Research Article

Large-Scale and Refined Green Space Identification-Based Sustainable Urban Renewal Mode Assessment

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Urban sustainable renewal has received extensive attention in a wide range of fields, including urban planning, urban management, energy management, and transportation. Given that environmental resource conservation is critical to urban sustainability renewal, this study highlighted the imbalance among green space, urban development, and transportation accessibility. Here, a novel node-place-green model is presented to measure sustainable urban development; meanwhile, deep learning is utilized to identify and extract the green space to measure the environmental index. Based on the generated node, place, and green value, urban developing status could be classified into nine modes for further analysis of transportation, urban function, and ecological construction. The experimental results of Harbin reveal the feasibility of the proposed method in providing specific guidelines for urban planning and policies on sustainable development.

1. Introduction

A multitude of efforts towards low-carbon urban development foster concentration strategies around improving built environment, which is closely related to vehicular emissions [1]. Recently, a multitude of efforts towards sustainable performance assessment are focusing on strategies around improving urban renewal, which is closely related to transportation emissions [2, 3]. For instance, a study demonstrated that the sustainability research board reported that the conservation of resources and the environment gains the highest weight of 29% in the sustainable urban renewal model [4]. Also, a more recent study showed that improving neighborhood design leads to a 75% reduction in energy use and GHG emissions [5]. Besides, some extensive literatures explored the strategies of reducing GHG emissions by improving the green space during urban renewal [6]. Hence, combining urban renewal with urban green space is critical to sustainable development [7]. During urban renewal, the imbalance in urban resource allocation is inevitable and is mainly reflected when developing transportation infrastructure and the corresponding urban functional facilities [8].

The cities in the developing countries renovate things that have long been supported by land finance and marked by space excessive consumption; the following consequential environmental and social issues as follows are in need of being urgently addressed: low concentration degree of functions [9], lack of vitality [10], and the public space being unsuitable for the demand of development [11, 12]. Additionally, an array of functional contradictions like the fading nature ecological system are primarily attributed to the urban huge inner stock space as well as pretty low efficiency of land use [13]. At present, mainly featuring the partial sections used for the planned regions of renovation projects, the ways through which these old cities renovate and implement schemes remain destitute of an all-round research on the urban systematical level [14]. During the renovation, typically, developers only pass the benchmark of various technique standards and compress the public service facilities and opened spaces [15, 16]; they also raise the volume of development at their will and maximize their profits [17, 18]. As a result, this leads to an array of the Gordian knots, including excessive intensity of old city development,

destitution of public service facilities, uncoordinated environmental landscape, and unbalanced urban functions [19]. Old city renovation, namely, a crucial method to revitalize the urban stock land, holds the key to raising land intensity degree and boosting the metabolism of old urban functions [20]. Therefore, it is impressive to study and explore the problem of how to strike a balance between transportation and land use in the stock development to revitalize the city and coordinate with the urban sustainable redevelopment goals [21].

Regarding urban sustainable redevelopment with balance, the node-place model has always been one of the hottest topics. The node-place model establishes a methodological framework, the maximum value for studying the coordinated development between land use and transportation in the adjacent regions [22]. This model makes a hypothesis that there exists a sustainable and positive feedback mechanism between the “node value” relying on the transportation services and the “place value” relying on the land use. The balance between the “node value” and the “place value” of a certain area can be considered as an important reference for evaluating whether this area possesses the potentials of urban construction. Five development states are distinguished by the node-place model (Figure 1). Each situation reflects its development stage and state in terms of the balance between urban function and traffic. The “balanced” state means the coordinated development of transportation and urban functions. The “dependent” state at the bottom of the curve shows that both the transportation construction and urban functions are relatively weak. Therefore, external factors need to intervene to maintain and promote the development of this area. As opposed to the “dependent” state, both transportation and urban functions have been developed to the utmost intensity on the “stress” state, which means further redevelopment may cause larger conflicts. The remaining two are the “unbalanced” state. On this state, the development only focuses on one aspect (transportation or urban function). A large number of articles attempted to utilize the node-place model from the perspective of station classification [23], transportation network assessment [24], sustainable redevelopment [25], accessibility analysis [26], and planning policy [27]. The node-place model is used to determine the form and extent of redevelopment of the Tokyo station regions [28]. Vale compared related literatures and combined land use, transportation, and walkability conditions to evaluate and classify station regions of Lisbon [29]. Considering the complexity of urban problems, the node-place model has gradually begun to be extended to evaluate complex situations [30]. The design index was included in the evaluation system and applied to location-related city regulations and policies [31]. In this paper, the refined evaluation indexes of urban green space are incorporated into the node-place models to widen the decision-making dimension of sustainable urban renewal mode. Combination of transportation, land use, and ecological construction could identify the development stage of sustainable urban renewal more scientifically.

As for the measurement of urban green space, instead of the time-consuming survey and fieldwork, with the rapid development of remote sensing [32] as well as computer vision techniques [33], the automatic

FIGURE 1: The node-place model by Bertolini [22].

extraction of the green space from remote sensing imagery based on machine learning methods [34] has emerged as a promising alternative strategy. In terms of remote sensing imagery for vegetation, although the normalized difference vegetation index (NDVI) [35] has been widely utilized in several empirical studies [36–38], the limitation of resolution and availability inevitably hinders its deployment in urban regions. Thanks to the dramatically increasing availability of new large-scale remote sensing data sources [39, 40], the ever-expanding high-resolution dataset with ground truth can be utilized for training the urban vegetation extraction model. On the other hand, the deep learning methods, here referred to as deep convolution neural networks [41], have shown the tremendous capability in pattern recognition tasks. Recent deep learning based studies for land feature extraction including vegetation segmentation [42, 43], which outperformed conventional machine learning based methods such as support vector machine (SVM) [44] and neural network (NN) [32], reveal its potential in different urban vegetation extraction tasks.

In this research, we chose the main urban districts of Harbin as our study area. First, we use U-Net [45] to identify and extract the green space, mainly including low vegetation and trees in Harbin; the ratio of vegetation to the region reveals and measures the environmental index of the corresponding region. Second, we expanded the node-place model, using those green indicators as the third dimension to jointly measure the state of urban construction. Finally, according to the evaluation results of the node-place-green model, we classified the sustainable renewal models in Harbin and proposed a targeted renewal strategy for each type of characteristic.

The main contributions of this study are fourfold:

We expanded the node-place model’s dimensions combining transportation, urban function, and ecological construction to analyze the sustainable urban development mode

We utilized the U-Net model to identify urban vegetation and trees on a large scale in satellite images, which ensures the refinement of urban feature recognition

We analyzed the sustainable urban renewal model using the identified green space, which dynamically monitors the sustainable renewal status

We identified the state of the urban construction in Harbin and proposed a future sustainable development model for transportation, urban function, and ecological construction

The remainder of this paper is organized as follows. In Section 2, the workflow of the proposed method is illustrated, where the details of metrics as well as the algorithms are also presented. Then, the study area and data source are introduced. After that, experimental results and discussion are demonstrated in Section 3. Finally, the conclusions are drawn in Section 4.

2. Materials and Methods

2.1. Study Area and Data. In this research, we choose the main urban districts of Harbin as our study area, endeavouring to identify which regions have the potential for further sustainable renewal. As the northernmost sub-provincial city in China, Harbin is located in the Northeast Plain. In Harbin, the urban construction land is 458 km², including the old town of 298 km². With the development of the city, various contradictions in the old town have become more prominent. The high urban density, traffic congestion, environmental pollution, and insufficient green space have led to a decline in the overall functions of main urban districts and increased difficulty in urban renewal. Harbin is also a typical winter city with a long and cold winter. Therefore, there is urgency to improve the green space and enhance the quality of the outdoor environment. In order to analyze the place value in each region, in this research, we collect land use status drawn by GIS in basic regions at the town-and-street level in the overall land use plan of the main urban area of Harbin and PoI data with 27 features. As for urban green classification, the ISPRS benchmark [39] and Google Earth (GE) RGB imagery are selected to perform the training and testing data, respectively. Considering the resolution and color space difference between training and testing datasets, the preprocessing, including downscaling and color normalization, is applied.

2.2. U-Net for Urban Vegetation Area Extraction. As one of the state-of-the-art models for deep learning based image semantic segmentation, U-Net has been successfully applied to perform different tasks with high accuracy and efficiency. Considering the characteristics of U-Net, which could perform pixel-to-pixel and end-to-end mapping from input to output while enabling precise localization for the vegetation segmentation results, in this study, we propose to adopt U-Net as a representative segmentation model for urban vegetation area extraction.

Concretely, the convolution operation performs element-wise multiplication via kernels. In U-Net, it can be formulated as follows:

$$z = \sum_{i=1}^{h_f} \sum_{j=1}^{w_f} \sum_{d=1}^{c_l} \Theta_{i,j,s,d'} \times x_{i,j,d} + b_{d'}, \quad (1)$$

where h_f and w_f represent the height and width of the kernel Θ , c_l is the number of channels for input x in layer l , and b in shape $1 \times 1 \times 1 \times d'$ denotes the bias.

Subsequently, Leaky ReLU [46] and batch-normalization [47] are used to generate the hypothesis from z and reduce internal covariate shift, respectively. The final classification of either vegetation or nonvegetation is predicted by using softmax function [48].

2.3. Node-Place-Green Model. The node-place model is applied to balance the transportations and urban functions of the railway network and the railway station area [22]. Considering the similarities between the transportation system and urban construction, the node-place model is gradually being applied to the evaluation of large-scale urban development. The subway and bus system in Harbin exhibit the same transportation functions as the railway network and are densely distributed in urban regions. Therefore, the establishment principles and theories of node-location model are also applicable to the research objects of this article.

Urban green space refers to the vegetation system that exists in the urban area in natural or artificial form, including trees and low shrubs. Urban green space is prone to regulate the urban ecosystem, protect the environment, and provide residents with a good place to relax. Therefore, the advantages of the green space system in the construction of sustainable urban development are constantly highlighted. This paper broadens the dimensions of the node-place model and incorporates the evaluation indicators of the green space system into the evaluation system (Table 1).

The place value, node value, and green value, are respectively, Z-transformed, and the processed result (x'_m , y'_m , and g'_m) represents the place value, node value, and green value of each basic region. Then, the three are used as three-dimensional coordinates to make a scatter plot, y , which can be denoted by equation (2). In the end, according to the division of balance, imbalance, dependence, and pressure, the location projected by the basic unit is judged as nine sustainable urban renewal modes. Each of these nine modes can be represented in a cube, as illustrated in Figure 2:

$$A_m = \Phi(x'_m, y'_m, g'_m), \quad (2)$$

where A_m denotes the coordinated development status of transportation, urban functions, and green space of region m , and x'_m , y'_m , and g'_m , respectively, denote the place value, node value, and green value of region m .

TABLE 1: Indicators in node-place-green model.

Description	Calculation of the indices
<i>Node index</i>	
Number of directions served by subway	y_1 = number of subway services offered at station
Daily frequency of services by subway	y_2 = number of subways departing from station on working day
Number of directions served by other public transport	y_3 = number of public transport services offered at station
Daily frequency of services by other public transport	y_4 = number of buses, trams, and underground trains departing from station on working day
Proximity to CBD	y_5 = travel time to the CBD
<i>Place index</i>	
Restaurant, entertainment, and hotel within 15 minutes' walking distance	x_1 = number of POIs within 15 minutes' walking distance in restaurant, entertainment, and hotel
Industry and distribution within 15 minutes' walking distance	x_2 = number of POIs within 15 minutes' walking distance in transport distribution centers and warehouses, private warehouses, gas stations, factories, and crafts
Commerce, finance, and real estate within 15 minutes' walking distance	x_3 = number of POIs within 15 minutes' walking distance in commercial corporations, banks, real estate agency, communication, newspaper, and broadcasting
Education, health, and culture within 15 minutes' walking distance	x_4 = number of POIs within 15 minutes' walking distance in hospitals, social insurance, social welfare, all kinds of schools, research institute, skill classroom, and government office
Administration and services within 15 minutes' walking distance	x_5 = number of POIs within 15 minutes' walking distance in travel agencies, amusement parks, gardens, public bathhouses, and temples
Land use mixture	
$x_6 = 1 - ((a-b)/d) - (a-c)/d/2$ $a = \max (x_1, x_2, x_3, x_4, x_5)$ $b = \min (x_1, x_2, x_3, x_4, x_5)$ $c = \text{mean} (x_1, x_2, x_3, x_4, x_5)$ $d = \sum x_1 + x_2 + x_3 + x_4 + x_5$	
<i>Green index</i>	
Low vegetation cover	g_1 = the ratio of low vegetation area to building area
Tree cover	g_2 = the ratio of tree area to building area

3. Results and Discussion

3.1. Place Value. First, the node-place-green model is utilized to calculate the place value of Harbin. The place value reflects the present status of public service facilities in urban functions. The larger the place value, the higher the completeness of urban functions in the region, which means living more conveniently. Deducing from the box plots (Figure 3), it can be stated that the place value of Harbin is mainly distributed between 0.05 and 0.38, and the median and mean value are lower than the node value and green value. In addition, it is demonstrated that there is a large gap in the place value in various regions of Harbin, and the overall development in urban function lags behind that of transportation and green space. The spatial distribution of Harbin place value is illustrated in Figure 4. On the whole, the Harbin place value presents a single-center structure. The place value gradually decreases with the old city as the center. Moreover, although individual residential regions in the outer urban regions have higher place value, the outer urban regions are generally lower than the old urban regions. In terms of central regions, regions with high place value are mainly concentrated in Nangang District and Daoli District, and they are distributed in multiple centers. The multicenter structure is consistent with the distribution of Harbin's main business districts. According to the distribution of the "three old" regions in Harbin, it can be stated that the urban functions in old southern Harbin are still relatively weak.

From the perspective of the spatial distribution of the place value, the urban renewal in the north, south, and west of the main urban area has potential.

3.2. Node Value. Second, the node value of Harbin is calculated. Node value reflects public transportation accessibility. The larger the node value, the more developed the public transportation, that is, the higher the regional accessibility. As shown in Figure 3, the Harbin node value is mainly distributed between 0.35 and 0.45, and the median and mean value are the highest of the three. More specifically, the development of public transportation in various regions of Harbin is relatively balanced, and the overall development level is higher than that of urban functions and green space. The spatial distribution of node value in Harbin is demonstrated in Figure 5. The node value is generally more scattered than the place value, showing one linear and multicenter structure. The node values in the southern part of the Songhua River are all higher than those in the northern part. In addition, the high value is more concentratedly distributed at the junction of the north and south urban regions. Deducing from the result, it can be stated that the urban transportation infrastructure construction focuses on the initial stage of strengthening the coordinated development of the northern and southern cities. In terms of the southern urban area, vertical transportation development is relatively mature and has excellent accessibility.

FIGURE 2: The node-place-green model and the nine sustainable urban renewal modes.

FIGURE 3: Box plots of the normalization of place, node, and green in Harbin.

From the perspective of node value, the northern parts of Harbin's main urban area have more significant potential for renewal.

3.3. Green Value. We use deep learning to identify the urban green space (low vegetation and trees) in Harbin. The ratio of vegetation to the region reveals and measures the environmental index. The larger the green value, the higher the green vegetation coverage in the region. As illustrated in Figure 3, most of the green value is distributed between 0.18 and 0.35, and the distribution is relatively concentrated. It shows that the gap in various regions of Harbin in green value is small, but the overall level is low. Harbin's green value is shown schematically in Figure 6. Opposed to the place value and node value, the green value distribution has no visible structural characteristics. Some regions on the edge of the city have high green value, and most of these regions are undeveloped farmland. The overall green value of the urban area is low, and there is no large-scale concentration. The green value in the old urban area with high place value and traffic value is generally low, mostly below 0.2, and this area has a high demand for greening.

3.4. Determination of Sustainable Urban Renewal Mode. As analyzed above, place value, node value, and green value, respectively, reveal the current status of urban construction in terms of urban function, transportation, and environment. These three comprehensively reflect the current situation of the city. For a comprehensive discussion on strategies for sustainable urban renewal, we performed a cluster analysis to identify the development status of the regions in Harbin. Based on the transformed place value, node value, and green value, nine unique clusters are interpreted in Table 2, and the corresponding structure is illustrated in Figure 7. The detailed analysis is as follows.

3.4.1. Mode 1: Ecological Restoration. Mode 1 comprises low place value, node value, and green value. That is, the region is relatively weak in transportation, urban functions, and the environment. 58% of regions in Harbin were identified in such a group.

This mode is named "ecological restoration" because these regions have a poor environment under low-intensity urban development. Except for the central area, such regions are widely distributed in Harbin's main urban area, which reveals the low overall development intensity and the lack of green space system. Due to geographical barriers, in the process of urban renewal, the development of the northern Songhua River has been lagging behind that of the southern part in the upgrading of transportation infrastructure or the improvement of urban public service facilities. Moreover, in the southern Songhua River, the development intensity of Qunli New District and residential quarters' density has gradually increased in recent years. Nevertheless, the result reveals the same problems exposed in the above two types of development states. Under the direction of sustainable renewal, regardless of the previous development status, the

FIGURE 4: Place value of the regions in Harbin.

region in this mode should focus on improving the green space system.

3.4.2. Mode 2: Enhancement to Node with Greenbelt. 9.1% of Harbin regions are identified with high place value and a low node value and green value. More specifically, the regions are relatively well developed in urban functions and weak in transportation and the environment.

Mode 2 is named “enhancement to node with greenbelt” because these regions have high-intensity urban functions but lack traffic accessibility and green space. These regions are concentrated in the old city of central Harbin. There are large-scale and high-density old buildings in these regions, with excellent urban historical and cultural characteristics. However, in the process of urban renewal, due to the obsolete road system and high building density, the development is still concentrated on the commercial development of existing buildings. This result reveals that the current development intensity of the area in terms of urban functions is tending towards perfection.

Consequently, it should focus on the redevelopment of public transportation and the recombination of green space and urban public space.

3.4.3. Mode 3: Enhancement to Place with Greenbelt. This mode comprises high node value and low place value and green value. Besides, the region is relatively well developed in urban transportation and weak in function and environment. The regions under this mode are identified to account for 9.2% of Harbin.

This mode is called “enhancement to place with greenbelt” because these regions have developed public transportation systems, but urban public service facilities and green space systems still need to be improved. Such regions are distributed in the central area and the south of Harbin. With the construction of the subway connecting the north and south of Harbin, the renewal of the area around the subway is gradually accelerating. As illustrated in Figure 7, with the development of two subway lines in the

FIGURE 5: Node value of the regions in Harbin.

central area, the accessibility of these regions has been well improved. Additionally, urban functions cannot meet the current traffic conditions. Moreover, in the construction of transportation infrastructure, it is rarely combined with green space. It reveals that, in the future sustainable urban renewal, the redevelopment of urban commercial and public service facilities should be appropriately increased, and urban traffic nodes should be combined with relevant green space for systematic construction.

3.4.4. Mode 4: Green Reinforcement. 6.5% of regions in Harbin were identified with high node value and place value and low green value. The regions under mode 4 are relatively well developed in urban functions and transportation and are relatively weak in the environment.

This mode is named “green reinforcement” because these regions have complete urban public service facilities and a developed public transportation system with fewer low vegetation and trees and weak green space systems. Such regions are distributed in parts of the old city and

commercial districts in the city center. The development of transportation and urban functions is relatively balanced, and the intensity is relatively high. However, the area and amount of green space are small. Except for parks, these regions have a small green area and low vegetation and tree coverage. This result reveals that the future renewal of the area should slow down the development of traffic and urban functions, focusing on the maintenance of existing green space and the expansion of public space.

3.4.5. Mode 5: Green Concerned Redevelopment. This mode incorporates low node value and space value and high green value. These regions are still in the infancy in urban functions and transportation, but the vegetation coverage rate is high. The regions under this mode are identified to account for 15.6% of Harbin.

This mode is named “green concerned redevelopment” because, compared with the development of transportation and urban functions, the vegetation coverage in this mode is higher, and the green environment is well. Such regions are

FIGURE 6: Green value of the regions in Harbin.

TABLE 2: Explanation for the sustainable urban renewal modes.

Sustainable urban renewal mode		Evaluation features		
		Place value	Node value	Green value
1	Ecological restoration	Low	Low	Low
2	Enhancement to node with greenbelt	High	Low	Low
3	Enhancement to place with greenbelt	Low	High	Low
4	Green reinforcement	High	High	Low
5	Green concerned redevelopment	Low	Low	High
6	Environmentally based enhancement to node	High	Low	High
7	Environmentally based enhancement to place	Low	High	High
8	Refined renewal	High	High	High
9	Problem-oriented renewal	Medium	Medium	Medium

scattered in various parts of Harbin, the outer area is large and concentrated, and the central area is small and scattered. Most of these regions distributed in the periphery of the urban area are undeveloped farmland. Additionally, most of these regions are urban green space. This reveals that the future renewal should focus on small-intensity redevelopment based on protecting the existing green environment.

3.4.6. Mode 6: Environmental-Based Enhancement to Node. 0.9% of the regions in Harbin are identified with high place value and green value and low node value. This indicates that the regions are well constructed in urban functions and green space, but the traffic accessibility is weak. This mode is named “environmentally based enhancement to node” because the urban functions and greening environment

FIGURE 7: Sustainable urban renewal modes of Harbin.

construction are coordinated and perfect. Nevertheless, transportation is relatively inconvenient. Such regions are scattered in the center of Harbin, corresponding to urban green spaces with little traffic. Moreover, they are adjacent to Harbin's commercial district and have a high potential for redevelopment. Therefore, future renewal should focus on increasing public transport connectivity while maintaining the existing environment.

3.4.7. Mode 7: Environmental-Based Enhancement to Place. Mode 7 comprises high node value and green value and low place value. These regions are identified to account for 0.2% of Harbin and are well constructed in urban traffic and greening with weak urban function. This mode is named “environmentally based enhancement to place” because the urban public transportation in these regions is highly

accessible and the green environment is good, but the urban functions are insufficient. Such regions are scattered in the city center, corresponding to several urban parks and parks with single functions. These regions are generally adjacent to “enhancement to place with greenbelt”; so future updates should be coordinated with the redevelopment of “enhancement to place with greenbelt” and endeavor to protect the existing environment.

3.4.8. Mode 8: Refined Renewal. Mode 8 contains high node value, place value, and green value. More specifically, the development of these areas has higher intensity and better perfection in terms of urban functions, transportation, and green space. These regions are identified to account for 0.17% of Harbin. This mode is called “refined renewal” because, in Harbin, these regions have concentrated and

complete development in the above three aspects. Such regions are scattered in central urban regions, and the renewal should focus on refinement and quality.

3.4.9. Mode 9: Problem-Oriented Renewal. 0.69% of regions in Harbin are identified with medium node value, place value, and green value. Additionally, the development of these regions is coordinated in terms of urban functions, transportation, and greening. Also, there is still a certain amount of development space. Given the relative balance in the above three aspects, the renewal of this type of the regions should focus on the current demands within the region, that is, to adjust the focus of development based on the problem to maintain the current equilibrium state.

In brief, based on the place value, node value, and green value, nine sustainable urban renewal modes are identified. These nine renewal modes are feasible to guide the redevelopment of Harbin in the future to a considerable extent. Moreover, the regions in modes 1–4 need to focus on the lack of green space. Modes 1–8 need to focus on the balance of urban functions and transportation in future construction.

4. Conclusions

The imbalance in urban resource allocation is inevitable and is mainly reflected when developing transportation infrastructure and the corresponding urban functional facilities during urban renewal. The refined evaluation indexes of urban green space incorporated into the node-place models are prone to widen the decision-making dimension of sustainable urban renewal mode. Moreover, combination of transportation, land use, and ecological construction could identify the development stage of sustainable urban renewal more scientifically. In this study, we use U-Net to identify the urban green space (low vegetation and trees) in Harbin. The ratio of vegetation to the region reveals and measures the environmental index of the corresponding region, which ensures the refinement of urban feature recognition. Secondly, we expanded the node-place model, using those green indicators as the third dimension to jointly measure the state of urban construction, which dynamically monitors the sustainable renewal status. Since then, we separately analyzed the development status of urban functions, transportation, and green space in Harbin. Finally, we identified the state of the urban construction in Harbin and proposed a future sustainable development model for transportation, urban function, and ecological construction. We find that there is a large gap in the place value in various regions of Harbin, and the overall development in urban function lags behind that of transportation and green space. Furthermore, regions in northern and southwest Harbin have potential for renewal. Based on the place value, node value, and green value, nine sustainable urban renewal modes are identified. Although three dimensions of urban development imbalance are introduced in this work, the proposed method still has limitations. This study does not incorporate population movement data as well as the scenario simulation. In future

research, we plan to explore a more comprehensive spatiotemporal analysis on the urban development imbalance. Such a study would provide more specific guidelines for sustainable urban renewal.

Data Availability

The data used to support the findings of this study are included within the article.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

Authors' Contributions

Rong Guo and Xiaoya Song contributed equally to this work.

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