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Research on the Evaluation of Spatial Perception Elements of Traditional Settlements in the West Liaohe River Basin Based on the IPA Method

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Abstract

The Western Liao River Basin is one of the cradles of Chinese civilization and is recognized as China's third mother river, following the Yellow River and the Yangtze River. This study focuses on traditional settlements in the Western Liao River Basin and evaluates their spatial perception elements using the IPA (Importance–Satisfaction Analysis) method. By enriching research on the spatial perception evaluation of traditional settlements, this work provides guidance for the protection and inheritance of traditional settlements in the Western Liao River Basin. Based on a field survey of the current spatial conditions of these traditional settlements, an evaluation system for spatial perception elements is proposed. Using SPSS software, the importance and satisfaction scores of each evaluated element are determined. Using the IPA method, this study classified 18 spatial perception factors of traditional settlements in the West Liao River Basin into four categories: strengths, potential overkill, low priority, and urgent improvement. Differentiated conservation and optimization strategies were proposed based on these findings. The study also reveals that local residents' spatial perception is an active construction process rooted in daily life and cultural practices, exhibiting characteristics of "place dependence" and "path orientation." Elements rated as high in importance but low in satisfaction reflect residents' cultural anxiety and sense of spatial loss. The study emphasizes that the conservation of traditional settlements should shift from expert-led approaches to local collaboration, fully incorporating residents' cognitive patterns to construct a dynamic pathway for heritage transmission grounded in daily practices and cultural memory.

Keywords: IPA method; the West Liao River Basin; traditional settlements; spatial perception elements; evaluation system

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1. Introduction

Against the backdrop of rapid urbanization and settlement revitalization, the spatial characteristics of traditional settlements are facing significant challenges. Although existing research has applied various methods—such as the Analytic Hierarchy Process, questionnaire surveys, and spatial perception theory—to the fields of urban planning, settlement studies, and tourism research, and has extensively explored traditional settlement spaces from multiple dimensions—including aging-friendly renovation [1], park optimization [2], perceptions of public spaces [3–7], variations in cultural spaces [8,9], landscape space

evaluation [10–14], destination image [15,16], and satisfaction evaluation [17]—thereby demonstrating the broad applicability and interdisciplinary value of this methodological framework across different spatial scales and research subjects, two significant shortcomings remain. First, research methods are predominantly qualitative, lacking the systematic incorporation of quantitative indicators and statistical testing, which results in highly subjective findings that are difficult to compare across studies or generalize more broadly. Second, research subjects are overly concentrated on designated settlements, such as those of historical and cultural significance, while severely insufficient attention has been paid to traditional watershed-based settlements that integrate hydrological ecology, cultural corridors, and agricultural production functions. This academic gap leaves the conservation and restoration of such settlements lacking a scientific basis.

In fact, the watershed environment profoundly shapes the spatial characteristics of settlements and serves the dual functions of ensuring ecological security and preserving regional culture. The West Liao River Basin is one of the cradles of Chinese civilization and is widely recognized as China's third-largest "mother river," after the Yellow River and the Yangtze River [18]. Since the reform and opening-up, its ecological and cultural environments have undergone drastic changes, and its spatial characteristics have been systematically impacted. At the same time, as a key national agricultural and grain-producing region, the sustainable development of settlements in this basin has become a provincial strategic priority, creating an urgent need for a quantifiable and verifiable evaluation tool. Accordingly, this paper selects the West Liao River Basin as a case study to construct an evaluation system for spatial perception elements of traditional settlements in river basins. The aim is to address the current research limitations characterized by "qualitative dominance and narrow typological scope," thereby providing quantitative evidence and methodological references for the precise conservation, landscape management, and targeted policy development of traditional settlements in northern regions characterized by multi-ethnic integration.

2. Research Object and Innovation

2.1. Scope of the Research

The West Liao River is one of China's seven major rivers and the largest river in Northeast China. The West Liao River Basin within Inner Mongolia is located in the upper reaches of the West Liao River, in the central-eastern part of Inner Mongolia and within the Beijing–Tianjin–Hebei radiation circle (see Figure 1). This basin covers an area of 127,000 km^2, accounting for 92% of the total area of the West Liao River Basin. The West Liao River Basin in Inner Mongolia encompasses three districts of Chifeng, two districts of Tongliao, one district of Xing'an League, and one district of Xilingol League. Chifeng and Tongliao together account for 97.5% of the basin's area [19].

The West Liao River Basin in Inner Mongolia is representative for the following reasons: (1) Cultural advantages: The regional civilization centered on the West Liao River Basin holds a prominent and significant position in the 5000-year history of Chinese civilization and is one of the cradles of Chinese culture. It retains abundant tangible and intangible cultural heritage. (2) Natural advantages: The West Liao River Basin in Inner Mongolia exhibits distinct natural ecological advantages and is rich in natural resources, including mountains, rivers, forests, lakes, and grasslands. (3) Location advantages: Situated within the radiation range of Beijing, Tianjin, and Hebei, the West Liao River Basin in Inner Mongolia possesses obvious locational advantages, a dense population, and substantial market potential. (4) Policy advantages: The West Liao River Basin in Inner Mongolia has actively responded to national policies on watershed protection and development, with effective policy implementation. In 2021, the 14th Five-Year Plan for the Protection

and Development of the West Liao River Basin in Inner Mongolia was officially issued and implemented.

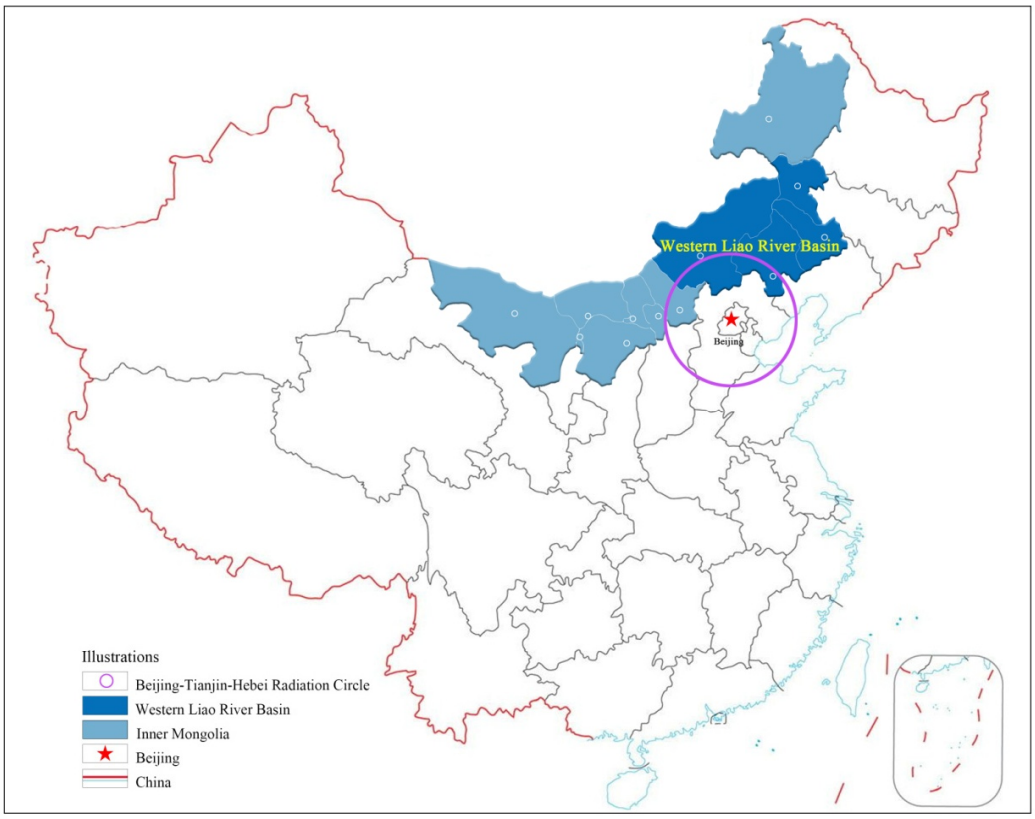


Figure 1. Geographical Location Map of the West Liaohe River Basin.

2.2. Research Object

This study focuses on a total of 130 traditional settlements within the West Liao River Basin, including 42 in Chifeng City, 54 in Tongliao City, 21 in Xing'an League, and 13 in Xilingol League, which are concentrated in the Chifeng and Tongliao areas. The study accounts for typicality as well as regional differences and imbalances. Leveraging the uniformity of the natural geographical environment of the West Liao River Basin and the variations in administrative divisions, the research aims to achieve comprehensive coverage of the entire basin, urban areas, and natural environments. A total of 26 settlements were selected as key research samples (see Figure 2). Based on existing literature, a combination of in-depth interviews and field surveys was employed to conduct extensive fieldwork on these key settlements. This approach enabled the collection of effective first-hand information, the establishment of a spatial characteristics database for traditional settlements in the West Liao River Basin, the exploration of the spatial characteristics of traditional settlements, and the overlapping and classification analysis of different features. These efforts facilitate subsequent research.

2.3. Innovation

The innovation and advantages of constructing an evaluation system for spatial perception elements of traditional settlements using the IPA method in this study are as follows: (1) Expanding the research scope. This study focuses on traditional settlements within watershed areas that possess dual historical, cultural, and natural ecological values, thereby broadening the previous emphasis on traditional settlement areas rich in historical and cultural heritage. (2) Innovating the research methodology. The application of the IPA method effectively addresses the limitations of subjective research approaches. This

method facilitates a transition from qualitative description to quantitative diagnosis. By integrating users' perceptions of the "importance" and "satisfaction" of spatial elements into a two-dimensional quadrant analysis framework, it enables a detailed deconstruction of multidimensional elements and effectively identifies weak elements requiring urgent intervention as well as resource redundancy resulting from excessive supply. Its core advantage lies in its visually oriented decision-making output, which directly generates priority strategies for differentiated protection and activation, thereby providing a scientific foundation for the adaptive renewal of traditional settlements in the basin.

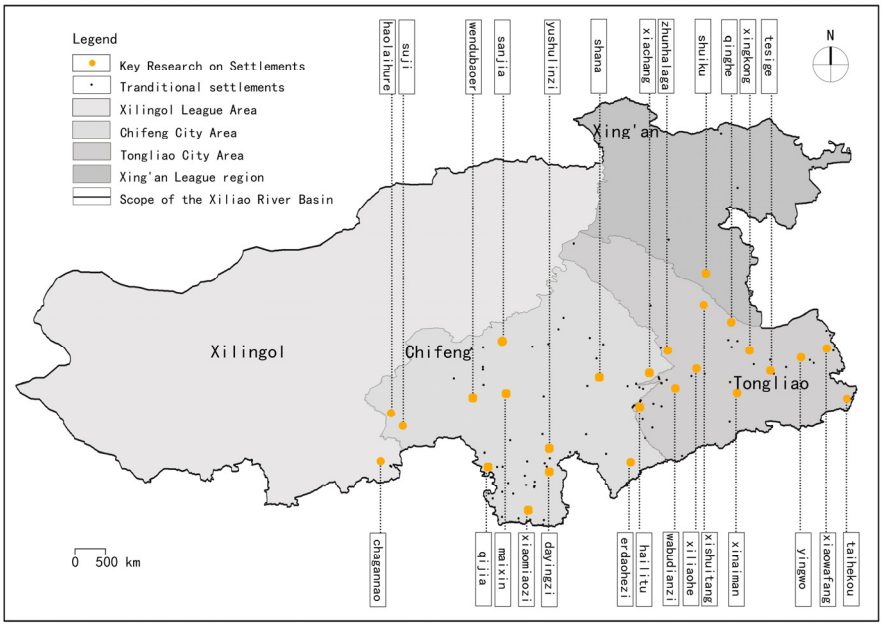


Figure 2. Distribution of Traditional Settlements under Key Research in the West Liaohe River Basin.

3. Method

3.1. IPA Research Method

To systematically explore the perception structure of residents and tourists regarding the spatial characteristics of traditional settlements in the West Liao River Basin, to identify the deviation between their expected perception and actual experience of these spatial characteristics, to accurately pinpoint the weak links in the current protection and inheritance of spatial characteristics, and to provide a scientific basis for the protective restoration and sustainable utilization of these characteristics, this study introduces the Importance–Satisfaction Analysis (IPA) method. This method, proposed by Martilla and James in 1977, requires respondents to quantitatively evaluate each indicator from two dimensions: importance and satisfaction (or perceived satisfaction) [20]. In IPA, with importance as the horizontal axis and satisfaction as the vertical axis, and the two-dimensional mean as the coordinate origin, four quadrants can be formed (Figure 3): Quadrant A (Advantage Preservation Area) indicates that both the importance and satisfaction of the elements are above the mean, suggesting that these elements need to be maintained and improved; Quadrant B (Maintenance Area) indicates low importance but high satisfaction, reflecting possible redundancy in resource investment; Quadrant C (Opportunity Area) corresponds to factors with low importance and low satisfaction, which can be temporarily deprioritized when resources are limited; Quadrant D (Improvement Area) refers to elements with high importance but low satisfaction, representing a key area that should be prioritized for subsequent optimization.

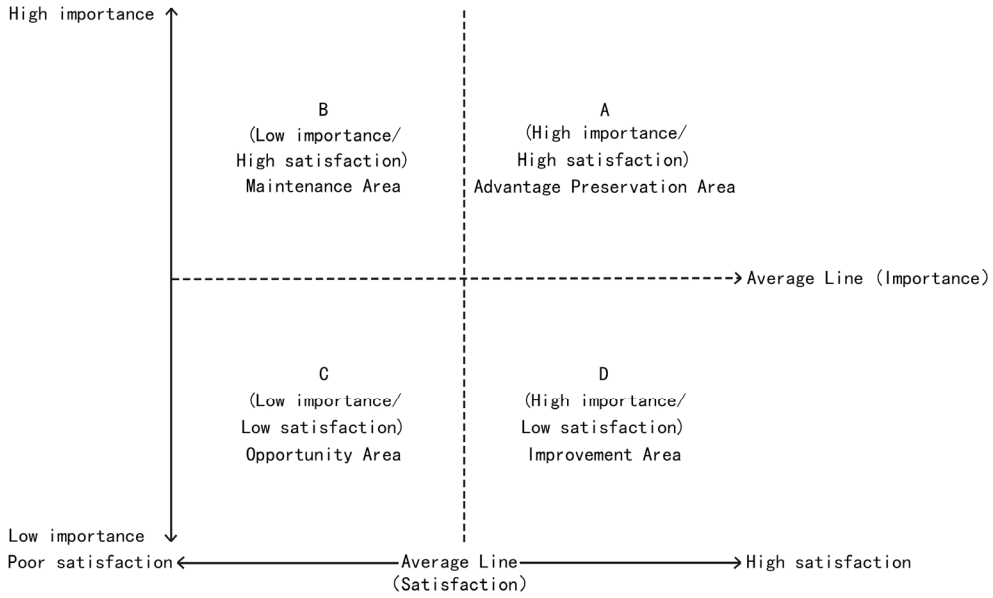


Figure 3. Schematic diagram of IPA method.

3.2. Data Scale

Core data of the sample settlements—including plot texture, natural elements, public spaces, and building styles—were obtained by the research team through field surveys and digital survey methods from 15 March to 25 September 2025. Qualitative data on cultural context, historical elements, primitive totems, and other intangible spatial attributes were collected by the research group through survey questionnaires, in-depth interviews, policy and case texts, and literature materials during two periods: 30 September to 31 October 2025, and 3 November to 29 November 2025 (Table 1).

Table 1. Data Scale Characteristics of Traditional settlements in the West Liaohe River Basin.

Data Type	Specific Scale
In-depth interviews (Survey questionnaires, interviews)	Survey questionnaires + 192 interviews, totaling 4784
Policy and Case Text	38–72 copies
literature	12 news reports, 26 archival records, 4 research papers, 7 letter manuscripts, 26 historical documents, and 8 related travelogues, totaling 83 copies
26 traditional settlement spatial locations	6819–8155 pieces

Given the large volume of data concerning the 26 traditional settlements, this study encountered instances of both partial and complete data missingness. Therefore, based on the characteristics of the data itself, linear interpolation was used to estimate specific missing values for partially missing data. For completely missing data, the average value of the corresponding indicator across the other traditional settlements was used as the indicator value for the settlement in question.

4. Indicators Selection and Data Analysis

4.1. Indicators Selection

The criteria for selecting these 18 evaluation indicators are as follows: first, using the nationally recognized and officially issued Evaluation Indicator System for China's Historic and Cultural Towns (Settlements) (Trial) and Evaluation and Certification Indicator System for Traditional Settlements (Trial) as the primary references; second, systematically

reviewing relevant literature in the field of spatial perception evaluation and conducting a comprehensive analysis; third, integrating the actual characteristics of traditional settlements in the West Liao River Basin with the results of the survey questionnaires. Based on these criteria, 18 perception-based indicators capable of reflecting the spatial characteristics of these settlements while balancing assessments of importance and satisfaction were ultimately identified. This study selected core indicators with comparability, directionality, and operability across four dimensions: site selection, spatial construction, buildings and small-scale components, and intangible culture. Through systematic integration, a three-level "scheme–criterion–indicator" evaluation system for spatial perception elements of traditional settlements was constructed, encompassing 4 criteria and 18 specific indicators (Table 2). Based on the classification criteria, the original data was dimensionless processed using the standardization model of SPSS 22.0 software. The resulting standardized results are shown in Tables S1 and S2.

Table 2. Spatial Perception Factors of Traditional Settlements in the West Liaohe River Basin.

Scheme Layer	Criterion Layer	Indicator Level
The spatial perception elements of traditional settlements (P)	Site selection (P1)	Plot texture (A1)
		Natural elements (A2)
		Water landscape (A3)
	Space Construction (P2)	Road streamline (A4)
		Space node (A5)
		Public space (A6)
		Central form (A7)
		Boundary form (A8)
		Ground paving (A9)
	Building and Accessories (P3)	Building style (A10)
		Building structure (A11)
		Building material (A12)
		Building decoration (A13)
		Building color (A14)
		Small-scale sculptures (A15)
	Intangible Culture (P4)	Cultural context (A16)
		Historical elements (A17)
		Primitive totem (A18)

4.2. Questionnaire Survey

This study focuses on the core components of spatial perception in the West Liao River Basin. Using random sampling, a survey was conducted across the basin to assess the importance of these components, and the results were used to rank them in order of importance. Based on these findings, the component system was screened and refined, ultimately establishing an indicator system suitable for the analysis and evaluation of spatial perception in the West Liao River Basin. The elements of the aforementioned indicator system were translated into colloquial language and adapted to create separate satisfaction survey checklists tailored to two distinct groups: out-of-town visitors and local residents. A five-point Likert scale (1 = not at all important/not at all satisfied; 5 = very important/very satisfied) was used to quantitatively measure the importance and satisfaction levels associated with the 18 spatial perception elements. First, respondents rated the importance of each element based on their subjective perceptions; second, the same scale was used to measure satisfaction with the current status of each element, thereby reflecting the public's level of recognition of the current effectiveness of spatial conservation efforts.

This study employed a hybrid questionnaire distribution strategy, combining on-site random sampling and targeted online push notifications (Table 3). Through in-person interviews, 832 questionnaires were distributed and collected in traditional settlements within the West Liao River Basin, achieving a 100% response rate. Additionally, due to the low level of tourism development in these settlements, obtaining visitor samples was challenging. Therefore, electronic questionnaires were distributed via QQ, WeChat, and Weibo, focusing on tourist groups. A total of 3952 questionnaires were distributed and fully recovered. After data cleaning and the removal of 264 invalid responses, the final valid sample size was 3688, yielding an effective response rate of 93.33%.

Table 3. Distribution and Collection of Survey Questionnaires.

Distribution Method	Quantity Issued	Recycling Situation		Effective Recycling Situation	
		Recycled Quantity	Recovery Rate	Effective Recycling Quantity	Effective Recovery Rate
Field	832	832	100.00%	832	100.00%
Network	3952	3688	93.33%	3688	93.33%
Total	4784	4520	94.48%	4520	94.48%

4.3. Data Analysis

4.3.1. Reliability and Validity Analysis

(1) Reliability analysis

Reliability refers to the extent to which a measuring instrument can consistently reproduce results under identical conditions, irrespective of testing time, location, or the individual administering the test. This research employed Cronbach's alpha coefficient to assess the reliability of the importance and satisfaction data for perceived elements of traditional settlement spatial characteristics in the West Liaohe River Basin (Equation (1)).

$$a = K/(K - 1)\ \{1 - (\sum S_i\hat{}2)/(S_x\hat{}2)\} \quad (1)$$

This research employed Cronbach's alpha coefficient to assess the reliability of the scale. The importance and satisfaction evaluation data for traditional settlement spatial perception elements in the Xiliao River Basin were imported into SPSS 22.0. The analysis results indicated that the alpha coefficient for the importance evaluation was 0.912 and for the satisfaction evaluation was 0.953. Both coefficients significantly exceeded the benchmark threshold of 0.9, demonstrating that the scale exhibits extremely high internal consistency and reliable data (Table 4).

Table 4. Reliability Analysis Table.

Varies	Cronbach's Alpha Coefficient	Number of Terms
Importance	0.914	26
Satisfaction	0.955	26

(2) Normality Analysis

The Shapiro–Wilk test was used to assess the normality of the data. The results showed that the test statistic W = 0.95000 (n = 26, $p = 0.247 > 0.05$), and the null hypothesis of normality could not be rejected, indicating that the data follow a normal distribution. Therefore, the data satisfy the assumptions of Bartlett's sphericity test (Table 5).

Table 5. Shapiro–Wilk Normality Test.

Test Methods	Test Statistic (W)	Sample Size (n)	Significance (*p*)	Conclusion on Normality
Shapiro–Wilk	0.95000	26	0.247	Follows a normal distribution

(3) Validity analysis

Regarding structural validity, the importance and satisfaction evaluation data of traditional settlement spatial perception elements in the West Liaohe River Basin were imported into SPSS 22.0 for analysis. The KMO test value was 0.846 (greater than 0.7), and the Bartlett sphericity test yielded a significance level of 0.000, indicating that the scale possesses good construct validity and is suitable for subsequent analysis (Table 6).

Table 6. KMO and Bartlett tests.

KMO sampling suitability quantity		0.847
Bartlett's sphericity test	Approximate chi-square	8002.415
	Degree of freedom	706
	salience	0.000

4.3.2. Descriptive Statistical Analysis

(1) Sample demographic analysis

This research is based on sample demographic survey data, analyzed across five dimensions: gender, age, education level, monthly income, and local resident identity. The results are presented in Table 7, and based on these results, the demographic characteristics of the sample are systematically sorted and explained.

Table 7. Analysis of demographic characteristics of sample population.

Varies Nature	Category	Frequency	Percentage (%)
Gender	Male	2470	51.6
	Female	2314	48.4
Age	18 years old and below	166	3.5
	19–35 years old	1550	32.5
	36–45 years old	1414	29.4
	46–60 years old	775	16.2
	over 60 years old	879	18.4
Educational level	Primary school	818	17.1
	Junior high school	936	21.74
	High school	1040	25.54
	Junior college	1222	19.57
	Undergraduate	610	12.75
	Master's degree and above	158	3.3
Monthly income	Below 1000	834	17.4
	1001–3000	1038	21.7
	3001–5000	1346	28.2
	5000–7000	1140	23.8
	Over 7000	426	8.9

Table 7. *Cont.*

Varies Nature	Category	Frequency	Percentage (%)
Occupation type	Management and Religious personnel	130	2.7
	Handicraft workers	846	17.7
	Personnel in the business and Service industries	1086	22.7
	Farmer	1242	26
	Herdsman	458	9.6
	Professional technical personnel	210	4.4
	Freelancers	344	7.2
	Enterprise employees/Individual industrial and commercial	245	5.1
	Households/Private enterprise households	149	3.1
	Others	74	1.5
Family size	Living alone	237	5
	Couple	627	13.1
	Three-person households	939	19.6
	Four-person households	1797	37.6
	Five-person households	983	20.5
	Over five-person households	201	4.2
Are you a local resident	Yes	2527	52.8
	No	2257	47.2

Gender

The gender structure analysis of 4784 respondents revealed that males constituted 51.6% (2470 individuals) and females constituted 48.4% (2314 individuals), resulting in a nearly balanced ratio between the two genders (see Figure 4 for details). This distribution pattern indicates that the sample demonstrates strong representativeness in the gender dimension and is capable of effectively reflecting the structural characteristics of the target population.

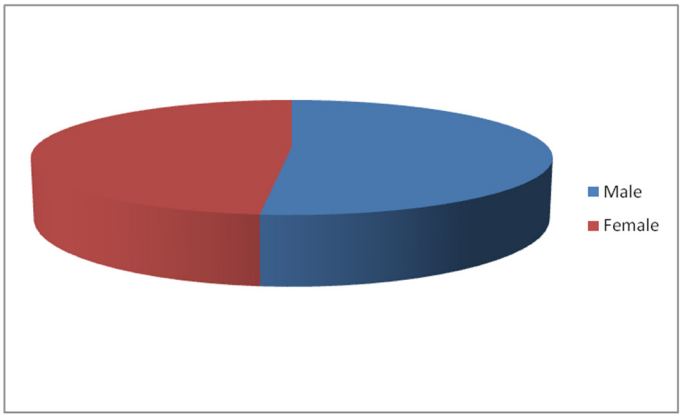


Figure 4. Gender Distribution Map.

Age

This survey employs a five-stage age grouping methodology (Figure 5). Respondents are primarily aged 19–35 (33.2%) and 36–45 (29.3%), collectively accounting for over 50% of the total population. Only 2.7% (5 cases) of the population consists of individuals less than 18 years of age. The primary reasons for this distribution are as follows: migrant workers aged 19–35 exhibit a high level of concern for their hometowns and actively participate

in online surveys; most individuals aged 36–45 have the financial means for tourism consumption. The remote settlement lacks basic educational infrastructure, leading minors to often accompany their parents during research trips and only participate in surveys when returning home during holidays.

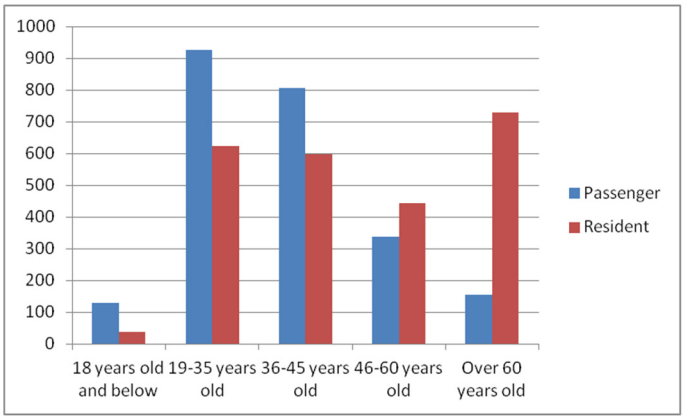


Figure 5. Age distribution chart.

Educational Level

Based on the analysis of the respondents' educational backgrounds (Figure 6), the educational structure exhibits a pyramid distribution. Junior high school (21.74%), high school (25.54%), and Junior college (19.57%) constitute the primary segments, followed by primary school at 17.1%. In contrast, undergraduate (12.75%) and Master's degree and above (3.3%) represent relatively lower proportions. This distribution is attributed to certain settlements being designated as 'traditional settlements at the autonomous region level,' which attract highly educated researchers to reside there, thereby forming local clusters.

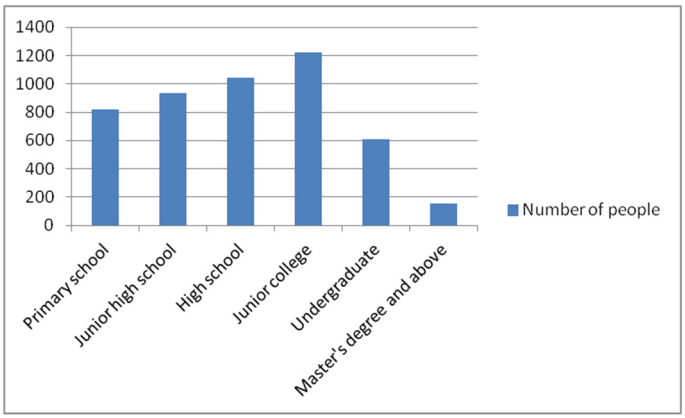


Figure 6. Distribution of Educational Level.

Monthly Income

Based on empirical survey (Figure 7), the income of permanent residents in the West Liaohe River Basin is concentrated below 3000 yuan, whereas the income range above 3000 yuan is primarily composed of foreign tourists. This differentiation reflects the industrial contradictions inherent in traditional settlements: on one hand, settlements rely on low-value-added livelihoods such as traditional farming, grazing, and migrant work, resulting in low incomes; on the other hand, the gathering place is situated in a remote area with inconvenient transportation (only a few shuttle buses connect it to the county town), while high-income tourists typically choose to travel by car. The root cause lies in the lack

of endogenous driving force in the modernization transformation of settlements and the unsmooth introduction of external resources.

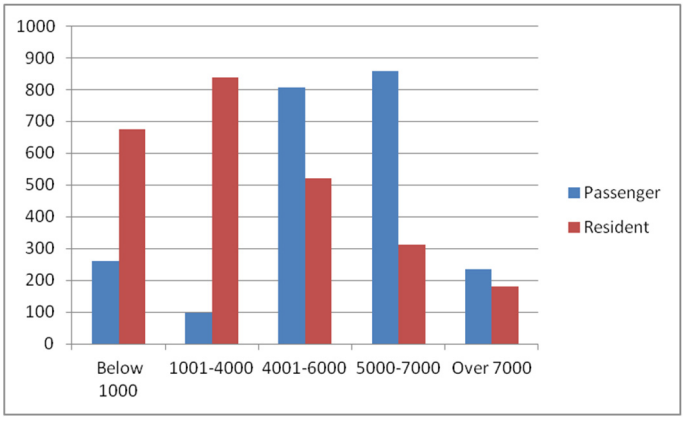


Figure 7. Income Distribution in June.

Occupational Type

As illustrated in Figure 8, the respondents exhibit a significantly uneven occupational composition. Farmers and herdsmen constitute the largest proportion, followed by freelancers, individual industrial and commercial households/private enterprise owners, professional and technical personnel, enterprise employees, and civil servants/public institution staff. In contrast, the proportions of retirees and workers are relatively low. This occupational distribution pattern intuitively reflects that the overall employment status of this group is at a relatively low level, characterized by a significant lack of occupational stability, thereby highlighting the disadvantaged employment position of the respondents.

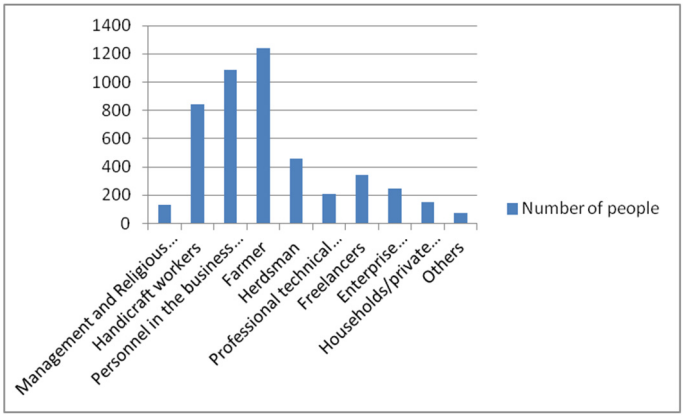


Figure 8. Distribution of Occupational Types.

Family Size

According to the statistical analysis of the survey data (Figure 9), there is a significant distribution pattern of nuclear family types within the respondents' family structures. Among these, the primary family model consisting of a four-member household has the highest proportion, accounting for 37.6%. Next are five-member and three-member families, which account for 20.5% and 19.6%, respectively. The proportions of single-person households and households with five or more members in the sample are the lowest, at 9.2%. This distribution pattern reflects the demographic characteristics of traditional settlements dominated by medium-sized core families.

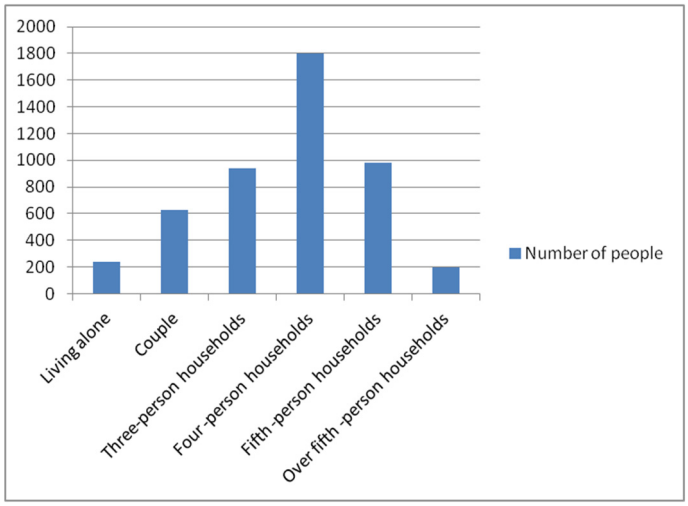


Figure 9. Distribution of Family Size.

4.3.3. Perception Analysis of Spatial Characteristics

(1) Historical elements

The historical element system of traditional settlements in the Xiliao River Basin comprises Party building stone carvings, Mengyuan Pavilion, wall paintings, landscape trails, and other components. Cultural identity surveys (Figure 10) indicate that wall paintings have emerged as the most representative cultural symbol, with 85.75% recognition. This is followed by memorial archways (82.45%) and landscape footpaths (80.22%). In contrast, awareness of Mengyuan Pavilion and Party building stone carvings remains low, at 15.57% and 11.81%, respectively. Current protection efforts exhibit imbalance: while Party building stone carvings have been identified and marked, the protective system requires improvement. Mengyuan Pavilion's cultural value has been recognized, yet certain sections have been abandoned and necessitate restoration for recreational purposes.

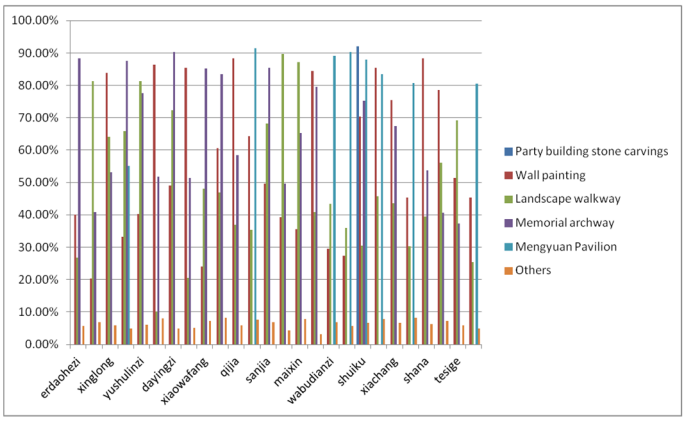


Figure 10. Statistical Table of Respondents' Perception of Historical Factors.

(2) Public Space

The public space system of traditional settlements in the Xiliao River Basin comprises multiple elements, including religious buildings, cultural facilities, commercial facilities, and leisure spaces. The cultural identity survey (Figure 11) reveals that the settlement history museum and folk customs museum constitute the core memory carriers, while the settlement green spaces, farmhouse entertainment areas, and markets form the secondary cognitive circle. The entrance square, Aobao, and mosque are positioned on the perceptual

edge. The settlement history museum and folk customs museum have emerged as historical and cultural landmarks due to their role in preserving historical memory and ethnic cultural heritage. Settlement green spaces serve dual functions of communication and production. The entrance plaza suffers from inadequate signage and maintenance, resulting in low public awareness and necessitating urgent revitalization and protection efforts.

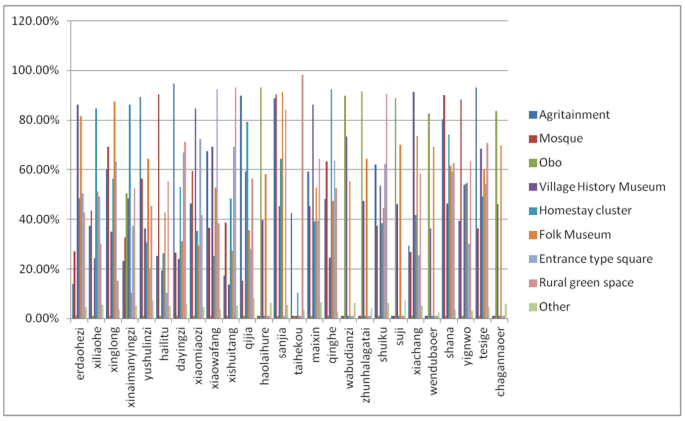


Figure 11. Statistical Table of Respondents' Perception of Public Spaces.

(3) Building Features survey

The building characteristics of traditional settlements in the West Liao River Basin exhibit distinct regional features, with their value carriers encompassing five dimensions: building style, material, structure, color, and decoration. Spatial perception surveys (Figure 12) indicate that building style has the highest recognition rate as a cultural symbol, at 86.47%. Building structure, decoration, and materials have also received high praise for their effectiveness in adapting to terrain and climate (all exceeding 80%). However, awareness of building color is relatively low, at 37.9%. This gradient reveals the attenuation pattern of the spatial characteristic value of material carriers.

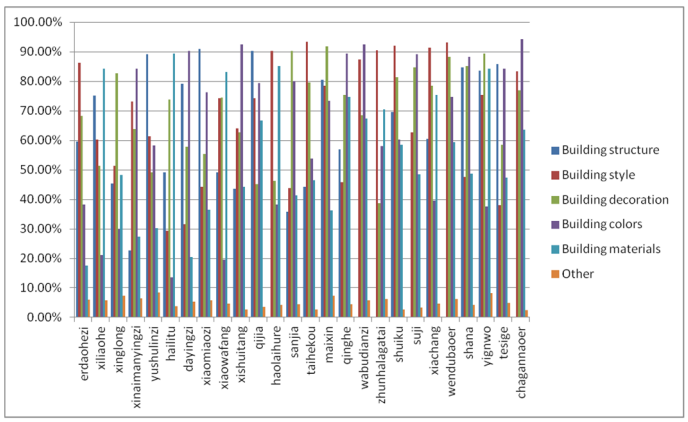


Figure 12. Statistical Table of Respondents' Perception of Building Features.

(4) Current situation of space characteristic protection

The protection status of traditional settlements in the West Liao River Basin has resulted in significant differences (Figure 13). A total of 81.35% of respondents indicated that current protection measures exhibit obvious deficiencies and that there is an urgent need to strengthen systematic protection. A total of 18.33% of respondents believe that the current level of protection aligns with the present condition of the settlements and advocate maintaining the status quo to avoid excessive intervention. An additional 2.86%

of respondents proposed following the laws of natural development and reducing human investment, taking into account practical factors such as settlement remoteness, economic underdevelopment, and weak infrastructure.

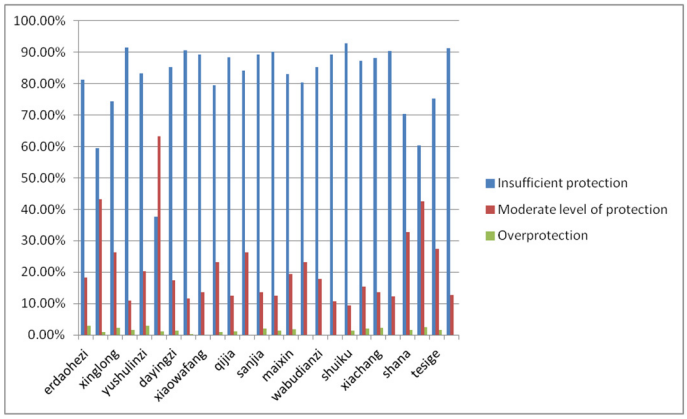


Figure 13. Statistical Table of Respondents' Perception of Settlement Protection Status.

4.3.4. Importance and Satisfaction Analysis

(1) Importance Analysis

According to Table 8, the average importance rating of perceived elements of traditional settlement spatial characteristics in the West Liao River Basin exceeds the theoretical median, indicating a high degree of consensus among respondents. Among these elements, intangible cultural and macro-spatial components—such as cultural context, central form, and plot texture—are particularly prominent and rank among the highest in importance. In contrast, specific material space components, including building decoration, water landscape, and ground paving, have relatively low importance. Based on primitive totems, two cognitive levels have been identified: high importance and medium-high importance.

Table 8. Importance of Descriptive Statistics.

	N	Average Value (E)	Standard Deviation	Rank
A16 Cultural context	4784	4.79	0.044	1
A7 Center form	4784	4.78	0.043	2
A1 Plot texture	4784	4.73	0.048	3
A17 Historical elements	4784	4.70	0.042	4
A18 Primitive totem	4784	4.62	0.051	5
A6 Public space	4784	4.59	0.049	6
A15 Small-scale sculptures	4784	4.54	0.045	7
A14 Building color	4784	4.51	0.055	8
A2 Natural elements	4784	4.46	0.044	9
A11 Building structure	4784	4.36	0.041	10
A8 Boundary form	4784	4.28	0.046	11
A4 Road streamline	4784	4.09	0.052	12
A12 Building material	4784	4.06	0.042	13
A10 Building style	4784	4.01	0.043	14
A5 Spatial node	4784	3.58	0.065	15
A13 Building decoration	4784	3.57	0.057	16
A3 Water landscape	4784	3.45	0.052	17
A9 Ground paving	4784	3.37	0.047	18
Effective N (in columns)	4784			

(2) Satisfaction Analysis

As shown in Table 9, the average satisfaction evaluation of traditional settlement spatial characteristics perception elements in the West Liaohe River Basin ranges from 3.12 to 4.66, with significant actual perception differences among respondents. Natural elements and spatial nodes fall within the highly expressive zone (mean > 4.45), exhibiting the most prominent perception. Public spaces related to water landscapes belong to the medium expressive zone (3.42–4.36), demonstrating moderate recognition. Building decoration and building materials are categorized in the low expressive zone (mean < 3.42), where perception of building materials is notably insufficient. The standard deviation for each element is relatively small (0.753–0.988), indicating high data reliability.

Table 9. Mean ranking of satisfaction.

	N	Average Value (E)	Rank	Standard Deviation
A2 Natural elements	4784	4.66	1	0.988
A5 Spatial node	4784	4.52	2	0.808
A6 Public space	4784	4.36	3	0.762
A10 Building style	4784	4.34	4	0.753
A1 Plot texture	4784	4.31	5	0.866
A16 Cultural context	4784	4.29	6	0.764
A18 Primitive totem	4784	4.23	7	0.824
A11 Building structure	4784	4.17	8	0.768
A7 Center form	4784	4.14	9	0.796
A8 Boundary form	4784	4.12	10	0.861
A4 Road streamline	4784	3.56	11	0.922
A3 Water landscape	4784	3.42	12	0.859
A13 Building decoration	4784	3.38	13	0.897
A17 Historical elements	4784	3.31	14	0.849
A14 Building color	4784	3.28	15	0.812
A9 Ground paving	4784	3.26	16	0.783
A15 Small-scale sculptures	4784	3.15	17	0.786
A12 Building material	4784	3.12	18	0.757
Effective N (in columns)	4784			

4.3.5. Paired Sample *T*-Test

Table 10 reveals a significant and negative gap between the expected importance and actual satisfaction of the 18 indicators at the 0.01 significance level. This indicates a substantial discrepancy between respondents' cognitive expectations and their perception of reality. The settlement space has not fully met social expectations regarding inheritance and perceptual experience, and there is a general lack of systematic awareness of various elements, suggesting considerable room for optimization. From a system integration perspective, future efforts should focus on the overall strengthening and collaborative enhancement of spatial characteristics.

Table 10. Paired sample *t*-test.

Indicator	Mean Importance (I)			Satisfaction Mean of Indicators (P)			Gap Value	T Value	Salience
	Average Value	Rank	Standard Deviation	Average Value	Rank	Standard Deviation	(I-P)		
A18 Primitive totem	4.62	5	0.691	4.23	7	0.787	0.79	11.127	0.005
A2 Natural elements	4.46	9	0.582	4.66	1	1.086	1.44	18.393	0.001
A6 Public space	4.59	6	0.625	4.36	3	0.857	0.86	12.502	0.000
A5 Spatial node	3.58	15	0.872	4.52	2	0.806	−0.26	−3.284	0.000

Table 10. *Cont.*

Indicator	Mean Importance (I)			Satisfaction Mean of Indicators (P)			Gap Value	T Value	Salience
	Average Value	Rank	Standard Deviation	Average Value	Rank	Standard Deviation	(I-P)		
A17 Historical elements	4.70	4	0.641	3.31	14	0.847	1.36	17.972	0.000
A16 Cultural context	4.79	1	0.576	4.29	6	0.762	0.88	15.606	0.000
A1 Plot texture	4.73	3	0.634	4.31	5	0.864	1.48	19.518	0.000
A7 Center form	4.78	2	0.567	4.14	9	0.794	0.93	15.328	0.000
A15 Small-scale sculptures	4.54	7	0.738	3.15	17	0.602	1.31	10.341	0.000
A8 Boundary form	4.28	10	0.607	4.12	10	0.858	0.88	12.508	0.000
A10 Building style	4.01	14	0.645	4.34	4	0.815	1.27	15.737	0.000
A3 Water landscape	3.45	17	0.571	3.42	12	0.785	0.73	3.294	0.000
A4 Road streamline	4.09	12	0.639	3.56	11	0.828	1.29	16.914	0.000
A12 Building material	4.06	13	0.563	3.12	18	0.731	0.93	17.364	0.000
A13 Building decoration	3.57	16	0.773	3.38	13	0.764	−0.24	−2.773	0.000
A11 Building structure	4.36	9	0.749	4.17	8	0.729	1.59	8.396	0.000
A14 Building color	4.51	8	0.632	3.28	15	0.866	1.42	11.493	0.000
A9 Ground paving	3.37	18	0.685	3.26	16	0.751	0.68	13.205	0.000

5. Results

This research adopts the IPA framework, with an importance mean of 4.42 as the *X*-axis and a satisfaction mean of 3.62 as the *Y*-axis, to divide 18 perceived elements into four quadrants (Figure 14) to clarify management optimization priorities.

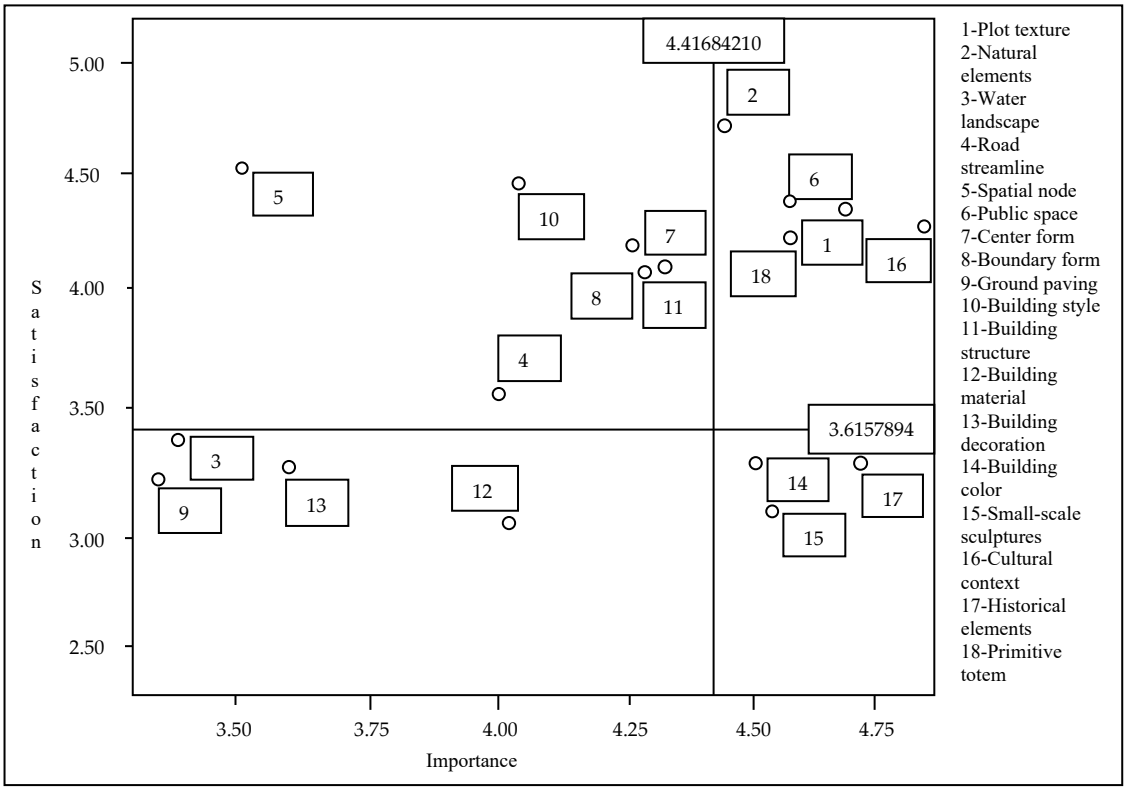


Figure 14. IPA grid diagram of traditional settlement spatial characteristics perception elements in the West Liaohe River Basin. Image source: Organized and analyzed using SPSS 22.0 software.

Based on the IPA quadrant division results, the spatial perception elements of traditional settlements in the West Liao River Basin can be categorized into four types, each corresponding to differentiated protection strategies. The "Advantage Preservation Area" (natural elements, original totems, public spaces, cultural context, and plot texture) in the first quadrant exhibits high importance and high satisfaction. It should be consolidated as a strategic pivot for maintaining cultural authenticity and settlement symbiosis. The "Maintenance Area" (spatial nodes, central forms, boundary forms, building styles, building structures, and road flow lines) in the second quadrant has higher satisfaction than importance. It is recommended to dynamically update these areas while maintaining the current situation, in conjunction with overall protection. The "Opportunity Area" in the third quadrant (water landscape, building decoration, ground paving, and building materials) is characterized by low importance and low satisfaction, facing the issue of disappearing appearance. A "moderate maintenance" strategy is advisable, with potential activation through the revival of traditional materials. The fourth quadrant, the "Improvement Area" (historical elements, building color, and building details), presents a significant gap characterized by high importance paired with low satisfaction. It is urgent to transform this area into a core asset for sustainable development through comprehensive measures such as spatial revitalization and style control.

6. Discussions

Although certain innovative achievements have been attained, this research remains subject to limitations, which are outlined as follows: 1. Research Methodology. (1) The requirement for accurate measurement of case characteristics hinders the acquisition of in-depth information and may lead to overlooking the specific change process. (2) The complexity of the current spatial context of traditional settlements complicates the precise determination of causal relationships among numerous variables. (3) Traditional Chinese settlements exhibit unique spatial perceptions that resist generalization; thus, quantitative analysis alone is insufficient. 2. Data Accuracy. Given the substantial volume of data from 26 traditional settlements, this research encountered both partial and complete data missingness, resulting in compromised data accuracy. 3. Analytical Strategies. Subjective bias was present during the survey process.

This study concludes that the identified limitations do not fundamentally undermine the reliability of the findings; rather, they primarily affect the precision of the results and the scope of their generalizability. Notably, subjective bias has been transformed into a strength of the study, as residents' subjective evaluations are central to research on spatial perception.

To address these limitations, the study implemented the following measures: Cronbach's $\alpha > 0.7$ and the KMO statistic > 0.6 were used to ensure reliability and validity; paired-sample *t*-tests were employed to verify the significance of differences; a large sample size (26 settlements) was utilized to mitigate the impact of extreme preferences; and missing data were handled using listwise deletion and mean imputation. In summary, the conclusions possess sufficient validity and robustness.

The contradiction between the "high importance" and "low satisfaction" of historical elements stems from the "invisibility" and "marginalization" of key sub-elements—such as the Mengyuan Hall and the Party-building stone carvings—in spatial perception. This is reflected in extremely low public awareness (only 15.57% and 11.81%, respectively) and a lack of functional and narrative coherence. Current strategies, which prioritize "preservation" over "perception," make it difficult for the public to have a meaningful spatial experience. Therefore, the key to improving satisfaction lies in "reactivating" the spatial perception of these high-value elements through measures such as restoring their functions and enhancing landscape coherence.

In the evaluation of spatial perception in traditional settlements, local residents and tourists are selected as the target groups rather than categorizing individuals based on residency status, because the research focuses on actual patterns of human–space interaction: residents provide functional and emotional perceptions based on long-term living, whereas tourists offer aesthetic and atmospheric perceptions based on brief experiences. Residency status (e.g., type of household registration) primarily reflects legal affiliation and has no direct correlation with the depth or quality of spatial perception. Furthermore, it is prone to include individuals who do not actually reside in the area or those who are merely passing through, making it unsuitable as a basis for evaluation.

Local residents and tourists each accounted for nearly half of the sample (52.8% vs. 47.2%), primarily due to the study's deliberate balancing strategy and the multifunctional characteristics of the settlements. Traditional settlements serve as both living spaces for residents and cultural destinations for tourists; these two groups exhibit significant differences in their perceptions of historical elements. Balanced sampling helps comprehensively capture these differing perspectives and ensures the statistical validity of subsequent comparative analyses. Furthermore, the survey period was scheduled to coincide with the peak tourist season and public holidays, naturally resulting in a balanced distribution of residents and visitors. This accurately reflects the "residential–tourism" mixed social structure of the settlements.

7. Conclusions

This study employs the Importance–Satisfaction Analysis (IPA) method to identify 18 evaluation factors based on the perceived dimensions of spatial characteristics in traditional settlements within the West Liao River Basin. Through quantitative analyses—including reliability and validity tests, descriptive statistics, and paired-sample *t*-tests—the factors were categorized into four groups: strength preservation areas, potential overkill areas, low-priority areas, and areas in urgent need of improvement. Based on these findings, differentiated strategies are proposed: in the advantage preservation area, cultural narratives and spatial experiences should be reinforced to consolidate regional identity; in the maintenance area, dynamic maintenance and functional integration should be adopted to avoid excessive intervention; in the opportunity area, potential value should be activated through the revival of traditional materials and landscape restoration; and in the improvement area, targeted interventions should be implemented, combining spatial revitalization, visual character management, and the transmission of traditional crafts to restore cultural expression functions and promote the transition of settlements from static preservation to dynamic transmission.

Furthermore, the study revealed the spatial perception characteristics and cognitive logic of local residents, indicating that their perceptions are actively constructed based on daily life, intergenerational experiences, and cultural practices, exhibiting the dual characteristics of "place dependence" and "path orientation." Core sites (such as ancient wells and ancestral halls) serve as anchors of local identity, while the alleys traversed daily and boundary nodes constitute the basic units of evaluation. Residents' judgments of "importance" emphasize social memory and functional utility, whereas their assessments of "satisfaction" depend on the state of spatial maintenance and environmental comfort. Elements identified in the IPA as "areas in urgent need of improvement"—those with high importance but low satisfaction—reflect residents' "cultural anxiety" and "sense of spatial loss." Therefore, residents' spatial perceptions serve not only as the experiential foundation for evaluating settlements but also as a key reference for shifting strategies from "expert-led" to "community-driven" approaches. Moving forward, residents' cognitive patterns

should be fully incorporated to establish a dynamic conservation approach anchored in daily practices and cultural memory.

Note: Tables 4–6 and 8–10 were made according to SPSS 22.0 software analysis and organization, and Table 3 is based on compiled questionnaire data; all other charts are self-made by the authors.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/buildings16091657/s1, Table S1: Standard Value of Evaluation Indicators for Spatial Perception Factors of Traditional Settlements in the West Liaohe River Basin (Part 1); Table S2: Standard Value of Evaluation Indicators for Spatial Perception Factors of Traditional Settlements in the West Liaohe River Basin (Part 2).

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Institutional Review Board Statement: Ethical review and approval were waived for this study because there are no risks associated with participating in this study. The core scope of ethical review applies to life science and medical research involving human subjects or their biological samples and data. The "Measures for Ethical Review of Life Science and Medical Research Involving Human Subjects," jointly issued by relevant national authorities, clearly defines its jurisdiction as research activities that use human subjects as participants or utilize their samples and data. The evaluation of spatial perception elements in traditional settlements primarily focuses on both tangible and intangible cultural aspects, such as spatial patterns, landscape features, and cultural contexts. Research methods typically include field surveys (primarily observing the physical environment). Since this type of research does not directly treat specific individuals as subjects and does not collect or analyze sensitive personal information such as health records or behavioral data, it does not fall within the scope of research requiring ethical review as defined by the "Measures".

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: As the data involves one years of local policies, management, financial audits, participation of multiple interest subjects, and other more sensitive information, it is internal information and cannot be made public according to local requirements.

Conflicts of Interest: The authors declare no conflicts of interest.

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