Research on the Performance Evaluation of Greenway Construction Projects

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Abstract. As a type of green infrastructure project, the construction management and evaluation of planning outcomes for greenway projects have attracted widespread public attention and research. However, due to the complexity of environmental factors, the planning of such projects cannot simply replicate the performance evaluation practices used for ordinary construction projects; therefore, a performance evaluation system specifically tailored to these projects must be redesigned. This research constructed a performance evaluation system for greenway construction projects using fifteen selected third-level indicators, including financial evaluation, aesthetic appeal, functionality, and social evaluation, and applied the Fuzzy Analytic Hierarchy Process to perform hierarchical analysis of the data. Actual case studies were applied to the constructed evaluation system to conduct performance evaluations, thereby verifying the system's applicability. The actual evaluation results of the case research align with the expected results, indicating that the performance evaluation system developed in this research is suitable for evaluating greenway construction projects.

Keywords: Greenway Construction Project; Fuzzy Analytic Hierarchy Process; Performance Evaluation.

1. Research Background and Significance

1.1 Research Background

Since the introduction of the new development philosophy—which emphasizes innovation, coordination, green development, openness, and shared benefits—the question of how to enhance the public's sense of fulfillment and well-being through the planning and construction of greenways has gradually become a hot topic in the industry. In recent years, greenway projects, as a vital component of national land greening initiatives, have not only improved and protected urban ecological environments but also met the needs of urban residents for green outdoor activities.

Research indicates that vegetation coverage in well-designed greenways is significantly higher than in urban green belts, with air dust absorption rates reaching 63% and noise reduction rates reaching 67%. Greenway construction projects are, in essence, a crucial component in improving the ecological environment and the living environment for citizens, and they hold great significance. However, currently, the planning and construction of most greenway projects primarily rely on accumulated subjective experience. Issues such as the lack of effective mechanisms and tools in project planning, as well as inadequate design, have become prominent, leading to a certain deviation between initial planning and actual construction. Additionally, as the concept of greenways spread rapidly during a period when sustainable development was highly popular, the pace of designing and constructing such projects had to accelerate in response to policies and requirements. Consequently, many current greenway projects lack long-term planning. Design flaws frequently arise, including land wastage, deterioration, and even soil erosion resulting from insufficient environmental considerations, as well as low public satisfaction.

In summary, establishing a robust performance evaluation system for greenway construction projects is a critical step in effectively assessing their outcomes. By establishing a scientific project performance evaluation system, we can effectively and accurately identify areas for improvement in the planning and construction of greenway projects, thereby providing solid data support for the subsequent planning and construction of such projects.

2. Literature Review

2.1 Definition of the Concept of Greenway

The term "greenway" originated in the United States. In the latter half of the 19th century, people began to recognize the importance of creating a continuous linear green space for leisure, recreation, and the regulation of urban development, leading to the emergence of various early greenway projects. The term was formally introduced in a 1987 report by the U.S. President's Commission, after which the concept of greenways began to gain widespread acceptance, and the planning and construction of greenways began to proliferate [1, 2]. Depending on the context, greenways are essentially natural corridors constructed along features such as valleys, riverbanks, and ridgelines, serving as green open spaces [3]. However, a literal translation of "greenway" tends to imply a natural urban corridor where man-made roads and landscapes intersect. Greenway, refers to a linear green open space—an artificial corridor that protects the environment while providing citizens with a healthy place for exercise [4].

2.2 Research on Greenway Construction Projects

The design of European green corridors typically involves the rehabilitation of abandoned transportation corridors; these corridors, which provide connectivity between fragmented natural environments, can mitigate the impact of habitat fragmentation on biodiversity [5]. Julien and James proposed a method for describing green corridor landscapes; the landscape design of such projects must focus on the composition of the biotope and ecosystem connectivity. The reserch notes that current greenway construction projects can be categorized according to the principles of ecological sustainability, regional adaptation, diversity, and human-centered design [6]. Dai et al. employed mathematical analysis tools to provide a more scientific approach to vegetation selection and planting in greenway design [7]. Greenway projects are based on a foundation that unifies fragmentation and integration. By connecting various types of green spaces and ecological environments in other areas, they form a cohesive whole that integrates fragmented green spaces [8]. Identical, the overarching concept of greenway projects aims to improve the living environment for citizens, enhance the city's appearance and quality, protect the environment, and achieve sustainable development [9].

2.3 Research on the Application of the Fuzzy Analytic Hierarchy Process in Project Performance Evaluation

The Fuzzy Analytic Hierarchy Process (FAHP) is currently the most widely adopted analytical method for performance evaluation, with applications spanning various construction sectors including industrial economics, water resources and hydropower, mining engineering, architectural science, and road and waterway transportation [10, 11]. Chen et al. applied FAHP to evaluate project progress management performance, analyzing the evaluation framework and its influencing factors [12]. Tong et al. utilized FAHP for assessing the performance of ecological corridor development plans, conducting statistical evaluations of green corridor designs that facilitated optimization and enhanced satisfaction among residents and visitors [13]. La and Chai employed FAHP to quantify factors in ecological architecture projects, determining weight values and ecological ratings for building indicators [14]. Yuan et al. conducted preliminary evaluations using FAHP, identifying key design management factors and proposing improvement recommendations [15]. In summary, FAHP has been extensively applied and studied in both infrastructure and ecological construction projects, laying a solid foundation for this performance evaluation research on greenway development initiatives.

2.4 Literature Review

Through literature review and analysis, it is both appropriate and necessary to focus the research on the performance evaluation of greenway construction projects. Although numerous research methods exist for evaluating the performance of green infrastructure projects, most are isolated or singular in nature. Given the unique benefits of urban health and environmental protection derived

from greenway designs, extending corporate performance evaluation frameworks to these projects would be inappropriate. The fuzzy hierarchy method, leveraging its inherent advantage in quantifying data, effectively addresses challenges in unified reasoning, enabling scientific assessment of greenway project outcomes and performance. This reserch should explore how to utilize selected indicators to accurately evaluate project management performance, identify potential issues in management practices, and propose actionable solutions.

3. Research Methods

3.1 Identification of Performance Evaluation Indicators for Greenway Projects Based on Literature Review Method

As shown in Figure 1, through literature review and synthesis, a fish bone diagram was ultimately developed outlining the key factors for performance evaluation indicators of greenway construction projects across four dimensions: financial assessment, aesthetic appeal, functionality, and social impact. These secondary indicators effectively facilitate subsequent metric identification in the research.

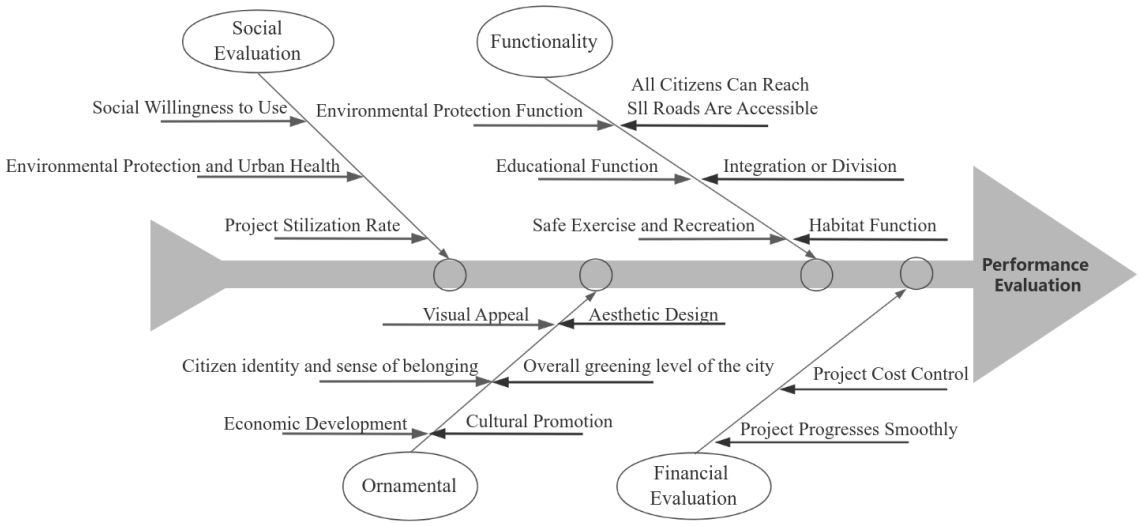


Figure 1. Fish bone diagram of key factors for evaluation indicators

3.1.1 Indicator Identification

(1) Employing the literature review method, based on literature mining and relevant policy research, we analyzed the most frequently cited and highly influential literature indicators by focusing on keywords such as "greenway construction project," "project performance," and "performance," thereby completing the initial selection of evaluation indicators.

(2) Considering that the original indicators possess the fundamental characteristics of reflecting actual conditions and broad coverage, while also suffering from issues such as redundant terminology and lengthy phrasing, this research optimized the indicators to some extent through expert interviews. The interviews focused on assessing the sensitivity, importance, and specific names of each indicator. Consequently, "Overall Visual Experience of Greenway Landscapes" was revised to "Overall Sensory Experience of Greenway Landscapes"; "Richness of Regional Character Expression" was renamed "Degree of Regional Character Expression"; and "Utilization and Protection of the Original Environment" was refined to "Utilization and Protection Rate of the Original Environment".

(3) Through literature review and research, combined with text mining and expert evaluation, the performance evaluation indicators for the greenway construction project were ultimately established. The specific performance evaluation indicator system for the greenway construction project is shown in Table 1.

Table 1. Performance Evaluation Indicator System for the Greenway Construction Project

Primary indicators	Secondary Indicator	Tertiary Indicators	Indicator Characte Ristics
Performance Evaluation	**A** Financial Evaluation	A1 Reasonableness of Budget Preparation	Qualitative
		A2 Engineering Payment Availability Rate	Quantitative
	B Ornamental	**B1** Overall Sensory Experience of Greenway Landscape	Qualitative
		B2 Reasonableness of Public Space Landscape Design	Qualitative
		B3 Degree of Regional Characteristics	Qualitative
		B4 Topographical Diversity	Quantitative
		B5 Vegetation Cover	Quantitative
	C Functional	**C1** Project Accessibility	Quantitative
		C2 Reasonableness of Coverage of Rest Facilities	Quantitative
		C3 Reasonableness of Coverage of Signage Facilities	Quantitative
		C4 Utilization and Protection Rate of the Original Environment	Quantitative
		C5 Natural Habitat Coverage Rate	Quantitative
	D Social Evaluation	**D1** Public Sports Experience	Qualitative
		D2 Long-term Public Willingness to Use	Qualitative
		D3 Urban Health	Qualitative

3.2 Performance Evaluation Process for Greenway Construction Projects Based on the Fuzzy Analytic Hierarchy Process

3.2.1 Establishment of the Evaluation Indicator System

(1) Source of Dat:This research invited five experts with extensive planning, management, and practical experience in the field of greenway construction projects.

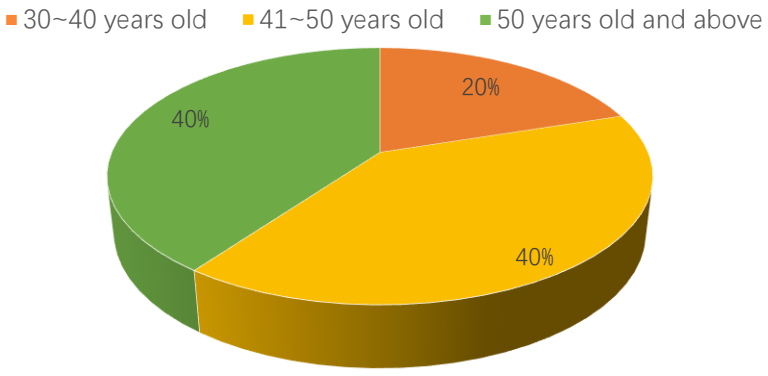


Figure 2. Age distribution of experts

Among them, two were project managers from the planning and construction units, with 17 and 21 years of professional experience respectively; two were planning designers with 12 and 13 years of experience in such projects. As shown in Figure 2 regarding the experts' age distribution, all participating evaluators were over 30 years old, and 60% had 11 to 15 years of professional experience.

(2) Construction of the judgment matrix: Based on the performance evaluation indicator system for the greenway construction project, a scale ranging from 0.1 to 0.9 was established.

Table 2. Meaning of each scale in the 0.1~0.9 scale method

Scale	Meaning
0.5	The two indicators are equally important.
0.6	When comparing the two indicators, one indicator is slightly more important than the other.
0.7	When comparing the two indicators, one indicator is clearly more important than the other.
0.8	When comparing the two indicators, one indicator is much more important than the other.
0.9	When comparing the two indicators, one indicator is extremely important compared to the other.
0.1/0.2/0.3/0.4	If factor $a_i$is compared with factor a_j, the judgment obtained is a_{ji}, then the judgment obtained by comparing factor $a_j$with factor a_i is a_{ji}=1—a_{ji}

Based on the construction of a judgment matrix using the 0.1–0.9 scale method, this reserch compares the indicators at various levels within the established performance evaluation system for greenway construction projects, thereby establishing a fuzzy judgment matrix.

$$A = \begin{pmatrix} a_{11,}a_{12,\ldots} & a_{1n} \\ a_{21}, a_{22}\ldots & a_{2n} \\ \ldots & \ldots \\ a_{n1}, a_{n2}, \ldots 1 \end{pmatrix} \tag{1}$$

Matrix A satisfies $a_{ii} = 0.5, i = 1,2,3 \ldots\ldots n$, When two indicators are the same, the value is 0.5, meaning that they are of equal importance. a_{ij} = 1— a_{ji}, i, j = 1, 2,3 …… n, Indicates that the importance of comparison between two indicators is complementary.After obtaining the fuzzy consensus judgment matrix through indicator comparison, it is necessary to solve for the weight vector corresponding $W = [w_1^c, w_2^c \ldots . w_n^c]$ to matrix A. The element values $\overset{c}{wi}$ in the vector represent the weights of each indicator C. The specific algorithm for each weight is solved using the following formula.

$$w_i^c = \frac{\sum_{j=1}^{n} a_{ij} + \frac{n}{2} - 1}{n(n-1)} \tag{2}$$

By calculating the arithmetic mean of the expert indicator evaluation scores, the final indicator weights are determined. Similar to the Analytic Hierarchy Process (AHP), the fuzzy judgment matrix in the fuzzy AHP also requires consistency testing. When the deviation exceeds the threshold, it indicates that the calculated weight vector results have significant discrepancies, rendering them unsuitable as a scientific basis for decision-making.

Based on relevant literature research, this paper uses the compatibility of the fuzzy judgment matrix to assess the consistency of the matrix. The specific calculation steps are as follows. Assume that matrix $W = (w_1, w_2, \ldots\ldots, w_n)^T$ is the weight vector of fuzzy judgment matrix A. If:

$$\sum_{i=1}^{n} w_i = 1, w_{ij} = \frac{w_i}{w_i + w_j}, w_i > 0, (i = 1,2,3 \ldots, n) \tag{3}$$

Then, $W^* = (w_{ij})$ is called the characteristic matrix of the judgment matrix A. Now that we have obtained the fuzzy judgment matrix A and its eigenvector W^*, we need to verify the compatibility between the two and then judge their consistency. The compatibility judgment method is as follows:

Assuming that matrix $A = (a_{ij})_{n\times n}$ and matrix $B = (b_{ij})_{n\times n}$ are both fuzzy judgment matrices, the formula for calculating the similarity between matrices A and B is:

$$I(A,B) = \frac{1}{n^2}\sum_{j=1}^{n}\sum_{i=1}^{n}\left|a_{ij} + b_{ij} - 1\right| \tag{4}$$

Due to differing attitudes among decision-makers toward matrix compatibility, this can be set as *a*. When the attitude toward compatibility and the compatibility index satisfy *I(A, B) < a,* the matrix is considered to meet the consistency requirement. The higher the consistency requirement, the smaller the value of *a*, and the more difficult it is for the matrix to meet the requirement. Typically, *a* = 0.1 is used. When the compatibility index is less than 0.1, the consistency test is considered passed. When it is greater than 0.1, the index needs to be re-evaluated and adjusted until it meets the compatibility requirements.

The sorting vector of A can be obtained by calculating the fuzzy judgment matrix of the indicators. After determining that its consistency meets the requirements, it can be used, i.e., $W = (w_1, w_2, \ldots\ldots, w_n)^T$. Note that the sum of the weights of all underlying elements should be 1, and the total ranking is the product of the weights of each single sorting indicator.

(3) Weight Calculation and Consistency Verification: Based on the calculation methodology, expert evaluation results for the performance indicators of the greenway project were collected, and a judgment matrix was constructed to determine the indicator weights. Table 3 presents the judgment matrix obtained by applying the weighted average method to the evaluation scores assigned by five experts to the secondary performance indicators of the greenway construction project.

Table 3. Secondary indicator judgment matrix for performance evaluation of greenway construction projects

Secondary Indicator	**A** Financial Evaluation	**B** Ornamental	**C** Functional	**D** Social Evaluation
A Financial Evaluation	0.5	0.400	0.420	0.340
B Ornamental	0.600	0.5	0.538	0.600
C Functional	0.580	0.5	0.5	0.815
D Social Evaluation	0.660	0.400	0.185	0.5

The weight calculation for the judgment matrix yielded the expert evaluation weights for the secondary indicators of the Greenway Construction Project Performance Evaluation, as shown in Table 4.

Table 4. Expert evaluation weights for secondary indicators of greenway construction project performance evaluation

Secondary Indicator	**Indicator Weighting**
A Financial Evaluation	0.222
B Ornamental	0.270
C Functional	0.283
D Social Evaluation	0.229

A consistency check was conducted on the weights of the secondary indicators. The calculation results showed that the compatibility index for this set of weights was 0.072 <0.1, confirming the validity of the weight vector through the consistency test.

Following this logic, the final indicator weights for the performance evaluation of greenway construction projects are derived by multiplying the weights of secondary and tertiary valid indicators, as shown in Table 5.

Table 5. Weighting of performance evaluation indicators for greenway construction projects

Primary Indicators	Secondary Indicator	Tertiary Indicators	Weighting of Tertiary Indicators	Results
Performance Evaluation	Financial Evaluation (0.222)	Reasonableness of Budget Preparation	0.520	0.115
		Engineering Payment Availability Rate	0.480	0.107
	Ornamentl (0.270)	Overall Sensory Experience of Greenway Landscape	0.230	0.062
		Reasonableness of Public Space Landscape Design	0.223	0.060
		Degree of Regional Characteristics	0.156	0.042
	Functional (0.283)	Topographical Diversity	0.190	0.051
		Vegetation Cover	0.201	0.054
		Project Accessibility	0.200	0.057
		Reasonableness of Coverage of Rest Facilities	0.180	0.051
		Reasonableness of Coverage of Signage Facilities	0.198	0.056
		Utilization and Protection Rate of the Original Environment	0.210	0.059
		Natural Habitat Coverage Rate	0.201	0.057
	Social Evaluation (0.229)	Public Sports Experience	0.310	0.071
		Long-term Public Willingness to Use	0.330	0.076
		Urban Health	0.360	0.082

4. Research Results and Analysis

4.1 Performance Evaluation Analysis of the Greenway Construction Project

4.1.1 Fuzzy Hierarchical Evaluation of the Greenway Construction Project

First, submit an application to the relevant authorities overseeing the Dianchi Lake Greenw and East Lake Greenway projects to obtain detailed construction information, and utilize the data appropriately in accordance with their requirements. Second, develop a survey questionnaire for citizens and distribute it to visitors who have used these greenways to collect data.Table 6 presents the calculation methods for quantitative data among the indicators related to the Greenway Construction Project, derived from data collection and organization.

This research conducted social surveys by distributing 250 questionnaires each for the Dianchi Greenway and East Lake Greenway construction projects. Specifically, 231 questionnaires were collected for the Dianchi Greenway, with 225 valid responses; 228 questionnaires were collected for the East Lake Greenway, yielding 227 valid responses. To facilitate comparative analysis between the two projects, two social survey questionnaires from the East Lake Greenway—containing data from individuals under 18 years old who were tourists—were excluded from the final analysis.

Table 6. Basis for calculating quantitative indicator data

Indicator Name	Principles of Data Calculation
Engineering Payment Availability Rate	Timely payment of project funds/total project funds
Topographical Diversity	E = H / ln(S), H is the diversity index, and S is the number of terrain and landform types that can exist.
Vegetation Cover	Coverage area/Total area
Project Accessibility	Statistics obtained through thermal imaging scans of the human body; An=Daily arrivals/distance between destination and origin, Accessibility=(A1+A2+...+An)/2n
Reasonableness of Coverage of Rest Facilities	Total project coverage area - Rest area / Total project coverage area
Reasonableness of Facility Coverage	According to relevant regulations, the greenway construction plan stipulates that one signpost shall be installed every 50 meters at most. Actual signposts/signposts installed
Utilization and Protection Rate of the Priginal Environment	Area of natural environment not subject to planned changes / Total project area
Natural Habitat Coverage Rate	Natural habitat space/total project area

Finally, the collected and calculated qualitative and quantitative indicators are multiplied by their respective weights to complete the fuzzy analytic hierarchy process, yielding the final project performance evaluation score.

Table 7. Performance evaluation results of the Dianchi greenway construction project

Primary Indicators	Secondary Indicator	Tertiary Indicators	Weighted results	Indicator Score	Final Score
Performance Evaluation	Financial Evaluation (0.222)	Reasonableness of Budget Preparation	0.115	84.00	9.660
		Engineering Payment Availability Rate	0.107	85.40	9.138
	Ornamentl (0.270)	Overall Sensory Experience of Greenway Landscape	0.062	75.00	4.650
		Reasonableness of Public Space Landscape Design	0.060	78.00	4.680
		Degree of Regional Characteristics	0.042	72.00	3.024
Performance Evaluation	Functional (0.283)	Topographical Diversity	0.051	50.00	2.550
		Vegetation Cover	0.054	77.60	4.190
		Project Accessibility	0.057	64.90	3.699
		Reasonableness of Coverage of Rest Facilities	0.051	67.10	3.422
		Reasonableness of Coverage of Signage Facilities	0.056	93.00	5.208
		Utilization and Protection Rate of the Original Environment	0.059	80.30	4.738
		Natural Habitat Coverage Rate	0.057	62.80	3.580
	Social Evaluation (0.229)	Public Sports Experience	0.071	80.00	5.680
		Long-term Public Willingness to Use	0.076	84.00	6.384
		Urban Health	0.082	78.00	6.396
				Total Score	76.998

Table 8. Performance evaluation results of the Donghu greenway construction project

Primary Indicators	Secondary Indicator	Tertiary Indicators	Weighted results	Indicator Score	Final Score
Performance Evaluation	Financial Evaluation (0.222)	Reasonableness of Budget Preparation	0.115	86.00	9.890
		Engineering Payment Availability Rate	0.107	88.60	9.480
	Ornamentl (0.270)	Overall Sensory Experience of Greenway Landscape	0.062	77.00	4.774
		Reasonableness of Public Space Landscape Design	0.060	78.00	4.680
		Degree of Regional Characteristics	0.042	70.00	2.940
	Functional (0.283)	Topographical Diversity	0.051	75.00	3.825
		Vegetation Cover	0.054	73.40	3.964
		Project Accessibility	0.057	74.00	4.218
		Reasonableness of Coverage of Rest Facilities	0.051	71.40	3.641
		Reasonableness of Coverage of Signage Facilities	0.056	100.00	5.600
		Utilization and Protection Rate of the Original Environment	0.059	59.40	3.505
		Natural Habitat Coverage Rate	0.057	71.30	4.064
	Social Evaluation (0.229)	Public Sports Experience	0.071	86.00	6.106
		Long-term Public Willingness to Use	0.076	82.00	6.232
		Urban Health	0.082	83.00	6.806
				Total Score	79.725

4.1.2 Project Performance Evaluation Results

The performance evaluation scores for the Dianchi Lake Greenway Project and the East Lake Greenway Project were 76.998 and 79.725, respectively. These scores directly indicate that the East Lake Greenway Project received a higher rating than the Dianchi Lake Greenway Project.

4.2 Analysis of Performance Evaluation Results for the Greenway Construction Project

4.2.1 Basic Information of the Greenway Construction Project Case

This research conducted a comparative performance evaluation of the planning and construction of two greenway projects—the Dianchi Greenway and the East Lake Greenway. Due to similarities in topography, geomorphology, and planning spatial configurations, the construction approaches of these two projects are highly analogous, employing essentially identical design techniques.The two projects's design and implementation have improved the ecological environment of two project while enhancing the greening level of the surrounding urban area. It has also boosted the development of local industries such as tourism, catering, and accommodation, thereby promoting regional economic growth.

4.2.2 Case Result Analysis and Evaluation

(1) Financial Evaluation Dimension: Both the Dianchi Greenway and the East Lake Greenway demonstrated satisfactory performance, scoring 18.798 and 19.370. However, high scores do not imply the absence of areas requiring improvement; both projects must prioritize monitoring fund utilization rates during subsequent optimization and maintenance efforts.

(2) Aesthetic Dimension: The performance evaluation score for aesthetic management of the Dianchi Greenwaty Project was 19.094, while that of the East Lake Greenway Project was 20.183, indicating that the latter's aesthetic design planning is slightly superior to that of the former. This

advantage is primarily reflected in two aspects: the overall sensory design management of the way and the effective control of topographical diversity.

(3) Functional Dimension: From the perspective of functional performance evaluation, the Dianchi Greenway Project scored 20.647 points in functional performance, while the East Lake Greenway Project scored 21.028 points. As a plateau lake that is narrower in the north and wider in the south, the Dianchi Greenway project faces significant planning and construction limitations, making it unsuitable for development as a comprehensive urban greenway network.

(4) Social Evaluation Dimension: In the social evaluation performance assessment, the Dianchi Greenway Project scored 18.46 points, while the East Lake Greenway Project scored 19.144 points. In contrast, the East Lake Greenway's layout maintains considerable distance from residential areas and urban infrastructure, coupled with inconvenient transportation access, resulting in lower long-term usage willingness compared to the Dianchi Greenway.

5. Research Conclusions and Prospects

5.1 Research Conclusion

This reserch establishes a performance evaluation index system for greenway construction projects using the Fuzzy Analytic Hierarchy Process (FAHP) and conducts an empirical analysis of the developed model. The index system features clear hierarchies, logical coherence, and practical applicability. The application of FAHP for determining indicator weights enhances the objectivity and scientific rigor of the evaluation results. Case analysis demonstrates that the FAHP-based performance evaluation system is suitable for assessing greenway projects. Through comparative case studies and data analysis, the model's practical value is confirmed, providing data support and a scientific foundation for project decision-making, optimization, and management improvement in such initiatives.

5.2 Recommendations Based on the Evaluation Results

(1) Landscape design must be integrated with regional culture and social realities.

This research posits that in the planning and construction of greenway projects, the landscape design should adopt a systematic approach by exploring the unique cultural essence of the region. By combining conventional traditional architectural elements with locally characteristic building materials, the design can be effectively transformed into a unique foundational architectural landscape feature specific to the region.

(2) Invite experts to optimize and improve the project plan

For the planning and construction of greenway projects or similar green infrastructure initiatives, experts with extensive practical experience should be engaged to ensure the feasibility and authority of optimization recommendations. Regarding optimization strategies, it is recommended to establish an expert database for greenway project planning and construction, facilitating expert consultations during subsequent project implementation. Long-term partnerships with these experts for optimizing and collaborating on greenway projects should be established to provide sustained professional support for future developments.

(3) Developing a greenway with a dedicated urban, convenient transportation design concept

Through case analysis and literature review, this research recommends establishing dedicated greenway bus routes within a 5-kilometer urban radius surrounding greenway projects. Enhancing transportation connectivity through convenient transit options is undoubtedly an effective approach to improve greenway accessibility. At junctions between urban areas and greenways, as well as at intersections of bicycle lanes and motor vehicle lanes, traffic signals and isolation facilities should be installed to ensure cyclist safety and enhance the riding experience for citizens.

(4) Promote the integration of economic development and environmental protection

Managers of greenway development projects can leverage the natural landscapes and ecological resources along the ways by incorporating features such as birdwatching areas, hiking routes through

distinctive terrains, and cycling paths during planning and construction to attract residents and visitors to experience the local natural scenery. It is recommended to create eco-themed parks in suitable open spaces along the greenways, enabling organizers to host environmental-themed cultural events like eco-fairs and green living seminars, thereby enhancing public environmental awareness.

5.3 Research Gaps and Prospects

Future research could consider establishing a comprehensive life cycle performance evaluation system to facilitate integrated management and assessment of greenway development projects.It should be acknowledged that the research could further expand the geographical representation of the expert panel by inviting experts responsible for planning and implementing such projects across various regions.Finally, the research should enhance empirical research on greenway construction projects by conducting case studies and analyses of more such initiatives, thereby providing comprehensive references for project planning, decision-making, and construction management.

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