Landscape Evaluation of Rural and Small Towns in Siming Mountain of Zhejiang Based on Landscape Performance

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Abstract. With the advancement of China's urbanization process, China's villages and small towns also begin to face a series of challenges such as ecological environment destruction, population outflow and aging. In order to better deal with these challenges, Zhejiang province issued the "Interim Measures for the Assessment and Acceptance of Environmental Comprehensive Improvement Actions in Small Towns in Zhejiang Province". The document provides detailed environmental assessments of villages and small towns, but lacks economic and social assessments. This study introduced the performance evaluation system of landscape, it focuses on the sustainable development of the thought and the advantage of quantitative evaluation system, combined with "Interim Measures for the Assessment and Acceptance of Environmental Comprehensive Improvement Actions in Small Towns in Zhejiang Province", to build a strong comprehensive evaluation index system. Then, the analytic hierarchy process (AHP) and fuzzy comprehensive evaluation method (FCE) are used to draw the conclusion. In this way, the direction of key construction in the next step of rural and small town development can be clarified to achieve better development of this region.

1 Background

In recent years, China's rapid urbanization has caused serious social and environmental problems in rural and small towns in China. At the same time, due to weak environmental protection awareness of rural and small town residents, insufficient government investment in environmental governance and insufficient supervision, the ecological environment of rural and small towns in China is deteriorating. In order to solve these problems, Zhejiang Province promulgated the "Interim Measures for the Assessment and Acceptance of Environmental Comprehensive Improvement Actions in Small Towns in Zhejiang Province" in 2018. Some of the content also applies to villages. It mainly evaluates the landscape and environment of villages and small towns, and the assessment is rich in content, which fits the actual construction situation of villages and small towns and has strong pertinence. [1] However, the evaluation indicators of this set of assessment methods are difficult to quantify, and there is a lack of evaluation on the economic and social levels.

The theory of Landscape Performance is based on three aspects: environment, economy and society. By quantifying the environmental, economic and social benefits of the completed landscape project (mainly referring to the urban park green space), the performance of the project can be clarified, so as to determine whether the design methods and strategies meet the design objectives and contribute to the sustainable development of the project. [2] This evaluation system not only meets the requirements of sustainable development, but also has a quantifiable calculation toolbox. However, some of the evaluation indicators are too micro, which do not fit well with the actual construction of rural and small towns in China.

2 Construction of index system

2.1 Selection of Indicators for “Interim Measures for the Assessment and Acceptance of Environmental Comprehensive Improvement Actions in Small Towns in Zhejiang Province”

The “ Interim Measures for the Assessment and Acceptance of Environmental Comprehensive Improvement Actions in Small Towns in Zhejiang Province” is dedicated to improving the landscape and environment of rural and small towns and improving the functions of towns. Its assessment and evaluation methods are mainly field research. This evaluation index has a strong pertinence to Siming mountain villages and small towns in eastern Zhejiang province.
Table 1. Evaluation Indicators of “Interim Measures for the Assessment and Acceptance of Environmental Comprehensive Improvement Actions in Small Towns in Zhejiang Province”

| First Level                      | Second Level                                      |
|---------------------------------|---------------------------------------------------|
| Environmental improvement       | Strengthen ground cleaning                        |
|                                 | Keep water clean                                  |
|                                 | Road occupied                                     |
|                                 | Unordered parking                                 |
|                                 | Freely placed by vendors                          |
|                                 | Demolition of illegal houses                      |
|                                 | Wire arrangement at random                        |
|                                 | Street elevation improvement                      |
|                                 | Promote the integration of renewable energy buildings |
| Improvement of town style       | Improve supporting facilities                     |
|                                 | Enhance landscape greening                        |
| Landscape enhancement           | Resident satisfaction                             |
| Extra points                    | Protection of historical and cultural blocks and historic buildings |
|                                 | Local characteristic residential renovation       |
|                                 |                                                   |

2.2 Selection of Landscape Performance Evaluation Index

Landscape Performance is an assessment of the operational status of completed projects, which in the United States are parklands. The current research results have covered 7 categories of assessment indicators: land, water, habitat, carbon, energy and air quality, materials and waste, economics and society. [2] The scope of this study is the rural areas and small towns of Siming Mountain in eastern Zhejiang. It has certain differences in scale and nature from the green space of American city parks. Therefore, some indicators of Landscape Performance need to be deleted.

Table 2. Landscape Performance Evaluation Index.

| First Level | Second Level | Third Level |
|-------------|--------------|-------------|
| Economic performance | Real estate value | Housing sales price |
|              | Construction cost savings | Save money by reusing materials |
|              | Job | Number of jobs created |
|              | Tourist consumption | Site rental fee |
|              | Economic Growth | Ticket income |
|              | Social performance | Parking revenue |
|              | Recreation and Social Value | Visitors |
|              | Cultural protection | Number of ancient trees |
|              | Healthy and quality life | type of activity |
|              | Landscape quality | Infrastructure quality |

2.3 Establishment of post-construction evaluation index based on Landscape Performance of Siming mountain village and small town in eastern Zhejiang province

According to the research and analysis of the two evaluation systems mentioned above, this evaluation system takes the first-level indicators in the Landscape Performance evaluation system: social performance, economic performance, and ecological performance as the overall framework, and combines some indicators of Evaluation Indicators of “Interim Measures for the Assessment and Acceptance of Environmental Comprehensive Improvement Actions in Small Towns in Zhejiang Province”. [3] The author establishes a post-evaluation system for rural and small town construction in Siming Mountain, eastern Zhejiang based on Landscape Performance.

Table 3. Post-construction Evaluation Index of Siming mountain village and small town in eastern Zhejiang based on Landscape Performance

| First Level | Second Level | Third Level |
|-------------|--------------|-------------|
| Economic performance | Real estate value | Housing sales price |
|              | House rental fee | |
|              | Job | Number of jobs created |
|              | Tourist consumption | Site rental fee |
|              | Economic Growth | Parking revenue |
|              | Social performance | Visitor satisfaction |
|              | Cultural protection | Number of ancient trees |
|              | Healthy and quality life | type of activity |
|              | Landscape quality | Satisfaction |
|              | Extra points | Protection of historical and cultural blocks and historic buildings |
|              | Ecological performance | Water quality |
|              | Infrastructure quality | |

| First Level | Second Level | Third Level |
|-------------|--------------|-------------|
| Traffic     | Traffic flow quality | |
|             | Walking system quality | |
|             | Quality of public transportation | |
|             | Material reuse | Recycled material as a percentage of total material |

| Environmental performance | Water | Water quality monitoring data |
|                          | Habitat | Green coverage |
|                          | air | PM2.5 reduction |

Table 3. Post-construction Evaluation Index of Siming mountain village and small town in eastern Zhejiang based on Landscape Performance
3 Research methods

At present, the commonly used systematic evaluation methods include fuzzy comprehensive evaluation method and analytic hierarchy process. Since the comments used in the post-construction evaluation are often vague, it is advisable to adopt a fuzzy comprehensive evaluation method. Using this evaluation method, the weight of each index has a decisive position, and the weight of fuzzy evaluation is usually given by experts based on experience, which is inevitably subjective. Analytic Hierarchy Process (AHP) is a method that combines quantitative and qualitative methods to express and process human subjective judgments in quantitative form. It can minimize the impact of personal subjective judgments and make the evaluation results more credible. [4]

In this study, two systematic evaluation methods were used to evaluate typical cases. The author attempts to further clarify the key direction of relevant cases in the future development through the evaluation results.

4 Case study: Fengcun

Fengcun is located in Siming Mountain, Yuyao, Zhejiang. It is 5 kilometers from Lanjiang Street and 10 kilometers from the urban area, covering an area of 7.5 square kilometers. The area of the hills in the village area is large, the water resources in the village are rich, and the vegetation is in good condition.

Fengcun compiled “the Village Planning of Fengcun (Zhu Feng Village) of Lanjiang Street in Yuyao City” and “the Village Design of Fengcun (Zhu Feng Village) of Lanjiang Street in Yuyao City” in 2017. The project covers an area of 7.5 square kilometers. It focuses on sorting out the road traffic in Fengcun and guiding the landscape of Fengcun.

Through field investigation and questionnaire distribution, the author made an evaluation and analysis on Fengcun by combining AHP and fuzzy comprehensive evaluation method, and reached the following conclusions (as shown in Table 4).

Since there is no real estate project development and construction in Fengcun, the index of real estate value is not applicable to the actual situation of construction in Fengcun. Therefore, this index is deleted.

5 Analysis and discussion

Through field investigation and data comparison, it can be found that in the evaluation of Fengcun Construction, the economic performance score was 10.615, the social performance score was 8.067, and the ecological performance score was 23.62. Ecological performance is better than economic performance, and economic performance is better than social performance. Therefore, in the future development of Fengcun, more attention should be paid to the construction of public transportation, public infrastructure, historical and cultural protection and utilization.

6 Conclusions

The evaluation system constructed in this study has strong regional specificity, and also combines the results of foreign research. The two evaluation systems at home and abroad complement each other and have a broader horizon. It is conducive to rural and small towns to supplement and improve the next stage of strategic research through the summary.

Secondly, although some data were obtained in this study, the evaluation of some indicators lacks dynamic tracking, which has a certain impact on the evaluation of the results.

Finally, the major difficulty of future research lies in the acquisition of large amounts of data and the processing of non-quantitative data.
| First Level | Second Level | Third Level | Implementati on effect | Weights | Classification | Score |
|-------------|--------------|-------------|------------------------|---------|----------------|-------|
| Economic performance | Job | Number of jobs created | The tertiary industry has developed, and the number of jobs has increased significantly | 0.27 | 1.00 | 4 | 10 | 4 | 2 | 1 | 6 | 16.0 | 0 | 10.15 |
| Tourist consumption | Site rental fee | Slight increase | 0.35 | 0.33 | 0.33 | 0 | 0 | 2 | 8 | 6 | 4 | 8 | 9.30 |
| | Visitors | The number of tourists has increased significantly | 0.33 | 0 | 0 | 0 | 0 | 3 | 11 | 3 | 3 | 1 | 4 |
| | Ticket income | Slight increase | 0.34 | 0 | 0 | 0 | 0 | 2 | 7 | 6 | 5 | 6 |
| Economic Growth | Parking revenue | Slight increase | 0.38 | 1.00 | 1.00 | 0 | 0 | 2 | 8 | 6 | 4 | 8 | 8.00 |
| Social performance | Relevant policy | Resident satisfaction | High satisfaction | 0.32 | 1.00 | 4 | 12 | 4 | 0 | 1 | 6 | 16.0 | 0 | 8.06 |
| Cultural | Number of ancient trees | Ancient trees are numerous and effectively protected | 0.33 | 0.25 | 0.25 | 0 | 0 | 8 | 8 | 4 | 2 | 4 | 8.25 |
| | Protection of historical and cultural blocks and historic buildings | There is no preservation of historic buildings | 0.25 | 0 | 0 | 0 | 0 | 2 | 12 | 6 | 2 | -2 |
| | Local characteristic residential renovation | There is no large-scale transformatio n and utilization of traditional dwellings | 0.25 | 0 | 0 | 0 | 0 | 2 | 12 | 6 | 3 | -2 |
| | Type of activity | Increase significantly | 0.25 | 0 | 0 | 0 | 0 | 3 | 9 | 6 | 2 | 1 | 3 |
| Traffic | Traffic flow quality | Slight increase | 0.35 | 0.34 | 0.34 | 0 | 0 | 3 | 15 | 2 | 1 | 0.64 |
| | Walking system quality | Slight increase | 0.32 | 0 | 0 | 0 | 0 | 5 | 12 | 3 | 2 |
| | Quality of public transportati on | Nothing much has changed | 0.34 | 0 | 0 | 0 | 0 | 2 | 15 | 3 | 1 | -1 |
| Ecological performance | Ecosystem | Water quality monitoring data | Nothing much has changed | 0.57 | 0.25 | 0.25 | 0 | 0 | 4 | 12 | 4 | 0 | 2 | 19.2 |
| | PM2.5 reduction | Nothing much has | 0.25 | 0 | 0 | 0 | 0 | 6 | 10 | 4 | 0 | 2 | 2 |
| Environmental Dimension                                                                 | Changed                          | 0.25 | 4    | 12   | 3    | 1    | 9 |
|----------------------------------------------------------------------------------------|---------------------------------|------|------|------|------|------|---|
| Recycled material as a percentage of total material                                     | Increase significantly           | 0.25 | 5    | 8    | 5    | 2    | 1 |
| Renewable energy efficiency                                                            | Increase significantly           | 0.25 | 0    | 0    | 6    | 5    | 29.4 |
| Landscape environment                                                                   | Green coverage                  | 0.43 | 0    | 6    | 8    | 5    | 1 |
|                                           | High satisfaction                | 0.27 | 0    | 5    | 9    | 4    | 2 |
|                                           | The effect of optimization is significant | 0.24 | 0    | 4    | 10   | 4    | 2 |
| Street environment                                                                      | The effect of optimization is significant | 0.24 | 0    | 4    | 10   | 4    | 2 |
| Community environment                                                                   | The effect of optimization is significant | 0.24 | 0    | 4    | 10   | 4    | 2 |

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