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Research Article

Analysis and Evaluation of Factors Influencing the Low-Carbon Effect of Urban High-Rise Settlement Planning Schemes Based on AHP-Fuzzy Comprehensive Evaluation Method

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With the rise of low-carbon concept and the trend of low-carbon planning, the evaluation of low-carbon planning has been paid more and more attention by the academic and planning circles. Carbon evaluation has become a hot topic after "environmental evaluation" and "green evaluation." In order to promote the important content of energy conservation and sustainable development in the construction of low-carbon cities, this paper constructs and plans the content of low-carbon city planning and construction. On the basis of the effectiveness evaluation index system, this paper discusses the linkage between analytic hierarchy process and fuzzy comprehensive evaluation method and makes a comprehensive quantitative evaluation on the effectiveness of case planning EIA. Combining the advantages of analytic hierarchy process and fuzzy comprehensive evaluation method, the subobjectives and weights of each index are determined by the analytic hierarchy process. The multi-level fuzzy comprehensive evaluation method is used to evaluate the factors that affect the low-carbon effect of urban high-rise residential district planning. This study leads the new trend of future urban construction, and the construction of low-carbon residential areas, as an important part of promoting urban sustainable development, is the core component of future low-carbon urban planning and construction.

1. Introduction

Housing is the basic material condition for human survival, which combines the means of survival, enjoyment, and development, and together with food, clothing, and transportation, it constitutes an indispensable consumer product in people's daily life to meet the needs of human physical and spiritual life [1]. In recent years, with the continuous development of social economy, the resources and environment are under great pressure, and the ecological environment on which human beings depend has been damaged as never before. In order to protect the ecological environment and achieve sustainable development, China has reversed the end-of-the-road thinking of "pollution first and treatment later" and taken corresponding measures to control environmental pollution at the source [2]. Low-carbon development is a trend, adaptation planning is a choice of the times, program carbon assessment is a quality control link, and standard adaptation is an inherent demand. Low-carbon planning is a way of thinking, a methodological system, and a technical path [3]. In contrast, the land supply is tight, and the development of urbanization requires more construction land indicators to meet the needs of rapid socioeconomic development, and under this double pressure, the efficiency of land resource utilization has received unprecedented attention [4].

Urban systems are a rather important part of the carbon cycle, and the development of a low-carbon economy is of great significance for maintaining climate and environment [5]. In the context of global climate change, the development of a low-carbon economy is gradually becoming a consensus among decision makers at all levels [6]. The ecological spatial

environment can promote the organic combination of indoor and outdoor spaces and provide a borrowed view for the living space, which is an important factor for high-rise settlements to win the market and has become the main criterion for measuring the quality of high-rise residential areas [7]. Also, high-rise residential areas have high efficiency for land use, which can meet the living needs of more people on the same area of land and become an effective way to solve the urban living space tension [8]. Promoting low-carbon economic development, energy saving, and emission reduction is both a key solution to combat global warming and an important means to practice the scientific concept of development [9].

The current large-scale residential construction at the edge of Chinese cities has led to the uncontrolled spread of cities in a pie-like circle, and the fervent development of more low-rise high-rise residential areas on the outskirts of cities, driven by developers with economic interests, was once considered as a solution to the urban population housing problem [10]. The evaluation of the carbon effect of settlement planning and design schemes is a research field that has emerged in recent years to effectively respond to global climate change and is an important technical tool to examine and control the low-carbon nature of planning schemes at the planning stage and to reduce the life-cycle carbon emissions of settlements. With the rise of low-carbon planning, the evaluation of low-carbon scheme (or the evaluation of carbon effect of scheme) has started to receive attention from academic and planning circles, and it is called "carbon evaluation" which is more respected after "environmental assessment" and "green assessment." "Carbon assessment is due to the introduction of existing technical specifications for residential planning under the baseline scenario without climate change response measures in China. Therefore, there are many incompatibilities with the International Low-carbon background, which fundamentally affect the low-carbon nature of urban settlement planning schemes. In contrast, AHP is a combination of quantitative and qualitative methods that expresses and processes subjective human judgments in quantitative form, minimizing the drawbacks associated with personal subjective judgments and making the evaluation results more credible. Since the rubric used in conducting the evaluation is often fuzzy, it is appropriate to use the AHP-fuzzy comprehensive evaluation method.

This paper analyzes the different problems of carbon emission and carbon absorption in different types of residential areas. Innovatively take the urban high-rise residential area as the starting point, comprehensively analyze the influencing factors of the carbon effect of the high-rise residential area planning and design scheme, and conduct the carbon effect evaluation research. Based on the idea and method of system theory, the analysis of low-carbon influencing factors of urban high-rise residential planning scheme is regarded as a complex system.From the overall, elements and environment three aspects of systematic analysis, to find out the constraints of low-carbon development factors. Compared with the traditional urban analysis method, the research method of this paper has a wider range and is discussed in the context of the whole urban system. From the overall perspective of urban design and residential planning, solve the problems existing in the interactive space design of urban high-rise residential buildings and increase the consideration and analysis of regional influencing factors.

2. Planning Ideas of High-Rise Residential Areas Based on AHP-Fuzzy Comprehensive Evaluation Method

2.1. Construction of AHP-Fuzzy Comprehensive Evaluation Model. When using the analytic hierarchy process to make decisions, we make full use of people's cognition and experience. Qualitative analysis and quantitative calculation are organically combined to decompose a complex system into a multi-level single-objective problem. The AHP-fuzzy integrated evaluation model (Figure 1) quantifies the qualitative factors in the evaluation of the effectiveness of planning EIA and realizes the quantitative evaluation.

First, a complex multi-objective decision problem is considered as a system by applying the principle of multi-level ordering. By analyzing the judgment of each factor within the system, it is decomposed into a recursive hierarchy of several levels of multiple indicators. If the factor data of different magnitudes are to be analyzed comparatively at the same time, they need to be normalized. The value of i factor and j factor in all samples is

$$Z_{i,j} = \frac{X_{i,j} - \mu_j}{\sigma_j}, \tag{1}$$

where μ_j is the mean value of factor i and σ_j is the standard deviation of factor j.

By analyzing the target layer and the interrelationship among the factors, the relevant factors are decomposed into several levels and categorized to form a multi-level structure. The carbon sources and carbon sinks of settlement products have multiple channels, which involve the production process, consumption process, and waste process of residential products, and are influenced by production technology, living concept, ecological background, and external policies. Therefore, in the evaluation stage of the carbon effect of the revised planning scheme at the settlement level, it is not appropriate to adopt the practice of increasing the floor area ratio and building density in the evaluation stage of the general planning and control planning schemes at the city level. We use an n-dimensional random variable to represent X with a weighting factor of A_i, i.e., the weighted sum of n basis vectors to represent X.

$$X = \sum_{i=1}^{n} \partial_i \phi_i. \tag{2}$$

So, the degree of influence of each indicator on the evaluation result is analyzed, and the quantitative result of the degree of influence, i.e., the weight coefficient of each indicator, is obtained. Through the open planning layout of small group homogeneity and large area mixing, which interpenetrate each other and maintain a certain

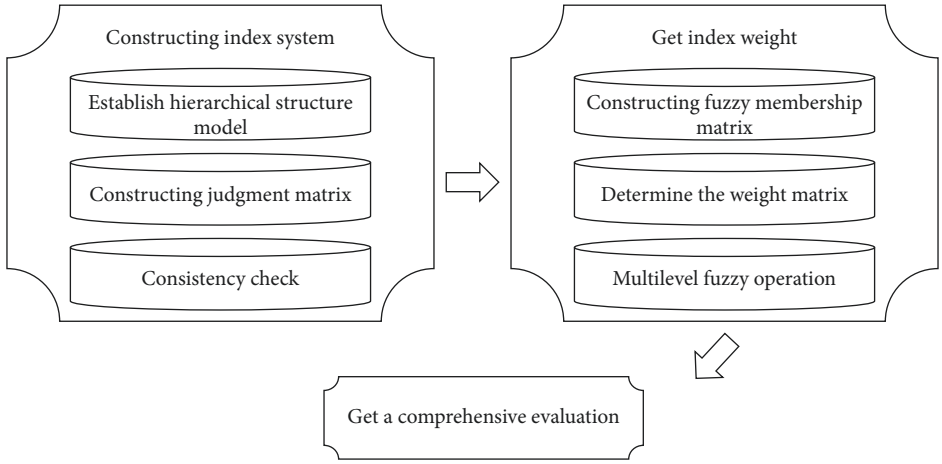

Figure 1: AHP-fuzzy comprehensive evaluation model.

independence and similarity to maintain a sense of security and identity, the income and social background between neighbors are similar, so that security and stability can be maintained. Carbon sink refers to the process, activity, or mechanism of absorbing carbon dioxide in the atmosphere through afforestation, vegetation restoration, and other measures, so as to reduce the concentration of greenhouse gases in the atmosphere. The weight coefficient of each index in this paper well reflects the evaluation characteristics of the carbon source sink effect of the "source sink" and "increase or decrease" schemes. The evaluation of carbon sink function of the scheme is highlighted, and the important position of soft soil in the construction of settlement carbon sink is considered. Combining the idea of weight set with the maximum weight value of horizontal weighting and vertical weighting, for the term set $X = \{i, i_2, i_3, \ldots, i_a\}$, the mixed weighted support of X is defined as

$$\begin{aligned}\text{Support}_m(X) &= h_x \sup_v(X) \\ &= \max\{h_1, h_2, \ldots, h_k\} \frac{\sum_{i=1}^{n} (V_i \text{Count}(X_i))}{N_v}.\end{aligned} \tag{3}$$

Second, relevant experts were invited to make comparative judgments on the relative importance of each index and assigned corresponding values. According to the established hierarchy, the expert consultation method is used to compare the importance of each factor of the same level belonging to the same upper level from the second level, and the judgment matrix is constructed using the 1~9 scale method. Due to the different knowledge level, structure, and knowledge of experts, the credibility of their judgment matrix given by using hierarchical analysis method is not the same. Assuming that there are k experts, the expert weights are obtained using the following formula:

$$p_i = \frac{1}{1 + \partial C\ R_i} (i = 1, 2, L, k). \tag{4}$$

The landscape layout of multi-storey residential areas mostly adopts the form of landscape layout combining centralization and decentralization. Pay attention to the homogeneity of the landscape, and the layout of the central landscape and group landscape of the residential area is relatively balanced. Ecological design of settlement environment refers to the planning and design of settlement environment. The environmental factors covered by the settlement space should be fully considered, and the decision-making and direction of the design should be determined. In order to maintain the ecological balance of the spatial environment, reduce the waste of energy and resources and finally realize the sustainable development of the settlement environment. Therefore, an evaluation problem is decomposed into multiple evaluation factors, and the evaluation index corresponding to each evaluation factor is determined to ensure that the evaluation index can reflect the evaluation problem comprehensively and the index meaning is not duplicated. The weights of the evaluation indicators are only two values, i.e., 0 or 1. If the lexical items appear in the matrix, the corresponding weight value is 1; otherwise, it is 0. The level-weighted support of the item set $X = \{i_1, i_2, \ldots, i_k\}$ is defined as

$$\text{Sup}_h = \max\{h_1, h_2, \ldots, h_k\} \times \text{Sup}(X), \tag{5}$$

where $\text{Sup}(X)$ is the traditional support count of item X and $\text{Max}\{h_1, h_2, \ldots, h_k\}$ is the weight of items.

This expression is intuitive, easy to understand, and provides a common platform for comparison between residential products of different areas, which better reflects the good or bad carbon emission effect of residential products. The supporting facilities of urban settlements mainly include municipal utilities and public service facilities, which indirectly affect the carbon emission of settlements through influencing the daily life energy consumption, water consumption, living habits, and traffic and travel of the residents in the settlements, whose daily outdoor activities are shown in Figure 2.

Finally, the weights of each index at each level are calculated using mathematical methods and ranked; the planning analysis and decision making are performed based on the ranking results. After the calculation of the weights of

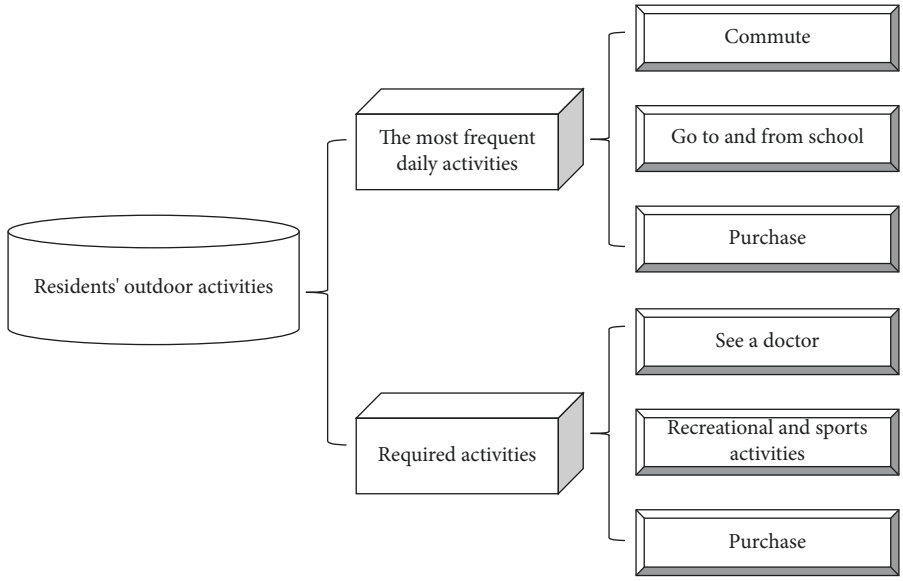

Figure 2: Frame diagram of outdoor activities of residents in residential areas.

the factors at each level, the constructed judgment matrix must be tested for consistency, which is generally judged by calculating the consistency ratio CR. Take the judgment matrix H as an example, that is:

$$HW = \lambda W, \tag{6}$$

H is the judgment matrix and W is the feature vector.

While keeping the development plot ratio as stipulated in the control plan of the site basically unchanged, the green area ratio and soft ground ratio can be increased by reducing the building density. This ensures that the increase in carbon sink is much larger than the increase in carbon source, thus achieving a reduction in net carbon emissions and a reduction in carbon volume ratio. By setting quantitative standards, the raw data are converted into dimensionless values such as fractions, so that indicators of different scales can be compared quantitatively in the same system and finally a "composite score" is obtained. Therefore, we do not consider these economic function indicators separately but focus on the input-output perspective to evaluate the carbon sink obligation per unit of input and emphasize that the real estate development behavior should be clearly responsible for carbon reduction while causing environmental load.

2.2. Ecological Design Method of High-Rise Residential Space Environment. The integrated method of AHP and fuzzy comprehensive evaluation is selected to study the spatial environmental ecological design of high-rise settlements, that is, the fuzzy comprehensive evaluation is based on the hierarchical analysis method. The combination of the two complements each other and helps to improve the authenticity and validity of the evaluation. The positioning, content, layout, and scale of public facilities should be considered comprehensively with the overall positioning and scale of the residential area. Secondly, the public service facilities should adapt to the changing needs of residents and be constantly changed, basically classified as shown in Figure 3.

First, the overall spatial layout of the building is determined by considering the climatic characteristics, topography, sunlight, prevailing wind direction, and surrounding environment of the area to which the settlement belongs. Measuring the carbon emissions in the life cycle of residential buildings is of positive significance for controlling carbon emissions and slowing down the global deterioration. In order to accurately calculate the life cycle carbon emissions of residential areas, it is necessary to comprehensively consider the carbon emissions in the whole stage and process of "from nothing to nothing and then from nothing to something." AHP-fuzzy comprehensive evaluation model based on fuzzy mathematics is used to evaluate the advantages and disadvantages of things, and the evaluation indexes of each level are evaluated according to the determined evaluation slogan level. The appropriate fuzzy affiliation matrix is established, and the relevant operations of fuzzy synthesis are carried out by the fuzzy affiliation matrix and the weight set matrix, so as to make an accurate judgment on the merits of the studied things. After the recursive hierarchy model is established, it is necessary to compare the importance of each index of the same level to the index of the previous level to which it belongs, i.e., to determine the weight occupied by each index, so the corresponding judgment matrix needs to be constructed first. That is, the diversity constraint is transformed into an upper and lower bound constraint for the classification, and the optimization problem is as follows:

$$\max \sum_{i,j} w_{ij} x_{ij}, \tag{7}$$

where w_{ij} is the ij judgment matrix and x_{ij} is the final match.

The original plan is optimized through the scientific and rational use of relevant low-carbon technologies and planning and design tools. While bringing a certain amount of

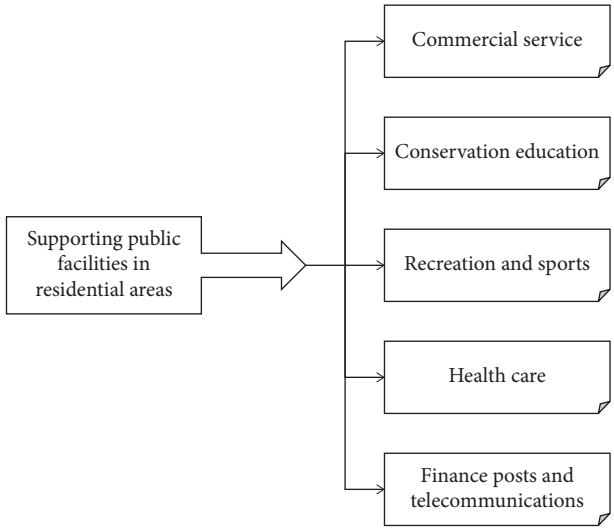

Figure 3: Classification diagram of public facilities.

carbon reduction to the settlement during the planning stage, it will also contribute to the sustainable development of the settlement's economy, society, and environment. The subsystems of indicators and the specific indicators play different roles in describing a social phenomenon or social situation. Therefore, the composite indicator value is not equal to the simple sum of the subindicators but is a weighted summation relationship, i.e.,

$$S = \sum_{i=1}^{n} w_i f_i(I_i), \quad i = 1, 2, \ldots, n, \tag{8}$$

where $f_i(I_i)$ represents some measure of I_i and w_i is the weight value of each index.

Secondly, a reasonable building orientation can not only give full play to natural lighting but also make maximum use of natural wind, thus reducing the use of machine ventilation, air conditioning and heating facilities, etc. By evaluating the carbon sink level of greening in residential areas, we can highlight the greening tree species, composite structure, and green space form. This helps us to analyze the importance of patch combination index and carbon sink plant proportion in the construction of low-carbon residential areas and is conducive to distinguishing between "low-carbon greening" and "landscape greening."" The differences and similarities between "low-carbon greening" and "landscape greening" can be distinguished. At the same time, there are shortcomings that the evaluation results depend on the experience and subjective judgment of the participants, and the calculation process is precise but the judgment is more arbitrary and cannot be used for problems requiring high precision. Therefore, after calculating the single ranking weights of the index factors of a certain level relative to the index factors of the previous level and then applying the weights of the index factors of the previous level for weighted synthesis, we can calculate the total ranking weights of the level. The weights of indicators at the same level can be obtained by normalizing the column vectors and ranking them according to their weights. The independent variable analysis, on the other hand, analyzes the higher-order characteristics of the signal, and finally the components that are independent of each other can be derived. Suppose a mixed signal, $X(k)$, consists of m-dimensional observed signal vectors.

$$x(k) = [x_1(k), x_2(k), \ldots, x_m(k)]^T. \tag{9}$$

Finally, the large floor space and the relatively less shaded vertical walls that point buildings have determine the building surface to receive more solar exposure. The residences are composed of both residential and office components, placing the offices to the north and ensuring a better daylight environment. The residence, on the other hand, is in the south direction and receives better sunlight, and a special sunroom is set up directly for the residence's interior and exterior, which corresponds to the different sunlight requirements in different seasons and makes sufficient preparation. Data envelopment analysis method does not need to determine the weights in advance, and the index values are ratio values, so that there is no need to unify the scale by other methods, which has the advantage of strong objectivity. Among them, determining the individual factors affecting the target is the key to decision evaluation. The absolute value is compared with the specified threshold, and the part less than or equal to the threshold is 0, and the part greater than the specified threshold is the difference with the specified threshold, which is the soft threshold denoising. The calculation formula is

$$\omega\lambda = \begin{cases} [\operatorname{sign}(\omega)](|\omega| - \lambda), & |\lambda| \geq \lambda, \\ 0, & |\omega| < \lambda. \end{cases} \tag{10}$$

After applying the sum and product method to the judgment matrix to find out the weights corresponding to the indicators, the judgment matrix is finally tested for consistency. The consistency test of judgment matrix a given by each expert must be carried out before it is adopted. Only a that meets the conformance test can be used to calculate a. That is, in a of N experts, the consistency condition is satisfied. Because when comparing results by combining all indicators of all levels, there are inevitably inconsistent factors. Therefore, when evaluating the demand for subsidized housing, the relative importance of each indicator must be determined on a case-by-case basis, usually expressed in terms of weights. This is because although each level has passed the consistency test of hierarchical single ranking, each judgment matrix has a more satisfactory consistency. However, when examined together, the nonconsistency of each level may still accumulate and cause more serious non-consistency in the final analysis results.

3. Application Analysis of AHP-Fuzzy Comprehensive Evaluation Method in the Evaluation of Influencing Factors of Low-Carbon Effect

3.1. Environmental Impact Assessment and Analysis of Carbon Emissions. Urban CO_2 emissions, as an environmental effect resulting from the urbanization process, are considered the main cause of urban heat island formation. At the same time, cities are also very vulnerable to the direct effects of

climate change because of the relative concentration of population, resources, and infrastructure there. Climate warming, carbon emission, and urbanization process are intertwined, and in the face of a series of serious ecological and environmental problems at present, we need to change the traditional urban development model to cope with them and accelerate the era of ecological civilization. The performance test of AHP-fuzzy comprehensive evaluation method with K-means algorithm and the time consumption analysis of single-pass algorithm are shown in Figure 4.

Firstly, ETM + images from Landsat 7 are used as the main data source, combined with other vector data and statistical data, to calculate and extract information about the urban environment and its related factors. Since the pace of population growth is much faster than the ability of the environment to absorb the waste generated by human activities, a continuously growing population will bring about a continuous deterioration of the environment. A reasonable allocation ratio is a means to ensure a reasonable amount of greenery, and there is a scientific basis that excessive greenery stacking will have an adverse effect on the ventilation of settlements. The whole environmental impact evaluation of carbon emission from the top to the bottom layer includes target layer, guideline layer, indicator layer and program layer, etc. The decision to select and evaluate the demand for guaranteed housing program is classified as the establishment of the comprehensive relative importance system of the bottom layer relative to the top layer of the target for guaranteed housing demand. In terms of impacts on abiotic natural processes, sustainable landscapes can help regulate the dynamic balance of above-ground and groundwater, reduce the hazards of storm flooding, and transform its use. Although each level has been tested for single ranking of levels, when comprehensive examination is made, the cumulative superposition of each level is needed, which still causes non-consistency in the total ranking results to some extent; therefore, the total ranking of levels also needs to be tested for consistency. In carbon emission environmental impact assessment, the data points near the prediction points are smoothly distributed, and the future trend can be estimated by analyzing these data points. This dataset is mainly based on the basic principles and methods of "ISO 14067:2018 Greenhouse gases-Carbon footprint of products-Requirements and guidelines for quantification" to determine the greenhouse gas emissions throughout the product life cycle including the whole life cycle from obtaining raw materials to production, use, and waste. For the convenience of use, we divide the whole life cycle emissions of a unit product into upstream emissions, downstream emissions, and waste management emissions. Since the construction of this dataset is based on the collection, collation, analysis, evaluation, and recalculation of public literature, the emission calculation of some products and some links cannot strictly follow the boundaries and processes of ISO 14067. For the benchmark datasets, three datasets Aggregation, Compound, and DIM1024 are selected in this paper, which are described in Table 1.

Secondly, the generated raster values are assigned to the rectangular grid covering them by mapping all micro-

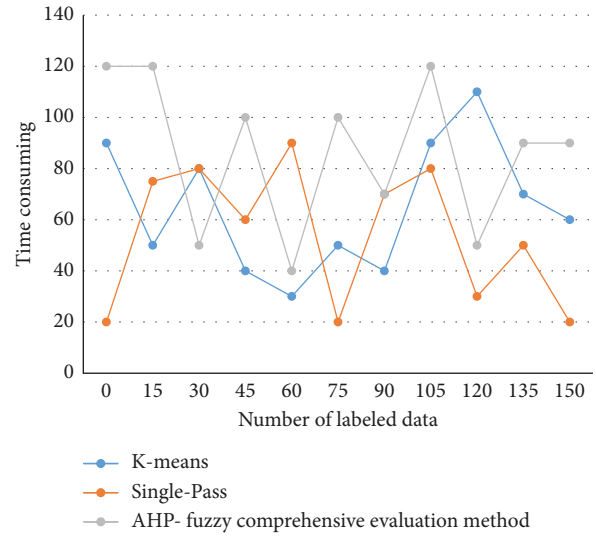

Figure 4: Performance test of AHP-fuzzy comprehensive evaluation method.

Table 1: Benchmark dataset.

Dataset	Aggregation	Compound	DIM1024
Number of samples	576	283	427
Sample dimension	3	2	6
Number of categories	8	7	3

locational environmental factor indicators and using a quantitative inversion model. The energy consumption of high-rise settlements mainly includes two parts: energy consumption of residential building system and energy consumption of external environment of settlements (such as electricity consumption of street lights and landscape lights), with energy consumption of residential building system accounting for the major part. Combining the current topography and geological conditions, the use of parking garage, landscape structures, the current water surface design elevation, and other conditions, the overall design is divided into two platform systems and the waterfront walking system intersecting with the water surface. The design elevation of the waterfront pedestrian system takes into account the connection with the external entrance and the two-way accessibility of the waterfront upper floors, as well as the interference of pedestrians with the view of the villa. Residents' needs and concerns for the public environment are low. However, when conditions become better and the needs of the private domain are satisfied, the residents will shift their attention and needs to the public environment and facilities. The results of the data fitting for the extraction of textual feature items are shown in Figure 5.

The biggest driver of carbon emission growth is per capita growth, and the increase in average annual household income brings a tendency toward carbon-intensive consumption patterns, which continues to drive the growth of carbon emissions. In view of the energy consumption of each part of the settlement and the local resource and environmental conditions, a comprehensive planning of the

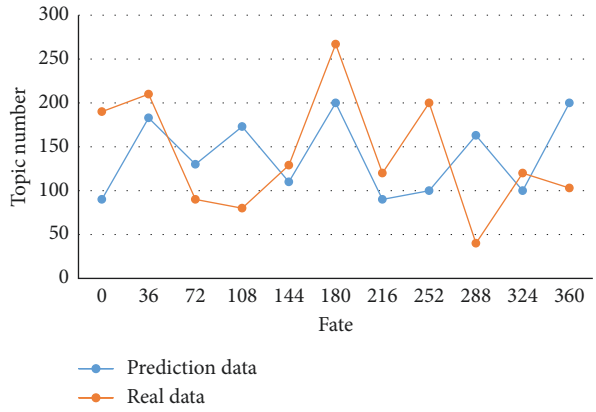

Figure 5: Data fitting results.

settlement energy use is carried out based on the principle of appropriateness, and the proportion and efficiency of renewable energy use are improved to reduce the overall energy consumption of the settlement.

Finally, the data of the indicators that have been gridded are standardized for later data mining and exploration purposes. In the energy supply chain, we can reduce energy waste at the source by developing new energy sources, increasing the scale of low-carbon energy use such as wind, water, and nuclear energy, and improving the efficiency of fossil energy use such as coal. In addition, in the process of waste treatment, with the development of carbon capture and sequestration technology, the carbon dioxide generated will be permanently stored on the seabed or in mines. Experts predict that if the supply, production, and application of ground source heat pump technology, it can effectively reduce the impact of adverse climate on the indoor environment of buildings, improve the living environment and reduce the consumption of conventional energy. Thereafter, it can gradually enter a stable development stage, showing self-consciousness and initiative. The specific layout techniques can be flexibly changed according to the scale and positioning of the residential area in order to create a landscape space with its own characteristics. In addition, in the absence of low-carbon policies to cope with climate change, there will be a substantial increase in the carbon source category indicators. The physical factor with the largest correlation coefficient with human subjective evaluation of road traffic noise can prove that noise exposure level plays a dominant role in the process of human subjective evaluation, and the change in the size of noise exposure level in the propagation process is mainly determined by the spatial morphological information related to the layout of settlement building forms.

3.2. Analysis of Index Weight in Factors Affecting Low-Carbon Effect. For the weight calculation process of each level, for example, when conducting the weight calculation of the target level and the criterion level, this calculation process is consistent; that is, for any level and several indicator factors under it, their calculation procedures in determining the weights are common and feasible. Hierarchical single ranking is the weight ranking of a group of indicators relative to the indicators of the higher level to which they belong, but eventually the weight ranking of each indicator in each level relative to the target level is determined, i.e., the total ranking of the levels. In addition, the weights also have a strong orientation function, and when determining the indicator weights, the importance of each indicator in the target should be carefully analyzed and the weights should be reasonably assigned, so that the comprehensive evaluation results can be objective. Determining the index weight is mainly divided into subjective weighting method and objective weighting method. Subjective weighting method is a method to determine the attribute weight according to the importance of each attribute. The original data are obtained by experts' subjective judgment based on experience. The basic idea of objective weighting method is to determine the attribute weight according to the connection degree of each attribute or the amount of information provided by each attribute.

Firstly, the influencing factors of low-carbon effect are analyzed in terms of correlation and affiliation, so as to form a multi-level weighting analysis model. In most countries, the share of government fiscal expenditure can be used to comprehensively measure the government's macro-control efforts, and this indicator can reflect the proportion of social resources spent by a country or region's government to the total social resources, which is convenient for international comparison. Due to the high population density of high-rise settlements, the public buildings occupy a large area according to the 1,000 people index method, and the buildings are large in shape, which often cause the effect of domination in the central space, and the outdoor activities for residents in the central space are the remaining corner areas squeezed by public buildings. The comprehensive evaluation indicators include two parts: external indicators and internal indicators. The external indicators include Jaccard similarity, FM index, and Rand index; the internal indicators include DBI index and Dunn index. The external performance indexes of the algorithm in this paper are tested with single-pass algorithm as a reference. The experimental results of Jaccard index, FM index, and Rand index are shown in Figures 6, 7, and 8.

In terms of the relationship between the building and the dominant wind direction, the ventilation of a single building is best when the main façade (long side) of the building is laid out vertically with the dominant wind in summer. However, it is not optimal for the overall building layout of the residential area because this layout tends to affect the summer ventilation effect of the rear buildings. According to the fuzzy evaluation terminology, a certain number of relevant experts are invited to judge the rank of each index of the lowest floor, and the judged rank is transformed into the affiliation degree. Through scientific and effective means, uphold the concept of sustainable development, integrate all major factors, avoid the recurrence of pollution of the

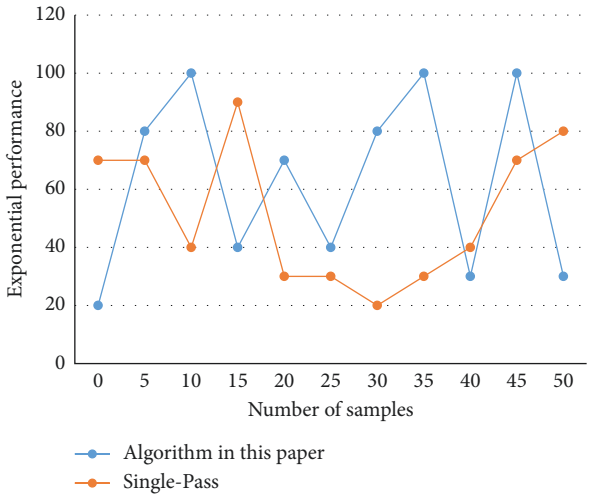

Figure 6: Performance comparison of Jaccard index.

environment, jointly create a harmonious and natural living

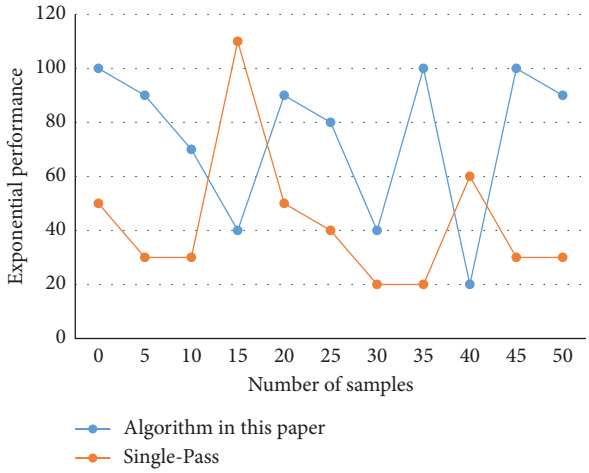

Figure 7: Performance comparison of FM index.

environment, combine social and economic development

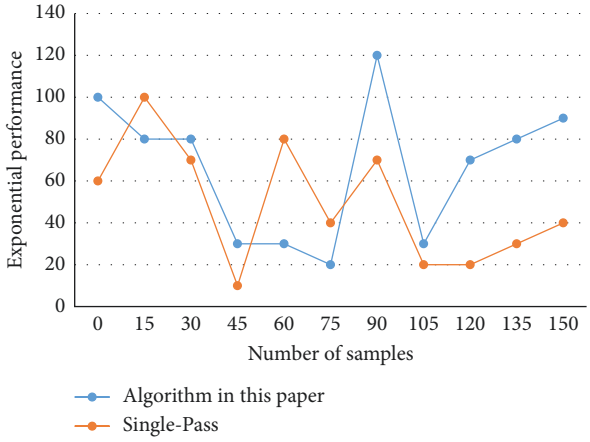

Figure 8: Performance comparison of FM index.

with nature, and improve the living environment and spiritual enjoyment of residents.

Secondly, constructing the judgment matrix is a key step of the AHP method. The judgment matrix is formed by comparing two by two the same-level indicators affecting the low-carbon effect with respect to the extent to which they affect the factors of the upper-level indicators. The expansion of the functions of a country and the expansion of the scope of state activities, as well as the government's efforts to maintain market order, address externalities, and optimize the allocation of resources, will increase the proportion of fiscal expenditure accordingly. The indicators of the evaluation of the construction effectiveness of high-rise settlements must be directly related to the construction effectiveness of high-rise settlements and can effectively reflect part of the construction effectiveness of high-rise settlements, rather than indicators that are irrelevant or not closely related to the construction effectiveness of high-rise settlements. Since the traditional sound pressure level evaluation method is one-sided, ACF and IACF analysis methods are introduced to analyze the temporal and spatial characteristics of measured road traffic noise. This paper uses DPC, KNN-DPC, and AHP-fuzzy integrated evaluation method to conduct experiments to verify the effectiveness as well as the feasibility of the AHP-fuzzy integrated evaluation method in this paper. The results are shown in Table 2.

Finally, hierarchical single ranking and hierarchical total ranking are performed according to the judgment matrix, and then the evaluation factors and evaluation factor weights are determined. Environmental pollution may have different characteristics depending on different open economic conditions, and the expansion of a country's exports will increase the consumption of energy and resources, thus leading to the intensification of the degree of environmental pollution. The indicators for the evaluation of the construction effectiveness of high-rise settlements must be comparable, and there should be a large enough gap between the indicator data of different high-rise settlements in the evaluation range to distinguish the advantages and disadvantages of the construction effectiveness of different high-rise settlements. If the evaluation results of a certain indicator of all high-rise settlements are similar, the indicator loses its significance. The construction of high-rise settlements is a systematic and complex process, and the resulting construction effectiveness involves various aspects such as economic construction, industrial construction, cultural construction, ecological construction, and people's livelihood construction of the area. Therefore, the selection of evaluation indexes of high-rise residential construction effectiveness should also reflect all aspects of high-rise residential construction effectiveness in a systematic and comprehensive manner. The physical factor reflecting the spatial information contained in the noise is mainly influenced by the spatial information of the settlement, including not only the spatial morphological information related to the layout of the building form but also the environmental information.

Table 2: Calculation results of index weights of different algorithms.

Algorithm	DPC	KNN-DPC	AHP-fuzzy comprehensive evaluation method
Parameter	0.2	0.4	5
Purity	0.452	0.376	0.568
F1	0.334	0.452	0.631
ARI	0.462	0.675	0.885

4. Conclusions

In recent years, as China continues to promote the construction of a resource-saving society, urban living space also needs to be developed economically and compactly. Although there are many advantages of low-density settlements, they must also be strictly limited, and the construction of high-rise high-density settlements is both a passive choice and an important means of sustainable urban development in China. Low-carbon planning, as a key technology and precondition for low-carbon city construction, has become a major direction of research in urban and rural planning disciplines.The high speed of urbanization makes the construction volume of urban settlements higher, and the energy security and environmental pollution brought by it can be solved by certain low-carbon and energy-saving technical means, but technology is not the only solution, and the application of low-carbon guiding technology from the source of settlement construction, i.e., planning and design, will become a new trend in the development of settlement construction concept. Both AHP and fuzzy integrated assessment are good at dealing with imprecise and fuzzy information, simulating human comprehensive judgment and reasoning ability, and establishing a link between qualitative and quantitative analysis. So, this paper explores the linkage between AHP and fuzzy comprehensive evaluation method on the basis of constructing an index system for evaluating the effectiveness of planning EIA and makes a comprehensive quantitative evaluation of the effectiveness of instance planning EIA. Based on the analysis and summarization of carbon effect evaluation studies, the influencing factors of carbon effect of urban high-rise residential planning and design scheme are analyzed. Thus, it provides more scientific, advanced, and reasonable methods and strategies for the development of ecological settlements to achieve the predetermined low-carbon goals and to obtain the ecological-economic win-win results.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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