Analysis on the Environmental Characteristics of Old Residential Areas in the North from the Perspective of Urban Renewal

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Abstract: In the process of urbanization construction, we should not only consider the economic construction of the city, but also consider the environmental construction of the city, especially the environmental construction of some old residential areas. The purpose of this paper is to explore the environmental characteristics of the old residential areas in the north from the perspective of urban renewal, and to provide a theoretical basis for the environmental construction of the old residential areas in the north. Using operational research-based analytic hierarchy process (AHP) and statistical-based principal component analysis (PCA), the environmental characteristics of the old northern residential areas are established, the weights of each index are determined, and the environmental characteristics of the old northern residential areas are put forward from the perspective of urban renewal.

1. Introduction
Since the reform and opening up, the floating population in our country has been increasing, especially the migrant population in the north has increased sharply. Although this has promoted the development of the urban economy, it has also brought pressure on housing, which shows that the city needs further construction and renewal[1][2]. The contents of urban renewal mainly include the division of urban administrative areas, the location of urban centers and the renovation of old residential areas[3]. Because of the large amount of early construction in the central area, there are few land resources available for new housing areas, and some old residential areas are not very suitable for occupancy because of their long time and poor living environment[4][5]. In this case, in order to solve the housing problem of a large number of outsiders, the transformation of old residential areas is imminent, and the concept of urban renewal has more profound and practical significance here.

But now, people's demand for housing is not only living, but also new requirements for the environment of the place of residence. Therefore, under the background of urban renewal, the environmental characteristics of the old residential areas are studied. It is helpful to the reconstruction and construction of the old district[6][7]. Many scholars have also put forward their views, such as the Antonio Nestico of the University of Salerno, that econometric models make it possible to obtain the best combination of projects for urban renewal in order to achieve the sustainable development in the Territory[8]. Roshanak Mehdipanah et al. suggested that urban renewal policies have a significant impact on vulnerable populations, and that policies leading to gentrification may have a negative health impact on that population, which requires a better understanding to influence future policies and to promote community participation models that include such populations at an early planning stage[9][10].
This paper focuses on some old residential areas in the north, studies their environmental characteristics from the perspective of urban renewal, selects some old residential areas in Beijing as the representatives of the old residential areas in the north, and puts forward the common environmental characteristics of the old residential areas in the north. According to the method of hierarchical analysis, the evaluation index of environmental characteristics is established, and from these indexes, the field investigation is carried out, and the environmental characteristics of the old residential areas in the north are put forward scientifically and objectively from the analysis of the data of the investigation. Combined with local data, the principles and strategies of environmental construction in old residential areas in the north are summarized.

2. Related concepts of environmental characteristics of old residential areas in the north from the perspective of urban renewal

2.1. Relevant concepts

2.1.1. Urban renewal. Nowadays, urban renewal is defined as a series of demolition, repair and reconstruction in order to make the city fresh again. Urban renewal includes the transfer of urban administrative area, the renewal of coastal wharf, the change of urban structure and the transfer of urban core area. The renewal of urban renewal in China focuses on the transformation of residential areas in the old city, which is a continuous completion and related to the daily life of urban residents.

2.1.2. North. The northern region is one of the four geographical divisions in China, which refers to the vast areas north of the Huaihe River line in Qinling, south of Inner Mongolia Plateau and east of Daxing'anling. The area is mainly plain terrain, most of the land is black soil. Northern region is mainly temperate Mainland climate and temperate monsoon climate, the four seasons temperature changes clearly, the annual precipitation is less, and the four seasons distribution is uneven. The northern region is rich in human resources and is a gathering place for high-tech industries.

2.1.3. Old residential district. The old residential area generally refers to the residential area built by the government and the unit before the unit system reform, compared with the residential area built after the commercial housing reform in 1998, most of them have not kept up with the pace of the times. The old residential district is mainly a residential district built before 2000 and the public facilities are backward and the residents' willingness to transform is strong.

2.2. Determination of the evaluation indicator system

The evaluation index system can analyze the overall characteristics of a thing from many angles, which is the data support to study the nature of a thing. As far as the old residential area in the north is concerned, according to its related concepts, it is concluded that when studying its environmental characteristics, the establishment principle, the scope and observation points of its evaluation index system are as follows:

2.2.1. Basic principles for system definition.[1].New and old. From the perspective of urban renewal, the comprehensive environmental evaluation of the old residential areas in the north needs to take into account the environment of the new urban area and the old residential area, and to find out. Find the organic combination of the two, and get the results of comprehensive environmental assessment. How to combine the two scientifically and effectively is one of the basic principles of the comprehensive environmental evaluation index system of the old residential areas in the north.

2.2.2. Simple and complete. In order to describe the environmental characteristics of the old residential areas in the north, it is necessary to study and demonstrate from many aspects and angles to prevent the situation from being partial. Therefore, when establishing the evaluation index system, the index should be comprehensive and avoid duplication, determine the main impact index and simplify
the problem.

2.2.2. The indicator system involves categories and observation points. [1]. Physical environment. The material environment is mainly some visible, can carry on the objective description through the concrete information some affairs, such as the old district planning and the layout, the transportation facility, the environment quality, the building performance and so on. The evaluation of the material environment of the old district is to analyze the environmental characteristics of the old district in the north from the perspective of urban renewal, which is helpful to the reconstruction of the infrastructure of the old district in the north.

[2]. Social environment. The social environment is mainly some things that are not obvious and have subjective recognition, such as the character of the general residents, the education level, the neighborhood atmosphere and so on. The evaluation of the social environment of the old district is mainly to analyze the environmental characteristics of the old district in the north from the perspective of urban renewal, which is helpful to the humanistic construction in the old district in the north and can meet the spiritual needs of the residents.

3. Experimental Study on Environmental Characteristics of Old Residential Areas in North China from the Perspective of Urban Renewal

3.1. Research subjects
As the capital of our country, Beijing is one of the representative cities in the north. This paper will study and investigate some old residential areas in Beijing, and get the general characteristics of the environment of the old residential areas in the north. In the process of research, it will not only carry on the field inspection to the construction in the district, but also carry on the questionnaire survey to the residents in the district, and understand the environment of the old district in the north from many aspects.

3.2. Research methodology

3.2.1. Literature studies. Collect and collate the relevant data directly and indirectly related to urban renewal and old residential areas, and summarize them, from the theoretical level, study the environmental characteristics of old residential areas in the north from the perspective of urban renewal.

3.2.2. Instrument measurement. With the help of modern instruments and equipment, the layout of old residential areas and related data are measured and calculated. From the level of scientific data, the environmental characteristics of old residential areas in the north are studied from the perspective of urban renewal.

3.2.3. Interviews. From the perspective of housing users, this paper studies the environmental characteristics of the old residential areas in the north from the perspective of urban renewal.

3.2.4. System analysis. The construction time of the old urban district is long, there are various problems, it is a complex urban settlement group, so we should synthesize the research results of many disciplines, and study the environmental characteristics of the old northern district from the perspective of urban renewal.

3.3. Index extraction methods
In this paper, the information extraction method based on remote sensing data and the information extraction method based on social statistics are adopted, and the final evaluation index data are obtained by combining the mathematical statistics of information space.

The results obtained by spatial mathematical statistics are generally cell pattern index. The pattern
index reflects the spatial pattern of each cell, including the unit type, number, spatial distribution and so on. The pattern index can be divided into three levels in scale: patch, class and region. In characterization, it can be divided into area index, density index, edge index, proximity index and dispersion index.

3.3.1. Area indicators. Patch type area (CA, patch index) index is the basis of calculating other indexes, and the size of different types of patch area can reflect the information of type and distribution. According to the proportion (PLAND) of the total area of the plot, the relative proportion of a certain patch type to the area of the whole plot can be determined. The formula is:

$$\text{PLAND} = P_i = \frac{\sum_{j=1}^{n} a_{ij}}{A} \quad (1)$$

where $a_{ij}$ represents the area of patch $ij$, $A$ represents the total area of all landscapes. Take the map of house prices in Beijing as an example, as shown in Figure 1:

![Beijing housing prices map](image)

Figure 1. An example of a map of house prices in Beijing

The proportion of each color area is similar to that of the total area of the plot. In this study, residential areas, traffic roads, public facilities, green landscape and so on will be divided as different patches.

3.3.2. Proximity indicators. Average nearest distance (MNN) index reflects the degree of dispersion of similar patches. The larger the distribution of the index is, the more discrete the index is, the closer it is, and the more lumpy it is. The formula is:

$$\text{MNN} = M = \frac{\sum_{i=1}^{n} h_{ij}}{N} \quad (2)$$

where $h_{ij}$ represents the nearest distance of plaque $i$ to the same patch, $N$ represents the total number of patches with the nearest distance. Taking the map of house prices in Beijing as an example, it can be seen that the patches of the same color are very close, which indicates that the average nearest distance index of the same kind of patches is very small and presents as blocks.

4. Analysis on Environmental Characteristics of Old Residential Areas in North China from the Perspective of Urban Renewal

4.1. Analysis of indicator data based on spatial mathematical statistics

The information extraction method based on basic remote sensing data, combined with spatial mathematical statistics, includes the proportion (PLAND) and the average nearest distance (MNN) index of patches to the total area of the community. The proportion (PLAND) and average nearest distance (MNN) index of green landscape in eight old residential areas with different directions and relatively dense population in Beijing are as follows:
### Table 1: PLAND and MNN data analysis for 8cells

|    | No.1 | No.2 | No.3 | No.4  | No.5  | No.6  | No.7  | No.8  |
|----|------|------|------|-------|-------|-------|-------|-------|
| PLAND | 10.1% | 9.1% | 8.7% | 11.5% | 7.8%  | 9.9%  | 11.8% | 12.7% |
| MNN  | 1.00 | 0.94 | 0.89 | 0.99  | 0.86  | 0.94  | 1.00  | 0.78  |

### Figure 2: PLAND and MNN data analysis for 8cells

From Figure 2, the green landscape in the old residential area of Beijing is insufficient. In the eight residential areas investigated, the proportion of green landscape to the total area of the district is less than 15, and these green landscapes are scattered. It may also be one of the reasons for the scattered activities.

### 4.2 Analysis of residents' knowledge of traditional culture

Increasing the people's understanding of traditional culture will help China's cultural rejuvenation, analyze the residents' understanding of traditional culture, and contribute to the construction of traditional culture in old residential areas. Table 2 is a survey of residents' feelings about night travel safety in 8 old residential areas in Beijing:

### Table 2: Statistics on the Safety Experience of trip for 8residents

|                | No.1 | No.2 | No.3 | No.4  | No.5  | No.6  | No.7  | No.8  |
|----------------|------|------|------|-------|-------|-------|-------|-------|
| Not At All     | 7.5% | 6.2% | 17%  | 15.1% | 10.6% | 16.8% | 22%   | 14.2% |
| General        | 24.4%| 20.7%| 38.1%| 30.2% | 17.1% | 23.1% | 25.5% | 34.9% |
| Very Familiar  | 68.1%| 73.1%| 44.9%| 54.7% | 72.3% | 60.1% | 52.5% | 50.9% |

### Figure 3: Statistics on the Safety Experience of trip for 8residents
From figure 3, it can be found that the residents of the old residential areas in Beijing generally have a high degree of understanding of traditional culture. More than 60% of the people in these eight residential areas know traditional culture very well. Can encourage residents to participate in traditional culture knowledge competition, or organize traditional culture knowledge competition.

5. Experimental Research on Environmental Characteristics of Old Residential Areas in North China from the Perspective of Urban Renewal

5.1. Environmental characteristics of older northern neighbourhoods

5.1.1. The traditional culture remains intact. Combined with the understanding of traditional culture among residents of new urban area and the understanding of traditional culture among residents of old residential areas in Beijing, it is found that the residents in old residential areas generally have a higher understanding of traditional culture. More willing to participate in some traditional festival activities.

5.1.2. Insufficient green landscape capacity. Combined with the proportion of green space area in the new urban area and the green space area of the old residential area in Beijing, it is found that the overall green space rate of residential area is low, the large area corner land is exposed, the green coverage is insufficient, the green landscape type is single, and the maintenance management is lacking.

5.2. Principles and Strategies for the Reconstruction of Old Residential Areas in the North from the Perspective of Urban Renewal

5.2.1. Principles. Taking into account the environmental characteristics of the new urban area and the old residential area, it is considered that the old residential area in the north should follow the following reform principles from the perspective of urban renewal: according to local conditions, overall consideration, people-oriented, space sharing, context rejuvenation, ecological saving and so on.

5.2.2. Strategy. In order to improve the living environment of the residents in the old and new urban areas, the following suggestions are put forward: improving and beautifying the residential space; adjusting the green landscape structure; optimizing road traffic organization; upgrading public service facilities; upgrading property service standards; paying attention to the needs of vulnerable groups; improving residents' mental health; and community residents' property autonomy.

6. Conclusions

Due to the influx of a large number of foreign population, the existing residential areas and existing land resources in the northern urban areas can not meet a large number of housing needs, while some old residential areas are large in scope and have high transformation value. Reconstruction of these old residential areas can effectively solve the demand for a large number of housing. As the most close stock planning carrier with people's daily life, the environment of residential area directly affects the health level and quality of life of residents. Therefore, this paper studies and analyzes the material and social environment of the old residential areas in the north, and puts forward some feasible suggestions and suggestions according to the research results.

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