Study on the Comprehensive Assessment of High-Quality Development Performance of Low Carbon Tourism in China's Rizhao City Empowered by New Quality Productivity

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Abstract: With the rapid development of China's urban economy, the new quality productivity empowerment to promote the high-quality development of tourism in Rizhao City has become a new trend, and the vigorous development of tourism has gradually become a new growth point under the influence of a series of policies on low-carbon tourism in Shandong Province. In order to effectively assess the performance of new quality productivity empowerment to promote the high-quality development of low-carbon tourism in Rizhao City, this paper utilizes the basic data of Rizhao City, China, for the period of 2013-2022, and comprehensively assesses the status of the high-quality development performance of low-carbon tourism in Rizhao City by constructing the spatial ecological niche integrated assessment model, and it is found that: the performance of the high-quality development of low-carbon tourism in the city of Rizhao City, China, which is empowered by the new quality productivity, has shown a There are some differences in the assessment results of the three models, the absolute ecological niche suitability model has the largest assessment result, the relative ecological niche suitability model has the smallest assessment result, and the assessment result of the spatial ecological niche suitability model is located in between the assessment results of the other two models with the effect of equalization, and the assessment result of the spatial ecological niche suitability model shows that the high-quality development performance of the target city's low-carbon tourism The assessment result in 2013 is 0.7783, and the quality level of low-carbon tourism high-quality development performance is III, and the assessment result in 2022 rises to 0.8972, and the quality level of low-carbon tourism high-quality development performance is II, which has already reached the edge of I. In terms of the degree of influence of the evaluation indicators, the insufficient strength of new quality productivity empowerment in Rizhao City, China, affects the performance of low-carbon tourism high-quality development, and the second most influential of the other guideline level indicators on the assessment results is the weak effect category.

Keywords: high-quality development performance, tourism industry, performance assessment, new quality productivity empowerment, high-quality development enhancement paths

1. Introduction and Literature Review

Rizhao City, China, is a prefecture-level city in southeastern Shandong Province. The city is rich in tourism resources, the sea, mountains, and ancient forests. There are 100 kilometers of coastline, including 64 kilometers of rough sandy beaches, known as "China's uncontaminated gold coast of the coast" by experts (Li et al. 2021). Rizhao City, built within the Olympic Water Sports Park, Wulian Mountain, and Juxian Fulaishan, are well-known tourist attractions both at home and abroad. Known attractions are the River Mountain "Rizhao" giant book of the world's largest Chinese character cliff carvings, the world's largest ginkgo tree in the Fulaishan Mountain, the largest green tea base in the north of the Jiangbei River, the largest bamboo growing belt in the north of the Jiangbei River and the largest wild rhododendron growing belt in the north of the Jiangbei River (Guo et al. 2023). Rizhao City, Shandong Province, is a famous scenic spot of Longmen Culture. Rizhao City, Shandong Province, is the birthplace of the Longmen culture. The Yao Wangcheng site, Lingyanghe site, Dantu site, and Donghaiyu site in its territory are well-known historical monuments, among which the primitive pottery (the first level of Chinese writing) unearthed at the Lingyanghe site is more than 1,000 years older than the oracle bone inscriptions. Rizhao City's Ju culture is known as one of the three major cultures of Shandong, along with the Qi and Lu cultures. There are also the ruins of the Great Wall of Qi, the old city of Ju, a well-known relic, and the port of Rizhao as of 2023, the largest green tea base in the world (Pan et al. 2023). By the end of 2023, Rizhao Port will be the sixth-largest port in China in terms of cargo throughput and the tenth-largest in terms of container throughput. Rizhao is a well-known seaside tourist city at home and abroad, with Japan and South Korea to the east, Linyi to the west, Qingdao and Weifang to the north, and Lianyungang in Jiangsu Province to the south, and is an important member of the Shandong Peninsula City Cluster (Wang

et al. 2023). Rizhao City, two districts and two counties is located between longitude 118°25′~119°39′ East and latitude 35°04′~36°04′ North, with a temperate monsoon climate in the warm-temperate semi-moist monsoon zone, with a total area of 53,749.90 square kilometers, and 3,079,100 people as of the end of December 2023, with a GDP of 239.086 billion yuan (Ma et al. 2024). The geographic location and administrative map of Rizhao City are detailed in Figure 1.
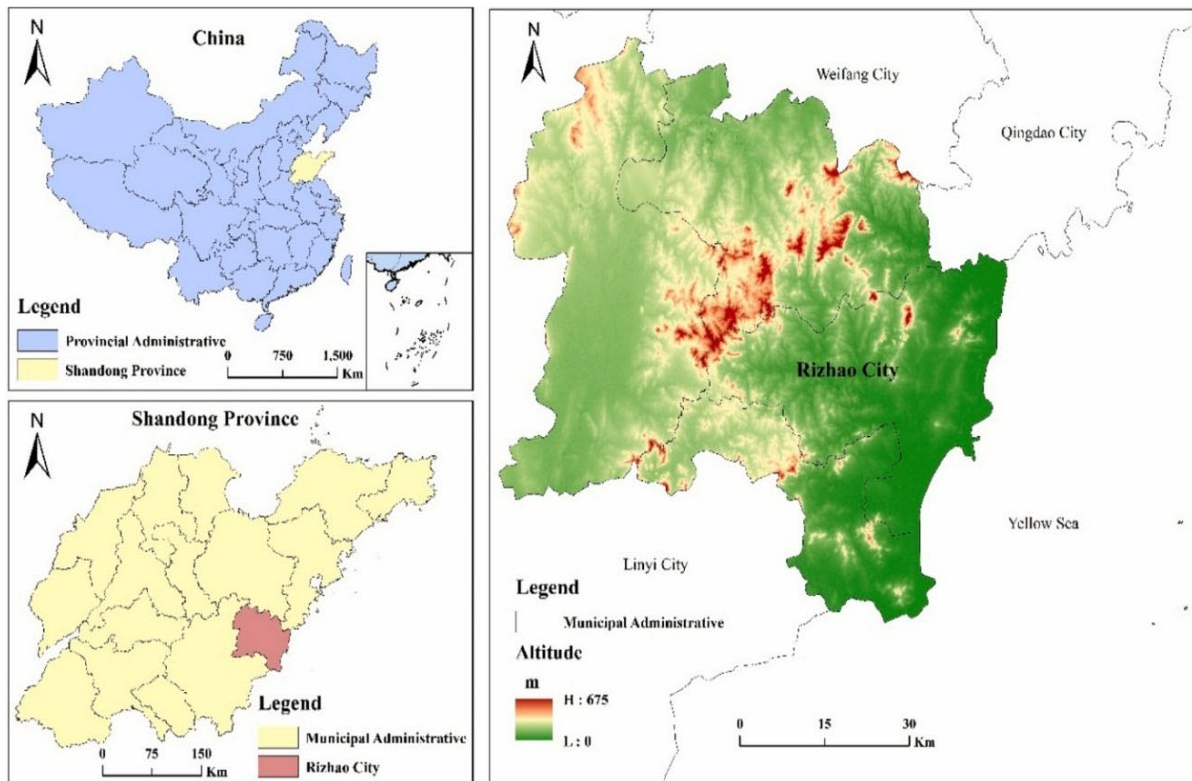

Fig. 1. Administrative Division Map of Rizhao City in China's Shandong Province

There is no 5A level scenic spot yet. There are 12 4A level scenic spots, 32 3A level scenic spots, and 11 2A-level scenic spots. Tourism business income in 2023 is 229 million yuan, an increase of 68.15% compared to 2022. There are 4,358 large and small mountains in Rizhao, seven unconnected mountain ranges in the south-central part of the country, and the eastern part of the country belongs to the Jiaodong hills. There are 39 of them above 500 meters above sea level (Li et al. 2021). To vigorously develop low-carbon tourism in Shandong Province and make full use of the existing tourism resources in Shandong Province, the People's Government of Shandong Province issued the Implementation Plan on Promoting the High-Quality Development of Rural Tourism (2023-2025) on March 26, 2023, and the Implementation Plan for the Action to Improve the Quality of Tourism Services in Shandong Province (2024-2026) on April 25, 2024. On August 2, 2024, the Action Program for Improving Modern Tourism System and Accelerating the Construction of a Strong Tourism Province (2024-2027) (from now on referred to as the Action Program) was issued. On August 4, 2024, the Department of Culture and Tourism of Shandong Province issued the Implementation Program on Further Revitalizing the Culture and Tourism Market, which began a new round of climax of tourism development in Shandong Province (Cui et al. 2022). In this case, making full use of the existing tourism resources in Rizhao City, Shandong Province, and vigorously developing the tourism industry in Rizhao City, Shandong Province is a powerful guarantee for realizing China's "double-carbon" goal. In September 2023, General Secretary Xi Jinping first put forward the concept of new quality productivity during his visit and research in Heilongjiang. In 2024, the National People's Congress wrote the concept of new quality production into the government's work report (Ma et al. 2024).

Academic research on urban low-carbon tourism started relatively late, in the early 1990s, when the United Nations adopted the United Nations Framework Convention on Climate Change (UNFCCC) on May 9, 1992, which was opened for signature during the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro, Brazil in June of the same year with the participation of heads of government of all countries in the world, and the Convention came into force on March 21, 1994 (Anonymous 2009), and with a total of 198 parties as of October 2023 according to the United Nations, the UNFCCC has become the official document for global low-carbon tourism. Along with the promulgation of the UNFCCC it has aroused

global research on low-carbon tourism and the construction of low-carbon tourist attractions, and low-carbon tourism has become a globally recognized requirement (Huang 2009, Weston & Mota 2012); analyzing the content of low-carbon tourism, scholars have focused on researching on the choice of ecological strategy of low-carbon tourism as well as low-carbon tourism-oriented to the future, focusing on the development of REAP tourism. focusing on the development and application research on REAP tourism (Ming et al. 2010, Whittlesea & Owen 2012). Influenced by the Paris Climate Change Agreement, scholars' research on low carbon tourism, while preventing the risk of climate policy, pays more attention to the future development of low carbon tourism, emphasizes the importance of low carbon tourism to economic development, and tries to promote the green development of the economy through the development of smoke-free industry (Liu 2014, Charlton & Paul 2014); along with the development of low-carbon tourism, scholars began to pay attention to environmental responsibility and its information sharing, began to pay attention to the greening of the environment and pay attention to the design of low-carbon products, and the globalized low-carbon tourism began to shift from the external form to the internal development of low-carbon tourism (Horng & Liaw 2017, Tang et al. 2018); along with the development of low-carbon tourism, the new trend of rural tourism has appeared in low-carbon tourism at home and abroad, global tourists began to like the rural idyllic life, and more and more tourists set their travel and leisure in the rural idyllic tourism, which began the new trend of global low-carbon tourism (Setyowati et al. 2019, Jiang 2019, Ojonugwa et al. 2020). On September 22, 2020, General Secretary Xi Jinping announced the "dual carbon" goal to the world at the 75th United Nations General Assembly, promising to achieve "peak carbon" by 2030 and "peak carbon" by 2060. This puts forward a new development goal for China's low-carbon tourism and sets the high-quality development of tourism as the core content of low-carbon tourism. The high-quality development of low-carbon tourism is comprehensive, including changes in factor structure, institutional environment, and all major aspects of the tourism economy. Although countries other than China have not mentioned high-quality development of tourism, many of them have been influenced by China's high-quality development of low-carbon tourism and have put forward quality requirements in terms of policies and institutions (Liu & Han 2020, Song et al. 2021). Low carbon tourism in all countries around the world recognizes that the key to low carbon tourism is to eliminate energy consumption, scholars in the European Union advocate energy innovation, and under the EKC hypothesis, they have studied the neutralizing effect of the EU5 on international tourism CO_2 emissions, and scholars in China have studied the impact of high-quality development of the manufacturing industry on low carbon production (Balsalobre-Lorente et al. 2021, Ma & Jiang 2022). With the development of low-carbon tourism, more and more people realize that the real low-carbon tourism is to realize carbon neutrality, and believe that carbon neutrality depends on technological innovation as well as low-carbon tourism under the low-carbon tourism model, the low-carbon tourism development model, as well as specific enhancement paths, have been explored (Ahmad et al. 2022, Yang et al. 2023). Due to the depletion of natural resources and the impact of global warming on the environment, the pressure of global environmental pollution governance is increasing. The gradual increase in the scale of global tourism has also increased the pressure on environmental pollution control, which further demands low-carbon tourism. This requires the tourism industry of low-income countries to gradually transform into a service-oriented economy with lower CO_2 intensity (Farrukh et al. 2023, Feng et al. 2024). With the gradual increase in CO_2 emissions from the tourism industry, the reputation of the environmental protection industry has been challenged. Although the development of the digital economy has brought opportunities for low-carbon tourism, the inverted "U" trend in environmental pollution governance has not formed. In fact, when the road density reaches the critical point of 0.361, it accelerates tourism carbon emissions, the growth of tourism, and also accelerates the rate at which tourism carbon emissions peak (Wang et al. 2024, Wang et al. 2024). With the increasing impact of climate change on the environment, exacerbating global warming, based on Malaysian data for the period 1990-2019, it is becoming increasingly difficult for the tourism industry to achieve carbon neutrality, which is mainly due to the role of carbon emissions from energy consumption, which is mainly due to the role of carbon emissions from energy consumption, and if the use of renewable energy sources instead of fossil energy, the difficulty of transitioning carbon emissions to carbon neutrality will be greatly reduced because renewable energy and carbon emissions show an inverse trend (Raihan 2024, Liang et al. 2024). New quality productivity is innovation plays a leading role, away from the traditional mode of economic growth productivity development path, with high-tech, high-efficiency, high-quality features, in line with the new development concept of advanced qualitative productivity, embodied in natural and social productivity. The ability of natural output value with nature as the main body is natural productivity (Shen et al. 2024, Dong 2024), and the ability of social output value with society as the main body is social productivity. According to China's CCTV Finance's Positive Point Finance report, the idea of constructing the New Quality Productivity Index is defined as a multidimensional framework of "one core and five wings" with high-quality economic development as the core and five wings: new economic impetus, scientific and

technological innovation, green and low-carbon, reform and opening up, and high-level talent, which means that China's New Quality Productivity Index is divided into the following categories: economic impetus index, scientific and technological innovation index, green and low-carbon index, green and low-carbon index, and high-quality talent index. Index, science and technology innovation index, green low-carbon development index, reform and opening up index, as well as high level of talent index five components, July 28, 2024, China's new quality productivity talent index release has been, by the Shenzhen Publishing Group under the Shenzhen Publishing House in conjunction with the People's University of China Institute of Advanced Studies in Social Sciences (Shenzhen) Talent Strategy and Governance Research Center, the People's University of China School of Labor and Personnel and the same road Hire Group to complete and release. Based on this idea, this paper identifies five new quality productivity indices in Rizhao City, Shandong Province, in combination with the economic development situation of Rizhao City, Shandong Province. In this context, it is particularly important and urgent to study the performance assessment of low-carbon tourism high-quality development in Chinese cities driven by new quality productivity.

From the results of the above literature analysis, it is obvious that along with the successive introduction of several low-carbon tourism policies in Shandong Province, the evaluation of the performance of the new quality productivity-enabled cities in the high-quality development of low-carbon tourism has become a strategic issue that needs to be solved urgently. This paper takes Rizhao City in Shandong Province as an example and draws on the construction framework of China's new quality productivity index, "one core and five wings", reported by CCTV's Positive Point Finance. By selecting five categories of 25 assessment indicators to construct the assessment index system, based on the actual situation of Rizhao City in China and the existing statistical indicators, and drawing on the mechanism of China's new quality productivity "one core and five wings", the five specific components of the new quality productivity of Rizhao City, Shandong Province, for the period of 2013-2022 are estimated based on a comprehensive analysis (Du et al. 2024). Based on new quality productivity empowerment, taking into full consideration the actual situation of new quality production and low carbon tourism in Rizhao City, Shandong Province, and drawing on the latest research results of low carbon tourism, we have constructed a comprehensive assessment model of the spatial "ecological location" of low carbon tourism and high-quality development in Rizhao City, Shandong Province, to assess the 2013-2022 development of Rizhao City, Shandong Province, in terms of the new quality productivity empowerment (Sun et al. 2024). A comprehensive assessment of productivity-enabled low-carbon tourism high-quality development performance in Rizhao City, Shandong Province, for the period 2013-2022 was conducted to explore in depth the status of productivity-enabled low-carbon tourism high-quality development performance in Rizhao City, Shandong Province, based on the specific assessment results, and to determine the extent to which the selected indicators of the main influencing factors support the performance of low-carbon tourism in Rizhao City, Shandong Province, based on the specific assessment results. Explore effective strategies to enhance the performance of low-carbon tourism high-quality development in Rizhao City, Shandong Province, empowered by new quality productivity.

2. Materials and Methods

2.1. Study area and data sources

On March 20, 2024, Prof. Meihua Zheng applied for the key project of the Social Science Fund of Rizhao Social Science Federation, and to successfully complete the research task of this project, she wrote the research paper on "Comprehensive Assessment of the Performance of Low-Carbon Tourism and High-Quality Development in Rizhao City by Empowering New Productivity" based on the research results of the phase-in period. Taking the high-quality development of low-carbon tourism in Rizhao City as a whole research object, the data period of 2013-2022 was selected with full consideration of the empowerment of new productivity. The starting point is 2013 because the Chinese government has only started to publish the Bulletin of Ecological and Environmental Conditions since 2012, and the stopping point is 2022 because the Chinese government's statistical yearbook for 2023 has not yet been published. The assessment data in this paper come from the Statistical Yearbook, Energy Statistical Yearbook, Urban Statistical Yearbook, and the Bulletin on the State of the Ecological Environment of the Chinese government, the Shandong provincial government, and Rizhao City, as well as five-year plans, annual plans, and circulars and bulletins issued by all levels of government.

2.2. The basic conceptual framework of this paper

The performance assessment of the high-quality development of low-carbon tourism empowered by the new quality productivity is an important topic that needs to be solved in the development of Chinese cities. The study of this topic is related to the status of the new quality productivity empowerment and the results of

the high-quality development of urban low-carbon tourism performance assessment. According to the results of the comprehensive analysis of this study, five categories of 25 indicators were selected: new quality productivity empowerment indicators, urban low-carbon tourism environment high-quality development indicators, urban low-carbon tourism resources high-quality development indicators, urban low-carbon tourism process high-quality development indicators, urban low-carbon tourism effect high-quality development indicators, and constructed a comprehensive assessment index system of Rizhao city's new quality productivity empowerment and high-quality development performance of low-carbon tourism. The assessment indicator system was constructed based on the technical processing of the assessment indicators, and a spatial ecological niche comprehensive assessment model was constructed to carry out a comprehensive assessment study on the high-quality development performance of low-carbon tourism empowered by new-quality productivity in Rizhao City, China. According to the above specific research ideas, the framework for constructing a high-quality development performance assessment of Rizhao City, China, empowered by new quality productivity, is shown in Figure 2.
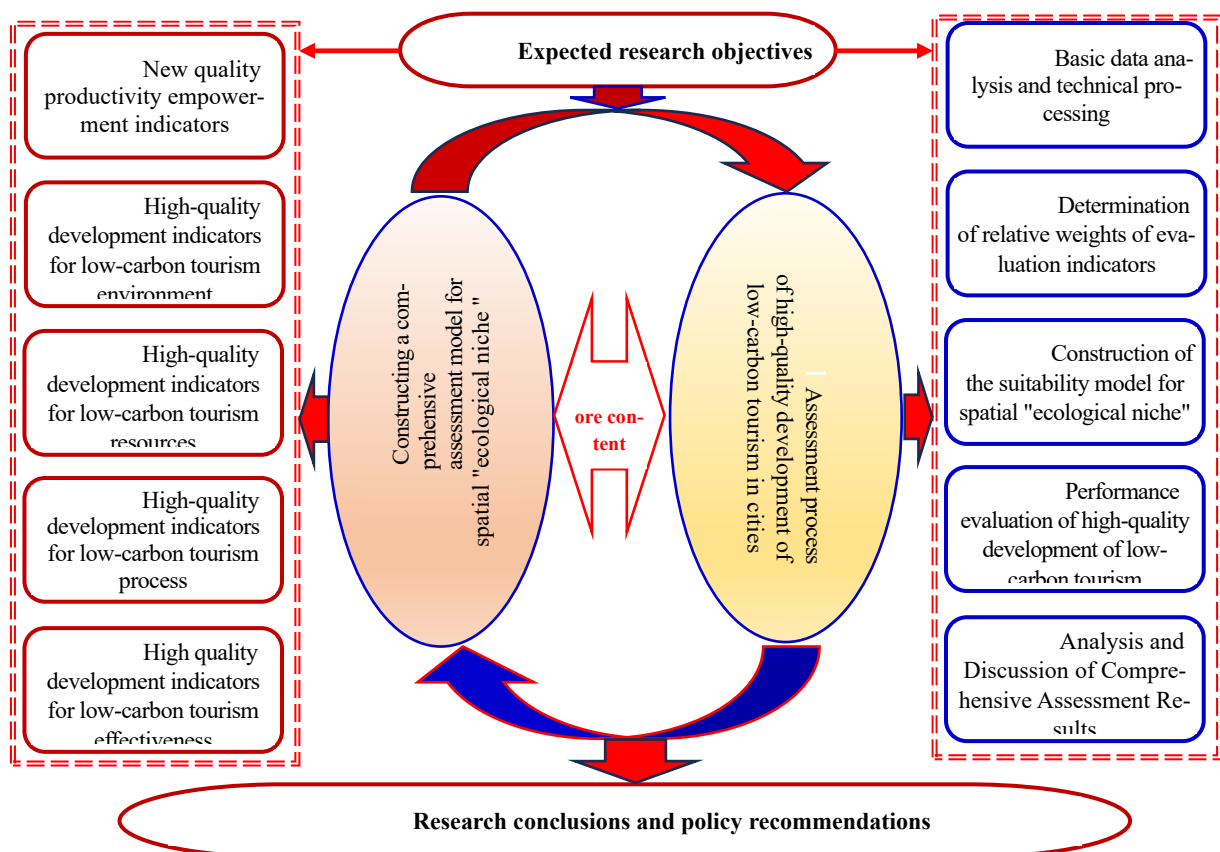

Fig. 2. The basic research idea framework of this paper

2.3. Construction of integrated assessment model for spatial ecological niche

2.3.1. Construction of a comprehensive assessment indicator system

According to the above literature review and research design, through the analysis of the performance status of high quality development of Rizhao City, China's green transformation empowered city, combined with the current situation of China's Rizhao City's green transformation and the current situation of high-quality development, the assessment index system was constructed by selecting five categories of 25 indicators, the specific guideline indicators include: new quality productivity-enabling indicators, indicators of high-quality development of the low-carbon tourism environment, indicators of high-quality development of the low carbon tourism resource The specific criteria indicators include: new quality productivity empowerment indicators, low-carbon tourism environment high-quality development indicators, low-carbon tourism resources high-quality development indicators, low-carbon tourism process high-quality development indicators and low-carbon tourism effect high-quality development indicators. The new quality productivity empowerment indicators are based on CCTV's multidimensional framework of "one core and five wings", and the five specific indicators of new quality productivity are identified as five specific aspects of the new economic momentum index,

science and technology innovation index, green and low-carbon development index, reform and opening up index, and high level of talent index. The construction mechanism of the new quality productivity development index, using the statistical data of Rizhao City, Shandong Province, to calculate the first four indices and the high-level talent index using the data in the "China's New Quality Productivity Talent Index Report" published by People's Daily Shenzhen on July 28, 2024. According to the needs of the subject research, this paper determines the composition, unit, and nature of the indicators of the basic data of the comprehensive assessment index of the performance of the high-quality development of low-carbon tourism in Rizhao City, China, empowered by the new quality productivity, followed by the relative weights of the comprehensive assessment indexes, and the status of the basic data of the specific assessment indexes is shown in detail in Table 1.

Table 1. Basic data on performance indicators for high-quality development of low-carbon tourism empowered by new quality productivity in Rizhao City

Goal	Standardized layer	Variant	Measure level (e.g. insurance against fraud)	Unit (of measure)	Nature of the indicator	Weight
Assessment of the High-Quality Development Performance of Rizhao' Green Transformation Empowering Cities in China	Indicators for the new quality productivity-enabling category (X_1)	X_{11}	New Economic Dynamics Index	%	Positive indicators	0.0428
		X_{12}	Science, Technology and Innovation Index	%	Positive indicators	0.0423
		X_{13}	Green and low-carbon development index	%	Positive indicators	0.0419
		X_{14}	Reform and Openness Index	%	Positive indicators	0.0391
		X_{15}	High-level talent index	%	Positive indicators	0.0414
	Indicators of high-quality development of urban low-carbon tourism environments (X_2)	X_{21}	Annual urban energy intensity	Tons/million	Contrarian indicator	0.0396
		X_{22}	Energy consumption per capita CO_2 Scale of emissions	Tons/person	Contrarian indicator	0.0386
		X_{23}	Annual urban air quality index	%	Contrarian indicator	0.0382
		X_{24}	Annual urban wastewater discharge management index	%	Contrarian indicator	0.0377
		X_{25}	Urban Ground Ecosystem Quality Index	%	Positive indicators	0.0409
	Indicators of high-quality development of low-carbon tourism resources in cities (X_3)	X_{31}	Attractiveness index of star-rated scenic spots to tourists	%	Positive indicators	0.0405
		X_{32}	Scenic Landscape Asset Quality Index	%	Positive indicators	0.0400
		X_{33}	Characterization index of low-carbon tourism resources	%	Positive indicators	0.0384
		X_{34}	Scenic Cultural Heritage Importance Index	%	Positive indicators	0.0380
		X_{35}	Tourism Services Condition Index	%	Positive indicators	0.0389
	Indicators of high-quality development of low-carbon tourism processes in cities (X_4)	X_{41}	Cityscape Building Character Index	%	Positive indicators	0.0373
		X_{42}	Urban Roads and Public Facilities Quality Index	%	Positive indicators	0.0393
		X_{43}	Quality Index of Public Facilities and Leisure Places	%	Positive indicators	0.0398
		X_{44}	Tourism Service Process Quality Index	%	Contrarian indicator	0.0407
		X_{45}	Degree of standardization of the tourism service process	Ingredient	Positive indicators	0.0412
	High-quality development indicators of the effects of low-carbon tourism in cities (X_5)	X_{51}	Share of urban green GDP	%	Positive indicators	0.0368
		X_{52}	Tourism revenue GDP share	%	Positive indicators	0.0416
		X_{53}	Greening coverage rate in urban areas	%	Neutral indicators	0.0403
		X_{54}	Realization status of emission reduction targets from EC	Ingredient	Positive indicators	0.0421
		X_{55}	Landscape index for the construction of urban scenic areas	%	Positive indicators	0.0426

EC: energy consumption

The system of evaluation indicators for the high-quality development performance of low-carbon tourism empowered by the city's new quality productivity in Table 1 reflects the status of the city's high-quality development performance of low-carbon tourism. Most of these evaluation indicators can be obtained from the government's statistics or calculations. Some of the indicators assigned to the categories are determined using the expert survey method to determine their quantitative values. To make the evaluation indicators comparable, all are normalized in the study. The basic method of normalization is to use the actual maximum value of each type of indicator or the maximum value of the industry divided by the quantitative value of each specific evaluation indicator and to make the results of the evaluation indicators have the characteristics of homogeneity, the maximum value of the industry or the maximum value of the standard is generally selected for the normalization. The minimum value of the evaluation indicators tries to select a 0 value, the maximum value selects the industry maximum value or the standard maximum value, and the standard value of the neutral indicators can be determined according to the actual situation or theoretical value.

2.3.2. Construction of a performance assessment model for the high-quality development of low-carbon tourism

To effectively assess the performance of low-carbon tourism development empowered by the new quality productivity of Chinese cities, this paper constructs an ecological niche suitability model for comprehensive assessment based on a comprehensive analysis and according to the nature and characteristics of the assessment object and its actual situation. Ecological niche, also known as "ecological niche", refers to the spatial position of different individuals or groups in their respective populations or communities in the original environment and their mutual functional relationship, reflecting the minimum threshold value of ecological environment required by each kind of organisms in the ecosystem for survival. The concept of ecological niche was first proposed and started to be used by Charles Elton, a British animal ecologist, in 1927, which was a term that reflected the interrelationships between animals in the natural world and eventually developed into an ecological professional concept with special significance. If we use x_i to represent the ecological factor and use X to represent the set of ecological factors, using the surface model is expressed as: $X = \{x_1, x_2, …, x_n\}$, if there are m regions, n ecological factors in m regions, there are m x n-dimensional ecological factor matrix, if EFM expresses this matrix, this m x n-dimensional ecological factor matrix can be expressed using the model as follows:

$$EFM = \begin{pmatrix} x_{11} & x_{12} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ x_{m1} & x_{m2} & \cdots & x_{mn} \end{pmatrix} \tag{1}$$

where: x_{ij} denotes the first i region, the first j quantitative value of the individual ecological factor. Using the t to calculate the ecological niche suitability, the time factor was introduced. To make the ecological factors comparable, the ecological factors in the matrix were normalized in the t. To make the ecological factors comparable, the ecological factors in the matrix were normalized at the time, and the result of the processing was expressed using x'_{ij}, in the matrix of ecological factors after normalization, there existed $minx'_{ij}$ denotes the first and second ecological factors in the i. The minimum value of the ecological factor in the region j, and $minx'_{ij}$ denotes the minimum value of the ecological factor in the region i maximum value of the j ecological factor in the region, n is the number of ecological niche factors, n is the ecological niche suitability, and n is the number of ecological niche factors. S_t is the ecological niche suitability, then there are:

$$S_t = \frac{1}{n} \sum_{i=1}^{n} \frac{\delta_{min} + \gamma \delta_{max}}{\delta_{it} + \gamma \delta_{max}} \tag{2}$$

In the above equation:
$\delta_{it} = |x'_{it}(t) - x'_{it}(\alpha)|$,
$\delta_{max} = \max\{\delta_{it}\} = \max\{|x'_{it}(t) - x'_{it}(\alpha)|\}$,
$\delta_{min} = \min\{\delta_{it}\} = \min\{|x'_{it}(t) - x'_{it}(\alpha)|\}$,
$i = 1,2,…,m$,
$t = 1,2,…,m$.

Thus, the above equation can be expressed as follows:

$$S_t = \frac{1}{n}\sum\nolimits_{i=1}^{n} \frac{min\left\{\left|x_i'(t)-x_i'(\alpha)\right|\right\} + max\, \gamma\left\{\left|x_i'(t)-x_i'(\alpha)\right|\right\}}{\left|x_i'(t)-x_i'(\alpha)\right| + max\, \gamma\left\{\left|x_i'(t)-x_i'(\alpha)\right|\right\}} \qquad (3)$$

Were $x'i(\alpha)$ is the first i ecological factor optimum value after normalization in the region, which has transformed the inverse assessment indicators into positive assessment indicators after normalization; $max x'i(t)$ is the maximum value of ecological factors in period t after normalization; γ is the suitability model parameter ($0\leq\gamma\leq1$), model (3) is often referred to as the traditional ecological niche suitability model. Here, the ecological factor suitability model is the basis for constructing the relative ecological niche suitability model and the relative ecological niche suitability model. Finally, the spatial ecological niche suitability model is constructed by using the weighted average of these two models. Suppose the performance assessment indicators of low-carbon tourism high-quality development empowered by the new quality productivity of Chinese cities are regarded as ecological factors. In that case, the time series of the ecological factors are expressed as $X = \{X_{i1}, X_{i2},\ldots, X_{it}\}$. To enhance the stability of the ecological factor, the buffer operator Θ is introduced, and the first-order weakening buffer is calculated to fix the ecological factor and the results after fixing are obtained as follows:

$$X_t\theta = \left(X_{1t}, X_{2t},\cdots, X_{mt}\right)\cdot\theta = \frac{1}{n-t+1}\left(X_{1t}, X_{2t},\cdots, X_{mt}\right) \qquad (4)$$

As the choice of buffer operator directly affects or determines the result after the homogenization, the actual process of homogenization can also be used to assess the index of homogenization by the method of moving average, if MX_t^1 is used to indicate the value of the index after 1 time of homogenization, then there is:

$$MX_t^1 = \sum\nolimits_{i=t-k+1}^{n}\left(X_{it}/k\right) \qquad \left(t\geq k\right) \qquad (5)$$

Based on one trimming, if k denotes the number of shifted data when $t\geq k$ is used, the second-order weakening buffer factor is denoted by Θ^2, and the second-order weakening buffer sequence trimming results of the evaluation metrics are obtained as follows by using the same method as above:

$$X_t\theta^2 = \left(X_{1t}, X_{2t},\cdots, X_{mt}\right)\cdot\theta^2 = \frac{1}{n-i+1}\left(X_{it}\theta + X_{i+1t}\theta + \cdots + X_{mt}\theta\right) \qquad (6)$$

In order to reduce the volatility of the fixing indicator, the second moving average method can also be used for the second fixing of the ecological factor, if MX_t^1 is used to indicate the value of the indicator after 2 fixing, and k is the number of indicators selected for certain averaging, then the second moving average can be expressed as follows:

$$MX_t^2 = \sum\nolimits_{i=t-k+1}^{n}\left(MX_t^1/k\right) \qquad \left(t\geq k\right) \qquad (7)$$

After two buffer smoothings, the assessment indicators have become relatively smooth and ready to calculate spatial ecological niche suitability. After the assessment indicators have been buffered and smoothed twice, to make different assessment indicators comparable, it is also necessary to normalize the assessment indicators after two buffer smoothing treatments, and the specific results of the treatment are shown in the following formula:

$$\begin{cases} X'_{it} = \theta^2 X_{it}\cdot\left(\theta^2 \max x_{it}\right)^{-1} & \text{Forward indicators} \\ X'_{it} = 1-\theta^2 X_{it}\cdot\left(\theta^2 \max x_{it}\right)^{-1} & \text{Contrary Indicators} \end{cases} \qquad (8)$$

Where X'_{it} is the first i factor, the first t year of the dimensionless treatment, and $max X_{it}\Theta^2$ is the second-order weakened buffer treatment for year t year after the second-order weakening buffer treatment i is the maximum value of the factor, $\Theta = (m - i + 1)^{-1}$ is the weakening buffer factor when the optimal value of the evaluation index is $X_{i\alpha}$ when the optimal value of the assessment indicator is $X'_{i\alpha}$ is the maximum value of the i. The optimal value of the dimensionless result of the assessment index. The following formula is the normalization formula for the optimal value of the index:

$$\begin{cases} X'_{i\alpha} = \theta^2\, X_{i\alpha} \cdot \left(\theta^2 \max x_{i\alpha}\right)^{-1} & \text{Forward indicators} \\ X'_{i\alpha} = 1 - \theta^2\, X_{i\alpha} \cdot \left(\theta^2 \max x_{i\alpha}\right)^{-1} & \text{Contrary Indicators} \end{cases} \tag{9}$$

(1) Construction of the absolute ecological niche suitability assessment model. After the dimensionless processing, the assessment indexes not only have a comparable nature but also can transform all the reverse assessment indexes into positive indexes so that the nature of the assessment indexes has the same direction and can be compared in terms of size. After normalization, the assessment indicators can be assessed for ecological suitability, and to construct the absolute ecological suitability comprehensive assessment model, it is necessary first to carry out absolute zero-imaging processing, zero-imaging processing is also known as "null conversion", that is, after the absolute conversion, the first row of the indexes of the indexes being processed are all converted to zero. The specific formula for calculating the absolute null conversion is as follows:

$$\begin{cases} X'_{it}(0) = X'_{it} - X'_{1t} \\ X'_{i\alpha}(0) == X'_{i\alpha} - X'_{1\alpha} \end{cases} \tag{10}$$

The absolute null conversion method refers to converting the difference after subtracting the value of the first line of assessment indicators from each line of the matrix of assessment indicators. Since the remaining difference after the first line is subtracted from the first line is zero, it is called the method of absolute null conversion. If we use $AS_{t\alpha}$ to represent the absolute ecological niche assessment value, the absolute ecological niche assessment model determined by the result of absolute null conversion is expressed as follows:

$$AS_{t\alpha} = \frac{1 + |S_\alpha| + |S_t|}{1 + |S_\alpha| + |S_t| + |S_\alpha - S_t|} \tag{11}$$

When the evaluation index is a continuous function, the integral can solve the area enclosed by the continuous function. If the integral is negative or to take the absolute value, the components in the above formula can be expressed as follows: $S_t = \int_1^m \left(X'_{it}(0) - X'_{i1}(0)\right) dt$, $S_\alpha = \int_1^m \left(X'_{i\alpha}(0) - X'_{i1}(0)\right) dt$, $S_\alpha - S_t = \int_1^m \left(X'_{i\alpha}(0) - X'_{it}(0)\right) dt$. When the assessment indicators are discrete variables, the components in formula (10), using the following formula:

$$\begin{cases} |S_t| = \left| \sum_{i=2}^{m-1} X'_{it}(0) + 0.5 X'_{mt}(0) \right| \\ |S_\alpha| = \left| \sum_{i=2}^{m-1} X'_{i\alpha}(0) + 0.5 X'_{m\alpha}(0) \right| \\ |S_t - S_\alpha| = \left| \sum_{i=2}^{n-1} \left(X'_{i\alpha}(0) - X'_{it}(0)\right) + 0.5\left(X'_{m\alpha}(0) - X'_{mt}(0)\right) \right| \end{cases} \tag{12}$$

(2) Construction of relative suitability assessment model. To construct a comprehensive assessment model of relative ecological niche suitability, using the same method, the relative null conversion calculation method is first used to calculate the relative null conversion value of the assessment indicators, and the specific null conversion formula is as follows:

$$\begin{cases} X''_{it}(0) = \left(X''_{mt}\right)/\left(X''_{1t}\right) - 1 \\ X''_{i\alpha}(0) = \left(X''_{m\alpha}\right)/\left(X''_{1\alpha}\right) - 1 \end{cases} \tag{13}$$

The relative null transformed value is the difference between each row of the matrix of assessment indicators compared to the value of the assessment indicator in the first row minus one. Since the values of the indicators in the first row are converted to zero by relative null conversion, they are called "relative null conversion" or "relative null conversion". If we use $RS_{t\alpha}$ to represent the relative ecological niche assessment value, when the assessment indicator is a discrete variable, then there are:

$$RS_{t\alpha} = \frac{1 + |S'_\alpha| + |S'_t|}{1 + |S'_\alpha| + |S'_t| + |S'_\alpha - S'_t|} \tag{14}$$

When the assessment indicator is a continuous function, the integral can solve the area enclosed by the continuous function. If the requested integral is negative, the calculation results will be offset, so it is necessary to take the absolute value of the components in the above formula is calculated as follows:

$$S'_\alpha = \int_I^m \left(X''_{i\alpha}(0) - X''_{i1}(0) \right) dt \quad S'_\alpha = \int_I^m \left(X''_{i\alpha}(0) - X''_{i1}(0) \right) dt \quad S'_\alpha - S'_i = \int_I^m \left(X''_{i\alpha}(0) - X''_{it}(0) \right) dt$$

When the assessment indicators are discrete variables, the components in formula (12), are calculated using the following formula:

$$\begin{cases} \left| S'_t \right| = \left| \sum_{i=2}^{m-1} X''_{it}(0) + 0.5 X''_{mt}(0) \right| \\[2mm] \left| S'_\alpha \right| = \left| \sum_{i=2}^{m-1} X''_{k\alpha}(0) + 0.5 X''_{m\alpha}(0) \right| \\[2mm] \left| S'_t - S'_\alpha \right| = \left| \sum_{i=2}^{n-1} \left(X''_{i\alpha}(0) - X''_{it}(0) \right) + 0.5 \left(X''_{m\alpha}(0) - X''_{it}(0) \right) \right| \end{cases} \tag{15}$$

Equation (14) is this paper's relative ecological niche suitability model. If we use $SS_{t\alpha}$ to denote the spatial ecological niche suitability model and ξ represents the absolute ecological niche suitability weight, (1-) is the relative suitability weight, the spatial "ecological niche" suitability can be expressed as follows ξ are the relative suitability weights, the spatial "ecological niche" suitability can be expressed as:

$$SS_{t\alpha} = \xi AS_{t\alpha} + (1 - \xi) RS_{t\alpha} \tag{16}$$

2.3.3. Criteria for assessing the performance of cities in terms of high-quality development of low-carbon tourism

Comprehensive assessment of the performance of low-carbon tourism high-quality development empowered by new quality productivity in Rizhao City, China, requires the identification of assessment objectives and specific assessment criteria for assessment indicators. This paper develops assessment standards at the level of assessment indicators and assessment objectives regarding the environmental quality standards set by regulations and the research results of scholars at home and abroad. China has not yet formulated specific assessment standards for the high-quality development of low-carbon tourism. Still, it has already formulated standards for the management of atmospheric environmental pollution, the management of water pollution, and the quality standards for soil pollution, and it is currently considering the formulation of standards for the New Quality Productivity Index, standards for the Urban High-Quality Development Index, and standards for the management of the environment, among others. To fulfill the specific research tasks of this paper, we refer to the various existing standards set by the state and draw on the research results of Chinese scholars as well as those of scholars from countries outside of China, to determine two levels of standards for the performance assessment and evaluation of urban low-carbon tourism high-quality development empowered by the new quality productivity of Chinese cities.

(1) Criteria determination of assessment indicators. According to the research design above, this paper selects five categories with a total of 25 assessment indicators, and to realize an effective assessment of the performance of high-quality development of low-carbon tourism empowered by the new quality productivity of Chinese cities, it determines the specific five-level assessment criteria for the 25 assessment indicators as shown in Table 2.

Table 2. Specific criteria for performance assessment indicators for the high-quality development of low-carbon tourism in cities

Indicator name	Class I	Class II	Class III	Class IV	Class V
X_{11}	0.9-1.0	0.8-0.9	0.65-0.8	0.5-0.65	0-0.5
X_{12}	0.9-1.0	0.8-0.9	0.65-0.8	0.5-0.65	0-0.5
X_{13}	0.9-1.0	0.8-0.9	0.65-0.8	0.5-0.65	0-0.5
X_{14}	0.9-1.0	0.8-0.9	0.65-0.8	0.5-0.65	0-0.5
X_{15}	0.9-1.0	0.8-0.9	0.65-0.80	0.5-0.65	0-0.5
X_{21}	0.50<	0.50-0.70	0.70-0.90	0.90-1.20	>1.20
X_{22}	<5	5-7	7-9	9-12	>12
X_{23}	0-50	50-70	70-150	150-300	>300
X_{24}	0-50	50-70	70-150	150-300	>300
X_{25}	0-50	50-70	70-150	150-300	>300
X_{31}	90-100	80-90	70-80	60-70	<60
X_{32}	90-100	80-90	70-80	60-70	<60
X_{33}	90-100	80-90	70-80	60-70	<60
X_{34}	90-100	80-90	70-80	60-70	<60

Table 2. cont.

Indicator name	Class I	Class II	Class III	Class IV	Class V
X_{35}	90-100	80-90	70-80	60-70	<60
X_{41}	90-100	80-90	70-80	60-70	<60
X_{42}	90-100	80-90	70-80	60-70	<60
X_{43}	90-100	80-90	70-80	60-70	<60
X_{44}	90-100	80-90	70-80	60-70	<60
X_{45}	90-100	80-90	70-80	60-70	<60
X_{51}	80-100	60-80	40-60	20-40	0-20
X_{52}	>10	8-10	6-8	4-6	0-4
X_{53}	60-65	65-70	70-80	80-90	90-100
	55-60	50-55	40-50	30-40	0-30
X_{54}	90-100	80-90	70-80	60-70	<60
X_{55}	90-100	80-90	70-80	60-70	<60

Source: Based on statistical data provided by the National Bureau of Statistics, Shandong Provincial Bureau of Statistics, and Rizhao Municipal Bureau of Statistics.

(2) Specific assessment criteria at the objective level. The assessment goal of this paper is to realize an effective assessment of the performance of the high-quality development of low-carbon tourism empowered by new quality productivity. Based on the relevant regulations, policies and systems formulated by the Chinese government, provincial and municipal people's governments as well as cities, and drawing on the research results of experts and scholars at home and abroad, the assessment criteria for the high-quality development performance of low-carbon tourism empowered by new qualitative productivity in Rizhao City, China, are divided into five levels: excellent, good, moderate, qualified and unqualified, and the spatial "ecological niche" is used to determine its specific effects using a moderate comprehensive assessment model. Using the spatial "ecological location" to determine the specific effects of the moderate comprehensive assessment model, the five assessment results of the new quality productivity-enabled low-carbon tourism high-quality development performance assessment criteria are shown in Table 3.

Table 3. Performance assessment criteria for high-quality urban development in Rizhao, China

Rating level	Class I	Class II	Class III	Class IV	Class V
Results$_i$	[0.90-1.00]	[0.80-0.90]	[0.65-0.80)	[0.50-0.65)	[0.00-0.50)
Performance status	talented	favorable	moderate	pass a test	fail

The performance assessment criteria for the high-quality development of low-carbon tourism empowered by the new quality productivity specifically include three aspects: assessment results, assessment level, and quality status, which are determined based on the standards of China's New Quality Productivity Development Index, the requirements of the performance assessment for the high-quality development of low-carbon tourism in Shandong Province, and by referring to the latest research results from both at home and abroad.

3. Results and Discussion

3.1. The comprehensive assessment results of the city's performance in high-quality development of low-carbon tourism

To effectively assess the high-quality development performance of low-carbon tourism in Rizhao City, China, empowered by the new quality productivity, based on the calculation of the above indicators and the statistical data provided by the government, and according to the multidimensional framework constructed by the New Quality Productivity Development Index as well as the requirements for the comprehensive assessment of the performance of high-quality development of low-carbon tourism in Rizhao City, China, the information based on the 25 assessment indicators for the period of 2013-2022 was organized and included in Table 4.

Table 4. Statistical table of basic data for performance assessment of new quality productivity enabling high-quality development of tourism in Rizhao City

Standardized layer	Indicator layer	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Indicators for the new quality productivity-enabling category (X_1)	X_{11}	0.2017	0.2105	0.2186	0.3061	0.3128	0.3791	0.4172	0.5103	0.6182	0.6871
	X_{12}	0.2106	0.2178	0.2072	0.2092	0.3168	0.3863	0.4194	0.5183	0.6195	0.6904
	X_{13}	0.3052	0.3128	0.3206	0.3861	0.4127	0.4186	0.4941	0.5195	0.6251	0.7016
	X_{14}	0.1627	0.1683	0.1728	0.1783	0.1827	0.1905	0.1984	0.2081	0.2182	0.2251
	X_{15}	0.3562	0.3672	0.3761	0.3971	0.4105	0.4547	0.6127	0.6827	0.7027	0.7242
Indicators of high-quality development of low-carbon tourism environments (X_2)	X_{21}	0.8725	0.8436	0.8304	0.8127	0.8025	0.7962	0.7852	0.7426	0.7216	0.6961
	X_{22}	7.7825	7.8942	8.1626	8.3617	8.5615	8.6527	8.7841	8.8951	9.0163	9.3017
	X_{23}	127.32	121.42	115.37	104.26	94.38	91.23	87.51	85.26	82.18	79.52
	X_{24}	126.82	119.37	112.26	108.52	101.63	96.38	88.36	85.27	81.34	76.36
	X_{25}	133.18	131.68	121.46	116.53	98.46	91.45	87.46	84.56	81.57	78.46
Indicators of high-quality development of low-carbon tourism resources (X_3)	X_{31}	82.07	82.82	83.06	83.78	84.21	84.87	85.72	86.48	87.85	89.71
	X_{32}	86.18	88.15	88.78	89.27	90.07	90.73	91.27	91.79	92.05	92.54
	X_{33}	85.28	86.57	86.75	86.89	87.31	88.15	89.21	89.87	90.16	90.56
	X_{34}	82.46	83.46	84.51	85.26	85.72	86.16	86.72	87.21	87.82	88.05
	X_{35}	80.82	81.21	81.52	81.82	82.05	82.21	82.74	83.17	83.83	84.32
Indicators of high-quality development of low-carbon tourism processes (X_4)	X_{41}	72.42	74.36	76.36	78.36	79.37	80.46	82.43	83.86	84.15	85.87
	X_{42}	73.26	74.36	75.38	76.85	77.07	78.68	79.35	80.82	81.27	82.82
	X_{43}	85.25	84.57	85.83	86.38	87.27	88.24	89.37	90.17	91.84	90.95
	X_{44}	84.15	84.85	85.62	86.03	86.56	87.07	87.62	88.16	88.92	89.05
	X_{45}	84.48	85.02	85.89	86.27	87.36	88.27	89.36	89.69	90.04	90.28
High-quality development indicators of the effects of low-carbon tourism (X_5)	X_{51}	48.27	49.56	52.37	55.81	57.35	59.82	62.45	64.46	66.81	67.38
	X_{52}	3.18	3.82	4.17	4.82	5.43	5.82	6.06	6.75	7.17	7.52
	X_{53}	50.72	51.62	52.32	52.73	53.64	54.02	54.83	56.46	58.36	60.25
	X_{54}	84.42	84.88	85.12	85.46	86.89	87.16	88.86	90.61	91.56	92.25
	X_{55}	86.05	86.35	87.42	88.86	89.06	89.87	90.51	90.68	91.07	91.46

To effectively assess the performance of high-quality development of low-carbon tourism empowered by new quality productivity in Rizhao City, China, it is necessary to carry out the necessary technical processing of the basic data in this paper according to the research design, which can be seen based on the changing status of the basic data in Table 4, which has good stability. Therefore, the basic data in this paper do not need to be buffer calculated. The basic data are directly normalized, using formula (9) and formula (10) to normalize the basic data in Table 4, and the results after processing are shown in Table 5.

Table 5. Normalization results of the basic data for comprehensive assessment of the effectiveness of environmental pollution governance

Indicators	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
X_{11}	0.2017	0.2105	0.2186	0.3061	0.3128	0.3791	0.4172	0.5103	0.6182	0.6871
X_{12}	0.2106	0.2178	0.2072	0.2092	0.3168	0.3863	0.4194	0.5183	0.6195	0.6904
X_{13}	0.3052	0.3128	0.3206	0.3861	0.4127	0.4186	0.4941	0.5195	0.6251	0.7016
X_{14}	0.1627	0.1683	0.1728	0.1783	0.1827	0.1905	0.1984	0.2081	0.2182	0.2251
X_{15}	0.3562	0.3672	0.3761	0.3971	0.4105	0.4547	0.6127	0.6827	0.7027	0.7242
X_{21}	0.7576	0.7657	0.7693	0.7743	0.7771	0.7788	0.7819	0.7937	0.7996	0.8066
X_{22}	0.7838	0.7807	0.7733	0.7677	0.7622	0.7596	0.7560	0.7529	0.7495	0.7416
X_{23}	0.7454	0.7572	0.7693	0.7915	0.8112	0.8175	0.8250	0.8295	0.8356	0.8410
X_{24}	0.7464	0.7613	0.7755	0.7830	0.7967	0.8072	0.8233	0.8295	0.8373	0.8473
X_{25}	0.7336	0.7366	0.7571	0.7669	0.8031	0.8171	0.8251	0.8309	0.8369	0.8431
X_{31}	0.8207	0.8282	0.8306	0.8378	0.8421	0.8487	0.8572	0.8648	0.8785	0.8971
X_{32}	0.8618	0.8815	0.8878	0.8927	0.9007	0.9073	0.9127	0.9179	0.9205	0.9254
X_{33}	0.8528	0.8657	0.8675	0.8689	0.8731	0.8815	0.8921	0.8987	0.9016	0.9056
X_{34}	0.8246	0.8346	0.8451	0.8526	0.8572	0.8616	0.8672	0.8721	0.8782	0.8805
X_{35}	0.8082	0.8121	0.8152	0.8182	0.8205	0.8221	0.8274	0.8317	0.8383	0.8432
X_{41}	0.7242	0.7436	0.7636	0.7836	0.7937	0.8046	0.8243	0.8386	0.8415	0.8587
X_{42}	0.7326	0.7436	0.7538	0.7685	0.7707	0.7868	0.7935	0.8082	0.8127	0.8282
X_{43}	0.8525	0.8457	0.8583	0.8638	0.8727	0.8824	0.8937	0.9017	0.9184	0.9095
X_{44}	0.8415	0.8485	0.8562	0.8603	0.8656	0.8707	0.8762	0.8816	0.8892	0.8905
X_{45}	0.8448	0.8502	0.8589	0.8627	0.8736	0.8827	0.8936	0.8969	0.9004	0.9028
X_{51}	0.6034	0.6195	0.6546	0.6976	0.7169	0.7478	0.7806	0.8058	0.8351	0.8423
X_{52}	0.3533	0.4244	0.4633	0.5356	0.6033	0.6467	0.6733	0.7500	0.7967	0.8356
X_{53}	0.7246	0.7374	0.7474	0.7533	0.7663	0.7717	0.7833	0.8066	0.8337	0.8607
X_{54}	0.8442	0.8488	0.8512	0.8546	0.8689	0.8716	0.8886	0.9061	0.9156	0.9225
X_{55}	0.8605	0.8635	0.8742	0.8886	0.8906	0.8987	0.9051	0.9068	0.9107	0.9146

Table 5 shows the results after normalization of the basic data of the assessment indicators. In the process of normalization of the assessment indicators, combined with the specific characteristics of the basic data in the process of selecting the maximum value of the normalization, the maximum value of the basic data of the forward and reverse indicators was comprehensively analyzed, and the maximum value of the normalization results was scientifically determined according to the actual situation to enhance the effectiveness of the

assessment results. According to the research design needs to assess the target level and criterion level of the assessment object at two levels of comprehensive assessment, due to the numerical limitations of this publication, the process of data processing was omitted from the specific assessment process, mainly omitting the absolute null conversion calculation process and the results of the assessment indexes, as well as the process and results of the relative null conversion. On this basis, the three eco-location comprehensive assessment models of formula (11), (12), and (16) are used to assess the low-carbon tourism effect in Rizhao City comprehensively, and the specific calculation process of the three eco-location assessment models and the corresponding calculation results are listed in Table 6.

Table 6. Performance assessment results of high-quality development of low-carbon tourism in Rizhao City

Methodologies	Norm	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
$AS_{t\alpha}$	$|S_t|$	2.2283	2.2805	2.3437	2.4442	2.4613	2.5025	2.5475	2.5721	2.5806	2.5862
	$|S_\alpha - S_t|$	0.2903	0.2919	0.2819	0.2767	0.2681	0.2598	0.2526	0.2473	0.2427	0.23851
	$1+|S_\alpha|+|S_t|$	4.3712	4.6347	4.8218	5.0549	5.2114	5.4198	5.5326	5.6861	5.8217	5.9527
	$I+|S_\alpha|+|S_t|+|S_\alpha-S_t|$	4.362`	48521	5.0372	5.2861	5.4517	5.6741	5.7851	5.8713	59071	6,0271
	Evaluation factor	0.7835	0.8086	0.8221	0.8434	0.8625	0.8763	0.8806	0.8962	0.9013	0.9062
	Rating	III	II	II	II	II	II	II	II	I	I
$RS_{t\alpha}$	$|S_t|$	2.3377	2.3631	2.4151	2.486	2.5162	2.5932	2.6113	2.6721	2.7026	2.7652
	$|S'_\alpha - S'_t|$	0.3076	0.2859	0.2804	0.2724	0.26231	0.25127	0.2436	0.23841	0.23472	0.22861
	$1+|S'_\alpha|+|S'_t|$	4.7212	4.7462	4.9870	5.2826	5.5223	5.8194	6.1040	5.6325	5.8216	5.9525
	$I+|S'_\alpha|+|S'_t|+|S'_\alpha-S'_t|$	5.4261	5.5614	5.6327	5.7251	5.8752	5.9852	6.0531	6.1626	6.2751	6.3426
	Evaluation factor	0.7704	0.7861	0.8026	0.8162	0.8302	0.8435	0.8537	0.8641	0.8751	0.8836
	Assessment level	III	III	II	II	II	II	II	II	II	II
$SS_{t\alpha}$	$AS_{t\alpha}$	0.7835	0.8086	0.8221	0.8434	0.8625	0.8763	0.8806	0.8962	0.9013	0.9062
	$RS_{t\alpha}$	0.7704	0.7861	0.8026	0.8162	0.8302	0.8435	0.8537	0.8641	0.8751	0.8836
	ξ	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
	Evaluation factor	0.7783	0.7996	0.8143	0.8325	0.8496	0.8632	0.8698	0.8834	0.8908	0.8972
	Assessment level	III	III	II	II	II	II	II	II	II	II

The above comprehensive evaluation of the high-quality development performance of low-carbon tourism empowered by new productivity in Rizhao City has obtained the results of the high-quality development of low-carbon tourism empowered by new productivity. In the evaluation, three methods were used: absolute niche suitability model, relative niche suitability model, and spatial niche suitability model.

3.2. Discussion of factors influencing assessment results

This paper assesses the performance assessment of low-carbon tourism high-quality development enabled by new quality productivity in Rizhao City, China. Based on the comprehensive analysis of the current situation of low-carbon tourism high-quality development in Rizhao City, an assessment index system was constructed by selecting five categories of 25 assessment indicators, which basically reflect the performance assessment status of the low-carbon tourism high-quality development enabled by new quality productivity in Rizhao City, China, and finally utilizes the three ecological niche suitability assessment models realized a comprehensive assessment of the target city's new quality productivity-enabled low-carbon tourism high-quality development performance, and the specific assessment results were determined by the status of the 25 assessment indicators, which were normalized in this paper to make the specific assessment results value domains merged in the interval [0,1]. The status of these assessment indicators determined the assessment results' values and their high-quality development performance ratings. To reflect the impact of the 25 assessment indicators on the assessment results, the changes of the 25 assessment indicators during 2013-2022 are plotted in right-angled coordinates using the curve family, and the impact of the specific assessment indicator system is shown in Figure 3.
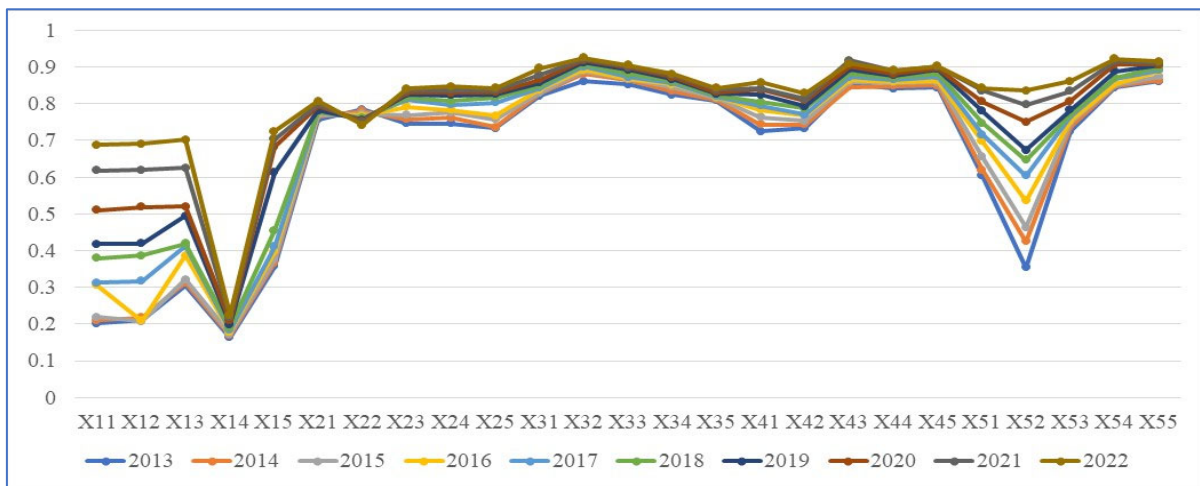
Fig. 3. Trends in assessment indicators

It can be seen in Figure 3 that according to the changing status of the assessment indicators, the indicators with relatively small impact on the assessment results are X_{11}-X_{15}, mainly the relative lack of impact of the new quality productivity, and the other indicators with relatively small impact are X_{51}-X_{53}, which are: the proportion of green GDP of the city, the proportion of GDP from tourism income, and the greening coverage rate of the urban scenic area, which have relatively low affiliation, and also ultimately affect the assessment results of the high-quality development performance of low-carbon tourism in the target cities; analyzing the years of the assessment indicators, it can be clearly seen that the smallness of the assessment indicators in the period of 2013-2016 affects the rise of the high-quality development performance of low-carbon tourism in the target cities. Therefore, upgrading these relatively low assessment indicators is the key to improving the assessment results of the high-quality development of low-carbon tourism in target cities.

3.3. Analysis of the differences between the two assessment methods

In this paper, two methods, namely, the guideline-level fuzzy comprehensive assessment model and the goal-level fuzzy comprehensive assessment model, were used to comprehensively assess the performance of the city's high-quality development empowered by the green transformation in Rizhao City, China, which are in fact the same method with different computation methods. The results of the two assessment methods and the differences between the two methods are detailed in Table 7.

Table 7. Analysis of the differences in the results of the three assessment methods

Chronology (years)	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
$AS_{t\alpha}$	0.7835	0.8086	0.8221	0.8434	0.8625	0.8763	0.8806	0.8962	0.9013	0.9062
$RS_{t\alpha}$	0.7704	0.7861	0.8026	0.8162	0.8302	0.8435	0.8537	0.8641	0.8751	0.8836
$SS_{t\alpha}$	0.7783	0.7996	0.8143	0.8325	0.8496	0.8632	0.8698	0.8834	0.8908	0.8972
$SS_{t\alpha} - AS_{t\alpha}$	-0.0052	-0.009	-0.0078	-0.0109	-0.0129	-0.0131	-0.0108	-0.0128	-0.0105	-0.009
$SS_{t\alpha} - RS_{t\alpha}$	0.0079	0.0135	0.0117	0.0163	0.0194	0.0197	0.0161	0.0193	0.0157	0.0136
$RS_{t\alpha} - AS_{t\alpha}$	-0.0131	-0.0225	-0.0195	-0.0272	-0.0323	-0.0328	-0.0269	-0.0321	-0.0262	-0.0226

As seen from Table 7, the assessment results of the AS method are slightly higher than those of the RS method. The assessment results of the SS method are located between the assessment results of the AS method and those of the RS method. The differences between the assessment results of the three assessment methods are shown in Table 7, which shows that the assessment results of the spatial ecological niche model have a modifying effect. According to the specific assessment results, the assessment results of the spatial "ecological niche" suitability model have the effect of homogenization, which absorbs the advantages of the absolute ecological niche suitability model and the relative ecological niche suitability model, and it is an ideal comprehensive assessment model. To reflect the differences between the assessment results of the three ecological niche suitability models, as well as the structure of the results and the trend of the change of the assessment results, the assessment results of the three ecological niche suitability models were analyzed by using the conical method in the same coordinate system. To reflect the differences between the three ecological site suitability models and the structure and change trend of the assessment results, the assessment results of the three ecological site suitability models were drawn in the same coordinate system using a conic diagram, and the specific differences are shown in Figure 4.
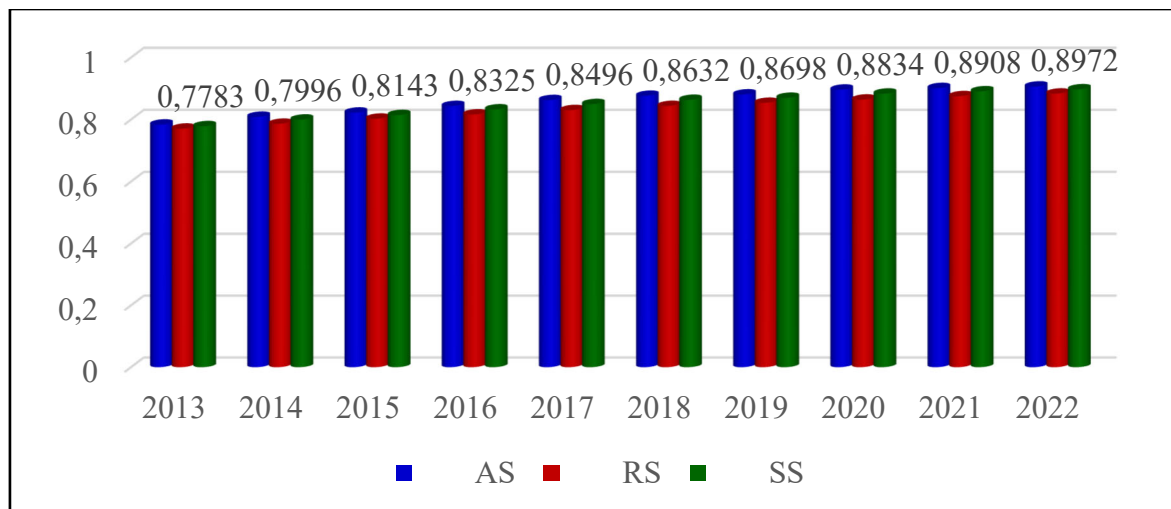
Fig. 4. Column chart of assessment results for the three assessment methods

The differences between the assessment results of the three ecological location suitability models are reflected in Figure 4. It is obvious from the assessment results in the figure that the errors between the three assessment models are very small. The assessment results of the three assessment models show a trend of slow growth, which indicates that the assessment effect of the performance assessment of the high-quality development of low-carbon tourism in the assessment object shows a gradual improvement.

4. Conclusions and Recommendations

To effectively solve this important research problem, this paper, based on the analysis of research background, literature review, and research design, selects five categories of 25 assessment indicators, including indicators of new quality productivity empowerment, indicators of high-quality development of urban low carbon tourism environment, indicators of high-quality development of urban low carbon tourism resources, indicators of high-quality development of urban low carbon tourism process, and indicators of high-quality development of urban low carbon tourism effect, and constructs five categories of 25 assessment indicators. A total of 25 assessment indicators in five categories, including indicators of high-quality development of urban low-carbon tourism environment, indicators of high-quality development of urban low-carbon tourism resources, indicators of high-quality development of urban low-carbon tourism process, and indicators of high-quality development of urban low-carbon tourism effect, were selected. An evaluation index system for the performance assessment of high-quality development of low-carbon tourism empowered by the novelty productivity of Chinese cities was constructed, and three evaluation indexes were constructed based on the evaluation index system. Three evaluation indexes were constructed based on comprehensive analysis. Based on comprehensive analysis, three ecological location suitability assessment models were constructed, taking into full consideration the enabling role of the new quality productivity and the actual situation of low-carbon tourism in the target cities and comprehensively assessing the guideline level and target level of the high-quality development of low-carbon tourism in the target cities, and determining the results of the assessment of the high-quality development performance of low-carbon tourism of the target cities for the ten years from 2013 to 2022. The study found that: the low-carbon tourism high-quality development status of the target city showed a continuous upward trend, and the assessment results of the AS model showed that: the low-carbon tourism high-quality development performance assessment result of the target city in 2013 was 0.7835, with a medium level of high-quality development performance, and the low-carbon tourism high-quality development performance assessment result in 2022 rose to 0.9026, with the high-quality development performance rose to an excellent grade; the assessment results of the RS model showed that the target city's low-carbon tourism high-quality development performance in 2013 was assessed as 0.7704, with a medium level of high-quality development performance, and the low-carbon tourism high-quality development performance assessment result by 2022 rose to 0.8836, with a good grade of high-quality development performance; the assessment results of the SS model showed that the target city's low-carbon tourism high-quality development performance assessment result in 2013 was 0.7783, with medium high-quality development performance, and the low-carbon tourism high-quality development performance assessment result by 2022 rose to 0.8972, with high-quality development performance rising to good grade. There are certain limitations in the research

process of this article, which can be summarized as follows: the collection of research data is not comprehensive enough, and some data have been corrected; The assessment model used in the assessment is limited, and the assessment indicators used in the assessment are also relative. The data reflects that the assessment indicators are not comprehensive enough. Based on the limitations in the research, combined with the actual situation of the performance assessment of the high-quality development of low-carbon tourism empowered by the new quality productivity in Rizhao City, China, the following policy recommendations are proposed for maximizing the performance assessment results of the high-quality development of low-carbon tourism empowered by the new quality productivity in Rizhao City, China:

(1) Give full play to the enabling role of the new quality productivity to promote the performance of the high-quality development of low-carbon tourism in the target cities. According to the assessment results of this paper, the main reason for the relatively low performance of the high-quality development of low-carbon tourism in the target cities is that the enabling role of the new quality productive forces is not strong enough, that is, they have not been able to give full play to the enabling role of the new quality productive forces in the high-quality development of low-carbon tourism.

(2) Promoting the improvement of assessment results by maximizing positive assessment indicators. Positive assessment indicators directly enhance the assessment results. By enhancing the positive indicators, that is, by making the positive assessment indicators continuously enhance the assessment effect of promoting the high-quality development performance of low-carbon tourism in the target cities, to maximize the high-quality development performance of low-carbon tourism in the target cities.

(3) Promote the improvement of assessment results by continuously improving and controlling the inhibitory effect of reverse indicators on assessment performance. Reverse assessment indicators have a suppressive effect on assessment performance in normalization, and by correcting and controlling the suppressive effect of reverse assessment indicators, the assessment results of the performance of low-carbon tourism and high-quality development in the target cities can be promoted.

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