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Evaluation Study on the Comprehensive Benefits of the "Three Olds" Renovation in Tianhe District of Guangzhou City

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Abstract

In order to study the innovative initiatives of the "Three Olds" transformation in the pilot areas in Guangdong Province, this paper attempts to take the evaluation of the benefits of the "Three Olds" transformation as a new paradigm, and firstly, to evaluate the comprehensive benefits of the "Three Olds" transformation in terms of indexes and indicators. This paper attempts to take the "three olds" transformation benefit evaluation as a new paradigm, firstly, analysing the content and structure of the "three olds" transformation comprehensive benefit evaluation index model, and at the same time, using the principal component analysis and hierarchical analysis, interpreting the mechanism of the urban "three olds" transformation comprehensive benefit evaluation, and providing a new benefit evaluation model for the government in the "three olds" transformation. It also explains the mechanism of comprehensive benefit evaluation of the "three olds" transformation and provides new reference suggestions for the government's benefit evaluation mode in the "three olds" transformation.

Keywords

"Three Olds" Transformation; Benefit; Evaluation Mode.

1. Introduction

The "Three Olds" renovation is a new approach to "old towns", "old factories" and "old villages" after a certain stage of urban development and under the requirement of intensive land development. In August 2009, the State Council determined that Guangdong Province would become a pilot area for the "three old" transformation of land saving and intensive use, and this paper presents a study of the "three old" transformation in Tianhe District of Guangzhou City, which is a pilot area for the "three old" transformation. This paper takes Tianhe District of Guangzhou City as an example of "three old" transformation, on the basis of the introduction of the transformation profile of Tianhe District, establishes a comprehensive benefit evaluation index system of the three old transformation, and dynamically analyses and evaluates the changes of the benefit indexes before and after the transformation, with a view to improving the development strategy of the three old transformations in Tianhe District, and to provide a methodology and reference to improve the evaluation of the comprehensive benefits of the three old transformations. As a national central city and provincial capital city, Guangzhou has an increasing number of national and provincial key projects located in Guangzhou, which need to occupy the scale of construction land in Guangzhou.

2. Methods and Procedures for the Comprehensive Benefit Evaluation of the "Three Olds" Transformation in Tianhe District, Guangzhou City.

The comprehensive benefit of "three olds" transformation refers to the social, economic, ecological and environmental benefits directly generated by unit land area in the process of land use within a certain period of time and area, in essence, it is the material outputs or effective results realised by the input and consumption of unit area of land in the social,

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economic, ecological and environmental aspects of regional development. Therefore, to evaluate the comprehensive benefits of the "three olds" transformation, we should design the index system around the three aspects of economy, society and ecology, establish a comprehensive evaluation model and carry out data processing and analysis. The specific process is as follows.

2.1. Selection of Methods for the Evaluation of the Comprehensive Benefits of Urban "Three Olds" Transformation

Hierarchical analysis and principal component analysis are commonly used quantitative processing methods in the evaluation of urban land intensive use and the evaluation of the benefits of agricultural land consolidation. In this paper, on the basis of relevant research results, we adopt the method of combining the two analyses to evaluate the comprehensive benefits of the "three olds" transformation.

Principal component analysis. Principal component analysis is to transform a given set of relevant variables into another set of irrelevant variables through linear transformation, and these new variables are arranged in order of decreasing variance. The total variance of the variables is kept constant in the mathematical transformation so that the first variable has the largest variance and is called the first principal component, and the second variable, which has the next largest variance and is uncorrelated with the first variable, is called the second principal component. By analogy, there are I principal components for I variables.

The analysis process involves four steps: standardising the raw data . Create an array of correlation coefficients between the variables R for the standardised array Z. Find the eigenvalues and eigenvectors of R. Analyse the principal components. The purpose of principal component analysis is to combine multiple indicators into several independent indicators that can fully reflect the information of the parent body through linear transformation, avoiding the problem of commonality between variables without losing the main information. However, principal component analysis is only a means of analysis, can not be regarded as the result of the study, should continue to be combined with other statistical methods in order to solve practical problems [1].

Hierarchical Analysis. Hierarchical analysis is a decision-making method that decomposes the elements that are always relevant to decision-making into levels of objectives, options, guidelines, etc., and then conducts qualitative and quantitative analyses. Hierarchical analysis method first decision-making problem according to the general objective, the sub-objectives of each level, evaluation criteria until the specific programme order decomposition into a number of hierarchical structure; by solving the judgement matrix eigenvectors approach, each level of each element of the previous level of a certain element of the priority weight; and then weighted calculation of the options on the total objective of the final weight, the final weight of the largest is the optimal programme. It can be divided into the following steps:

Establishment of the recursive hierarchy. Firstly, analyse the problem of decision-making, organize and hierarchize the hierarchical structure of the hierarchy. Find out the criteria affecting the achievement of the goal as the criterion level factors under the goal level, analyse in detail the interrelationships between the criterion factors, divide the criterion elements into different levels and groups, and there is a subordination relationship between the elements of different levels. Finally, to analyse what are the final solutions to achieve the decision-making goals, under the above criteria, which are placed in the lowest level of the recursive hierarchy as the measure level factors.

Constructing a judgement matrix and assigning values. Method of constructing the judgement matrix: each element with a downward subordination (called criterion) is the first element of the judgement matrix (in the upper left corner), and the elements subordinate to it are arranged

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in the first row and column after it. For the criterion of the judgement matrix, the degree of importance is assigned a value from 1 to 9.

2.2. Hierarchical Single Ordering (Calculation of Weight Vectors) and Tests

Calculate the weight vector For a consistent judgement matrix, each column is normalised to the corresponding weight. For non-consistent judgement matrix, each column is normalised to the corresponding weight.matrix, each column is normalised to approximate its corresponding weight, and the arithmetic mean of the n column vectors is taken as the final weight. In cascade sorting, the consistency test is performed on the judgement matrix. The steps of consistency test are as follows: the first step is to calculate the consistency index (CI). The second step, check the table to determine the corresponding average random consistency index R. I. (random index). In the third step, the consistency ratio CR (consistency ratio) is calculated and judged.

When CR<0. 1, it is considered that the consistency of the judgement matrix is acceptable, and when CR>0. 1, it is considered that the judgement matrix, does not meet the consistency requirements, and the judgement matrix needs to be recorrected.

2.3. Hierarchical Total Sorting and Testing

The total ranking is the relative weight of each factor of each judgement matrix against the target level (top level). This weight is calculated using a top-down approach, synthesised layer by layer. Similarly, a consistency test is required for the total ranking results.

2.4. Analysis of Results

Through the analysis of the sorting results, the final decision scheme is derived. In this paper, the evaluation method combining system analysis is adopted, and the hierarchical analysis method is also the most common analysis method in the study of intensive land use and the evaluation of agricultural land efficiency [2], which has already formed a set of relatively perfect research system. Although its evaluation method process has its subjectivity, but the idea can be learnt from, while the principal component analysis method is completely dependent on the evaluation of the actual data of the index is more objective. The combination of the two methods, you can avoid the shortcomings.

3. The Construction of Evaluation Index System for the Comprehensive Benefit of "Three Olds" Transformation

In view of the above understanding of the connotation of the comprehensive benefits of the "three olds" transformation, in accordance with the principles of wholeness, scientificity, hierarchy and feasibility, the evaluation index system reflecting the changes in the comprehensive benefits of the "three olds" transformation of Tianhe District is constructed from the three dimensions of economy, society and ecology. According to the content and purpose of the evaluation of the comprehensive benefits of the urban "three olds" transformation, combined with the principles of indicator selection established in the previous section, a system of indicators is selected to reflect the changes in the comprehensive benefits of the urban "three olds" transformation. After selecting the elements that have changed a lot in the process of land consolidation of the three old transformations of the city as the elements to be considered when selecting the comprehensive benefit evaluation indexes, and at the same time, extracting and referring to the research results on the evaluation of land consolidation at home and abroad [3], we have formulated the evaluation index system of the comprehensive benefit of the urban "three old" transformation.

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4. Comparative Analysis of the Benefits before and after the Transformation of the "Three Olds" in Tianhe District

According to the previous theoretical analysis of the "three old" transformation comprehensive benefit evaluation, research steps, as well as indicators and calculation methods, the collection of Tianhe District "three old" transformation before and after the comprehensive benefit of the relevant data and information, the use of principal component analysis, respectively, the calculation of the sub-systems Using principal component analysis, the benefit evaluation index of each subsystem is calculated separately. Considering the continuity and perfection of the available data, and taking into account the implementation of the "Three Olds" in Tianhe District, 2008 is chosen as the base year and 2011 as the comparison year. In the following, each benefit evaluation index is calculated and analysed.

4.1. Comparison of Economic Benefits

Obtaining higher economic benefits is the main driving force of the "Three Olds" transformation, and it is also the vitality of urban renewal development. Urban "three old" transformation through the urban land use in-depth potential, promote industrial renewal and upgrading, so that the city in the limited space to achieve continuous economic growth and urban development, can be measured by the comparative relationship between the urban area and the regional economic returns to the level of economic benefits. From the point of view of development in recent years, Tianhe District built-up area growth rate is significantly lower than the regional GDP growth rate, in 2011 Tianhe District per billion yuan of GDP land consumption (built-up land) 3.2 hectares compared with 4.4 hectares in 2008 decreased by 1.2 hectares, a decline of 27.27%; year-on-year average GDP and per capita GDP growth reached 46.46% and 15.72%; and In 2011, the total social fixed investment per unit of land increased by 132% compared with 2008, which can be initially judged that the economic benefits generated by the unit of land area have been improved.

According to the principal component analysis method, the factor score table of economic efficiency is extracted as shown in Table 1:

Table 1. Score table of factors of economic efficiency public factors

Item	1	2	3	4	5
J1	.204	-.894	-.421	-13.905	290.507
J2	.198	1.912	2.840	4.457	52.084
J3	.202	1.080	-4.086	-4.021	-69.401
J4	.204	-.912	1.511	-6.501	-338.844
J5	.204	-1.12	-.662	20.124	65.914

Based on the above analysis the composite factor scores for economic efficiency are F1=0.205, F2=0.199,F3=0.203, F4=0.205. F5= 0.205.

$$E = \sum_{i=1}^{5} F_i * P_i (i = 1,2,3,4,5)$$

Combined with Eq:Fi denotes the score of the composite factor F on the initial indicator Xi factor;.Pi denotes the growth rate of the initial indicator Xi value in 2011 compared to 2008.

Taking the growth rate of each economic benefit factor of Tianhe District in 2011 compared with that of each economic benefit factor in 2008 as the processed value after standardisation,

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and taking the score value of the comprehensive benefit factor on each indicator as the weight, the growth rate of the economic benefit of urban land consolidation in Tianhe District in 2011 compared with that of 2008 is calculated as.E=0.205*46.46%+0.199*15.72%+0.203*14.53%+ 0.200*53.78+0.205%*58.27%=38.57 per cent.

Through the analysis and calculation, we get that the economic benefit of Tianhe District of Guangzhou City in 2011 is 38.57% higher than that of 2008.

4.2. Comparison of Social Benefits

Firstly, according to the indicator system, the original data values of Tianhe District in recent years were collected to calculate the economic benefit indicators, and according to the correlation coefficient matrix of the indicator variables to judge whether there is a linear relationship between the original indicator variables.

The correlation coefficients of the five indicator variables are all relatively high, most of them are above 0. 8. It indicates that the variables show a strong linear relationship and can be analysed by the principal component method.

Then, according to the correlation coefficient matrix of the original indicator variables of economic efficiency, the principal component analysis is used to extract the common factors, and the eigenroots with the eigenroot value greater than 1 are selected, and their variance contribution ratio is calculated, which is used to determine the weight of each of its factor.

According to the calculation, the eigenroot of the first common factor is 4.371, which is 87.429% of the total variance of the original five indicator variables, and the eigenroot values of other common factors are relatively small, which do not have much influence on the analysis results, and therefore can be ignored. Because this new extracted common factor reflects the information of the original five indicator variables in a more comprehensive way, it can be called the economic efficiency composite factor, which is expressed by F. The score of its allocation on the original indicators is shown in Table 2.

Table 2. Score table of social benefit public factor

	S1	S2	S3	S4	S5
F	0.223	0.225	0.216	0.173	0.228

According to the above analysis, the social benefit composite factor scores are F1=0.223, F2=0.225, F3=0.216, F3,F4=0.173, F5=0.228 and substituted into the formula.

Take the growth rate of each economic benefit factor of Tianhe District in 2011 and each social benefit factor in 2008 as the processed value after standardisation, and take the score value of the comprehensive benefit factor on each index as the weight, calculate the growth rate of social benefit of Tianhe District's urban transformation in 2011 compared with 2008 as.

Through the analysis and calculation we get that the social benefit of Tianhe District of Guangzhou City in 2011 is 47.85% higher than that of 2008.

4.3. Comparison of Environmental Benefits

Enhancing the environmental benefits of urban construction, improving the natural ecology of the city, beautifying the landscape and livable living space is the purpose of the "Three Olds" urban transformation.

Firstly, four factors such as green space per capita, greening coverage rate, major air pollutants and urban spatial aesthetics are selected as the evaluation factors of the environmental benefit evaluation system.

Then, according to the index system to find or calculate the original as the original index data values as shown in Table 10, of which H4 urban spatial aesthetics index by the expert scoring

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and derived. Through the statistical software analysis, it is found that the four indicator variables of the selected environmental benefits do not show a linear relationship between them, which is not suitable for the principal component analysis method. Therefore, the hierarchical analysis method can be chosen to carry out the analysis of environmental benefit evaluation.

Thus, according to the weights of each indicator of ecological environmental benefits obtained from the previous analysis and the formula.

Wi indicates the weight value of indicator Xi.Pi indicates the growth rate of the initial indicator Xi value in 2011 compared with 2008; and C=0.1(13.33%)+0.2*9.78%-0.3*(-46.51%)+0.4* 30%=26.58.

Through the analysis and calculation, the environmental benefit of Tianhe District of Guangzhou City in 2011 is 26.58% higher than that of 2008.

5. Analysis and Evaluation of the Comprehensive Benefits of the "Three Olds" Transformation in Tianhe District

The comprehensive benefits of the "Three Olds" transformation in Tianhe District are analysed empirically in three subsystems, namely, economic, social and environmental, and the improvement of the comprehensive benefits is analysed from various aspects through comparison. According to the principle of combining the hierarchical analysis method and principal component analysis method of the comprehensive benefit evaluation method of urban transformation introduced in this paper, the conditions of use and applicable characteristics of the two analysis methods are fully considered. For each subsystem benefit evaluation weights, a comparison matrix is constructed with reference to the combination of previous research.

It is calculated that CR=0.048<0.1, which meets the consistency requirements of hierarchical analysis. The weight of economic benefits in the comprehensive benefit evaluation is 0.46, the weight of social benefits is 0.28, and the weight of ecological and environmental benefits is 0.26. The growth rate of the benefits of each system is multiplied by the weight of the benefits to obtain the comprehensive benefits of land use in Tianhe District, as shown in Table 14.

The results of the analysis show that the three old renovation in Tianhe District from 2008 to 2011 improved the comprehensive benefits of land, with the largest growth in social benefits, while the growth in economic benefits and environmental benefits was relatively small (Table 14). The trend of growth among the three major benefits is obvious, and the comprehensive benefits of the "three olds" have increased by 38.05 per cent in three years, with land intensification in Tianhe District greatly enhanced by the transformation project. The practice of Tianhe District's transformation has proved that carrying out urban "three olds" transformation activities can promote the intensive use of urban land and is an important means of improving the comprehensive benefits of urban land. The case of "three olds" transformation will become a model for urban renewal and improving the comprehensive use of urban land, and will be a useful practical exploration for other cities.

6. Conclusion

Before the transformation of the "three olds" in Tianhe District, the land use benefit has been increasing slowly; in the first year of the transformation, the comprehensive benefit and economic and social benefits have not changed significantly, and the ecological benefit has also decreased slightly, indicating that the effect of the transformation of the "three olds" on the comprehensive benefit of the city has not yet been reflected. This indicates that the effect of "three olds" transformation on the comprehensive benefits of the city has not been reflected.

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Through four years of "three olds" transformation, the comprehensive benefit of urban renewal has been significantly improved in general. 2011 compared with 2008, the comprehensive benefit index increased by 38.05%, and the economic benefit, social benefit and environmental benefit increased by 38.57%, 47.85% and 26.58% respectively. The increase in comprehensive benefits relies on the gradual improvement of per capita GDP, per capita disposable income of residents, the aesthetics of urban space and the continuous improvement of the ecological environment.

While the comprehensive benefits of the "Three Olds" transformation have been improved, there are also some problems. In the future transformation, it is still necessary to adjust the functional layout of the land, strengthen the urban infrastructure, improve the efficiency of land use to promote the transformation and upgrading of the industry, and improve the ecological environment and the level of sustainable development through urban greening.

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