buildings

MDPI

Article

Evaluation of Satisfaction with Spatial Reuse of Industrial Heritage in High-Density Urban Areas: A Case Study of the Core Area of Beijing's Central City

Fanlei Meng *, Xinyu Zhang and Yuxiang Pang

School of Architecture and Urban Planning, Beijing University of Civil Engineering and Architecture, Beijing 100044, China; 2108510022023@stu.bucea.edu.cn (X.Z.); 2108510021016@stu.bucea.edu.cn (Y.P.)
* Correspondence: mengfanlei@bucea.edu.cn

Abstract: Industrial heritage is regarded as an important stock of spatial resources in cities, which highlights its utilization value for urban regeneration in high-density urban areas. With the dramatic increase in the number of industrial heritage reuse projects, how to scientifically evaluate the satisfaction with their spatial reuse is a key part of the solution for the mutual balance between heritage preservation and urban renewal. This paper takes eight industrial heritage conversion and utilization projects in the high-density core area of Beijing's central city as examples; establishes an evaluation system for the satisfaction with the spatial reuse through six dimensions, namely, functional replacement, transportation accessibility, carrying capacity, public space, boundary form, and recognition of value; and uses the IPA method to evaluate the cases. This method is used to determine the degree of user satisfaction with the spatial reuse of industrial heritage in the core area of Beijing's central city and to summarize the advantages and problems of its reuse. The results of this study reveal a trend toward the "community-oriented" re-generation of industrial heritage in the core area of Beijing's central city, and this paper proposes recommendations for adaptive use to support high-quality urban regeneration work.

Keywords: high-density urban areas; industrial heritage; spatial reuse; satisfaction evaluation; the core area of Beijing's central city

Citation: Meng, F.; Zhang, X.; Pang, Y. Evaluation of Satisfaction with Spatial Reuse of Industrial Heritage in High-Density Urban Areas: A Case Study of the Core Area of Beijing's Central City. *Buildings* **2024**, *14*, 1473. https://doi.org/10.3390/buildings14051473

Academic Editors: Jiazhen Zhang and Chenyang Liao

Received: 30 March 2024
Revised: 11 May 2024
Accepted: 14 May 2024
Published: 18 May 2024

1. Introduction

High-density urban development has significant impacts on spatial resources such as land, energy, transportation, buildings, and public facilities. As of 2023, there are 76 cities in the world with population densities of more than 15,000 people/km^2, including Manhattan in New York City, Tokyo in Japan, the core of London in the United Kingdom, and Paris in France. China's rapid urban development has also attracted attention. Since the implementation of China's "reform and opening up" in 1978, the urban population has increased from 172.45 million people to 932.67 million people in 2023, an incremental increase of almost more than the total population of Europe, and the urbanization rate of the resident population, which stood at 17.92% in 1978, increased to 66.2% in 2023, with super-tier cities such as Beijing and Shanghai already exceeding 85% [1]. The contradiction between ultra-high population density and limited residential land has become an unavoidable challenge in China's urban development process [2]. How to use the existing stock of resources to improve the urban environment and enhance the quality of cities has become the main focus of current urban renewal development.

The research on spatial resources in high-density cities mainly includes the following aspects. Lingzhu Zhang, Sherman Lewis, Higgins, and Christopher D. conducted research on transportation systems in high-density cities [3–5]. Scholars such as Jusheng Song, Shuang Niu, and Chunxiao Wang focused their research on park green spaces in high-density cities [6–8]. Yihao Wu focused on urban forms in high-density environments [9].

Public space, which has been the focus of several scholars such as Yuelai Liu, Shu Zhang, and Rui Liang, is also an important research direction in high-density urban environments [10–12]. Sajjad, Muhammad systematically studied high-density resilient urban systems [13].

In recent years, industrial heritage in urban centers has received widespread attention, and the historical, social, and cultural values it possesses, as well as its unique value for renovation and utilization [14,15], have become a new focus for the renewal and development of high-density urban areas. In 1978, the International Committee for the Conservation of Industrial Heritage was established in Sweden to promote the preservation and exploitation of industrial heritage on a global scale. The Nizhny Tagil Charter, officially launched in Russia in 2003, clarified the value and significance of industrial heritage and marked its recognition worldwide. With the promulgation and continuous improvement of relevant policies, the government and experts have realized that industrial heritage cannot only be passively protected from the past. The adaptive reuse of buildings whose original functions have become obsolete by adjusting, upgrading, or reusing them to suit new environments and requirements is considered to be an effective method for industrial heritage preservation [16]. Industrial heritage is a living heritage, and its dynamic preservation in the form of adaptive reuse plays an important role in the sustainable development of cities. In the adaptive reuse of industrial heritage, the problems that need to be taken into account are also intricate and complex, including not only objective factors such as the urban structure, the historical and cultural background of the city, the architectural characteristics of the region, and the attributes and conditions of the industrial heritage itself, but also dynamic factors such as the public's aesthetics, the technological changes, the updating of materials, etc., and after mastering these basic conditions, reasonable transformation means should be adopted to renovate and renew the existing industrial heritage [17]. Therefore, the reuse of different industrial heritage sites needs to be adapted to local conditions. After studying the international adaptive reuse of industrial heritage, it has been found that according to its transformation function, it can be mainly divided into the thematic museum model, landscape park model, creative industry model, industrial heritage tourism model, and comprehensive development model. The thematic museum model is the conservation use of industrial heritage in its original location and state in the form of a museum. This model will generally set up exhibition halls or memorial halls on industrial topics according to the original industries in the industrial heritage site so as to truly display the historical and cultural values of the industrial heritage site so as to arouse the public's historical memory and sense of identity. Examples include the Tate Modern in London, England, which was converted from a power station, and the Customs Union 12 coal mine building in Essen, Germany, which was converted into an industrial art gallery. The landscape park model is the transformation of abandoned urban industrial heritage sites, utilizing the remains of their original industrial structures, into public recreational spaces suitable for modern leisure and relaxation. This type of reuse can effectively improve the urban ecological environment and explore the aesthetic value of industrial heritage sites, such as the Seattle Gas Works Park. In the creative industry model, industrial heritage sites, due to their unique large-scale spatial advantages, convenient transportation location advantages, and lower transformation costs, are used for the development of cultural and creative industries to provide superior natural conditions. At the same time, the intervention of these industries also promotes the protection and regeneration of the industrial heritage sites. After the Great Depression, many factory warehouses in Manhattan's Soho district in the United States remained idle. These industrial heritage sites have been repurposed as spaces for artistic creation, exhibitions, and communication, with a growing appeal that positions them to become renowned hubs for creative industries. The industrial heritage tourism model not only triggers the public to trace the roots of industrial history and culture but also effectively promotes regional economic development. The industrial heritage corridors formed by the large number of industrial heritage sites preserved in Europe have become a must-stop

place for industrial culture tours, such as the Essen Customs Union Industrial Zone in Germany. The comprehensive development model, based on industrial heritage, is the transformation or support of the establishment of an open mode integration office and residential, commercial, cultural, and recreational activities, such as the Ruhr industrial zone in Germany and the new city of gas tanks in Vienna, Austria, and so on. Overall, the adaptive reuse of industrial heritage sites is complex and diverse, and choosing the right approach can effectively solve urban problems and promote urban development.

In 2006, China issued the Wuxi Recommendations and the Circular on the Protection of Industrial Heritage and officially included industrial heritage in the Third National Cultural Heritage Census. In the historical process of industrial iteration in Chinese cities, there are few industrial heritage sites that have been preserved due to their historical value, and these industrial heritage sites usually have superior location advantages and stocks of spatial resources. The value of spatial reuse is an important feature that distinguishes architectural heritage from other cultural heritage, and the flexible and changeable spatial attributes unique to industrial heritage make its spatial reuse value more prominent in architectural heritage. Therefore, evaluating the spatial reuse of industrial heritage is of great practical significance for carrying out the protection and reuse of industrial heritage and promoting the development of high-density urban renewal.

The evaluation of China's industrial heritage mainly includes two aspects: one is the research on heritage value, and the other is the research on reuse evaluation. From 2006 to 2010, Chinese scholars reached the peak of the research on the value of industrial heritage. Boying Liu earlier discussed the value composition and evaluation of industrial heritage [14] and proposed a value evaluation method for Beijing's industrial heritage for the two dimensions of history and reuse [18]. Since then, scholars from various parties have also begun to study this field. Lei et al. further guided the improvement of China's industrial heritage evaluation system by studying in depth the composition and evaluation methods of mature foreign value evaluation systems [19,20]. At the same time, Hong Ji, Heping Lim, and other scholars have carried out research on the value evaluation system for industrial heritage in Tianjin, Chongqing, etc., in China [21–25]. As for the evaluation of industrial heritage reuse, Kai et al. and Huimin et al. conducted a study on the satisfaction of industrial heritage reuse by using the mature tourism satisfaction evaluation method [26–28]. Nan Jiang explored a comprehensive value evaluation index system for industrial heritage based on adaptive reuse [29]. Dan Wang and Jing Dong established an evaluation system for the regeneration potential of industrial heritage and conducted evaluation studies on actual cases by combining GIS, entropy weight–TOPSIS, and other methods [30,31]. With the continuous development of the reuse of industrial heritage, the post-use evaluation of certain industrial heritage sites carried out by Guangye Rui, Xin Liu, Haifang He, and other scholars has also become a key research direction in academic circles in recent years [32–36].

Western scholars have earlier tried to promote the evaluation of industrial heritage by quantitative methods. Şebnem Ertaş Beşir established a decision-making model by comparing the frequencies of relevant parameters between the protection and reuse of industrial heritage so as to achieve a balance between the protection and reuse of industrial heritage [37]. Juan Claver established a system for evaluating the value assessment and reuse assessment of industrial heritage through the analytic hierarchy process (AHP) and formed a transformation strategy with the minimum harm to the value of industrial heritage by combining and analyzing the assessment results [38]. Lucia Della Spina conducted a pre-renovation assessment on industrial heritage to judge potential factors affecting the reuse of industrial heritage so as to effectively allocate public resources [16]. Dušan M. Milošević established an evaluation system for the reuse of industrial heritage using the fuzzy analytic hierarchy process (FAHP) to identify industrial buildings with adaptive reuse potential [39]. By studying the public's evaluation of industrial heritage after transformation and utilization, Luis Loures discussed the relationship between public opinion and decision making regarding industrial heritage reuse and proposed that public participation can

make the reuse of industrial heritage more sustainable [40]. Manuel V. Castilla established a potential assessment system for heritage architecture from the perspective of human comfort and sustainable development [41].

Existing studies have focused more on the evaluation of value and the potential for transformation of industrial heritage, but there is still a lack of research on the satisfactory evaluation of its spatial reuse and industrial heritage in high-density urban environments. China's industrial heritage protection and reuse research started late and should also be put into practice to continuously improve the theoretical research. Such a model, although promoting the rescue of a large number of industrial heritage sites, also makes the quality of industrial heritage reuse vary. Evaluating the satisfaction with industrial heritage space reuse in high-density urban areas will help to objectively evaluate the actual situation of industrial heritage space reuse, clarify its current renewal problems as well as its future optimization direction, and thus continuously inject vitality into the renewal of high-density cities. This study investigated the satisfaction with the spatial reuse of industrial heritage on the basis of domestic and international industrial heritage evaluation studies and studies on high-density urban environments. Through the research and analysis of existing evaluation methods and evaluation indexes, we chose to form a satisfaction evaluation system for the spatial reuse of industrial heritage by virtue of the IPA evaluation method. Finally, an evaluation study of eight transformation cases in the high-density core area of Beijing was carried out, and the results are discussed so as to provide corresponding references for the protection and reuse of industrial heritage in high-density cities.

2. Materials and Methods

2.1. Scope of Research

Beijing was an early adopter of industrial heritage preservation and utilization within China and is one of the first 21 pilot cities for urban renewal in China. The Beijing Urban Master Plan (2016–2035) designates the old city of Beijing (the Dongcheng and Xicheng districts) as the central core area, encompassing approximately 92.5 km^2. This region represents the most densely populated and developed section of the city, with a resident population density reaching 23,800 people/km^2, comparable to Manhattan, but roughly twice that of Tokyo's or London's respective core areas [42]. The building density of Beijing's core area is reported to be 1.3838 million m^2/km^2, whereas the corresponding figure for London's core area in the UK, which also encompasses a significant number of historically valuable structures requiring preservation and serves as the national economic hub, amounts to only 54% of that observed in Beijing [43]. Therefore, the sustainable renewal of the high-density urban environment in the core area of Beijing is facing a serious challenge, and the urban development mode has shifted from "incremental development" to "quality improvement of stock".

As of 2023, there are a total of 34 industrial heritage sites in the core area (Figure 1), and the principles of sample selection are established by comparing the factors of location, type, scale, and function:

1. The principle of location selection: It reflects the differences in the surrounding environment where the samples are located, for example, next to the city's main roads, in hutongs (hutongs are the smaller streets between the main streets in a town or village that lead all the way to the interior of a residential neighborhood), in residential areas, and in business districts.
2. The sample size selection principle: Covering single-type, compound-type, and park-type spaces, the area is distributed in several interval scales of industrial heritage at below 1000 m^2, 1000 m^2–5000 m^2, and 5000 m^2–10,000 m^2.
3. The principle of functional screening: The selection of composite samples with more than three functions or samples with one characteristic function.

4. The principles for screening building types: The sample includes common types of industrial buildings—such as single-story, multi-story brick or frame structures of production buildings, such as warehouses, and multi-story frame structure types of accessory buildings—and special structural types of buildings.

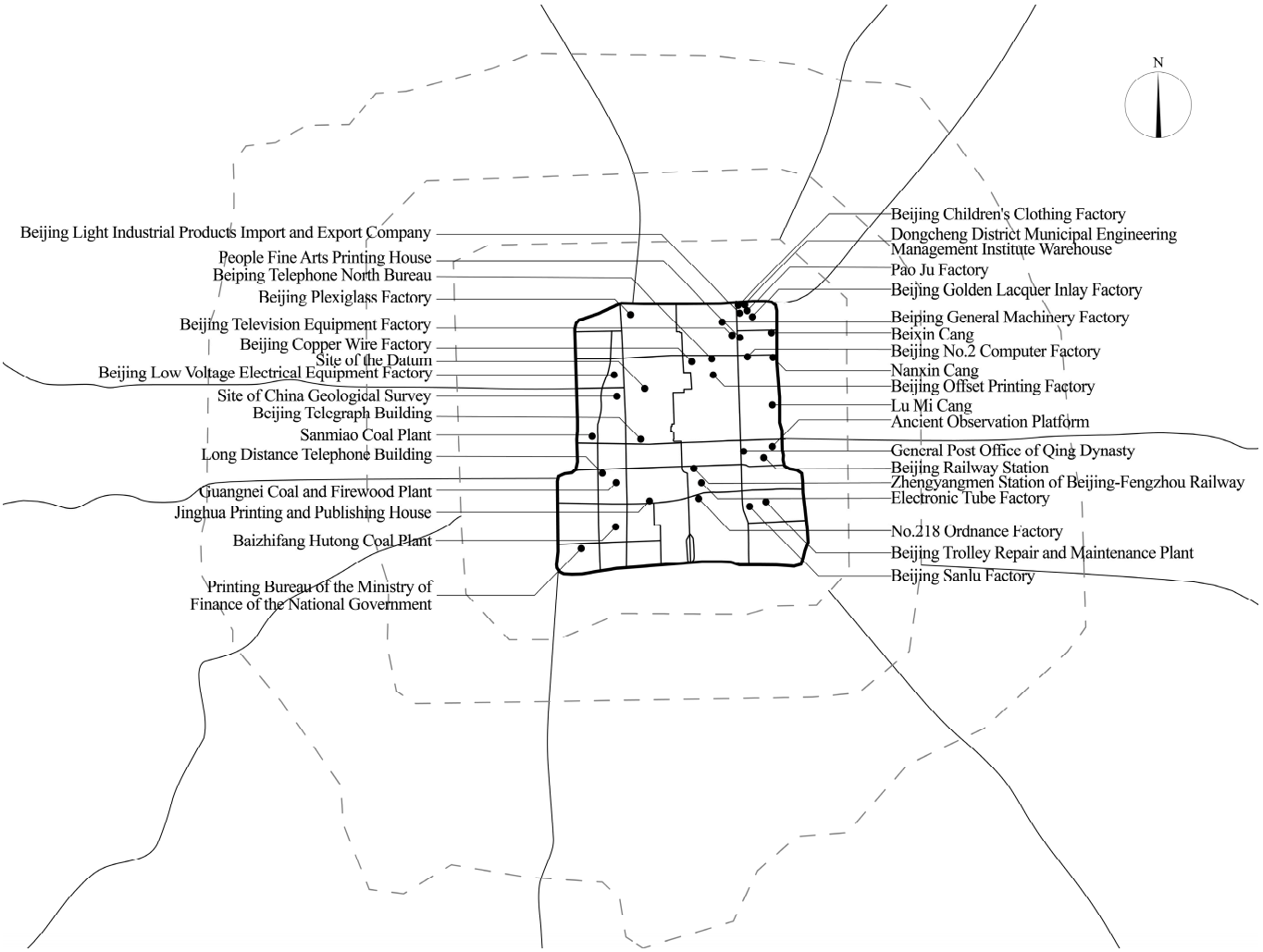
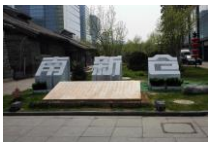


Figure 1. Distribution of industrial heritage sites in Beijing core area.

With the above principles in mind, eight final samples were selected as follows (Table 1).

Different from the well-known large industrial zones such as Shougang and 798, the eight samples cover a smaller area but have a higher building density, mostly small factories or plants of light industries or handicraft industries. The plant covers an area of 0.2–0.8 hectares in general, and the transformation direction is to become a public space with diversified functions, which, to some extent, carries the diversified demands of the high-density population [11].

Table 1. Basic information of the sample.

The Designated Sample	Predecessor of Sample	Construction Time	Function of the Sample	Covered Area Scale	Photo of the Sample	Reasons for Selection
Nanxinchang Cultural and Leisure Street	Nanxinchang, Beijing, China	1409	Office and commercial	3400 m^2		Sample of the only street form
No.46, Fangjia Hutong	Beiping General Machinery Factory, Beijing, China	1929	Office, commercial, cultural, and entertainment	8000 m^2		Compound functions with more than three types
Jiacheng Impression	Beijing Light Industrial Products Import and Export Co., Ltd., Beijing, China	1992	Office and community service	1000 m^2		Featured functions
77 Cultural and Creative Parks	Beijing Offset Printing Factory, Beijing, China	1954	Office, sports, commercial, cultural, and entertainment	7400 m^2		Composite functions and special functions
No. 29, Qingyun Hutong	Electronic Tube Factory, Beijing, China	Around 1960	Cultural and entertainment	400 m^2		Sample of the only single-story factory building
Jihua Business Building	Beijing Automobile Instrument Factory, Beijing, China	1960	Office	2000 m^2		Multistorey frame plant
No. 107 Yard, Beidian Kelin	Beijing Television Equipment Factory, Beijing, China	1971	Office	12,000 m^2		Sample with the largest footprint
Jintai Yishouxuan Nursing Home Peacock Branch	Sanmiao Coal Plant, Beijing, China	Unknown	Health and recreation	1200 m^2		Uniquely within the residential area

2.2. Methodology for Research

The analytic hierarchy process is often used in conjunction with the Delphi method and questionnaire survey method, which can quantify the indicators that are difficult to evaluate, turn qualitative data into quantitative data, and cut down the influence of subjective judgments, to a certain extent, through mathematical calculations, but it cannot provide a new scheme for decision making, and the weight is difficult to be determined when there are too many evaluation indicators. Gray correlation analysis needs to have an ideal scheme and actual renovation cases for correlation and comparison, but for different renovation cases, receiving the constraints of scale, location, building quality, and other

aspects of the conditions, the ideal scheme is often variable, so it is difficult to form a universal value for the evaluation method. The fuzzy comprehensive evaluation method is currently a more widely used method in cultural heritage, but the method is greatly influenced by subjective judgment, which can cause errors in the evaluation results.

The IPA evaluation method (importance–performance analysis) was adopted in this study. Its principle is to regard customer satisfaction as a method of product expectation and product performance and to obtain customer satisfaction through the comparison of importance and performance. IPA analysis takes the importance evaluation data as the abscissa axis and the performance evaluation data as the ordinate axis, thus dividing into four quadrants (Figure 2), which represent different regions: the "excellent performance area", "continued maintenance area", "slow improvement area", and "key improvement area" [44,45].

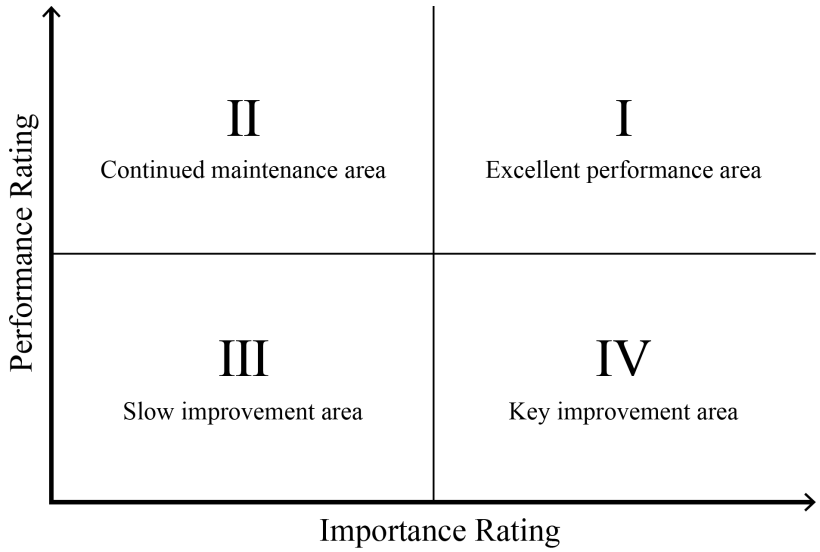


Figure 2. IPA quadrant chart.

The IPA method can transform the qualitative analysis of satisfaction into quantitative intuitive data, and its model is intuitive and can clearly indicate the priority of the various price indicators for the transformation needs and has been widely utilized in many fields such as transportation facilities [46], urban public spaces [6,47], industrial landscapes [36,48], heritage tourism [49], etc., and it is a tool for evaluating satisfaction. The main purpose of this paper was to construct a satisfaction evaluation system for the spatial reuse of industrial heritage and to evaluate eight industrial heritage reuse projects in the core area of Beijing, taking into account the actual feelings of the urban residential population toward the industrial heritage projects. Therefore, the IPA method was selected to evaluate the satisfaction with the spatial reuse of industrial heritage, which has the following advantages:

1. Compared with other methods, the IPA evaluation method can intuitively relate the spatial reuse of the sample to the user's satisfaction.
2. Through the establishment of the IPA four-quadrant diagram, it can clearly reflect the urgency of the sample indicators for optimization and improvement and summarize the commonalities and characteristics of the current sample reuse advantages and disadvantages so as to continuously promote the dynamic updating of industrial heritage.

At the same time, however, there are limitations to the method, as the needs of different users are different, and, therefore, a large number of users need to be involved in the evaluation to reduce subjectivity.

For the study of industrial heritage evaluation, the existing studies have mainly focused on the value of industrial heritage given by history and its intrinsic value, and its reuse value and derivation value. Among them, most scholars have focused on the dimensions of historical value, cultural value, scientific value, economic value, and social value [18,25,38,50]. With regard to the value of derivation, it can be found that when scholars have selected evaluation factors, they have focused on different aspects due to different evaluation targets, but there are certain commonalities. These mainly contain studies on building physical conditions, transportation roads, transformation effects, landscaping and greening, and supporting facilities [16,29,32,37,51]. For evaluation studies of high-density urban environments, the dimensions of transportation accessibility, functional type, public space, street interface, urban density, and ecological environment have been developed [4–6,11–13]. Based on the current situation of industrial heritage reuse in the high-density core area of Beijing, on the basis of the existing evaluation system for industrial heritage and the evaluation system for high-density urban environments, a satisfaction evaluation system for industrial heritage space reuse was formed, which contains six evaluation dimensions, namely, functional replacement, transportation accessibility, carrying capacity, public space, boundary patterns, and recognition of value, with a total of 25 evaluation indexes (Table 2).

Table 2. Table of indicators for evaluating satisfaction with space reuse.

Dimension of Evaluation	**Functional Replacement**		
Evaluation Indicators	**Business function**	**Office function**	**Cultural and sports functions**
The Quantitative Model	The number of buildings in the sample converted to commercial functions, such as convenience businesses, restaurants, hotels, etc.	The number of buildings in the sample converted to office functions, such as shared offices, community offices, etc.	The number of buildings in the sample transformed into entertainment and sports, such as pavilions, sports halls, community activity centers, etc.
Example of Image			
Evaluation Indicators	**Medical function**	**Open space**	**Other functions**
The Quantitative Model	The number of buildings in the sample converted to medical functions, such as nursing homes, community hospitals, etc.	The number of outdoor spaces in the sample converted into open spaces, such as parking or parks	The number of spaces inside and outside the sample chamber transformed for other functions
Example of Image			

Table 2. *Cont.*

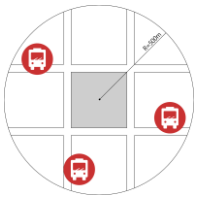
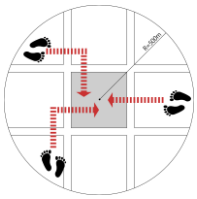
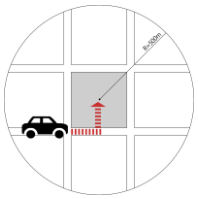
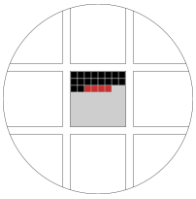
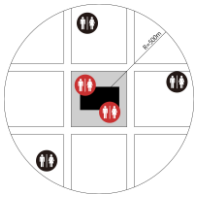
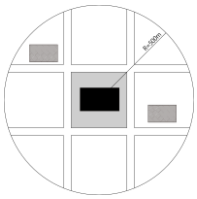
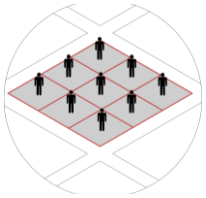
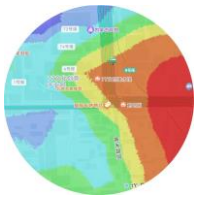
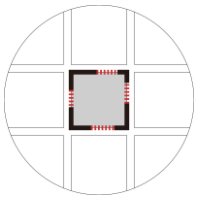
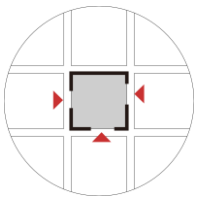
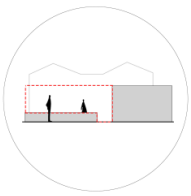
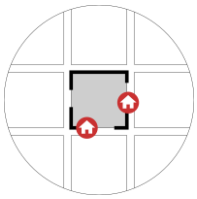
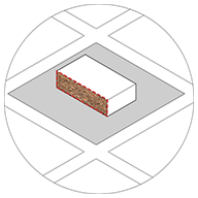
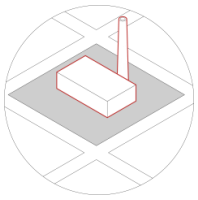
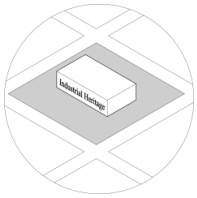
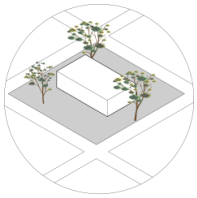
Dimension of Evaluation	**Transportation accessibility**			
Evaluation Indicators	**Public transportation accessibility**	**Walking accessibility**	**Vehicle accessibility**	
The Quantitative Model	The number of bus and subway stations located within a 500 m radius	Average pedestrian flow potential within a 500 m radius	Average vehicular flow potential within a 500 m radius	
Example of Image				
Dimension of Evaluation	**Carrying capacity**			
Evaluation Indicators	**Growth of building density**	**Growth of building floor area ratio**	**Three-dimensional utilization**	**Per capita facility location entropy**
The Quantitative Model	Increased building density after the renovation of the sample	The volume rate increase after the sample renovation	The newly added and used areas (such as roof, corridors, underground, etc.) in the sample other than the indoor and outdoor area	LQ = (Qi/Si)/(Qj/Sj) Qi is the number of service facilities in the sample area, Si is the total area of the sample, Qj is the number of service facilities within the service scope, and Sj is the total area of the service scope.
Example of Image				
Dimension of Evaluation	**Public space**			
Evaluation Indicators	**Degree of proportionality**	**Public welfare**	**Degree of complement**	**Degree of activity**
The Quantitative Model	The overlap degree between the functional attributes of public space and those within the service scope	Ratio of the number of public welfare benefits in the sample to the total number	Compensation of per capita public space area within the research scope	Baidu City heat map data
Example of Image				

Table 2. *Cont.*

Dimension of Evaluation	**Boundary morphology**			
Evaluation Indicators	**Ratio of enclosed boundaries**	**Number of entrances and exits**	**Degree of boundary display**	**Human regulation**
The Quantitative Model	Ratio of the sample's passable boundary length to the overall boundary length	Number of samples imported and exported	Opening degree of enclosure interface in vertical direction	The quantity of security personnel stationed at the entrance and exit points
Example of Image				
Dimension of Evaluation	**Recognition of value**			
Evaluation Indicators	**Degree of appearance preservation**	**Degree of preservation of buildings (structures)**	**Degree of historical information retention**	**Degree of green plant retention**
The Quantitative Model	Ratio of the surface area of the old building retained the style to the total surface area of the remodeled building	Ratio of reused building area to total building area before renovation	Retention and presentation of industrial historical information	The amount of original vegetation retained in the sample
Example of Image				

The research in this paper utilized a combination of questionnaires and on-site interviews, and the questionnaire was divided into two parts: a survey of basic information about visitors, which included visitors' gender, age, work status, and place of residence, and a sample satisfaction survey. The satisfaction evaluation indexes of industrial heritage were surveyed for visitors' satisfaction and the importance of visitors' opinions, and the Likert scale was adopted for the measurement of evaluation indexes, and the satisfaction options were "very dissatisfied", "dissatisfied", "general", "satisfied", "very satisfied", and the importance options were "very unimportant", "unimportant", "general", "important", and "very important". A score of 1, 2, 3, 4, and 5 was assigned to each of the 5 levels of satisfaction and order of importance described above. Given the varying levels of understanding of the indicators among the population, the indicators were converted into more easily understood questions, such as "satisfaction with the boundary enclosure ratio" to "satisfaction with the openness of the site" (Appendix A).

Questionnaires were distributed randomly to the visitors, workers, and residents in the neighborhood of each sample during the morning, afternoon, and evening of weekdays and weekends, respectively, as well as online questionnaires to ensure the diversity of the data sources of the questionnaires. For each industrial heritage reuse case, 200 questionnaires were distributed, and the recovery rate was over 95 percent.

3. Results

3.1. Data Processing

With the help of SPSS 27.0, Cronbach's alpha and KMO were used to test the level of reliability of the data results. The formula for Cronbach's α is as follows:

$$\alpha = \frac{K}{K-1}\left(1 - \frac{\sum S_i^2}{S_x^2}\right), \quad (1)$$

where α is the reliability coefficient, K is the number of test questions, S_i^2 denotes the variance of the scores of all subjects on question i, and S_x^2 is the variance of the total score obtained by all subjects. In general, an alpha coefficient greater than 0.8 indicates that the questionnaire is highly credible, while an alpha coefficient of 0.5–0.7 indicates average credibility [52]. The KMO is calculated as follows:

$$KMO = \frac{\sum\sum a_{ij}^2}{\sum\sum a_{ij}^2 + \sum\sum b_{ij}^2}, \quad (2)$$

where a_{ij} denotes the correlation between the ith and jth variables, and b_{ij} denotes the partial correlation between the ith and jth variables. When the value is greater than 0.6, this means that the result is credible [53]. The data of the eight samples were tested, and the alpha coefficients of the questionnaire data results of each sample were all greater than 0.8 (Table A1), and the KMO values were all greater than 0.6 (Table A2), which indicates that this study had a high credibility in reflecting the evaluation of the public's satisfaction with the spatial reuse of the industrial heritage.

3.2. Data Analysis

The questionnaire data were subjected to further processing. Means and standard deviations were obtained for the questionnaire results of importance and expressiveness for each sample, separately, with the following formulas:

$$\overline{X} = \frac{X_1 + X_2 + \ldots + X_n}{n}, \quad (3)$$

$$S^2 = \frac{\sum (X - \overline{X})^2}{n}, \quad (4)$$

In order to objectively and scientifically quantitatively reflect the difference between importance and performance, it is necessary to construct the IPA index, which can scientifically quantify the difference between the importance and performance of the satisfaction with the spatial reuse of industrial heritage through the measurement of the IPA index [49]. The measurement equation is:

$$IPAI = (I - P)/I \times 100, \quad (5)$$

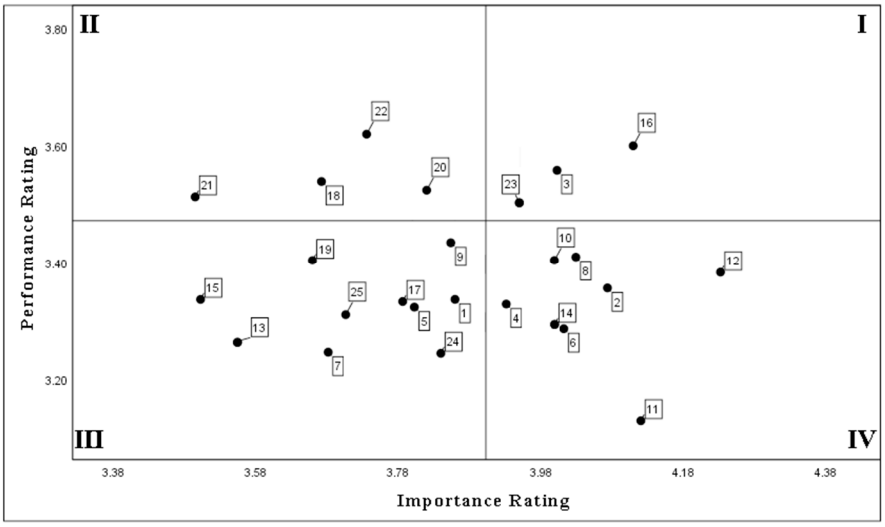
where IPAI stands for the importance–performance analysis index; I stands for importance; and P stands for performativity. The lower the IPAI index, the higher the level of satisfaction. In order to break down the degree of impact caused by different elements, the IPA index was divided into five levels, namely, ≤5.00, 5.01~10.00, 10.01~20.00, 20.01~30.00, and ≥30.01, which denote very satisfactory, relatively satisfactory, generally satisfactory, unsatisfactory, and very unsatisfactory, respectively. Taking 77 cultural and creative parks as an example, the importance and expressiveness of each indicator and the evaluation results of the IPA index were collated (Table 3).

Table 3. Indicators of 77 cultural and creative parks.

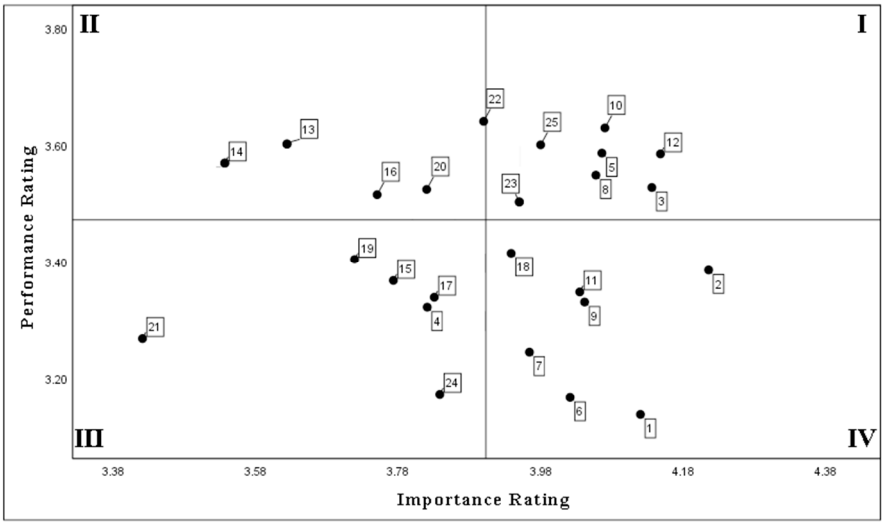
Indicator	Importance		Performance		Mean Deviation	IPA Index
	Average Value	Standard Deviation	Average Value	Standard Deviation		
Vehicle accessibility	4.12	0.918	3.18	0.983	0.94	22.81
Accessibility by public transport	4.26	0.694	3.4	0.756	0.86	20.18
Walking accessibility	4	0.948	3.18	0.873	0.82	20.50
Growth of building density	3.88	0.94	3.32	0.868	0.56	14.43
Growth of building floor area ratio	4.06	0.682	3.6	0.857	0.46	11.33
Per capita facility location entropy	3.94	0.913	3.22	0.954	0.72	18.27
Three-dimensional utilization	3.88	0.849	3.42	0.906	0.46	11.85
Degree of proportionality	3.92	0.752	3.36	0.898	0.56	14.28
Public welfare	3.78	0.864	3.54	0.908	0.24	6.34
Degree of complement	3.98	0.869	3.32	0.999	0.66	16.58
Degree of activity	3.72	0.927	3.18	0.941	0.54	14.51
Business function	4.12	0.94	3.4	0.948	0.72	17.47
Office function	3.82	0.873	3.76	0.625	0.06	1.57
Cultural and sports functions	3.8	0.904	3.48	0.762	0.32	8.42
Medical function	3.8	0.969	3.42	0.758	0.38	10.00
Open space	3.86	0.969	3.48	0.863	0.38	9.84
Other functions	4.02	0.979	3.68	0.653	0.34	8.45
Ratio of enclosed boundaries	3.98	1	3.54	0.952	0.44	11.05
Number of entrances and exits	3.92	0.829	3.56	1.013	0.36	9.18
Degree of boundary display	3.8	0.833	3.48	0.789	0.32	8.42
Human regulation	3.38	0.987	3.64	0.851	−0.26	−7.69
Degree of appearance preservation	3.9	0.839	3.64	0.875	0.26	6.66
Degree of preservation of buildings (structures)	3.82	0.962	3.76	0.716	0.06	1.57
Degree of historical information retention	3.84	0.842	3.66	0.688	0.18	4.68
Degree of green plant retention	3.98	0.742	3.56	0.787	0.42	10.55

3.3. Data Visualization

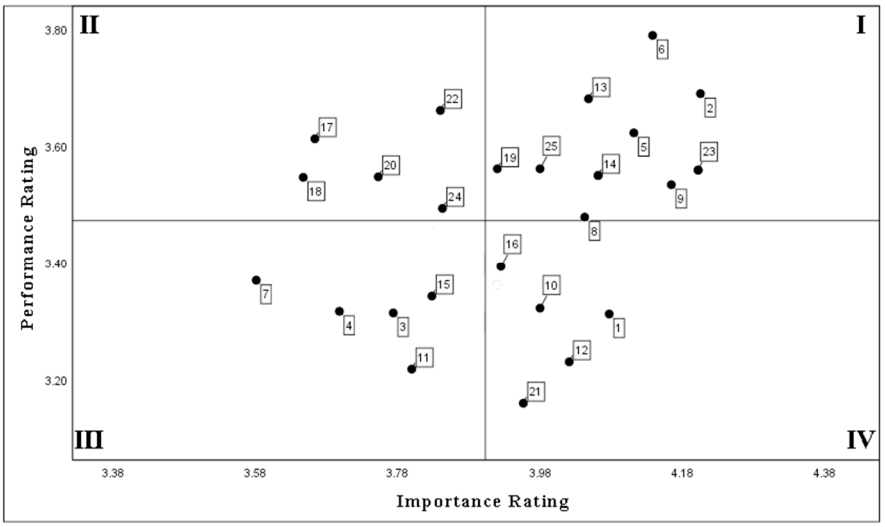
In order to analyze the industrial heritage reuse data more intuitively, the IPA quadrant diagram was used to visualize the data. The IPA quadrant diagram was divided based on the degree of importance and expressiveness of the 25 indicators, and the four major quadrants, i.e., I, II, III, and IV, were divided by taking the overall mean deviation of the importance and performance data of each sample as the demarcation line between the vertical and horizontal coordinates, respectively. The four quadrants are characterized as follows: Quadrant I represents the zone of performance excellence, where the indicator's importance and expressiveness surpass the mean value. This indicates that users not only attach significance to this quadrant's indicator but also acknowledge its performance. Quadrant II denotes the continuation zone, where the indicator's importance is low while its expressiveness remains high. This suggests that users do not assign great importance to this quadrant's indicator but still recognize its performance. Quadrant III signifies the slow improvement zone, wherein both the indicators' importance and expressiveness fall below the mean value. This implies that users neither recognize nor value their performance in this quadrant. Lastly, Quadrant IV embodies the focused improvement zone, with high importance assigned to its indicators despite their low expressiveness. Consequently, users highly value these indicators even though their performance may be challenging to recognize. The selected eight samples of industrial heritage reuse in the core area of Beijing's central city were used to establish IPA quadrant maps based on their indicator data (Figure 3).



(**a**) Nanxinchang Cultural and Leisure Street

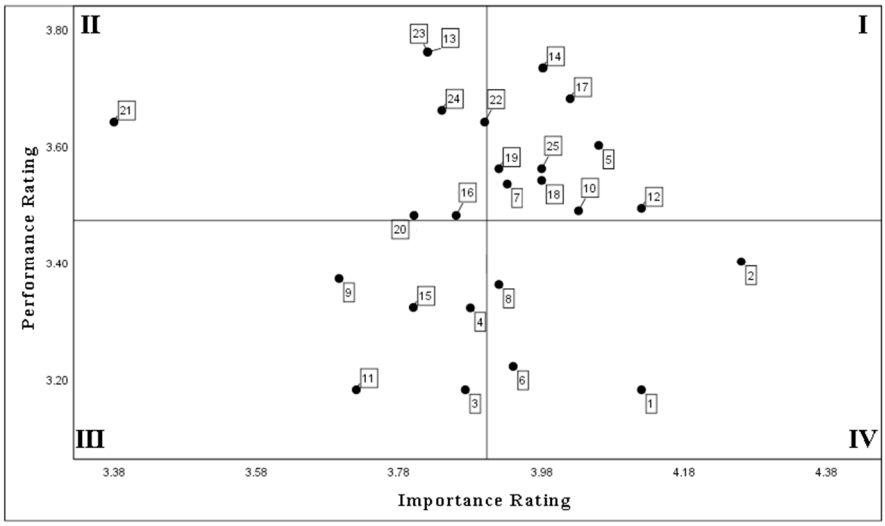


(**b**) No. 46, Fangjia Hutong

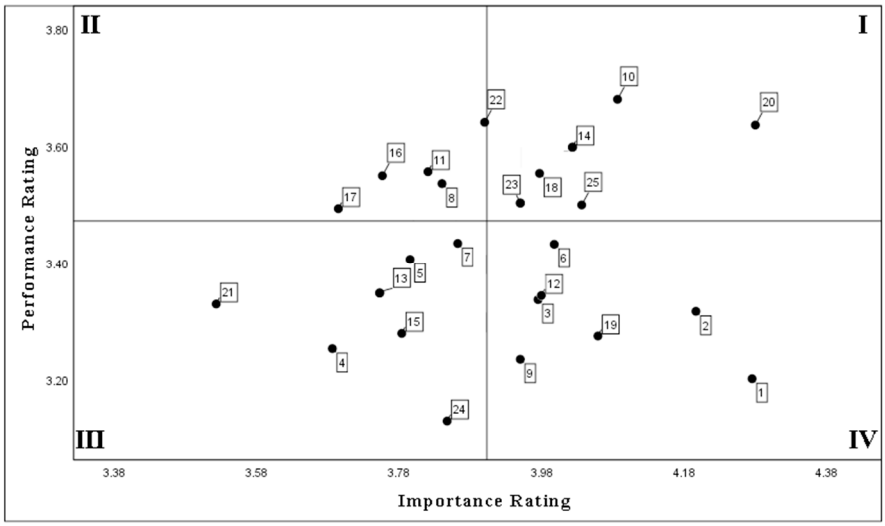


(**c**) Jiacheng Impression

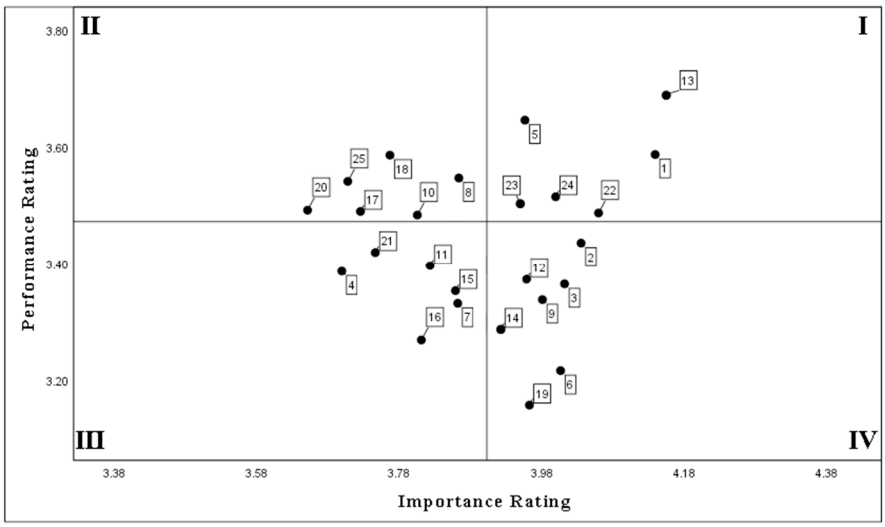
Figure 3. *Cont.*



(**d**) Seventy-seven cultural and creative parks

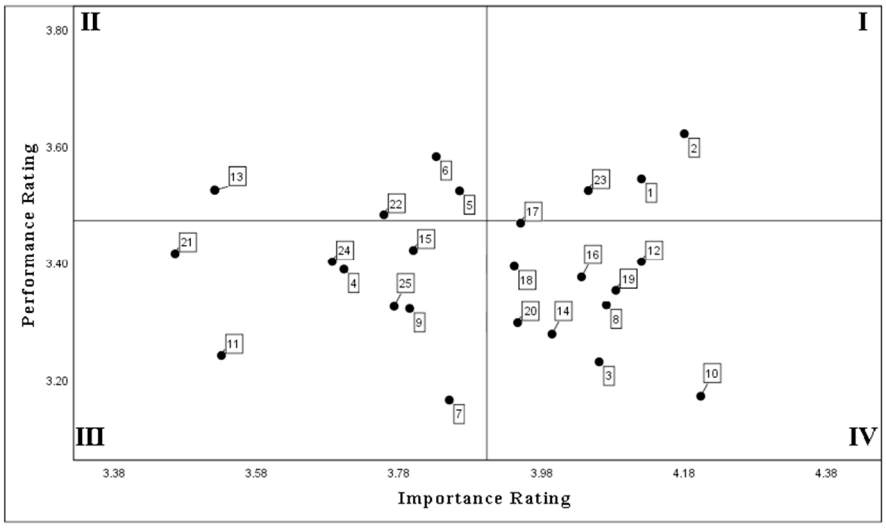


(**e**) No. 29, Qingyun Hutong

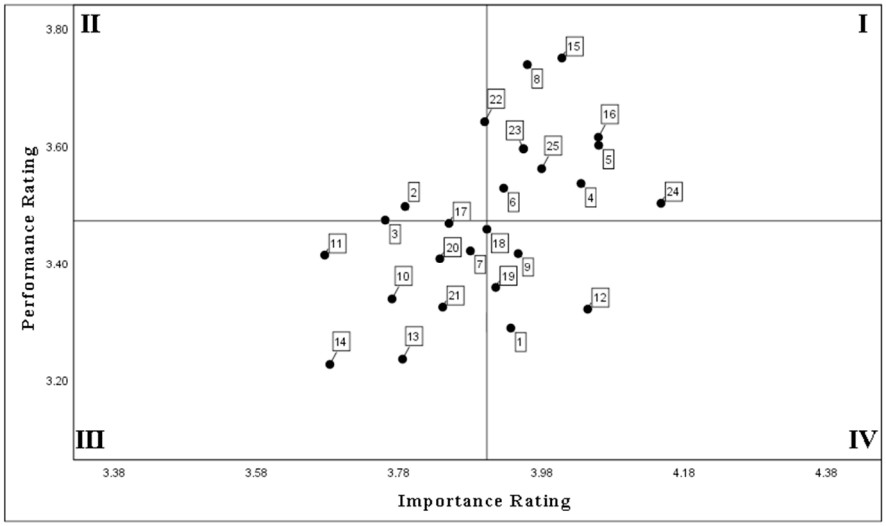


(**f**) Jihua Business Building

Figure 3. *Cont.*



(**g**) No. 107 Yard, Beidian Kelin



(**h**) Jintai Yishouxuan Nursing Home Peacock Branch

Figure 3. Sample IPA quadrant chart: 1—vehicle accessibility; 2—accessibility by public transport; 3—walking accessibility; 4—growth of building density; 5—growth of building floor area ratio; 6—per capita facility location entropy; 7—three-dimensional utilization; 8—degree of proportionality; 9—public welfare; 10—degree of complement; 11—degree of activity; 12—business functions; 13—office function; 14—cultural and sports functions; 15—medical function; 16—open space; 17—other functions; 18—ratio of enclosed boundaries; 19—number of entrances and exits; 20—degree of boundary display; 21—human regulation and manipulation; 22—degree of appearance preservation; 23—degree of preservation of buildings (structures); 24—degree of historical information retention; and 25—degree of green plant retention.

3.4. Analysis of Satisfaction with Spatial Reuse of Industrial Heritage

Through the visualization of the IPA quadrant map, it can be seen that the indicators in quadrants I and II show the existence of advantages in the spatial reuse of industrial heritage, which should be maintained; the indicators in quadrants III and IV show the existence of disadvantages, which need to be improved. Indicators in these quadrants can be put on hold, while those in quadrant IV need to be addressed immediately. The eight industrial heritage reuse samples were collated and ranked according to the number of occurrences of their own 25 indicators in the four quadrants (Figure 4).

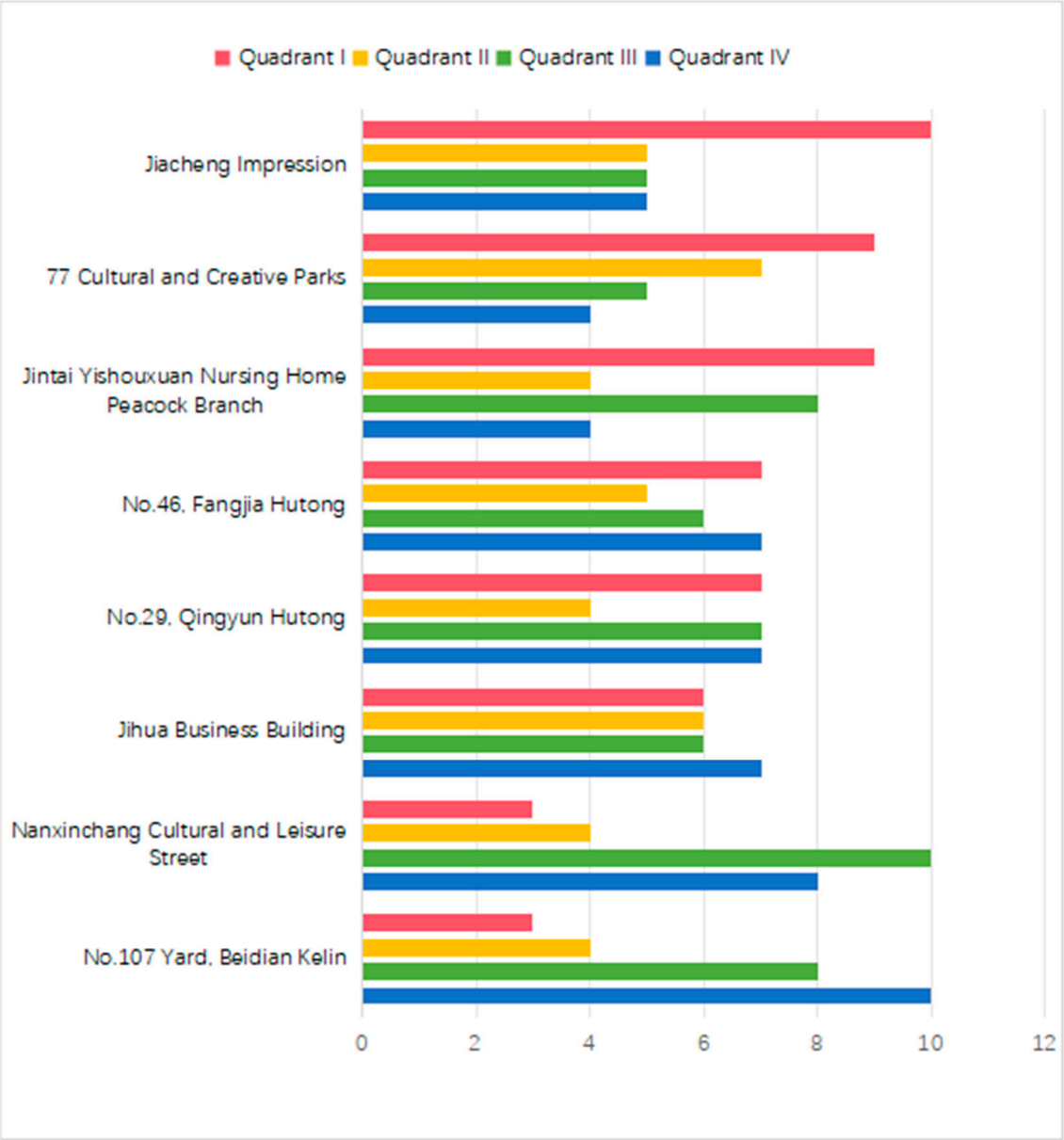


Figure 4. Satisfaction with utilization of the sample.

The eight samples categorized according to space reuse satisfaction can be divided into a high-satisfaction category, medium-satisfaction category, and low-satisfaction category.

High-satisfaction category: The characteristics of this category are that the number of indicators in quadrant I is more than that in quadrant IV. After comparison, the satisfaction with the three industrial heritage samples, Jiacheng Impression, 77 cultural parks, and Jintai Yishouxuan Nursing Home, is significantly higher than that of the other samples. Combined with the field situation, the following reasons can be analyzed:

1. The diversified function types or accurate function positioning make the service objects of the sample fit well with the surrounding people, forming a good industrial effect. Moreover, the function of Jiacheng Impression is outstanding in public welfare and highly recognized by users.
2. The architectural utilization rate of the sample itself is high, and the density and volume ratio are significantly improved while maintaining a positive impact on the user's spatial perception. Moreover, the 77 cultural and creative parks place particular

emphasis on three-dimensional application indicators, thereby enhancing their utility value in densely populated urban areas.
3. In terms of both quality and scale, it compensates for the limited availability of public space in high-density urban areas.
4. The site exhibits a higher level of openness compared with other samples, while still maintaining an overall industrial style that is widely recognized within the city.

Overall, among the eight industrial heritage reuse samples selected, the high-satisfaction category has outstanding advantages, plays a positive role in promoting the development of society, and has a high reference value for subsequent industrial heritage reuse projects.

Medium-satisfaction category: It is characterized by a more balanced distribution of various indicators in the four quadrants. This type includes No. 46 Fangjia Hutong, No. 29 Qingyun Hutong, and the Jihua Business Building. Considering the field situation, the following reasons can be analyzed:

1. The index performance of the dimension of functional replacement is uneven, which is considered to be the reason that the functional type is relatively simple or the fit degree with the surrounding population demand is not high, resulting in the low importance and low performance of some functional indexes.
2. Owing to their geographical location, the majority of hutongs are situated at a lower street level, resulting in limited accessibility across various aspects. Furthermore, the excessively enclosed boundaries and inadequate number of entrances and exits further exacerbate the division between the city and the hutongs.
3. The type of service facilities is relatively singular, and there is a lack of types.

Although the industrial heritage in the medium-satisfaction category has reused its own stock space resources in the high-density urban area, it still has great potential development value and optimization space and should be optimized and improved according to the indicators in the third and fourth quadrants.

Low-satisfaction category: The indexes in the third and fourth quadrants are significantly more than in other industrial heritage samples. Nanxinchang Cultural Leisure Street and No. 107 Yard of Beidian Kelin belong to this type, and the specific problems are as follows:

1. The functional positioning is significantly misaligned with the needs of the surrounding population or lacks high repeatability. In this case, insufficient emphasis has been placed on enhancing industry prominence to gain competitiveness, resulting in an overall lack of vitality.
2. Taking Beidian Kelin No. 107 as an example, it covers the largest area among the eight samples; however, its urban connectivity is relatively low. Although this building can adequately serve its single-office function, it clearly falls short of meeting the public attributes required for a high-density urban area like the Beijing central city's core area.
3. In terms of bearing capacity, both the building space and outdoor space have not undergone significant improvements, thereby maintaining the low-density characteristics of the original factory area. Consequently, this results in a wastage of valuable urban space within a high-density environment.
4. The low degree of maintenance of the industrial style leads to a low recognition in the city.

Industrial heritages in the low-satisfaction category are the key objects for optimization and have huge potential for future improvement. They should be improved and strengthened according to their respective indicators in the fourth quadrant so as to integrate them into high-density cities in an appropriate manner and promote urban renewal.

4. Discussion

As one of the important stocks of spatial resources in high-density cities, industrial heritage, through its spatial reuse, can effectively enhance the regional economy, improve the ecological environment, disseminate history and culture, and play a positive role in promoting urban renewal. However, the existing research on high-density urban environments pays more attention to public space, green space landscape, urban renewal strategies, urban morphology, etc., and significantly less attention to industrial heritage. The research on industrial heritage in China tends to synchronize theoretical research and project practice, which has led to the fact that the existing research focuses more on industrial heritage renewal strategies and directions, while the evaluation of the actual use of the renovated industrial heritage has received less attention. Moreover, the current research on the evaluation of industrial heritage reuse often focuses on a single case and is not well integrated with the urban environment to form an evaluation system with general applicability. This study took eight samples of industrial heritage reuse in the high-density core area of Beijing as examples and started from the perspective of users' satisfaction with spatial reuse so that it could objectively reveal the successful aspects of reuse and the shortcomings that need to be strengthened and optimized in the future of Beijing's industrial heritage after it has been transformed for a period of time. At the same time, this study can also reflect the actual demand orientation of high-density urban residents so as to provide reference value for subsequent industrial heritage preservation and reuse work and further urban renewal.

5. Conclusions

This study established an evaluation system for the reuse of industrial heritage in the high-density core area of Beijing, combined the needs and feelings of users, and conducted a quantitative study on eight cases of industrial heritage reuse from the perspective of satisfaction with spatial reuse combined with the IPA method. The results of this study show that the transformation of industrial heritage is closely related to the needs of the residents in the communities where it is located, and industrial heritage spaces with higher satisfaction levels have a higher degree of compatibility with the environmental and functional needs of the local communities, i.e., the transformation and utilization of industrial heritage in high-density urban areas are inextricably linked to community-based regeneration, which is defined the "community-oriented" transformation and utilization of industrial heritage. The "community-oriented" transformation of industrial heritage refers to the fact that the planning, design, operation, and maintenance of renovation and utilization are all closely linked to the needs of the community, including the flexibility of spatial design, the diversification of service facilities, the localization of functional replacement, the openness of maintenance boundaries, and the interactivity of spatial use, among five other aspects:

1. The flexibility of spatial design: Due to their special structural type, industrial buildings have relatively open internal space, which provides great flexibility and replaceability for the use of this space. The design of the space can be flexibly adjusted according to the changes in the needs of the surrounding population so as to maintain a high level of urban vitality.
2. The diversification of service facilities: This can greatly improve the public attribute of industrial heritage reuse and improve urban public space. Improving the type, quantity, and quality of service facilities can effectively improve the validity of satisfaction with the spatial reuse of industrial heritage.
3. The localization of functional replacement: Through investigation and study, it can be found that the functions that can meet the needs of people and facilitate their lives have mostly obtained a high level of vitality. Therefore, in considering functional replacement, more attention can be paid to improving the supporting functions of the community.

4. The openness of maintenance boundaries: This can improve the accessibility and identification of industrial heritage, thus improving the dynamic atmosphere within the sample and alleviating the "heritage island" phenomenon.
5. The interactivity of spatial use: In order to better present the historical information of industrial heritage, holographic effects and virtual reality can be combined to organically combine the use functions and industrial scenes and strengthen the interactive space experience.

The evaluation of satisfaction with the spatial reuse of industrial heritage can present a good picture of the impact that the content and manner of reuse has on the city and society. By deeply exploring the influencing factors of the spatial reuse of industrial heritage, combining the historical and natural reuse conditions of industrial heritage, and studying the advantages and disadvantages of its reuse status so as to improve the industrial heritage itself and its surrounding environment in high-density urban areas and maximize the release of the spatial value of the stock of industrial heritage, industrial heritage can be effectively prevented from falling into the predicament of secondary desertion, which is of great significance for the promotion of the dynamic renewal of industrial heritage. However, it should be pointed out that the protection and reuse of industrial heritage is a dynamic updating process, and the scoring by experts and users is inevitably subjective and limited. The satisfaction evaluation system established in this study mainly focuses on the core indicators of the spatial reuse of industrial heritage in high-density urban environments but is unable to assess all of the impact factors. Therefore, the scientific quantification of all relevant indicators and the further deepening and improvement of the evaluation system will be the direction of continuous improvement in the future.

Author Contributions: Conceptualization, F.M. and X.Z.; methodology, X.Z. and Y.P.; investigation, F.M. and X.Z.; resources, F.M.; data curation, X.Z.; writing—original draft preparation, F.M. and X.Z.; writing—review and editing, X.Z.; visualization, X.Z.; project administration, F.M.; funding acquisition, F.M. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the National Social Science Foundation Art Program (grant number: 23BG139).

Data Availability Statement: Data is contained within the article.

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

Appendix A. Satisfaction Survey on Spatial Reuse of Industrial Heritage

Thank you very much for taking up your valuable time to conduct the questionnaire survey.

As a valuable spatial resource in high-density urban areas, the transformation and utilization of industrial heritage plays an important role in the process of urban metabolism. We would like you to evaluate your satisfaction and importance of the following indicators based on your actual experience. Satisfaction refers to how satisfied you are with the actual experience of each indicator, and importance refers to how important you think each indicator is for the reuse of industrial heritage.

Thank you again for your participation!

Appendix A.1. Basic Information

1 What is your gender?
A. Male B. Female
2 What is your age?
A. Below 18 years B. 19–40 years C. 40–60 years D. Above 60 years
3. What is your current work status?
A. student B. active employee C. freelance D. retired
4 Where do you currently live?
A. Xicheng District B.Dongcheng District C. Chaoyang District D. Haidian District
E. Fengtai District F. Daxing District G. Tongzhou District H. Shijingshan District
J. Other areas of Beijing K. Outside Beijing
5 What is your level of knowledge about the reuse of industrial heritage?
A. Very well known B. Known C. Generally known D. Not very well known

Appendix A.2. Satisfaction Survey

1. Are you satisfied with the current number of public transportation facilities (bus, subway, etc.) around the campus?
A. Very dissatisfied B. Dissatisfied C. Average D. Satisfied E. Very satisfied
2. Do you think public transportation facilities (bus, subway, etc.) are important for you to travel to the park?
A. Very unimportant B. unimportant C. Average D. Important E. Very important
3. Are you satisfied with the pedestrian system around the park?
A. Very dissatisfied B. Dissatisfied C. Average D. Satisfied E. Very satisfied
4. Do you think the pedestrian system around the park is important?
A. Very unimportant B. unimportant C. Average D. Important E. Very important
5. Are you satisfied with the drive-through system around the park?
A. Very dissatisfied B. Dissatisfied C. Average D. Satisfied E. Very satisfied
6. do you think the drive-through system around the park is important?
A. Very unimportant B. unimportant C. Average D. Important E. Very important
7. How do you feel about the current building density in the park (do you feel that the buildings are overcrowded)?
A. Very dissatisfied B. Dissatisfied C. Average D. Satisfied E. Very satisfied
8. Do you think building density is important for park use?
A. Very unimportant B. unimportant C. Average D. Important E. Very important
9. Are you satisfied with the space capacity of the buildings in the park?
A. Very dissatisfied B. Dissatisfied C. Average D. Satisfied E. Very satisfied
10. Do you think space capacity is important for the use of park buildings?
A. Very unimportant B. unimportant C. Average D. Important E. Very important
11. Are you satisfied with the current number of service facilities (restrooms, seating, etc.) in the park?
A. Very dissatisfied B. Dissatisfied C. Average D. Satisfied E. Very satisfied
12. Do you think the number of services is important for the use of the park?
A. Very unimportant B. unimportant C. Average D. Important E. Very important
13. Are you satisfied with the current three-dimensional use of the park (use of roofs, development of underground space, addition of corridors, etc.)?
A. Very dissatisfied B. Dissatisfied C. Average D. Satisfied E. Very satisfied
14. Do you think three-dimensional use is important for the use of the park?
A. Very unimportant B. unimportant C. Average D. Important E. Very important
15. Are you satisfied with the number of commercial functions (convenience businesses, restaurants, hotels, etc.) currently in the park?
A. Very dissatisfied B. Dissatisfied C. Average D. Satisfied E. Very satisfied
16. Do you think the commercial functions in the park are important for the use of the park?
A. Very unimportant B. unimportant C. Average D. Important E. Very important
17. Are you satisfied with the number of office features (e.g., shared office, community office, etc.) currently on campus?
A. Very dissatisfied B. Dissatisfied C. Average D. Satisfied E. Very satisfied
18. Do you think the office functions in the park are important for the use of the park?
A. Very unimportant B. unimportant C. Average D. Important E. Very important

19. Are you satisfied with the number of civic and sports functions (recreational and sports functions such as pavilions, sports halls, community activity centers, etc.) in the current park?
A. Very dissatisfied B. Dissatisfied C. Average D. Satisfied E. Very satisfied
20. Do you think that the cultural and sports functions in the park are important for the use of the park?
A. Very unimportant B. unimportant C. Average D. Important E. Very important
21. Are you satisfied with the number of medical functions (e.g., nursing homes, community hospitals, etc.) currently on campus?
A. Very dissatisfied B. Dissatisfied C. Average D. Satisfied E. Very satisfied
22. do you think that medical functions in the park are important for the use of the park?
A. Very unimportant B. unimportant C. Average D. Important E. Very important
23. Are you satisfied with the amount of open space (e.g., parking or parks, etc.) in your current park?
A. Very dissatisfied B. Dissatisfied C. Average D. Satisfied E. Very satisfied
24. do you think open space in the park is important for park use?
A. Very unimportant B. unimportant C. Average D. Important E. Very important
25. Are you satisfied with the current features in the park other than those mentioned above?
A. Very dissatisfied B. Dissatisfied C. Average D. Satisfied E. Very satisfied
26. Do you think adding other features is important for the use of the park?
A. Very unimportant B. unimportant C. Average D. Important E. Very important
27. Are you satisfied with the combination of the current functional business in the park and the neighboring functional business?
A. Very dissatisfied B. Dissatisfied C. Average D. Satisfied E. Very satisfied
28. Do you think it is important for the park to be integrated with the functional businesses in the neighborhood?
A. Very unimportant B. unimportant C. Average D. Important E. Very important
29. Are you satisfied with the current number of public benefit (free) features in the park?
A. Very dissatisfied B. Dissatisfied C. Average D. Satisfied E. Very satisfied
30. Do you think the public benefit (free) features in the park are important for the use of the park?
A. Very unimportant B. unimportant C. Average D. Important E. Very important
31. Are you satisfied with the size of the public space (the functions mentioned in questions 8–13 above) currently provided in the park?
A. Very dissatisfied B. Dissatisfied C. Average D. Satisfied E. Very satisfied
32. Do you think the provision of public space in the park is important for the use of the park?
A. Very unimportant B. unimportant C. Average D. Important E. Very important
33. Are you satisfied with the current park dynamics?
A. Very dissatisfied B. Dissatisfied C. Average D. Satisfied E. Very satisfied
34. Do you think a vibrant atmosphere is important for the use of the park?
A. Very unimportant B. unimportant C. Average D. Important E. Very important
35. Are you satisfied with the current openness of the park?
A. Very dissatisfied B. Dissatisfied C. Average D. Satisfied E. Very satisfied
36. do you think openness is important for park use?
A. Very unimportant B. unimportant C. Average D. Important E. Very important
37. Are you satisfied with the current number of entrances and exits to the park?
A. Very dissatisfied B. Dissatisfied C. Average D. Satisfied E. Very satisfied
38. Do you think the number of entrances and exits is important for the use of the park?
A. Very unimportant B. unimportant C. Average D. Important E. Very important
39. Are you satisfied with the visual permeability of the current park boundaries?
A. Very dissatisfied B. Dissatisfied C. Average D. Satisfied E. Very satisfied
40. do you think the visual permeability of the park boundaries is important for the use of the park?
A. Very unimportant B. unimportant C. Average D. Important E. Very important
41. Are you satisfied with the current number of gatekeepers rationed at the park entrances and exits?
A. Very dissatisfied B. Dissatisfied C. Average D. Satisfied E. Very satisfied
42. Do you think the number of janitorial allotments at entrances and exits is important for the use of the park?
A. Very unimportant B. unimportant C. Average D. Important E. Very important
43. Are you satisfied with the degree to which the current style (façade, ambiance, etc.) of the park's buildings has been maintained?
A. Very dissatisfied B. Dissatisfied C. Average D. Satisfied E. Very satisfied
44. Do you think the degree to which a building's appearance is maintained is important to the experience of visiting the park?
A. Very unimportant B. unimportant C. Average D. Important E. Very important
45. Are you satisfied with the level of architectural preservation of current campus buildings?
A. Very dissatisfied B. Dissatisfied C. Average D. Satisfied E. Very satisfied

46. Do you think the degree of architectural preservation is important to the experience of visiting the park?
A. Very unimportant B. unimportant C. Average D. Important E. Very important
47. Are you satisfied with the current presentation of historical information about the park?
A. Very dissatisfied B. Dissatisfied C. Average D. Satisfied E. Very satisfied
48. Do you think the presentation of historical information about the park is important to the experience of visiting the park?
A. Very unimportant B. unimportant C. Average D. Important E. Very important
49. Are you satisfied with the current green space ratio in the park?
A. Very dissatisfied B. Dissatisfied C. Average D. Satisfied E. Very satisfied
50. Do you think the green space ratio is important for the feeling of visiting the park?
A. Very unimportant B. unimportant C. Average D. Important E. Very important

Appendix B

Table A1. Credibility statistics table.

	Importance		Performance	
Research Sample	**Cronbach's α**	**Item Count**	**Cronbach's α**	**Item Count**
Nanxinchang Cultural and Leisure Street	0.921	25	0.919	25
No. 46, Fangjia Hutong	0.923	25	0.921	25
Jiacheng Impression	0.915	25	0.912	25
77 Cultural and Creative Parks	0.93	25	0.925	25
No. 29, Qingyun Hutong	0.917	25	0.913	25
Jihua Business Building	0.921	25	0.917	25
No. 107 Yard, Beidian Kelin	0.914	25	0.911	25
Jintai Yishouxuan Nursing Home Peacock Branch	0.92	25	0.915	25

Table A2. KMO test.

Research Sample	**Importance**	**Performance**
Nanxinchang Cultural and Leisure Street	0.673	0.685
No. 46, Fangjia Hutong	0.687	0.692
Jiacheng Impression	0.662	0.725
77 Cultural and Creative Parks	0.663	0.75
No. 29, Qingyun Hutong	0.681	0.693
Jihua Business Building	0.712	0.746
No.107 Yard, Beidian Kelin	0.675	0.719
Jintai Yishouxuan Nursing Home Peacock Branch	0.724	0.742

References

1. People's Daily. Over 65% of the Target Set in the 14th Five-Year Plan Has Been Achieved Ahead of Schedule, and Urbanization Has Entered the "Second Half of the Game". Available online: http://paper.people.com.cn/rmrbhwb/html/2023-03/29/content_25972874.htm (accessed on 25 April 2024).
2. Dong, C. Reflections on Architecture in High Density Urban Environments. *Archit. J.* **2010**, *4*, 20–23.
3. Zhang, L.; Hou, P.; Huang, C.; Ye, Y. Comprehensive Performance Evaluation of High-Density Urban Rail Transit Station Areas Supported by Multi-source Data Based on a Comparison of Shanghai and Hong Kong. *Time + Archit.* **2023**, *2*, 30–36. [CrossRef]
4. Lewis, S. Neighborhood density and travel mode: New survey findings for high densities. *Int. J. Sustain. Dev. World Ecol.* **2018**, *25*, 152–165. [CrossRef]
5. Higgins, C.D. A 4D spatio-temporal approach to modelling land value uplift from rapid transit in high density and topographically-rich cities. *Landsc. Urban Plan.* **2019**, *185*, 68–82. [CrossRef]

6. Song, J.; Sun, Y.; Hou, X. Analysis of Spacial Environment Characteristics of Community Park in Densely Populated District Based on Activity Classifi cation of Elderly. *Archit. J.* **2017**, *5*, 116–120.
7. Niu, S.; Tang, X. Research on the Equity Measurement of Park Green Space Distribution in High-density Urban Areas-A Case Study of Huangpu District, Shanghai. *Chin. Landsc. Archit.* **2021**, *37*, 100–105. [CrossRef]
8. Wang, C.; Huang, S.; Deng, M.; Wei, W. Research on Equity of Park Green Spaces in High-density Cities from the Perspective of Supply-demand Coupling Coordination: A Case Study of Longhua District, Shenzhen. *Chin. Landsc. Archit.* **2023**, *39*, 79–84. [CrossRef]
9. Wu, Y.; Liu, Y. Research Progress on Urban Morphology in Compact and High-density Environments: Origins, Evolution, Mainstream Categories and Response Strategies. *New Archit.* **2023**, *5*, 139–145.
10. Liu, Y.; Xu, J.; Yin, K. Participatory Construction of Community Public Space in High-density Cities-A Case Study of Community Gardens. *Landsc. Archit.* **2019**, *26*, 13–17. [CrossRef]
11. Zhang, S.; Chen, T. Constructing Effectiveness Assessment and Decision Model of Urban Public Space in High-Density Context. *Mod. Urban Res.* **2020**, 82–89.
12. Liang, Y.; Liang, Z.; Jiang, H.; Qiu, Y. Research on publicness evaluation of building attached openspaces in high-density blockes. *Ind. Constr.* **2021**, *51*, 39–44. [CrossRef]
13. Sajjad, M.; Chan, J.C.L.; Chopra, S.S. Rethinking disaster resilience in high-density cities: Towards an urban resilience knowledge system. *Sustain. Cities Soc.* **2021**, *69*, 102850. [CrossRef]
14. Liu, B.; Li, K. Formation of industrial Heritage and Method of Value Evaluation. *Archicreation* **2006**, *9*, 24–30.
15. Simjanović, D.; Randelović, B. The AHP approach to evaluation of cultural heritage in Sredačka Župa: The case of Mušnikovo village. In Proceedings of the Fourth International Scientific Conference the Importance of Media Interpretation for the Promotion of Cultural Heritage, Belgrade, Serbia, 30 September 2023; Volume 4, pp. 37–56, Article 2.
16. Della Spina, L.; Carbonara, S.; Stefano, D.; Viglianisi, A. Circular Evaluation for Ranking Adaptive Reuse Strategies for Abandoned Industrial Heritage in Vulnerable Contexts. *Buildings* **2023**, *13*, 458. [CrossRef]
17. Sowińska-Heim, J. Adaptive Reuse of Architectural Heritage and Its Role in the Post-Disaster Reconstruction of Urban Identity: Post-Communist ód. *Sustainability* **2020**, *12*, 8054. [CrossRef]
18. Liu, B.; Li, K. Beijing Industrial Heritage Evaluation Methods. *Archit. J.* **2008**, *12*, 10–13.
19. Nobuo, A.; Xu, S.; Zhang, L.; Yan, M. The designation criteria for the industrial heritage in Britain. *Ind. Constr.* **2014**, *44*, 33–36. [CrossRef]
20. Lei, Y.; Aoki, N.; Xu, S. A Study on the Appraisal of Industrial Heritage in the UK, the US and Canada. *Archit. J.* **2016**, *2016*, 1–4.
21. Ji, H.; Aoki, N.; Xu, S. Historical study and an attempt on the evaluation of industrial heritage: A Case Study on North Navy's Taku Dockyard. *Archit. J.* **2011**, *S2*, 80–85.
22. Zhang, W.; Ye, Q. Research on evaluation system of Changsha industrial heritage based on AHP. *Ind. Constr.* **2015**, *45*, 30–33. [CrossRef]
23. Lie, H.; Zheng, S.; Zhang, Y. Research on Value Evaluation and Protection and Utilisation Gradient of Chongqing's Industrial Heritage. *Archit. J.* **2012**, *1*, 24–29.
24. Yu, H. Research on the Protection of Industrial Heritage in Chongqing Metropolitan Area Based on Value Evaluation. Master's Thesis, Chongqing University, Chongqing, China, 2018.
25. Wang, R.; Wang, D.; Liu, M.; Qin, K. Value Evaluation of Qingdao Great Harbour Industrial Heritage. *Ind. Constr.* **2023**, *53*, 79–86. [CrossRef]
26. Han, F.; Tong, Y.; Zhang, L. Tourism Value Evaluation of Northeast Industrial Heritage—Dalian modern industrial heritage being examplified. *Urban Dev. Stud.* **2010**, *17*, 114–119.
27. Wang, K.; Tang, C.; Liu, J. A Measuring Model on Tourist Satisfaction Index in Cultural Creative-type Tourism Destination—A Case of 798 Art Zone in Beijing. *Tour. Trib.* **2011**, *26*, 36–44.
28. Luo, H.; Yu, Z.; Zhang, H. Tourists'satisfaction and influencing factors in cultural and creative tourism destination for Tianzifang, M50 and Hongfang in Shanghai. *Resour. Sci.* **2016**, *38*, 353–363.
29. Jiang, N. Technigues and Methods for Value Evaluation of industrial Heritage Based on Adaptive Reuse. *New Archit.* **2016**, *3*, 4–9.
30. Wang, D.; Pan, Y.; Wang, T. Evaluation and Empirical Study on Regeneration and Renewal Potential of Old Industrial Estate Based on Multi-source Data. *Constr. Econ.* **2023**, *44*, 98–104. [CrossRef]
31. Dong, Q.; Guo, R.; Guo, F. Potential assessment and renewal strategy for regenerating urban abandoned railways:The case study of the Dalian Locomotive Factory Railway Line. *J. Nat. Resour.* **2023**, *38*, 2627–2686.
32. Rui, G.; Li, R. POE on the Reuse and Innovation of Old Industrial Buildings: Through Case Study of the Redtory in Canton. *South Archit.* **2015**, *2*, 118–123.
33. Liu, X.; Sao, Y.; Wang, Y. Optimization Strategies on the Creative Industrial Parks Transformed from industrial Heritage Based on the POE. *Mod. Urban Res.* **2017**, *5*, 58–66.
34. He, M.; Zheng, K.; Huang, H.; Li, X. Study on Comprehensive Evaluation of the Satisfaction Degree of Urban Industrial Heritage:A Case Study of Nanchang Cultural and Creative Park. *Urban Dev. Stud.* **2017**, *24*, 129–134.
35. Li, S.; Wang, H.; Chen, G. Research on the Improving Strategies for the Revitalization of Industrial Heritage Based on POE: A Case Study of Taikoo Warehouse in Guangzhou. *Art Des.* **2023**, *8*, 130–132. [CrossRef]

36. Wang, S.; Duan, W.; Zheng, X. Post-Occupancy Evaluation of Brownfield Reuse Based on Sustainable Development: The Case of Beijing Shougang Park. *Buildings* **2023**, *13*, 2275. [CrossRef]
37. Ertaş Beşir, Ş.; Çelebi Karakök, M.E. Determination of Conservation–Reuse Parameters for Industrial Heritage Sustainability and a Decision-Making Model Proposal. *Sustainability* **2023**, *15*, 6796. [CrossRef]
38. Claver, J.; García-Domínguez, A.; Sebastián, M.A. Multicriteria decision tool for sustainable reuse of industrial heritage into its urban and social environment. Case studies. *Sustainability* **2020**, *12*, 7430. [CrossRef]
39. Milošević, D.M.; Milošević, M.R.; Simjanović, D.J. Implementation of adjusted fuzzy AHP method in the assessment for reuse of industrial buildings. *Mathematics* **2020**, *8*, 1697. [CrossRef]
40. Loures, L.; Panagopoulos, T.; Burley, J.B. Assessing user preferences on post-industrial redevelopment. *Environ. Plan. B Plan. Des.* **2015**, *43*, 871–892. [CrossRef]
41. Castilla, M.V. Analysis of Performance Strategies for the Preservation of Heritage Buildings: The Case of Puerto de Santa Maria. *Buildings* **2023**, *13*, 1196. [CrossRef]
42. Municipality, T.P.s.G.o.B. Beijing Urban Master Plan (2016–2035). Available online: https://www.beijing.gov.cn/gongkai/guihua/wngh/cqgh/201907/t20190701_100008.html (accessed on 25 February 2024).
43. Chang, Q.; Xu, Q.; Yang, C.; Wang, S. Reflections and explorations on the decrement regulation of construction land in the new beijing city master plan. *City Plan. Rev.* **2017**, *41*, 33–40.
44. Rui, G.; Wang, S.; Zhao, M. IPA Method Based Cityscape Renovation Evaluation. *Planners* **2014**, *30*, 95–100.
45. Chen, T.; Xu, L.; M, Q.; Shi, Y.; Lu, Z. Research on Satisfaction Evaluation and Application of Pocket Park in Shangcheng District of Hangzhou Based on User Perception. *Landsc. Archit. Acad. J.* **2022**, *39*, 119–125.
46. Zhang, J.; Liu, J.; Yang, H.; Quan, J.; Wang, L.; He, Q.; Li, F. Satisfaction Evaluation for Underpass Green Spaces in Mountainous Cities under the Perspective of Environmental Perception. *Buildings* **2023**, *13*, 1489. [CrossRef]
47. Li, H. Residents Satisfaction Evaluation of Urban Public Leisure Space Based on IPA Method: Taking Xuzhou City as an Example. *Resour. Dev. Mark.* **2020**, *36*, 1067–1073.
48. Yu, W.; Zhu, H.; Liu, J. Analysis of factors affecting the evaluation of recreational use of industrial heritage: A case study of the Seonyudo Park, South Korea. *World Reg. Stud.* **2020**, *29*, 588–597.
49. Cai, C.; Luo, P.; Tang, C.; Zhang, X. An Evaluation of Tourists' Satisfaction Degree of Folk House World Heritages Based on IPA Analysis: A Case Study of Yongding Hakka Earth Building in Fujian Province, China. *Resour. Sci.* **2011**, *33*, 1374–1381.
50. Liu, F.; Zhao, Q.; Yang, Y. An approach to assess the value of industrial heritage based on Dempster–Shafer theory. *J. Cult. Herit.* **2018**, *32*, 210–220. [CrossRef]
51. Ren, B.; Liu, C.; Li, J. Evaluation Study on the Utilization Effectiveness of Industrial Heritage in Hebei Province Based on Multi-source Data. *Ind. Constr.* **2023**, *53*, 139–144.
52. Jiang, X.; Shen, Z.; Zhang, N.; Liao, H.; Xu, H. Reliability and validity analysis of the questionnaire. *Mod. Prev. Med.* **2010**, *37*, 429–431.
53. Chen, X. *Theory and Application of Modern Statistical Analysis Method*; National Defense Industry Press: Beijing, China, 2016; 321p.