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Comparative Study on the Vitality of Typical Historical Districts in Beijing from the Perspective of Scene Theory

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Abstract: *Over the past 20 years, historical districts in Beijing have undergone a transition from destructive renovation to organic renewal. This paper compares the vitality of historical districts under different renewal models, analyzing the factors influencing the choice of renewal model, providing a useful decision-making basis for the planning of historic district renewal. By integrating the characteristics of authenticity, a comprehensive evaluation system consisting of three levels and ten indicators is constructed. The Entropy weight and TOPSIS model are used to comprehensively assess the vitality of historical districts. The results show that Nanluoguxiang district has the highest vitality among all districts, followed by Dashilar district, while the Xianyukou district has the lowest vitality. The study indicates that the vitality of historical districts is most significantly influenced by cultural vitality indicators, which are closely related to the preservation of the district's authenticity. Therefore, public participation models demonstrate significant advantages in the renewal of historical districts. It is advisable to widely expand public participatory forms in district renewal to promote cultural heritage and provide sustainable renewal planning for historical districts.*

Keywords: *Scenario theory, Historical districts, Authenticity, Renewal model, Neighborhood vitality*

1. Introduction

The ongoing issue of revitalizing historical districts(HD) in Beijing's old city while preserving their cultural values has been a subject of continuous contemplation and exploration. As of 2023, Beijing has designated 43 HDs, 33 of which are located within the old city. In the past 20 years, following the destructive 'demolish and rebuild' transformations, these districts within the old city of Beijing have been exploring various organic renewal modes to invigorate their historical vibrancy. This paper selects three districts that employ distinct types of renewal models. By comparing the vitality of each district, it delves into the factors influencing the choice of these models, providing meaningful decision-making bases for the planning of the renewal of historical districts.

For HDs, this paper starts from the perspective of scenario theory to do in-depth characterization, combining indigenous people, cultural value, and economic vitality, to seek the influencing factors of the regeneration of the vitality of HDs. The core idea of scenario theory is to explain the important role of cultural consumption on regional and even urban development from the consumption level of history and culture.[1] From the perspective of scenario theory, we can more comprehensively and profoundly recognize the influencing factors in the protection and development of historical districts, focus on excavating the cultural connotation while protecting the material carriers, emphasize the interaction between human beings and the elements in the social space, and push the HDs to develop in a more active and organic direction, to provide a new way of thinking for the renewal of the HDs.

Research on the renewal of historical districts primarily focuses on the evolution and optimization of district spaces [2-3], renewal planning methods [4-5], and strategies [6]. Studies specifically addressing the vitality of historical districts are relatively scarce. He Qingsong and Zeng Chen utilized geographic "big data" and spatial explicit indices to analyze urban vitality, highlighting the importance of multi-dimensional indicators such as urban functional mix, livability, accessibility, and diversity [7-8]. Niu Yingxiang and Wu Jiayu focused on machine learning techniques to explore the relationship between urban form and vitality [9-10]. Bai Xuefeng and Atakara, C. analyzed the evolution of urban spatial structure through historical maps and spatial syntax theory, providing important perspectives for understanding the growth of historical districts [2-3]. Yin, Siming applied deep learning techniques to

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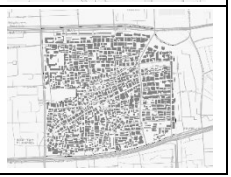
extract urban landscape features from street view images, offering new methods for the characteristic analysis of historical districts.[4] .A. Agapiou and Chen, Y. emphasized the application of remote sensing technology and GIS in cultural heritage management and risk assessment, providing new perspectives for the integrity and sustainability of historical districts.[5,11] Hu Changjuan explored the application of ecological renewal policies in historical districts, proposing spatial practice strategies[6]. Research related to vitality primarily focuses on the relationship between spatial structure and vitality, centering on block spaces. However, there is a lack of study involving human factors (especially the original inhabitants in historical districts), and there is a dearth of research measuring the relationship between cultural diversity, social attributes, and vitality in historical districts. Although various assessment methods are provided by the research, their universality and effectiveness still need further exploration. The renewal of historic blocks requires a more comprehensive evaluation system to thoroughly understand the relationship between the vitality of historical districts and the inheritance of culture.

The HD located in the old city of Beijing cover a vast area and feature a variety of functional types. Due to these functional differences, the paths of renewal for these HDs also vary. This paper focuses on the HDs themselves and constructs an evaluation system with 10 indicators across three dimensions: authenticity of the district, cultural vitality, and commercial vitality. It measures the vitality of three typical districts post-renewal, including the partial development renewal model of Xianyukou District (XYKD), the functional replacement renewal model of Nanluoguxiang District (NLGXD), and the public participation renewal model of Dashilar District (DSLD) (Table 1). Through longitudinal and lateral comparisons, the paper analyzes the changes in cultural and commercial vitality of the blocks under different proportions of authenticity, dissects the factors affecting the vitality of HDs, and thereby proposes planning bases for district renewal models.

Table 1: Typical Historical Districts Renewal Patterns within the Old City of Beijing

Way	Analyze	Case	Legend
Partial Development Model	Partial remodeling with mainly commercial development	Xianyukou District (XYKD)	
Functional Replacement Model	Preserving the original style while partially introducing commercial functions	Nanluoguxiang District (NLGXD),	
Public Participation Model	Preserving the original style with native residents' participation, focusing primarily on cultural functions	Dashilar District (DSLD)	

2. Measurement and Calculation Methods for Vitality in Historical Districts

2.1. Framework for Measuring the Vitality of Historical Districts

For HDs, authenticity is concerned with the neighborhood's maintaining its original historical and cultural character, qualities that are key to attracting visitors and sustaining community vitality [12-14]. Based on previous research on the factors influencing the vitality of HDs this paper integrates authenticity characteristics and comprehensively considers the authenticity, integrity, legibility, and sustainability of HDs. A framework consisting of ten indicators (proportion of original residents, degree of preservation of overall appearance, density of cultural buildings, attractiveness of historical resources, changes in population heat distribution, functional density, and mixed-use intensity, etc.) is constructed from three dimensions: authenticity, cultural vitality, and commercial vitality (Table 2). The aim is to provide a comprehensive evaluation of the vitality of HDs, compare different renewal models, and offer planning ideas and decision-making support for the renewal of HDs.

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Table 2: Evaluation System for Vitality Measurement Indicators of Historical Districts

Objective Layer	Indicator Layer	Meaning	Feature
Authenticity	Proportion of Original Residents	Proportion of native residents to the total population in the block	+
	Degree of Overall Appearance Preservation	Proportion of renovated building area to the total area in the block	+
Cultural Vitality	Cultural Building Density	Proportion of historical and cultural buildings to the total area in the block	+
	Attractiveness of Historical Resources	Average star rating of historical and cultural attractions in the Points of Interest (POI) of the block	+
	Changes in Population Heat Distribution	Difference in population heat distribution at 12 pm between weekends and weekdays	+
Commercial Vitality	Functional Density	The proportion of the number of shops in the district to the total area	+
	Mixed-Use Intensity	The distributional balance of different types of commercial facilities within the district (Shannon Index)	+

Note:
1) POI: A Point of Interest (POI) refers to a place that is of specific interest or importance to users in a geographic location. POIs can include a variety of locations, such as restaurants, shopping malls, tourist attractions, hospitals, banks, bus stations, etc.
2) Difference in Population Heat Map between Weekdays and Weekends at Noon: The change in population heat maps can reflect the attractiveness of HDs to residents and tourists at different times. Noon is a critical moment of the day. By analyzing the differences in population heat maps between weekdays and weekends, we can reveal people's living patterns and behavioral trends at different times.
3) Shannon Index: The Shannon Index can be used to measure the diversity and balance of different functions within an area.

$$V_3 = -\sum \left({}^{n_i}/_{N}\right) \log_2 \left({}^{n_i}/_{N}\right)$$

V_3: Per Capita Consumption Shannon Index;n_i: Average Per Capita Consumption Level of Each Store;N:Sum of Average Per Capita Consumption Levels of All Stores

2.2. Calculation Method

The Entropy method [15] and TOPSIS method [16] are comprehensively utilized for the quantitative assessment study of three HDs (Historical Districts). First, the Entropy method is used to determine the weight of evaluation indicators for the three HDs. Then, the TOPSIS method is applied to determine the ranking of the evaluation objects using the technique of approaching the ideal solution. The overall score is calculated and analyzed to establish the vitality ranking of the HDs.

3. Results of the Vitality Measurement of Historical Districts

3.1. Analysis of the Results of Entropy Weight Calculation

Based on the original values of the three primary indicators (authenticity, cultural vitality, and commercial vitality) and seven secondary indicators in HDs, the information entropy and weight of each indicator are obtained through the entropy method, as shown in Table 3.

From the results of the weight calculation, cultural vitality has the highest proportion, accounting for 55.1%. The three secondary indicators included in it also have high proportions, ranking 1st, 2nd, and 3rd respectively, indicating that the growth of cultural vitality is crucial for the vitality of HDs. Commercial vitality is the next highest, at 22.66%. However, within the target layer of commercial vitality, the secondary indicator - degree of functional mix ranks 7th, suggesting that overemphasis on commercial vitality might impact the protection of cultural and historical values, while neglecting commercial vitality could lead to economic unsustainability. Authenticity has the lowest proportion, at

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22.23%, but is not significantly different from commercial vitality, reflecting the need to balance historical preservation and commercial development in the assessment and planning of district vitality. This demonstrates that authenticity is very important for maintaining the uniqueness and attractiveness of a district.

Table 3: Summary of Weight Calculation Results by Entropy Method

Primary Indicator	Authenticity		Cultural Vitality			Commercial Vitality	
Weight	22.23%		55.1%			22.66%	
Secondary Indicator	Indigenous Population Proportion	Conservation of Overall Appearance	Cultural Building Density	Attractiveness of Historical Resources	Changes in Population Heat Map Distribution	Functional Density	Mixed-Use Intensity
Information Entropy	0.6308	0.6302	0.4001	0.5741	0.1936	0.6155	0.631
Coefficient of Variation	0.3692	0.3698	0.5999	0.4259	0.8064	0.3845	0.369
Weight	11.11%	11.12%	18.04%	12.81%	24.25%	11.56%	11.10%
Weight Ranking	6	5	2	3	1	4	7

3.2. Comparison of the Vitality of Historical Districts

3.2.1. Longitudinal Comparison Results of the Vitality of Historical Districts

Through the TOPSIS model research method, the distance of each evaluation object to the ideal solution d_i^* and the negative ideal solution d_i^0, as well as the relative closeness c_i^*, are calculated to compute and rank the value of each evaluation object, and the results are obtained as shown in Table 4.

Table 4: Longitudinal Vitality Measurement Results of Historical Districts

Number	Historical Districts	Distance to the Ideal Solution d_i^*	Distance to the Negative Ideal Solution d_i^0	Relative Closeness c_i^*	Ranking Results
1	Xianyukou	0.904	0.192	0.176	3
2	Nanluoguxiang	0.374	0.886	0.703	1
3	Dashilar	0.65	0.757	0.538	2

Based on the TOPSIS analysis method for determining the vitality of HDs, NLGXD ranks first with the highest vitality value, DSLD ranks second with a moderate vitality value, and XYKD ranks third with the lowest vitality value.

The NLGXD adopts a function-replacement renovation model. Its authenticity retention rate is relatively high, and despite undergoing a certain degree of commercial transformation, the overall social structure is well maintained, which is beneficial for maintaining cultural continuity. A good cultural atmosphere not only enhances the attractiveness of the HD but also improves the sense of belonging and participation of the residents. A diversified commercial structure is beneficial in attracting different consumer groups, increasing the district's economic income, and maintaining its vitality. NLGXD ranks first in the overall vitality measurement among HDs, successfully combining social, cultural, and commercial elements, creating a vibrant and historically rich exemplar.

The DSLD adopts a public participation renovation model. It has the highest authenticity retention rate, demonstrating its significant achievements in preserving historical appearances and community structures. Simultaneously, with its variety of historical resources and cultural activities, it offers tourists and residents rich cultural experiences. The rational planning and diversified development of commercial spaces also help to meet the consumption needs of district residents and tourists. Therefore, although DSLD ranks second in overall vitality measurement, its public participation renovation model has achieved a good balance in protecting history, enhancing cultural vitality, and promoting commercial development, showing strong potential for future development.

The XYKD adopts a partial development renovation model. This model involved relocating all original residents, resulting in the lowest authenticity retention rate and impacting the district's original appearance and historical characteristics during reconstruction. Therefore, XYKD has deficiencies in

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utilizing cultural resources and developing commercial activities. As a historical district undergoing reconstruction-style renovation, XYKD faces the challenge of better preserving historical culture during renewal and needs to adjust its development strategy to enhance its attractiveness and vitality as a HD.

3.2.2. Horizontal Comparison Results of the Vitality of Historical Districts

(1) Authenticity

Based on the TOPSIS model, the evaluation results for the authenticity indicator are calculated, as shown in Table 5.

Table 5: TOPSIS Evaluation Results for the Authenticity Indicator

Number	Historical Districts	Distance to the Ideal Solution d_i^*	Distance to the Negative Ideal Solution d_i^0	Relative Closeness c_i^*	Ranking Results
1	Xianyukou	1	0	0	3
2	Nanluoguxiang	0.064	0.939	0.936	2
3	Dashilar	0	1	1	1

Comparing the authenticity indicator, DSLD ranks the highest in authenticity, demonstrating its outstanding performance in preserving historical architecture and the cultural environment. A high proportion of original residents has maintained the cultural continuity of the community, and a high degree of facade preservation reflects good protection of historical buildings and street environments. NLGXD ranks second in authenticity, indicating that while maintaining traditional characteristics, it has accepted a certain degree of modernization. This balance allows the district to attract tourists eager for cultural exploration, as well as adapt to more diversified market demands, promoting the diversity of economic activities and vitality of the district. In contrast, XYKD faces greater challenges in preserving authenticity. A lower proportion of original residents and inadequate facade preservation reveal the erosion of the district's historical integrity in the process of modernization.

(2) Cultural Vitality

Table 6: TOPSIS Evaluation Results for the Cultural Vitality Indicator

Number	Historical Districts	Distance to the Ideal Solution d_i^*	Distance to the Negative Ideal Solution d_i^0	Relative Closeness c_i^*	Ranking Results
1	Xianyukou	0.817	0.259	0.241	3
2	Nanluoguxiang	0.482	0.876	0.645	1
3	Dashilar	0.876	0.482	0.355	2

In terms of cultural vitality, the NLGXD ranks first with its rich historical architecture and cultural relics, showcasing its profound cultural heritage and unique charm. The DSLD, although ranking slightly lower than NLGXD, can transform cultural resources into important means of attracting tourists and promoting cultural exchange. The cultural vitality of the XYKD is somewhat lacking; its cultural environment and utilization of historical resources need further enhancement to increase cultural attractiveness and regional influence.

(3) Commercial Vitality

Table 7: TOPSIS Evaluation Results for the Commercial Vitality Indicator

Number	Historical Districts	Distance to the Ideal Solution d_i^*	Distance to the Negative Ideal Solution d_i^0	Relative Closeness c_i^*	Ranking Results
1	Xianyukou	1	0	0	3
2	Nanluoguxiang	0.222	0.856	0.794	2
3	Dashilar	0.012	0.992	0.989	1

In the comparison of commercial vitality, the DSLD ranks first with its diversified and vibrant commercial environment, providing residents and tourists with a wealth of shopping options and a convenient living environment. NLGXD follows closely, with its cultural characteristics adding unique charm to commercial activities, attracting a continuous flow of tourists and shoppers. XYKD, however, falls short in terms of commercial diversity and integration, with relatively monotonous activities and lacking a diverse experience that effectively combines social, cultural, and commercial elements.

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4. Discussion and Reflection

This article constructs an evaluation framework consisting of 3 objective layers and 10 indicators to measure the vitality of HDs, which effectively compares the vitality of HDs under different renovation models. However, there are some deficiencies. On one hand, the vitality measurement evaluation system for HDs is quite complex overall, with data collection sources not being unified. The evaluation also requires the integration of qualitative analysis to fully reflect the vitality and characteristics of the districts. In subsequent research, it is necessary to consider the comprehensiveness of the evaluation model to make it more practical and understandable. On the other hand, the acquisition of some indicators requires further scrutiny, such as changes in population heat map distribution, which requires continuous data updates and involves issues of data availability and timeliness. Some social and cultural factors are difficult to quantify, leading to their omission in indicator construction.

Different renovation models of HDs significantly impact their authenticity, cultural, and commercial vitality. The high vitality ranking of DSLD shows that compared to partial development or function-replacement renovation models, the public participation renovation model performs better in enhancing the overall vitality of the district, especially in promoting commercial development and cultural activities. Adopting a public participation renovation model is more conducive to balancing modernization needs and historical-cultural preservation in HDs. Therefore, the following suggestions are proposed for the choice of renovation models for HDs:

(1) Strengthen the public participation mechanism. To protect HDs and promote their sustainable development, it is necessary to enhance public participation and feedback mechanisms. Establish a consultative committee composed of local residents, business owners, and cultural workers to participate in the planning and management decisions of HDs.

(2) Balance cultural and commercial activities. To protect and utilize historical buildings, transforming them into cultural exhibition centers, art studios, or specialty stores not only preserves the architecture but also adds commercial vitality. Support cultural and creative industries such as handicrafts, design studios, and independent bookstores, which can blend with the cultural atmosphere of historical districts.

(3) Continuous monitoring and assessment. During the renewal process of historical districts, establish an assessment mechanism to regularly evaluate the economic, cultural, and social impacts on the district. Therefore, this paper hopes to encourage the widespread application of public participation in the renewal of historical districts, as revealed by the research results, to achieve their cultural inheritance and sustainable development.

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