Research on the Design of Public Space in Old Communities in China: Visualization Analysis of Literature Based on CiteSpace

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Abstract: This study analyzes and summarizes periodical literature on the public space renovation of old communities in China from 2014 to 2024. The development status, trends, and research hotspots in this field are identified, providing a reference for future research on old community renovation under the framework of high-quality urban development. Based on Chinese journals and papers from the CNKI database, information visualization software CiteSpace is utilized to analyze authors, institutions, keywords, and emergent terms in the research on public space renovation. The study outlines the future development direction and research trends in this field, dividing the research progress into three stages: formation, growth, and development. Despite notable achievements, challenges remain, such as insufficient collaboration among research teams, low correlation between different clustering topics, the need for interdisciplinary integration, and a lack of quantitative research.

Keywords: CiteSpace; Old Community; Public Space; Design Research

1. Introduction

In China, urbanization is in the late stage of rapid development, and urban construction has shifted from the incremental era of infrastructure construction to a new stage of high-quality urbanization development, such as improving urban cultural image, public service quality, and consumption upgrading, which has become a key focus of local governments. Community, as the basic unit of a city, is also an important starting point for improving the quality of the city. The renovation of public spaces is not only an important way to improve people's quality of life, but also a key factor in promoting sustainable community development. However, how to effectively transform these spaces to not only meet the specific needs of residents but also enhance the overall vitality of the community is an urgent issue that needs to be addressed in current urban planning and community management.

1.1 Data Sources

In this paper, CNKI is used as the literature source database. In order to prevent the semantic mismatch between the search term and the field of atlas rendering, the author uses professional search tools. The search expression on CNKI is :(TKA 'old community' OR TKA=' public space 'OR TKA=' design research '). The author limited the sources of literature to academic journals, including SCI, EI, Peking University Core, CSSCI, CSCD and general journals. All literatures from 2014 to 2024 were searched, and the retrieval date was April 25, 2024. After manual screening, 280 literatures were obtained as the final research samples. To cover all journals and literatures on the renovation of public space in old communities in China.

1.2 Research Methods

This study is based on the literature sources of CNKI core database for 10 years (2014-2024), and uses CiteSpace software to analyze the retrieved literature data through information visualization technology, bibliometric analysis methods, and data mining algorithms. A network diagram of relevant research institutions, authors, keywords, and time series is drawn. In a visual form, the development process of current research on public spaces in old communities is presented, and the research status, research path evolution, and trends of public area renovation in old communities are grasped.

2. Publication Analysis

The number of publications can reflect the

researchers' continuous attention to the research field in a certain period of time. As shown in Figure 1, the annual number of published papers on the public space renovation of old communities in China shows a linear growth trend.
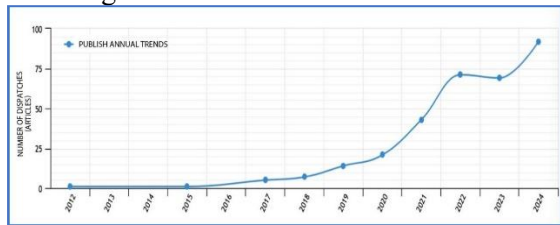

Figure 1. Annual Number of Published Documents in the Research on Public Space Renovation of Old Communities from 2004 to 2023

Overall, the annual number of published papers on the renovation of public spaces in old communities in China over the past 10 years can be divided into three stages. They are the first stage - the formation stage (2012-2016). The research in this stage shows a trend of starting, which proves that relevant research on the renovation of public spaces in old communities has begun to receive attention, but the number of studies is very small. This may be related to the speed of urbanization in China at that time. Urban expansion and new construction projects have become the main focus, while the renovation and optimization of existing community spaces have not yet become a policy and research focus. The second stage - growth stage (2017-2021). This stage presents an explosive trend, with a sudden increase in the number of publications and maintaining a rapid growth trend. During this period, with the deepening of urbanization, urban renewal and renovation of old residential areas gradually became the focus of policies and research. The country has also introduced a series of policies, such as the Guiding Opinions on Comprehensively Promoting the Renovation of Urban Old Residential Areas (General Office of the People's Republic of China (2020) No. 23), which has promoted the rapid development of related research. The third stage - development stage (2022-2024). The new research peak will be broken in mid-2024. This indicates that the renovation of community public spaces has become a stable research field, and with the improvement of urban development quality, the attention in this field continues to increase. Research may focus more on practical applications and

theoretical deepening, with more diverse keywords covering areas such as community participation, sustainable design, and intelligent technology applications.

According to the statistics of published papers, research on the renovation of public spaces in old communities has become a hot topic at present. With the continuous development of the Chinese economy, the size and structure of cities have also changed, and the development process of cities has shifted from increasing and improving infrastructure to high-quality and refined directions. Community is the basic unit and important component of a city, and attention to it is increasing year by year. In addition, research on the transformation of urban community public spaces is also significantly influenced by national policies and plans, and each issuance of relevant policies leads to corresponding fluctuations in the number of documents released.

3. Collaboration Networks

3.1 Author Networks

In order to understand the collaboration status of different authors in publishing papers, this article uses citation space to generate author co-occurrence knowledge graphs (Figure 2). Among them, there are 207 author nodes and 105 lines between authors. The number of connections is significantly less than the number of nodes, indicating that the connections between authors are very loose, with most of them being independently created and having no collaborative relationships with other authors. Based on the high-frequency cited journal articles in Table 1, it can be found that 8 out of the top 10 high-frequency cited journals were co authored by multiple authors, indicating that collaboration among authors contributes to creating high-quality papers.

Based on existing literature data, it can be found that the characteristics of these journals with high citation frequency are innovation and pioneering [1], such as Exploration of the Situational Transformation Strategy of Public Spaces in Chongqing's Old Town, which has the highest citation frequency. This article applies scenario theory to the renovation of public spaces in old residential areas in Chongqing, proposing a comprehensive strategy that includes character shaping, spatial design, and cultural activity organization. It

aims to promote the reshaping of community public spirit, the improvement of spatial quality, and the regeneration of vitality. To promote the renovation of old urban areas, improve the quality of life of residents, and provide support for innovative planning and governance of local communities in Chongqing. The journal co authored by Cao Lei and others showcases a multi participatory and demand-oriented model for the renovation of old residential areas through a participatory landscape renovation case study in Yingshuili Community, Tianjin. It proposes a complete participatory design process and employs innovative research methods such as progressive on-site intervention to explore community autonomy models, emphasizing the importance of enhancing residents' sense of participation and community self-management capabilities [2].

Based on the frequently cited journal papers listed in Table 1, most high-impact studies in the field of public space design in old residential areas are collaborative efforts. For example, papers by Zhao Manmin et al. (82 citations) and Wang Zhiyong et al. (74 citations) were co-authored by multiple researchers, demonstrating the importance of teamwork in producing influential research. This trend highlights that collaboration among authors plays a significant role in enhancing the quality and visibility of academic work in this area. However, the overall author network analysis shows loose connections, suggesting room for improving research collaboration across the field.

Overall, the popularity and importance of the transformation of community public spaces have always been a concern for researchers, but the number of high-quality papers is relatively small, and there is a lack of close collaboration between authors and institutions, resulting in a lack of comprehensive, in-depth, and rich content articles.

3.2 Institution Distribution

The research on authoritative research institutions in the academic field provides a new perspective for evaluating the academic influence of institutions [3]. This article uses CiteSpace to generate co-occurrence knowledge maps of research institutions (Figure 3). According to the number of papers published by the main institutions in Figure 4,

Beijing University of Civil Engineering has the highest number of papers (14). It can be seen that research institutions in China on the renovation of public spaces in old city communities are mainly based on universities. Institutional Cooperation From the perspective of institutional cooperation networks, the overall distribution remains relatively fragmented, with weak cooperation between different research institutions. Most research is still dominated by independent efforts or collaboration between two institutions. Although research on public spaces in old urban communities in China is primarily led by higher education institutions, cross-institutional and cross-regional collaboration is relatively limited. Future research should focus on strengthening connections among universities and institutions to jointly advance the development of public spaces that cater to the aging population.

Figure 2. Relevant Core Research Authors of Domestic Community Public Space Transformation Research

Table 1. Frequently Cited Journal Papers on Public Space Design Research in Old Residential Areas

Serial Number	Author	Title	Citations
1	Zhao Manmin et al.	Research on scenario-based transformation strategy of public space in old residential areas in Chongqing	82
2	Wang Zhiyong et al	Planning countermeasures to improve the quality of old residential areas in Qingshan City, Wuhan	74
3	Zhong Yaoqiong et al	Optimization strategy of public space in old community based on health promotion of the elderly	73
4	Hua Xia-hong et al	Promoting renewal of public daily living Space by design -- An overview of urban micro-renewal practice in Shanghai	70

5	Hou Xiaolei et al	Micro landscape renewal of public space in old communities based on the concept of People's City -- A case study of the participatory design of small and micro green Spaces in Changying, Beijing	57
6	Cao Lei et al.	The application of participatory design in public space landscape transformation of old residential areas -- A case study of Yingshuili Community in Tianjin	54
7	Zheng Yu et al.	Research on micro-transformation strategy of healthy community from the perspective of friendly aged and young -- A case study of Sanyanjing Community in Guangzhou	50
8	Tan Xiaoyan	Sociological intervention in the governance of old communities -- taking the Xinqinghe Experiment as an example	38
9	Wang Zuo et al.	Research on street space environment transformation of old urban residential areas based on the concept of urban repair	35
10	Yu Yang et al.	Research on micro-renewal design of public facilities in old urban communities	34

Source: Author Self-care

Figure 3. The Main Institutions of Domestic Urban Community Public Space Transformation Research
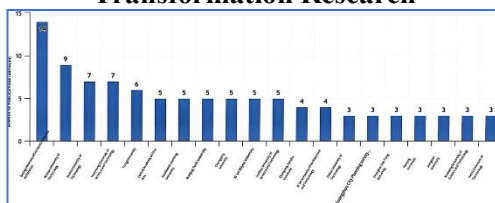

Figure 4. Core Research Institutions Related to Domestic Community Public Space Renovation Research

4. Research Hotspots

Keywords are highly summarized for the research topic of this article. By using indicators such as the frequency, relevance, and frequency of occurrence of keywords, research hotspots in the field can be revealed, the overall content characteristics of research results in the field can be understood, the intrinsic relationships between research contents can be revealed, as well as the development background and future direction of academic research. It is helpful to have a deep understanding of research trends and priorities in the academic field.

4.1 Keyword Co-Occurrence

In Citespace software, select Keyword as Node Types, set Time Slicing as 2004 to 2024, and #Year Per Slice as 1 year. The connection strength is Cosine (cosine similarity), Selection Criteria is set to TOP N=50, and the research network is pruned with Minimum Spanning Tree.

According to the above parameters, CiteSpace is run to perform visualization processing, and finally a keyword co-occurrence graph of N=234(number of network nodes), E=367(number of connections), Density=0.0135(density of network) is generated (Figure 5), indicating the existence of 234 nodes and 367 connections. The number of connections is greater than the number of nodes and the complexity of keywords indicates that the keywords are closely related [4].

It is generally believed that the keywords with high frequency and strong centrality are the research hotspots [5]. The centrality of mediations such as old community and public space is relatively large, which is 0.54 and 0.52 respectively, indicating that the old community and public space are the primary nodes of the network graph. Micro-renewal (0.10) and urban renewal (0.12) are the second-level important nodes. This indicates that these keywords are not only worthy of attention, but also an important medium to connect other research hotspots. According to Figure 5 and Table 2, the old residential areas in China are closely connected with the renewal of urban stock. How to make full use of the stock space in the city with scattered layout and unreasonable use is the research hotspot of the

renewal of old residential areas. At the same time, the aging of the old community is also the problem we are facing at present. While the

research on the renewal design, we should also pay attention to the use needs of special groups.

Table 2 Frequently Cited Journal Papers of Public Space Design Research in Old Residential Areas

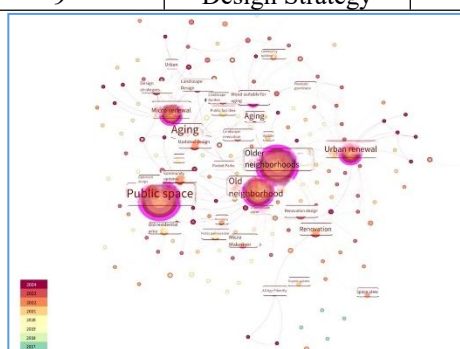| Serial Number	Keyword	Frequency	Centrality	Year	Importance Level
1	Old Community	106	0.54	2017	High
2	Public Spaces	99	0.52	2018	High
3	Old Quarters	63	0.23	2018	Medium
4	Micro Update	33	0.10	2018	Medium
5	Urban Update	29	0.12	2020	Medium
6	Suitable for Aging	13	0.07	2019	Low
7	Retrofit Design	8	0.07	2017	Low
8	Landscape Design	7	0.03	2022	Low
9	Design Strategy	7	0.03	2022	Low

Figure 5. Keyword Co-Occurrence Map of Domestic Urban Community Public Space Transformation Research

4.2 Keyword Clusters

Keyword cluster analysis is helpful to find the distribution of related studies. The smaller the cluster number, the larger the literature research scale and the higher the research heat under the cluster [3]. On the basis of the above keyword co-occurrence network, the keyword clustering map (see Figure 6) is generated. The clustering module value (Q value) is 0.6815(greater than 0.3), indicating that the clustering structure is very significant, and the average clustering contour value (S value) is 0.92(greater than 0.5), indicating that the clustering result is reasonable. In addition, the clustering is basically consistent with the above high frequency and high central keywords [6].

Each color block in Figure 6 represents a cluster, with the largest cluster labeled #0 and the remaining clusters decreasing in order. They are public space, community building, planning and design, senior citizens, landscape design, communication space, landscape, community aged care, and child friendliness. These cluster analysis show the research trends

and hot issues in the field of urban planning and community development, and reflect the focus of the current academic and practical circles [7]. It can be seen from the cluster map that there is a large degree of overlap among the cluster units, indicating that the cross-integration of various disciplines has become the focus of research.

(figure 7) illustrates the temporal evolution of keywords in domestic research on urban community public space renovation. The analysis of high-frequency keywords over time reveals that research hotspots have undergone three phases: the formation phase, the growth phase, and the development phase. Between 2015 and 2024, keywords such as "micro-update," "old neighborhood renewal," and "public facilities" reflect the continuous deepening of research in this field. Notably, "micro-update" exhibited strong citation bursts from 2018 to 2021, highlighting the growing focus on small-scale, incremental updates to improve community environments. Additionally, the keyword "public facilities" demonstrated significant citation strength from 2020 to 2021, emphasizing the importance of optimizing infrastructure in community renovation efforts. Overall, research priorities have gradually shifted from basic infrastructure construction to resident-oriented needs, social interactions, and smart technology applications, showcasing the academic community's sustained interest and in-depth exploration of sustainable community public space development.

According to the keyword prominence graph (figure 8) of the research on the transformation of domestic community public space, it can be seen that the evolution of research hotspots has

experienced three stages [8], the formation stage (2012-2016), and the number of papers in this stage is relatively small. The hot words in the research are residential area, public facilities and human settlement environment; In the growth stage (2017-2021), the number of published papers in this stage increased significantly [9]. Community renewal, suitable for aging, residents' participation and population aging became the high-frequency keywords in this stage; In the development stage (2022-2024), the number of published papers in this stage shows a rapid development trend. Research hotspots focus on multiple topics such as urban double repair, all-age sharing, space creation, all-age friendship, and sharing concept, showing the characteristics of more and more extensive research scope and more and more detailed research topics [10].
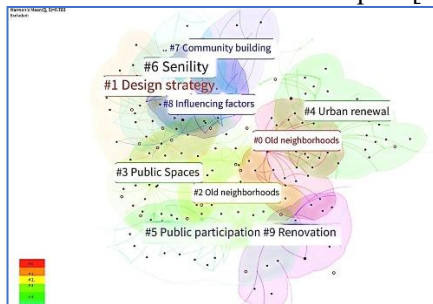

Figure 6. Keyword Clustering Co-Occurrence Map of Domestic Urban Community Public Space Transformation Research
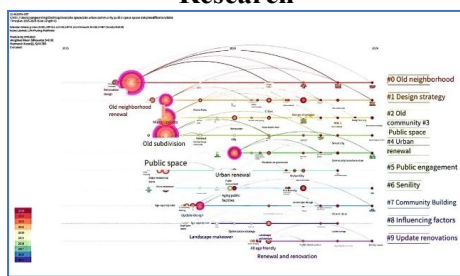

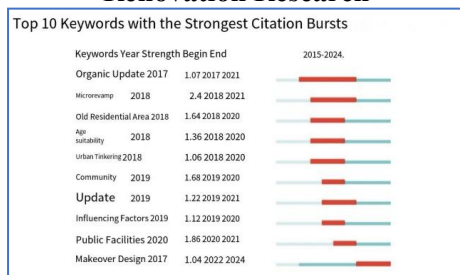**Figure 7. Keyword Timeline Map of Domestic Urban Community Public Space Renovation Research**

Figure 8. Keyword Prominence Map of Domestic Urban Community Public Space Renovation Research

5.Conclusion

This article uses Cite spatial visualization software to analyze the annual publication quantity, core authors and institutions, keyword co-occurrence, keyword clustering, and keywords related to public spaces in old communities in China from 2014 to 2024. It comprehensively summarizes the development status and trends in this field and identifies the following three characteristics:

(1) The research on the design of public spaces in old residential areas in China began in 2017, and the number of published literature has shown a rapid growth trend, which has continued to increase in recent years. This indicates that with the rapid development of urbanization in China, research enthusiasm is shifting towards a stock updating model, showing an upward trend year by year, and is also greatly influenced by national policies and plans. (2) The popularization and importance of research on the design of public spaces in old residential areas have always been a concern for researchers, but there are few high-quality papers, and the cooperation between authors and institutions is not close, resulting in a lack of comprehensive, in-depth, and rich content articles.

Based on this, according to the data obtained from visual analysis, this article proposes future research trends and hotspots in this field: At present, the renovation of old communities has been included in the 14th Five Year Plan. The author believes that in the future, research on public spaces in old communities will still be a focus of academic research. The content and direction of research have gradually shifted from a simple focus on material spaces (residential campuses, public facilities, community environments, parking lots, etc.) in the early days to people's spiritual needs (public participation, cultural spaces, friendships among different age groups, etc.).

Hot spot 1: Community Micro Update and Micro Transformation

As urban development enters the stage of stock improvement and quality transformation, micro updates, as a small-scale and gradual update method, are receiving increasing attention from people. Micro updates focus more on the connotation of space and the improvement of residents' happiness and satisfaction. It focuses on problem oriented and

meticulous renovation activities to improve the living environment and quality of life of residents in old urban communities. Essentially, research in this field also focuses on establishing long-term maintenance and management mechanisms to ensure that the results of renovations continue to have a positive impact on the community, thereby achieving sustained improvement and vitality without large-scale demolition and reconstruction.

Hot spot 2: Public Participation and Community Building

At present, research in related fields is increasingly focusing on people's needs. It emphasizes the core role of community residents in community development and transformation, with a research focus on improving the self-organizing ability of the community through community activities and cultural projects, enhancing residents' sense of belonging and community identity. The latest research also explores how to integrate resources such as government, businesses, and non-profit organizations, establish collaborative networks, and jointly promote community transformation. In recent years, it has been suggested that social capital can participate in the renovation of old residential areas through various means, indicating a shift toward focusing on the development of community economy and supporting innovation and entrepreneurship. The goal is to optimize community public spaces through various efforts, improve residents' quality of life, and create a sustainable community environment.

Hot spot 3: Public Space and Public Cultural Space

Improving the quality of public space is an important issue in the renovation of old communities. This includes innovative public space design to meet the needs of different residents and integrate local cultural characteristics; Explore effective strategies for managing public spaces to ensure their long-term sustainability and functionality; Enhance community identity through public art and cultural activities. Attention should also be paid to the social role of public spaces in promoting social interaction, community integration, and residents' well-being, with a focus on the emotionalization of space and environmental sustainability. With the development of intelligent technology, the concept of intelligent public spaces can also be introduced to enhance the attractiveness and usability of public spaces. The study of community public spaces not only helps to develop effective renovation strategies to meet social needs and urban development goals, but also promotes sustainable development of communities and improvement of residents' quality of life.

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