utilization of historical and cultural heritage. Under the impetus of the 2011 “Berlin Principles” and the 2012 “Taipei Declaration on Asian Industrial Heritage,” holistic preservation and adaptive reuse of industrial heritage have emerged as central themes. The third stage, spanning from 2019 to 2022, entered a phase of accelerated development, with research output increasing to 156 publications over four years and the highest annual output reaching 41 articles. However, beginning in 2023, there has been a notable decline in publication output, with 20 articles in 2024 and merely 4 articles projected for 2025, indicating that the research has transitioned from broadening its scope to delving into more profound investigations (As shown in Figure 1).

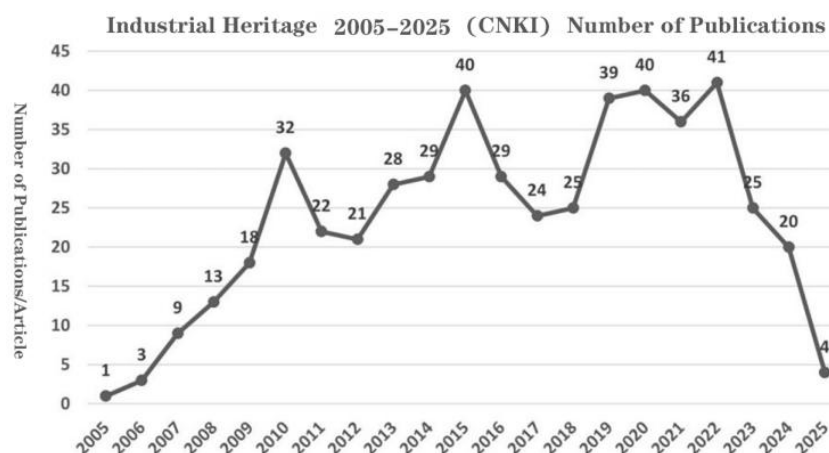


Figure 1. Analysis of Annual Publications on Industrial Heritage, 2005–2025.

3.2. Analysis of Publishing Institutions and Authors

After analyzing 499 selected articles in this field from CNKI using Citespace software, it was found that Liu Boying, Xu Subin, Han Fuwen, Tong Yuquan, and Lu Jianchang are the five most prolific authors. The top three authors by citation count are Zhang Yishan [2] (186 citations), Li Heping [3] (130 citations), and Liu Fuying [4] (123 citations); the top four by download count are Zhang Huanzhou [5] (4431), Zhang Yishan (4425), Zhang Song [6] (3766), and Jin Xin [7] (3748). This study involves 170 institutions participating in research in this field, among which Tsinghua University and the School of Architecture at Tianjin University lead with 9 publications each, followed by the Tourism Management College at Shenyang Normal University with 8 publications. In terms of regional distribution, universities in the Beijing and Tianjin regions have the highest concentration of publications, indicating a higher level of attention to industrial heritage protection in these areas. Furthermore, industrial cities including Shanghai, Shenyang, and Xi'an have developed multi-center research clusters in collaboration with academic institutions, demonstrating spatial distribution patterns centered around industrial areas and historical-cultural zones. (as illustrated in Figure 2 and Figure 3).

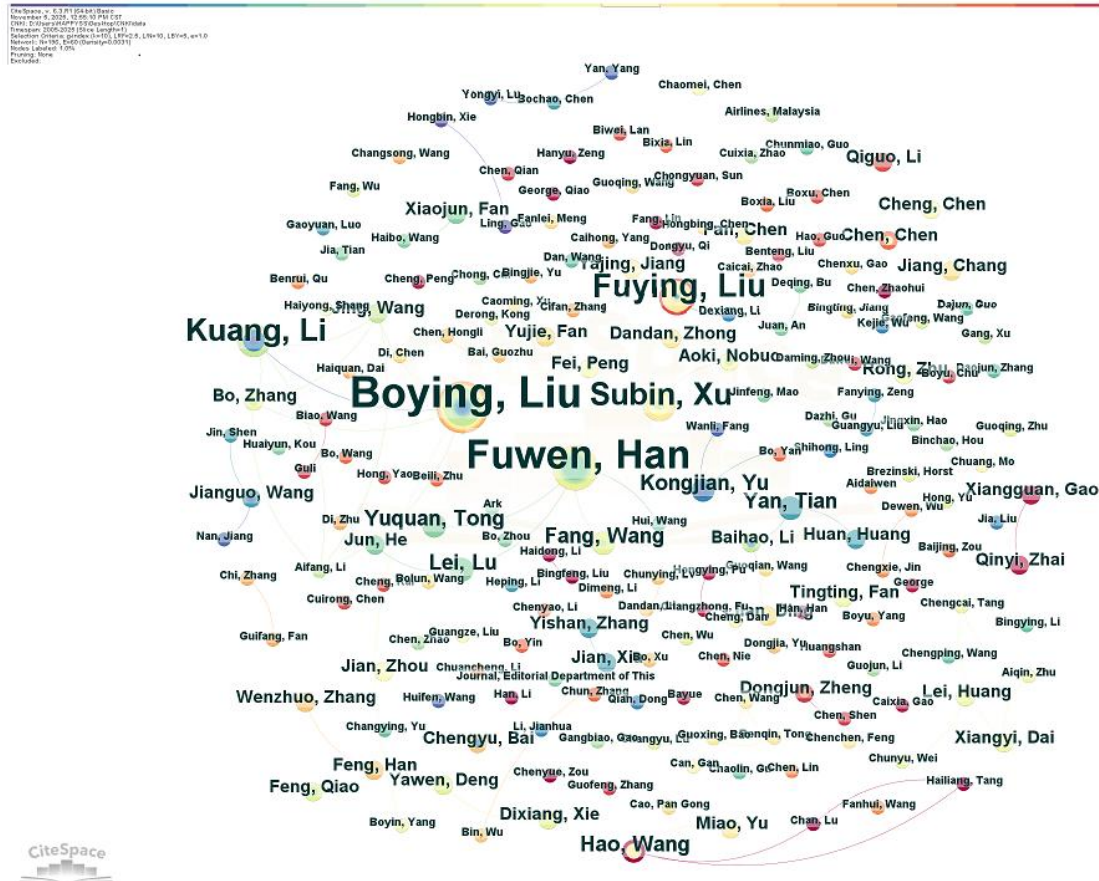


Figure 2. Analysis Diagram of Authors Who Published Papers (Source: Self-made by the Author).

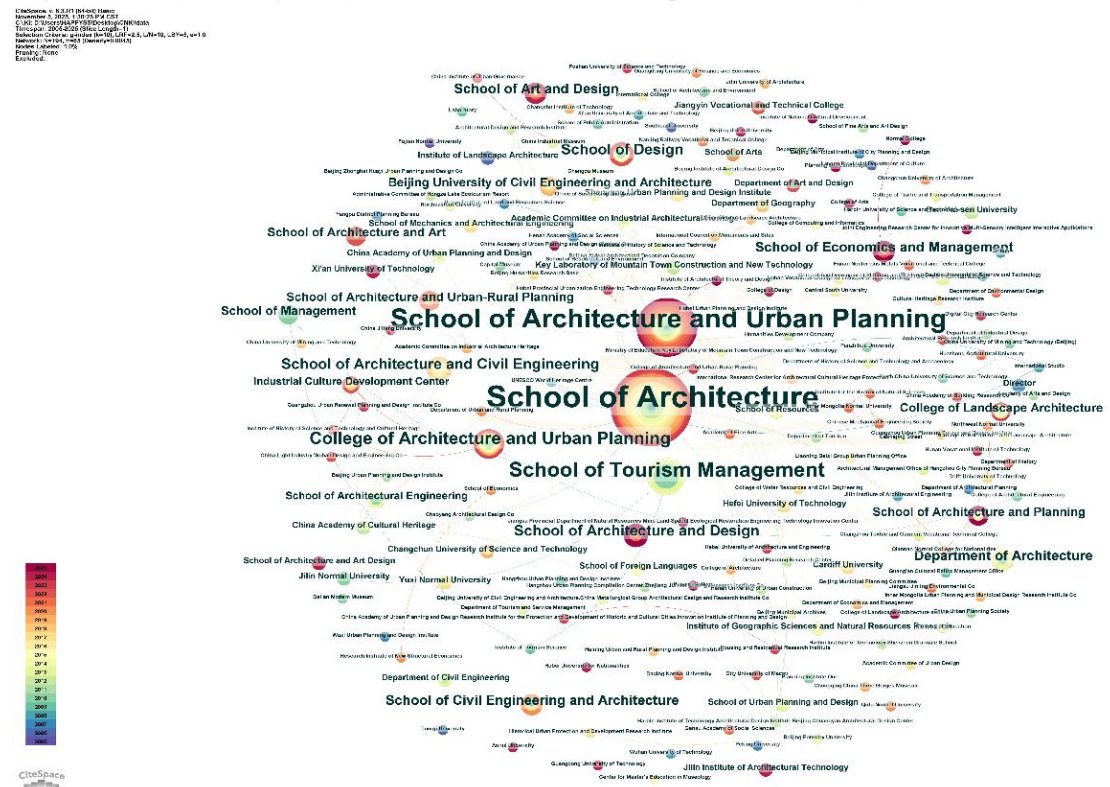


Figure 3. Analysis Diagram of Issuing Institutions.

3.3. Keyword Co-occurrence Network Analysis

[illegible]

Figure 4. Co-occurrence Network Analysis of Keywords.

3.4. Keyword Cluster Analysis

Property	Line 1	Line 2	Line 3	Line 4	Line 5	Line 6	Line 7	Line 8	Line 9	Line 10	Line 11	Line 12	Line 13	Line 14	Line 15	Line 16	Line 17	Line 18	Line 19	Line 20	Line 21	Line 22	Line 23	Line 24	Line 25	Line 26	Line 27	Line 28	Line 29	Line 30	Line 31	Line 32	Line 33	Line 34	Line 35	Line 36	Line 37	Line 38	Line 39	Line 40	Line 41	Line 42	Line 43	Line 44	Line 45	Line 46	Line 47	Line 48	Line 49	Line 50	Line 51	Line 52	Line 53	Line 54	Line 55	Line 56	Line 57	Line 58	Line 59	Line 60	Line 61	Line 62	Line 63	Line 64	Line 65	Line 66	Line 67	Line 68	Line 69	Line 70	Line 71	Line 72	Line 73	Line 74	Line 75	Line 76	Line 77	Line 78	Line 79	Line 80	Line 81	Line 82	Line 83	Line 84	Line 85	Line 86	Line 87	Line 88	Line 89	Line 90	Line 91	Line 92	Line 93	Line 94	Line 95	Line 96	Line 97	Line 98	Line 99	Line 100
Property	Line 1	Line 2	Line 3	Line 4	Line 5	Line 6	Line 7	Line 8	Line 9	Line 10	Line 11	Line 12	Line 13	Line 14	Line 15	Line 16	Line 17	Line 18	Line 19	Line 20	Line 21	Line 22	Line 23	Line 24	Line 25	Line 26	Line 27	Line 28	Line 29	Line 30	Line 31	Line 32	Line 33	Line 34	Line 35	Line 36	Line 37	Line 38	Line 39	Line 40	Line 41	Line 42	Line 43	Line 44	Line 45	Line 46	Line 47	Line 48	Line 49	Line 50	Line 51	Line 52	Line 53	Line 54	Line 55	Line 56	Line 57	Line 58	Line 59	Line 60	Line 61	Line 62	Line 63	Line 64	Line 65	Line 66	Line 67	Line 68	Line 69	Line 70	Line 71	Line 72	Line 73	Line 74	Line 75	Line 76	Line 77	Line 78	Line 79	Line 80	Line 81	Line 82	Line 83	Line 84	Line 85	Line 86	Line 87	Line 88	Line 89	Line 90	Line 91	Line 92	Line 93	Line 94	Line 95	Line 96	Line 97	Line 98	Line 99	Line 100

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heritage studies, the core themes remain highly concentrated. The non-overlapping areas, however, indicate that although all research centers on industrial heritage protection, significant differences exist in terms of methodology and research content. (As shown in Figure 5).



Figure 5. Keyword Clustering Analysis Diagram.

3.5. Research Topics and Hotspot Analysis

Cluster analysis of research in this field using CiteSpace’s LLR algorithm yielded 8 main clusters and identified 7 burst words, including “industrial heritage” and “protection” (as shown in Figure 6). These terms are predominantly concentrated in the Beijing-Tianjin region with earlier emergence times, reflecting sustained attention from both academic and national levels. The top 10 high-frequency keywords in the atlas can be categorized into three themes (as presented in Table 1). The dominant category comprises industrial heritage (290 occurrences), protection (73 occurrences), reuse (48 occurrences), and protection and utilization (37 occurrences); the value and theme category encompasses urban renewal (30 occurrences), value evaluation (15 occurrences), and third-line construction (12 occurrences); the implementation strategy category involves value assessment (6 occurrences), protection strategy (4 occurrences), and creative industry (3 occurrences).Overall, there is an uneven distribution of research topics and a relative weakness in specific implementation strategies, necessitating further in-depth research by scholars in this field.

Table 1. Ranking Table of Keyword Frequency in Industrial Heritage Protection and Reuse Research.

Keywords	Year	Frequency	Keywords	Year	Frequency
Industrial Heritage	2006	290	Value	2009	6
Conservation	2005	73	Value Assessment	2012	6
Reuse	2008	48	Northeast China Region	2009	4

Conservation and Utilization	2009	37	Urban Characteristics	2015	4
Urban Renewal	2008	30	Historical Buildings	2010	4
Value Evaluation	2011	15	Museums	2011	4
Utilization	2005	13	Conservation Planning	2010	4
Third Front Construction	2008	12	Conservation Strategies	2012	4
Revitalization	2015	8	Industrial Buildings	2008	4
Spirit of Place	2013	6	Symbiosis Theory	2013	4

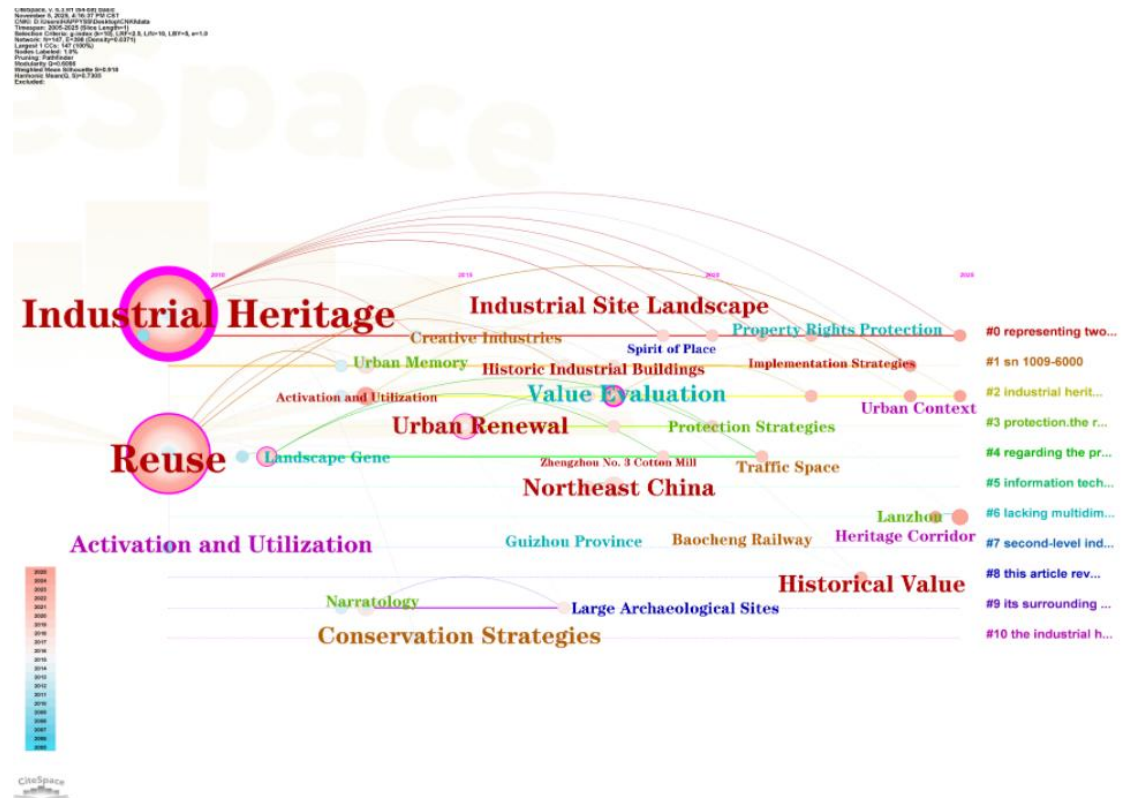


Figure 6. Keyword Cluster Analysis Diagram.

3.6. Keyword Timeline Analysis

The length of the red bands in the map demonstrates a positive correlation with the research duration, wherein longer bands indicate greater time spans and more significant burstiness of keywords. The temporal distribution reveals two clusters of high-intensity burst terms: ‘protection’ emerging in 2005 and ‘activation and utilization’ in 2015, reflecting a sustained scholarly shift from focusing on heritage preservation to functional transformation. The emergence of ‘Third-line Construction’(burst intensity 1.61) and ‘urban renewal’ (burst intensity 3.79) around 2015 signifies a pivotal transition in research from singular protection approaches to systematic renewal strategies. Notably, ‘protection and utilization’ (intensity 2.54) maintains the longest burst cycle throughout the entire period, intersecting with concepts such as ‘reuse’ and ‘symbiosis theory’ (intensity 0.76). This convergence has constructed a disciplinary methodology that integrates the values inherent in heritage protection and utilization with innovations in contemporary functionality. (As shown in Figure 7)

Top 25 Keywords with the Strongest Citation Bursts

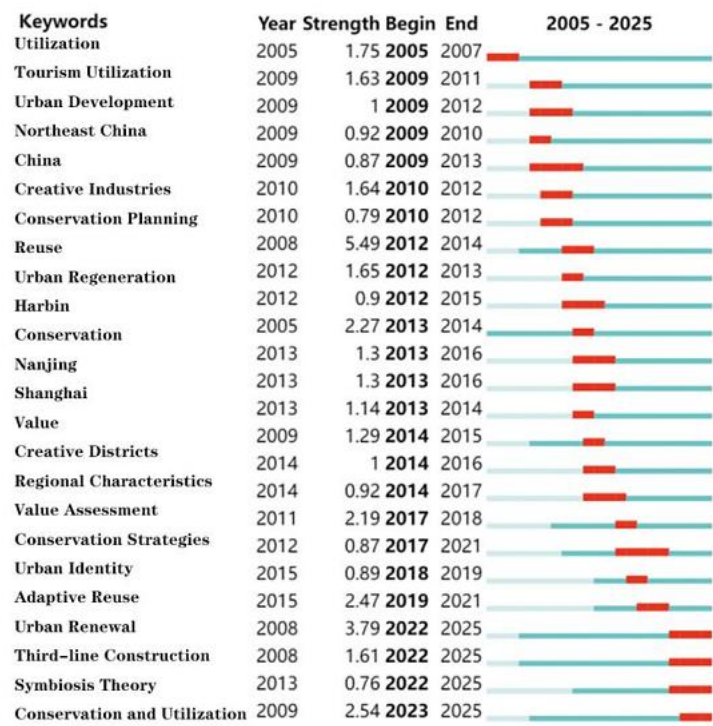


Figure 7. Emergent Keyword Analysis.

4. Research Trends in Domestic Industrial Heritage Conservation and Reuse

4.1. Level of Industrial Heritage Conservation

Conservation serves as the prerequisite for the reuse of industrial heritage. Only by ensuring the preservation of the heritage itself can its contemporary value be activated and revitalized. The research trends related to industrial heritage conservation are presented in the table below, with relevant studies primarily focusing on the following three aspects (as presented in Table 2):

Table 2. Research Trends in Industrial Heritage.

Research Trends in China over the Past Two Decades	
2005-2010	Studies primarily focused on cities, old industrial plants, and buildings, addressing the preservation and adaptive reuse of industrial heritage, as well as its integration with tourism.
2010-2015	High-frequency keywords included industrial architectural heritage, industrial heritage conservation, industrial parks, industrial cultural heritage, former industrial sites, and digital preservation of industrial heritage. Building upon traditional disciplinary foundations, research themes expanded, yielding a series of outcomes.
2015-2025	Research has been conducted against backdrops such as stock regeneration, heritage corridor perspectives, rural revitalization, and urban renewal. Since 2015, high-frequency keywords have encompassed industrial heritage value, regeneration of industrial heritage districts, cultural DNA of industrial heritage, conservation strategies for industrial heritage, and industrial sites. The study of industrial heritage preservation and adaptive reuse has sustained long-term scholarly interest in China.

4.1.1. Research Directions in Industrial Heritage Legislation and Policy

The International Committee for the Conservation of the Industrial Heritage (TICCIH) promulgated the Nizhny Tagil Charter in 2003, which stipulates that “countries must qualify, document, and preserve industrial heritage for future generations.” This charter established a theoretical framework and international consensus for industrial heritage conservation, prompting Chinese scholars to progressively deepen related research. Shan Jixiang (2006) systematically introduced international industrial heritage theories while critically examining domestic preservation challenges [8]. The release of the Wuxi Proposal in the same year marked the transition of China’s industrial heritage conservation into a new phase. Subsequently, the National Cultural Heritage Administration reinforced preservation requirements, and in 2018, the Ministry of Industry and Information Technology implemented the Interim Measures to advance the qualification and study of industrial heritage [9].

Subsequently, from 2020 to 2023, the state successively issued multiple policies primarily aimed at promoting the conservation, utilization, and transformational development of industrial heritage. For instance, in 2020, five departments including the National Development and Reform Commission jointly issued the “Implementation Scheme for Promoting the Conservation and Utilization of Industrial Heritage in Old Industrial Cities,” proposing the integration of industrial heritage conservation with urban functional enhancement to facilitate the transformation of “industrial rust belts” into “vibrant life belts,” while supporting the establishment of national demonstration zones for cultural relic preservation and utilization as well as new models of industrial tourism. This scheme catalyzed the introduction of the national policy “Implementation scheme for Promoting Industrial Culture Development (2021-2025)” in 2021, which explicitly identified the conservation and utilization of industrial heritage as a core objective, fostering new formats of industrial culture, supporting the construction of industrial museums and industrial tourism demonstration bases, and strengthening the inheritance of industrial spirit. To implement the relevant requirements, the Ministry of Industry and Information Technology revised the Management Measures for National Industrial Heritage in 2023, further improving the management mechanism, strengthening dynamic supervision and tiered protection, and continuously enhancing the industrial heritage preservation system.

Thus, the introduction of these policies has facilitated the transition of industrial heritage from individual conservation to systematic inheritance, achieving the integration of cultural heritage value with urban functional enhancement.

4.1.2. Industrial Heritage Evaluation System Level

(i) Evaluation Standards for Industrial Heritage Value

As an integral component of cultural heritage, industrial heritage has been incorporated into the national-to-regional cultural relics protection unit system. Its conservation must adhere to the principles of authenticity, integrity, and minimal intervention, while also aligning with urban development. The grading criteria for industrial heritage are primarily based on six value dimensions—historical, social, technological, and economic, among others—as outlined in national policies such as the “Interim Measures for the Management of National Industrial Heritage.” An indicator system centered on value evaluation has been established accordingly. This

system follows eight principles, including guidance, independence, and conciseness, and employs a methodology that prioritizes quantitative assessment supplemented by qualitative analysis to comprehensively evaluate heritage value. Based on weighted criteria, protection levels are categorized into primary, secondary, and tertiary tiers, following the evaluation standard that “higher value corresponds to greater protection intensity and a higher classification level.”

(ii) Industrial Heritage Value Evaluation Analysis

The evaluation of industrial heritage values constitutes a significant research focus among domestic scholars, encompassing multiple dimensions such as historical, technological, and socio-cultural aspects. Yu Kongjian and Fang Wanli (2006) [10] and Peng Yunqi (2022) [11] emphasized the importance of value recognition in the hierarchical management of heritage. Scholar Kou Huaiyun (2007) [12] argued that technological value should be positioned at the core of industrial heritage, asserting that the essence of preservation lies in safeguarding the value of industrial technology. Tan Chao (2008) [13] focused on economic value and introduced methods such as opportunity cost and contingent valuation to highlight its significance in conservation practices. Wang Runsheng (2023) [14], taking Qingdao Port as a case study, proposed that evaluation systems should prioritize historical and scientific values, as they are directly linked to industrial context and serve as the primary basis for preservation, while also considering artistic value to reflect aesthetic characteristics. Overall, the academic community places greater emphasis on the scientific technological and historical values of heritage, while economic value requires functional integration and dynamic utilization to achieve effective conservation. Artistic value, as an aesthetic vehicle, serves as a crucial medium for activating the spirit of place and promoting regeneration.

(iii) Analysis of Industrial Heritage Value Evaluation Methods

Industrial heritage valuation primarily employs a combination of quantitative and qualitative approaches, with distinct indicator systems constructed according to specific research subjects. Zhang Yishan (2008) [15] developed an evaluation framework by adapting ecological factor assessment methodology, emphasizing equal distribution of indicator weights. Scholar Liu Boying (2008) [16] utilized expert scoring to categorize Beijing's industrial heritage into historical value and current conservation/reuse dimensions, establishing classification levels through professional evaluation. Qi Yi (2008) [17] adopted a predominantly qualitative approach, establishing 5 categories with 17 indicators and defining conservation tiers based on aggregate scores. Subsequent researchers including Yuan Fen (2014) [18], Qian Chuan (2016) [19], and Chen Xin (2024) [20] further integrated qualitative and quantitative methodologies. These scholars adjusted weighting systems according to industrial characteristics, proposing principles for holistic conservation and hierarchical planning, with protection levels determined through calculated weight distributions. It is evident that current research still faces challenges such as the strong subjectivity in weight allocation and the lack of a unified evaluation framework. Future efforts should focus on strengthening empirical studies of industrial heritage and implementing dynamic assessments to enhance the systematicity and objectivity of the evaluation system.

4.1.3. Industrial Heritage Conservation Strategy

Industrial heritage can be classified into three conservation tiers based on value assessment outcomes. The first tier comprises heritage with the highest value, designated as protected cultural relics units, which require stringent conservation mechanisms. Their restoration and maintenance must adhere to the Cultural Relics Protection Law, preserving the authenticity and integrity of the heritage. The second tier includes heritage of relatively high value, reflecting industrial history of specific periods and possessing regional typicality and cultural significance. Controlled conservation is implemented, allowing functional adaptation and structural reinforcement without altering the main structure and appearance of the heritage. For the third tier, which consists of heritage with ordinary value, the focus is on rational utilization while retaining industrial characteristics, enabling adaptation to urban development needs. In addition to improving laws and regulations, government authorities should strengthen publicity and guidance to enhance public awareness and concern for industrial heritage, expanding social participation through policies and communication.

Experts and scholars should draw on domestic and international experience to deepen theoretical research, clarify definitions, classifications, and value assessment standards for heritage, thereby providing a basis for conservation practices. Meanwhile, social organizations and the public, as foundational forces, should correctly recognize the value of heritage and take practical actions to participate in its preservation.

4.2. Industrial Heritage Reuse

Industrial heritage reuse refers to the renovation and repurposing of former heritage sites. Scholars primarily categorize reuse models into the following two types based on adaptive reuse principles:

4.2.1. Protective Utilization

This approach involves preserving the original appearance of heritage assets while perpetuating historical memory and cultural continuity. It highlights cultural and social value through museum formats, fostering the dynamic transmission of heritage. Industrial heritage museums focus on multi-valued industrial relics, systematically retaining historical information, physical spaces, zeitgeist, and the authenticity of technological processes. Gao Xiaoxu (2022) [21] summarized the definition, classification, and advantages of this model, noting challenges such as functional limitations and insufficient innovation. Ma Qiuyun (2015) [22] transformed industrial relics into museums integrating historical exhibition and public leisure through functional restructuring and technological integration, effectively enhancing social engagement and receiving practical validation. Jin Xin (2011) [7] demonstrated that converting the Dahua Cotton Mill into a museum is an effective approach for repurposing industrial buildings. In contrast, Wang Lei (2015) [23] emphasized heritage conservation, proposing value extension and spatial mending to overlay historical and contemporary functions, thereby offering methodological support for addressing functional fragmentation in heritage sites. Currently, industrial heritage museums lack universal assessment systems and quantitative methods, necessitating enhanced research on heritage value exploration and functional transformation within the context of new urbanization.

4.2.2. Adaptive Reuse

While preserving the fundamental form of industrial heritage, adaptive reuse achieves value transformation through innovations in morphology and function, converting these structures into commercial, recreational, and educational spaces, thereby creating sites where history and consumption coexist.

(i) Reuse of Industrial Heritage as Commercial Spaces

The commercial reuse of industrial heritage primarily takes two forms: creative industrial parks and tourism district development. Creative industrial parks, built upon industrial heritage sites, represent a new type of cultural space that integrates creative ambiance with historical depth, characterized by intensive creative labor. Li Wenxuan (2025) [24] explores the fusion of commercial and industrial aesthetics in the renovation of steel heritage, emphasizing the role of interaction between old and new spaces in reconstructing the spirit of place; Zhang Hao (2018) [25] proposes a “preservation–renovation–revitalization” transformation pathway for cultural-creative parks based on historical context, offering practical references for revitalizing industrial heritage in Northwest China; Deng Yawen (2013) [26] and Xie Dixiang (2013) [27], using the Redtory Art Factory and Shanghai’s Tianzifang as case studies respectively, demonstrate how heritage value is revitalized through narrative mechanisms that sustain cultural symbols and recreate memories. From the perspective of research topics, scholars have primarily focused on regenerative value, while paying insufficient attention to community identity and the continuity of cultural memory. Future studies should further explore the relationship between spatial production and cultural regeneration, thereby advancing heritage transformation from spatial renewal to cultural-ecological reconstruction.

Industrial heritage tourism, a new sector emerging from industrial archaeology and heritage conservation during post-industrial transformation, originated in the United Kingdom and gradually expanded to industrialized nations such as Germany and the United States. In recent years, domestic scholars have shown increasing interest in this field. Han Fuwen(2010)[28] and Lü Jianchang(2021) [29], among others, analyzed the historical and spiritual value of Third Front industrial heritage in central and western China. They proposed eight categories of tourism targets, employing the Delphi method and analytic hierarchy process to evaluate a case study in Dalian. Their research emphasized the need to enhance the appeal of medium-value heritage through integrated development. The study recommended preserving high-value industrial heritage in its entirety, adaptively reusing medium-value sites, and improving low-value assets through consolidation. Zhang Jing(2007) [30] stressed that tourism development should integrate heritage conservation with scientific research and education, creating cultural exhibition spaces and urban vitality zones. This approach offers a development model characterized by “functional diversity and ecological sustainability” for regions experiencing industrial decline.

In summary, while current research has developed diversified approaches for transforming industrial heritage, challenges persist including fragmented case studies and insufficient sustainability assessments. There remains a need to establish systematic value evaluation frameworks and strengthen interdisciplinary research to achieve dynamic heritage conservation.

(ii) Adaptive Reuse of Industrial Heritage for Recreational Spaces

Industrial heritage is transformed into recreational spaces through landscape park models, reactivating industrial zone functions by reorganizing and regenerating

natural and industrial elements. Zhang Jie (2017) [31] examined decommissioned factory equipment to explore methods for converting it into open industrial landscape parks. Cheng Wei (2011) [32] proposed integrating ecological restoration, cultural continuity, and functional regeneration through hierarchical conservation strategies to facilitate the transformation of industrial wastelands into cultural-recreational spaces. Taking Xi'an Dahua Textile Mill as a case study, Liu Lingling (2014) [33] emphasized employing linear narrative techniques centered on historical memory to connect industrial cultural threads. By combining functional reprogramming with ecological remediation, the industrial space was transformed into a multifunctional public cultural venue with composite value. In summary, current research generally advocates for multifunctional synergistic conformity, yet achieving sustainable revitalization of industrial landscapes requires collaborative mechanisms built through the concerted efforts of multiple stakeholders.

(iii) Adaptive Reuse of Industrial Heritage for Educational Spaces

As significant physical carriers of social culture and educational development, educational architectural heritage demonstrates considerable value in the adaptive reuse of specialized industrial building heritage. Dai Bincheng (2020) [34] explored strategies for transforming industrial buildings into educational spaces, advocating for the integration of modern teaching facilities through functional replacement and spatial reconfiguration while preserving industrial aesthetics, thereby achieving harmony between industrial relics and campus culture. Sang Zihan (2024) [35] established a quantitative evaluation system, providing a basis for the conformity between industrial heritage and modern education through three dimensions: functional compatibility, historical continuity, and technical adaptability. Current research focuses on developing systematic methodologies for the educational transformation of industrial heritage, aiming to achieve organic unity between historical preservation and educational innovation.

(iiii) Industrial Heritage Reused as Comprehensive Development Space

Comprehensive development space refers to the transformation of industrial heritage with redevelopment potential into multifunctional complexes integrating commercial, recreational, and other functions. Under the context of industrial restructuring, Oberhausen, Germany, revitalized industrial heritage to promote urban renewal by converting abandoned factories into multifunctional consumption spaces. A 117-meter-high air receiver was preserved as an industrial landmark and repurposed into exhibition facilities. The newly built shopping center incorporates diverse formats and develops ecological landscapes such as an artificial lake in a mining pit, forming a cultural-tourism-commercial complex model characterized by “industrial landscape + commercial service.” Leveraging its locational and transportation advantages, Oberhausen has evolved into a shopping and cultural hub in the Ruhr region, attracting tourists from multiple countries and facilitating the city's transition from an industrial decline area to a key European tourism destination. This model can compensate for the functional homogeneity of industrial heritage, expanding development epitaxy and enhancing regional image. However, current academic attention remains insufficient, necessitating further research into its functional mechanisms and value realization pathways.

5. Conclusions

Although certain research achievements have been made in the field of industrial heritage, current studies predominantly focus on aspects such as current situation analysis, conservation, and utilization. Issues such as a singular research perspective, high similarity in research themes, and inconsistency in viewpoints persist. Particularly notable is the evident gap in the integration of tangible and intangible heritage values and in holistic understanding. From the knowledge mapping analysis above, it can be observed that collaborations among authors and research institutions are sparse, with insufficient connectivity and continuity in research efforts, leading to a fragmented research landscape that urgently requires strengthened research conformity. Therefore, future efforts should emphasize interdisciplinary approaches and the integration of multiple perspectives, establishing a relational framework between intangible and tangible heritage. Such systemic research will facilitate value regeneration and the dynamic transmission of industrial heritage conservation.

Conflicts of Interest

The author declare that there is no conflict of interest regarding the publication of this article.

Funding

This work was supported by the General Project of Humanities and Social Sciences in Henan Province Higher Education Institutions for 2026, “A Design Study on the Cultural Gene Translation of Zhengzhou No. 3 State-Owned Cotton Mill Industrial Heritage Based on Extenics”, 2026-ZZJH-346.

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