Performance evaluation of the development of eco-cultural tourism in Fujian Province based on the method of fuzzy comprehensive evaluation

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The performance evaluation serves as a crucial means of examining the economic, ecological and social benefits of eco-cultural tourism in a holistic manner and a vital method of assessing the sustainable development of regional eco-cultural tourism. However, due to the non-profit features of public resources, it is hard to evaluate the performance of eco-cultural tourism in an objective manner through the conventional approach that depends on economic performance as the primary evaluation indicator. Therefore, based on the balanced score card, this paper aims to build a system of performance evaluation indicators custom-tailored to the eco-cultural tourism development in Fujian Province from four aspects, namely, financial performance, public benefits, internal process and learning and growth. By adopting the method of fuzzy comprehensive evaluation, the study intends to objectively assess the economic value, efficiency and public benefits of eco-cultural tourism in Fujian Province. In addition, by adopting the method of Analytic Hierarchy Process (AHP), the study has identified the weights of the performance evaluation indicators, namely, 0.558 for public benefits, 0.122 for financial performance, 0.057 for internal process and 0.263 for learning and growth. Judging from the fuzzy comprehensive evaluation, the effects are found to be at the average level for the eco-cultural tourism development in Fujian Province, scoring between 60 and 74. As shown by the research findings, although Fujian Province is endowed with optimal resources of eco-cultural tourism, further efforts need to be made in exploring and optimizing the building of eco-cultural tourism.

KEYWORDS

eco-cultural tourism, performance evaluation, analytic hierarchy process, fuzzy, evaluation, balanced scorecard

1 Introduction

At present, China has made increasingly rapid progress in the development of eco-cultural tourism, which corresponds more to the concept of low-carbon, healthy and harmonious development of tourism. During the development of eco-cultural tourism, the ecological and natural environment is regarded as the primary resource of tourism.

This approach effectively integrates the strengths of ecological and cultural resources, while meeting people's demands for optimal ecosystem and culture at the same time, and is thus favored by the general public (Su et al., 2022). Eco-cultural tourism plays a pivotal role in promoting China's growth of forests, enhancing the well-being of people and alleviating poverty through green development, among other aspects. Hence, its benign growth can provide a strong impetus to the Chinese ecological development. At present, the development of China's eco-cultural tourism sector has achieved rapid growth from varying aspects, including the market capacity, construction investment and employees, and has demonstrated a strong scale effect. Nevertheless, while paying heed to the economic and social benefits brought by eco-cultural tourism, relevant parties shall also pay closer attention to the potential risks incurred by the development of eco-cultural tourism (Yuan, 2022). It has become a vital research topic with respect to the proper methods of developing, utilizing and safeguarding the benefits of eco-cultural tourism under the premise of ensuring the socioeconomic benefits accordingly. Over the recent years, an increasing number of scholars start to pay attention to and adopt new techniques of measurement to assess the performance of tourism development. Most of these studies elaborate on the indicators of economic benefits (Zheng, 2012), but have insufficient explanatory power for the performance of eco-cultural tourism development, and there are still certain deficiencies in terms of objective measurement and evaluation. Based on the balanced score card, this study has identified a system of performance evaluation indicators for the eco-cultural tourism development in Fujian Province, and adopted the method of fuzzy comprehensive evaluation to holistically assess the performance of eco-cultural tourism. In particular, the study has evaluated the economic, ecological and social benefits brought forward by the development of major eco-cultural tourism areas in Fujian Province with a scientific, objective and fair approach. It makes up for the deficiencies of conventional approaches of regarding economic benefits as the sole measurement indicator, and conducts a holistic assessment of eco-cultural tourism from varying dimensions. Last but not least, the study is expected to provide reference for the eco-cultural tourism development in other regions.

2 Literature review

Scholars tend to have divergent perceptions when it comes to eco-cultural tourism. German scholars first proposed the term "ecology". On this basis, the International Union for Conservation of Nature (IUCN) defined eco-cultural tourism as the introduction of ecological concepts into culture, and an activity in which humans can live in harmony with nature and obtain optimal spiritual experience accordingly (Li, 2000).

According to Liu et al. (2021) the approach of eco-cultural tourism centers around the needs of tourists' eco-cultural experience and values the integration and development of both ecological and cultural tourism. Moreover, the method caters to the ecological and cultural demands of tourists, and provides a holistic approach of integrating eco-tourism with cultural tourism. The studies on the performance evaluation of eco-cultural tourism development mainly center around two aspects. First, the system of measurement indicators. Larry Dwyer et al. (2004) proposed a new model for evaluating the economic effect of tourism, namely, the Computable General Equilibrium (CGE) model. Fu. (2021) adopted the method of conditional value to set up a system of indicators that serves the purpose of assessing the ecological performance of alleviating poverty through cultural tourism in ancient cities. Shi et al. (2021) developed a system of performance evaluation indicators for the eco-cultural tourism areas from socio-economic and other aspects, thus enriching the theories of performance evaluation of eco-cultural tourism areas. Second, the methods of performance evaluation. By adopting the AHP method, Yang et al. (2021) carried out a study of empirical evaluation on the ecological performance of poverty alleviation through tourism in the Shangluo mountainous area from two aspects, namely, the natural, ecological and environmental performance, in addition to the human, cultural and environmental performance. Wang et al. (2021) established a system of performance evaluation indicators for the poverty alleviation through eco-tourism, which is composed of three major subsystems of ecological, economic and social performance. By adopting the methods of multiple regression analysis, researchers have assessed the effects of targeted poverty alleviation through eco-tourism in the Shanxi Taihang destitute area and carried out the spatial pattern analysis.

In general, rather few studies are available on the performance evaluation of eco-cultural tourism development. Some scholars have conducted studies based on the establishment of the system of indicators and methods of evaluation. While achieving certain results, these studies are still in the stage of infancy. From the aspect of indicators, the established system of indicators covers a rather narrow range of factors without analyzing and assessing the performance of eco-cultural tourism development in a holistic manner. Moreover, the system of indicators features an extremely complex structure, and the detailed indicators are redundant with weak operability in reality.

3 Establishment of the system of performance evaluation indicators of eco-cultural tourism development in Fujian Province

The balanced score card proposed by Kaplan and Norton (Kaplan, 2022) is a systematic and comprehensive system of

performance evaluation, which mainly involves the assessment from the four perspectives of clients, finance, internal process, and learning and growth. As a method of performance evaluation, the balanced score card is primarily oriented towards strategic goals, which features the holistic and detailed assessment of development trends and strategic goals from varying aspects. This paper mainly draws inspirations from the research findings of Wei. (2021). With respect to the development of eco-cultural tourism in Fujian Province, this method proves to be able to holistically assess the strategic goals of eco-cultural tourism development, and provides detailed indicators corresponding to the performance measurement of each goal. This approach enables policymakers to fully understand the overall circumstances of the eco-cultural tourism sector, and to timely modify and devvise plans on the future strategy implementation of eco-cultural tourism development. As shown in the following sections, researchers will analyze and design the key assessment indicators for the performance of eco-cultural tourism development (A) in Fujian Province from each of the four perspectives of public benefits, financial performance, internal process, and learning and growth based on the balanced score card.

3.1 Public benefits (B_1)

3.1.1 Employment contribution (C_1)

The rate of employment contribution is a crucial indicator of measuring the level of eco-cultural tourism development. Through the eco-cultural tourism, relevant parties are able to plan and develop idle land, thus injecting impetus to the growth of related industries including construction, accommodation, catering, transportation, agriculture and sideline industries. Hence, the eco-cultural tourism can increase the demands for social labor, and the jobs of related sectors can attract laborers of different levels of competence and create a large number of both direct and indirect employment opportunities for local residents. These jobs are expected to increase the income and improve the overall quality of life of residents, thereby driving the growth of the local economy (Burger et al., 2022).

3.1.2 Social performance (C_2)

During the development of eco-cultural tourism, the social performance is mainly reflected in two aspects. First, from the aspect of the quality of life, further development of the eco-cultural tourism sector can provide people with rich and diversified options of consumption, enhance the residents' sales of products with unique local features, and improve the quality of air, among other advantages (Guri et al., 2020). Second, from the aspect of the sustainable development, the cultural connotation and social image of tourist attractions can play a better role in enhancing the publicity, improving the tourist flows, attracting investment and encouraging entrepreneurship,

thus driving the economic growth and promoting the sustainable development and operation of local eco-cultural tourism sector.

3.1.3 Ecological performance (C_3)

During the development of eco-cultural tourism, the ecological performance is mainly reflected in the changes taken place in the living environment and people's satisfaction with ecological quality. During the actual development of eco-cultural tourism, extra attention should be paid to ensure that the air quality is aligned with better standards of people's living environment, and to build an optimal ecological environment, so as to bring actual benefits to residents through the development of eco-cultural tourism, and to enhance their satisfaction with the ecological quality improved accordingly (Corne and Peypoch, 2020).

3.1.4 Product evaluation (C_4)

During the development of eco-cultural tourism, the product evaluation is mainly reflected in the capacity of tapping into the potential of local culture, history, tourism and other resources as well as the efforts made in launching innovative projects of tourism (Spyros and Dimitrios, 2019). The in-depth development of both resources and related projects will provide a wider variety of cultural tourism resources. In particular, it will provide people with diversified options of eco-cultural tourism in terms of areas and products while enhancing the vitality as well as momentum for further development of eco-cultural tourism.

3.2 Financial performance (B_2)

3.2.1 Economic contribution (C_5)

Economic contribution is a crucial indicator that measures the economic stimulus effect of capital investment during the eco-cultural tourism development. Proper level of capital investment and planning can drive the growth of regional GDP, which is also a vital indicator assessing the economic status and development of a region (Hadad et al., 2012). The increase in the proportion of income from related industries driven by the eco-cultural tourism development represents stronger local economic growth, and it can also reflect the contribution of the eco-cultural tourism development to the local regional economy.

3.2.2 Social capital investment (C_6)

Social capital investment is a vital indicator that measures the sustainable development of eco-cultural tourism. The long-term growth of an industry is inseparable from the investment of social capital. Moreover, the growth of social capital investment can improve the building of public and industrial facilities of tourism as well as the quality of living environment, thereby enhancing the overall infrastructure building related to the eco-cultural

tourism sector. On the other hand, the synergy between the infrastructure building and the development of eco-cultural tourism will further attract the investment of social capital. In general, larger investment of social capital will evidently facilitate the sustainable development of eco-cultural tourism (Tsung, 2013).

3.2.3 Financial investment (C$_7$)

Financial investment refers to the fundamental and strategic investment that serves as a pillar to the eco-cultural tourism sector in the long run, and lays a critical material foundation for the development of the sector (Wei, 2015). Financial investment can promote the publicity and building of local eco-cultural tourism cities, and support and improve the establishment of the local system of public cultural services. It will contribute to the protection of cultural relics for tourism, and provide solid and robust financial guarantees for the eco-cultural tourism development in the long run.

3.3 Internal process (B$_3$)

3.3.1 Management efficiency (C$_8$)

During the development of eco-cultural tourism, the management efficiency is mainly reflected in whether the government, tourism supervision and other relevant authorities can improve tourists' satisfaction with their experience of eco-cultural tourism. In addition, the authorities have taken measures to improve the tourism transportation system and strengthen the training of staff engaged in the tourism-related industry to hone their skills and enhance their competence. These measures are expected to improve the overall services of tourism and enhance the management efficiency in an all-round way, thereby optimizing the overall experience and satisfaction of tourists through the eco-cultural tourism development (Rita et al., 2019).

3.3.2 Information disclosure (C$_9$)

During the development of eco-cultural tourism, the openness of information is mainly reflected in the transparency and the convenience of access to information. Relevant authorities have built a system of information supervision to facilitate maximal information disclosure and transparency under the premise of ensuring information security. In addition, they have conducted activities of ecological and cultural publicity to extensively disseminate information throughout all aspects of tourism so as to further enhance the ecological environment. The optimal information disclosure during the cultural tourism development is expected to provide tourists with a rather transparent environment, thus meeting the diverse needs of tourists for gaining access to information (Bampatsou et al., 2022).

3.3.3 Management fairness (C$_{10}$)

During the development of eco-cultural tourism, the management fairness is mainly reflected in the justified management of the industry as well as the consumption environment (Ted, 1995). Relevant authorities have established an array of management systems for the tourism sector to ensure the fairness of varying industries during the implementation of supervisory and supporting policies. Only by effectively ensuring the fairness of management can the authorities promote the common and sound development of varying industries. Moreover, the regulatory authorities have strengthened the rectification measures for the consumption environment of tourism so as to ensure the fairness of tourists' consumption behaviors as much as possible and to safeguard the vital interests of tourists. Overall, managing the industry and consumption environment in a fair manner can promote the eco-cultural tourism development in the long run.

3.4 Learning and growth performance (B$_4$)

3.4.1 Sustainable development (C$_{11}$)

During the development of eco-cultural tourism, the capacity of sustainable development is mainly reflected in the tourists' overall recognition of the experience of eco-cultural tourism. Higher level of tourists' recognition indicates better quality of development of the eco-cultural tourism, which can attract the inflow of tourists to the maximum extent. Driven by the increased number of tourists, the local eco-cultural tourism sector will be further developed, thus driving the growth of regional economy and enhancing the residential income. In turn, the constant growth of residential income provides sufficient financial support for the further development of eco-cultural tourism, thereby facilitating the sustainable development of eco-cultural tourism (Li et al., 2019).

3.4.2 Cultural education (C$_{12}$)

During the development of eco-cultural tourism, the cultural education is mainly reflected in the satisfaction of tourists' cognitive demands of tourism culture as well as the exploration and development of characteristic eco-cultural resources. Relevant tourism authorities have taken measures to meet the demands of tourists for understanding and recognizing the unique culture of tourist attractions by building learning bases. These measures are custom-tailored to the tourists' potential mentality of eco-cultural tourism, thereby enhancing their experience of cultural tourism (Li et al., 2019). In addition, by fully leveraging the resources of eco-cultural tourism with unique local features through innovative thinking, relevant authorities are able to further enrich the projects of local cultural tourism and enhance the benefits brought forward by such tourism.

TABLE 1 Set of performance evaluation indicators of eco-cultural tourism development in fujian province.

	First-tier indicators	Second-tier indicators
Index A of the performance evaluation of eco-cultural tourism development in Fujian Province	Public Benefits B_1	Employment Contribution C_1
		Social Performance C_2
		Ecological Performance C_3
		Product Evaluation C_4
	Financial Performance B2	Economic Contribution C_5
		Social Capital Investment C_6
		Financial Investment C_7
	Internal Process B_3	Management Efficiency C_8
		Information Openness C_9
		Management Fairness C_{10}
	Learning and Growth B_4	Sustainable Development C_{11}
		Cultural Education C_{12}
		Ecological Education C_{13}

3.4.3 Ecological education (C_{13})

During the development of eco-cultural tourism, the ecological education is mainly reflected in the governmental and supervisory departments' guidance and publicity effects related to raising people's awareness about ecological protection. Relevant authorities have improved their educational effects by establishing centers of ecological education and training and conducting publicity activities of ecological and environmental protection. Optimal educational effects can enhance people's awareness of ecological protection during the experience of eco-cultural tourism, and minimize the damage caused to the ecological environment during actual tourism, so as to protect the public tourism environment as much as possible.

The dimensions and detailed indicators of the performance evaluation for the development of eco-cultural tourism in Fujian Province are specified as follows in Table 1.

4 Process of performance evaluation of eco-cultural tourism development in Fujian Province

4.1 Advantages of the method of fuzzy comprehensive evaluation

First, the fuzzy comprehensive evaluation method features strong applicability. This method is able to assess both subjective and objective factors at the same time as opposed to some other methods, which can only evaluate objective factors but can do nothing for subjective factors. To address the issue of subjectivity while evaluating the performance of eco-cultural tourism development in Fujian Province, this method allows for fuzzy treatment. By determining the fuzzy membership of a single

factor to each level of the comment set, the factor can be converted into a quantitative index from a qualitative one. Second, the method is capable of addressing complex issues. The method of fuzzy comprehensive evaluation allows for the implementation of multi-tier and multi-level assessment, whereas the process of evaluation can be repeated. Numerous factors can impose an impact on the performance of eco-cultural tourism development in Fujian Province. It is a tedious and complicated task to integrate the aforementioned factors of varying categories based on their features and properties, and classify them into different levels and collections. Nevertheless, the method of fuzzy comprehensive evaluation helps to easily organize and categorize different factors, thus laying the foundation for the identification of weight and membership of each factor, and this method is able to easily cope with complex issues. Third, the weights are adjustable. Different factors in distinct matters that are subject to the evaluation may impose an impact of varying extents. Therefore, different weights are required to be set for varying factors during the evaluation, which hold true for the performance evaluation of eco-cultural tourism development in Fujian Province. The evaluators can opt for the method of weight determination based on different purposes, thus leading to distinct results of evaluation.

4.2 Establishment of the set of evaluation factors and the corresponding stratification

The performance of the eco-cultural tourism development in Fujian Province should be evaluated from multiple aspects. Based on the system of evaluation indicators specified in Table 1, the evaluation is conducted from four aspects, namely, financial

performance, public benefits, internal process, and learning and growth. Therefore, the first-tier set of indicators of the performance evaluation of eco-cultural tourism development in Fujian Province are specified as follows:

B = {B1,B2,B3,B4} = {Financial performance, public benefits, internal process, and learning and growth}.

Each dimension of evaluation of the first layer is composed of detailed evaluation indicators of distinct nature specified as follows.

B_1 = {C_1,C_2,C_3,C_4} = {Employment contribution, social performance, ecological performance, and product evaluation} = Public benefits.

B_2 = {C_5,C_6,C_7} = {Economic contribution, social capital investment, financial investment} = Financial performance.

B_3 = {C_8,C_9,C_{10}} = {Management efficiency, information openness, management fairness}= Internal process.

B_4 = {C_{11},C_{12},C_{13}} = {Sustainable development, cultural education, ecological education} = Learning and growth.

4.3 Establishment of the evaluation effects

Based on the actual needs of the performance evaluation of eco-cultural tourism in Fujian Province, the evaluation effects can be divided into five levels, namely, "excellent", "good", "average", "poor" and "very poor", corresponding to the range of scores of "90–100", "75–89", "60–74", "50–59" and "below 50", respectively. The corresponding set of performance evaluation indicators of the eco-cultural tourism development in Fujian Province is specified as follows:

V = {V_1,V_2,V_3,V_4,V_5} = {Excellent, good, average, poor, very poor}.

4.4 Establishment of the single factor evaluation matrix

Relevant experts specialized in the eco-cultural tourism sector are invited to assess the eco-cultural tourism development in Fujian Province. The specific indicators of evaluation are specified in Table 2, and different indicators are scored respectively.

Assuming that there are k members in the evaluation team, the scores of k members on u_i being rated as v are respectively $c_{ij1}, c_{ij2}, \cdots, c_{ijk}$. Among $0 \le c_{ijp} \le 100$, ($p = 1, 2, \cdots, k$; $i = 1, 2, \cdots, n$; $j = 1, 2, \cdots, m$), The average value is calculated, and the formula is thus specified as follows:

$$r'_{ij} = c_{ij1} + c_{ij2} + \ldots + c_{ijk} / k \qquad (1)$$

Each factor is normalized as follows:

$$r_{ij} = \frac{r'_{ij}}{r'_{i1} + r'_{i2} + \ldots + r'_{im}}. \qquad (2)$$

Hence, researchers can obtain the evaluation result of a certain factor during the performance evaluation of the eco-cultural tourism development in Fujian Province. On this occasion, 15 experts were invited to score each of the evaluation indicators one by one before calculating and normalizing the average value. The evaluation results of each factor in the system of indicators are specified in Table 2.

Judging from Table 2, the evaluation matrices of each single factor are specified as follows.

$$R_1 = \begin{bmatrix} 0.1 & 0.1 & 0.2 & 0.4 & 0.2 \\ 0.2 & 0.2 & 0.4 & 0.1 & 0.1 \\ 0.3 & 0.2 & 0.4 & 0.1 & 0.0 \\ 0.0 & 0.3 & 0.1 & 0.1 & 0.5 \end{bmatrix}, \qquad (3)$$

$$R_2 = \begin{bmatrix} 0.1 & 0.2 & 0.3 & 0.1 & 0.3 \\ 0.1 & 0.1 & 0.4 & 0.3 & 0.1 \\ 0.1 & 0.2 & 0.5 & 0.2 & 0.0 \end{bmatrix}, \qquad (4)$$

$$R_3 = \begin{bmatrix} 0.1 & 0.2 & 0.3 & 0.3 & 0.1 \\ 0.0 & 0.1 & 0.2 & 0.3 & 0.4 \\ 0.1 & 0.1 & 0.2 & 0.4 & 0.2 \end{bmatrix}, \qquad (5)$$

$$R_4 = \begin{bmatrix} 0.1 & 0.3 & 0.5 & 0.1 & 0.0 \\ 0.1 & 0.3 & 0.3 & 0.1 & 0.2 \\ 0.1 & 0.2 & 0.2 & 0.2 & 0.3 \end{bmatrix}, \qquad (6)$$

4.5 Setting of the weights of indicators

This paper has adopted the method of fuzzy comprehensive evaluation to assess the weight of the performance evaluation indicators during the eco-cultural tourism development in Fujian Province. To compare each of the indicators in pairs, the value of quantization scale of a_{ij} is used.

4.5.1 Setting of the weights of first-tier indicators
This study has established the analytical matrix of "A-B1, B2, B3, B4" so as to calculate the weights of the first-tier indicators, and performed the compatibility analysis, as specified in Table 3.

4.5.2 Setting of the weight of second-tier indicators
This study has established the analytical matrix of the second-tier indicators for each of the first-tier indicators respectively in Tables 4, 5, 6, 7 for details.

4.6 Weights of comprehensive indicators

Based on the aforementioned analysis, the weights of the system of performance evaluation indicators for the eco-cultural tourism development in Fujian Province can be obtained as follows.

(Weights of first-tier indicators) = (a_1,a_2,a_3,a_4) = (0.558,0.122,0.057,0.263).

The weights (for second-tier indicators) of the elements in each subset B_i (i = 1,2,3,4) are respectively:

TABLE 2 Evaluation indicators and results of the single factor evaluation of the eco-cultural tourism development in Fujian Province.

	First-tier indicators	Second-tier indicators	Results of the single factor evaluation				
			Excellent	Good	Average	Poor	Very Poor
Index A of the performance evaluation of eco-cultural tourism development in Fujian Province	Public benefits B_1	Employment Contribution C_1	0.1	0.1	0.2	0.4	0.2
		Social Performance C_2	0.2	0.2	0.4	0.1	0.1
		Ecological Performance C_3	0.3	0.2	0.4	0.1	0.0
		Product Evaluation C_4	0.0	0.3	0.1	0.1	0.5
	Financial performance B2	Economic Contribution C_5	0.1	0.2	0.3	0.1	0.3
		Social Capital Investment C_6	0.1	0.1	0.4	0.3	0.1
		Financial Investment C_7	0.1	0.2	0.5	0.2	0.0
	Internal process B_3	Management Efficiency C_8	0.1	0.2	0.3	0.3	0.1
		Information Openness C_9	0.0	0.1	0.2	0.3	0.4
		Management Fairness C_{10}	0.1	0.1	0.2	0.4	0.2
	Learning and growth B_4	Sustainable Development C_{11}	0.1	0.3	0.5	0.1	0.0
		Cultural Education C_{12}	0.3	0.3	0.1	0.1	0.2
		Ecological Education C_{13}	0.1	0.2	0.2	0.2	0.3

(These data include the scores given by 15 experts).

TABLE 3 Weights of first-tier indicators.

A	B_1	B_2	B_3	B_4	W_i^o	λ_{max}
B_1	1	5	7	3	0.558	4.118
B_2	1/5	1	3	1/3	0.122	
B_3	1/7	1/3	1	1/5	0.057	
B_4	1/3	3	5	1	0.263	

It can be calculated from the table that CI = 0.039, CR = 0.044 < 0.1, which consists with the one-time verification.

TABLE 5 Weights of second-tier indicators (2).

B_1	C_1	C_2	C_7	W_i^o	λ_{max}
C_5	1	3	7	0.643	3.066
C_6	1/3	1	5	0.283	
C_7	1/7	1/5	1	0.074	

It can be calculated from the table that CI = 0.33, CR = 0.063 < 0.1, which consists with the one-time verification.

TABLE 4 Weights of second-tier indicators (1).

B_2	C_3	C_4	C_5	C_6	W_i^o	λ_{max}
C_1	1	3	5	1/3	0.263	4.118
C_2	1/3	1	3	1/5	0.122	
C_3	1/5	1/3	1	1/7	0.057	
C_4	3	5	7	1	0.558	

It can be calculated from the table that CI = 0.059, CR = 0.066 < 0.1, which consists with the one-time verification.

TABLE 6 Weights of second-tier indicators (3).

B_3	C_7	C_8	C_{10}	W_i^o	λ_{max}
C_8	1	3	5	0.648	3.003
C_9	1/3	1	2	0.230	
C_{10}	1/5	1/2	1	0.122	

It can be calculated from the table that CI = 0.0035, CR = 0.0067 < 0.1, which consists with the one-time verification.

TABLE 7 Weights of second-tier indicators (4).

B$_4$	C$_9$	C$_{10}$	C$_{11}$	W_i^o	λ_{max}
C$_{11}$	1	7	3	0.633	3.007
C$_{12}$	1/7	1	1/5	0.106	
C$_{13}$	1/3	5	1	0.260	

It can be calculated from the table that CI = 0.039, CR = 0.044 < 0.1, which consists with the one-time verification.

$$B_1 = (a_{11}, a_{12}, a_{13}, a_{14}) = (0.263, 0.122, 0.057, 0.558),$$
$$B_2 = (a_{21}, a_{22}, a_{23}) = (0.643, 0.283, 0.074),$$
$$B_3 = (a_{31}, a_{32}, a_{33}) = (0.648, 0.230, 0.122),$$
$$B_4 = (a_{31}, a_{32}, a_{33}) = (0.633, 0.106, 0.260),$$

4.7 Fuzzy comprehensive evaluation

Based on the aforementioned analysis and calculation, the study has adopted the multi-factor and multi-tier method of fuzzy comprehensive evaluation to carry out a holistic assessment of the performance of eco-cultural tourism development in Fujian Province.

$$U_1 = B_1 \circ R_1$$

$$= (0.263, 0.122, 0.057, 0.558) \circ \begin{bmatrix} 0.1 & 0.1 & 0.2 & 0.4 & 0.2 \\ 0.2 & 0.2 & 0.4 & 0.1 & 0.1 \\ 0.3 & 0.2 & 0.4 & 0.1 & 0.0 \\ 0.0 & 0.3 & 0.1 & 0.1 & 0.5 \end{bmatrix}, \quad (7)$$

$$U_1 = (0.0678, 0.2295, 0.18, 0.1789, 0.3438),$$

$$U_2 = B_2 \circ R_2 = (0.643, 0.283, 0.074) \circ \begin{bmatrix} 0.1 & 0.2 & 0.3 & 0.1 & 0.3 \\ 0.1 & 0.1 & 0.4 & 0.3 & 0.1 \\ 0.1 & 0.2 & 0.5 & 0.2 & 0.0 \end{bmatrix},$$
$$(8)$$

$$U_2 = (0.1000, 0.1717, 0.3431, 0.164, 0.2212),$$

$$U_3 = B_3 \circ R_3 = (0.648, 0.230, 0.122) \circ \begin{bmatrix} 0.1 & 0.2 & 0.3 & 0.3 & 0.1 \\ 0.0 & 0.1 & 0.2 & 0.3 & 0.4 \\ 0.1 & 0.1 & 0.2 & 0.4 & 0.2 \end{bmatrix},$$
$$(9)$$

$$U_3 = (0.0770, 0.1648, 0.2648, 0.3122, 0.1812),$$

$$U_4 = B_4 \circ R_4 = (0.633, 0.106, 0.260) \circ \begin{bmatrix} 0.1 & 0.3 & 0.5 & 0.1 & 0.0 \\ 0.1 & 0.3 & 0.3 & 0.1 & 0.2 \\ 0.1 & 0.2 & 0.2 & 0.2 & 0.3 \end{bmatrix},$$
$$(10)$$

$$U_4 = (0.0999, 0.2737, 0.4003, 0.1259, 0.0992),$$

In this study, researchers have adopted the (•, +) operator due to its capacity of taking all factors into account while retaining all the information of single factor evaluation.

B$_1$, B$_2$, B$_3$, and B$_4$ constitute the total matrix of fuzzy comprehensive evaluation for the performance evaluation of the eco-cultural tourism development in Fujian Province.

$$R = (B1, B2, B3, B4)^T$$

$$= \begin{bmatrix} 0.0678 & 0.2295 & 0.1800 & 0.1789 & 0.3438 \\ 0.1000 & 0.1717 & 0.3431 & 0.1640 & 0.2212 \\ 0.0770 & 0.1648 & 0.2648 & 0.3122 & 0.1812 \\ 0.0999 & 0.2737 & 0.4003 & 0.1259 & 0.0992 \end{bmatrix}, \quad (11)$$

In addition, the weights of indicators (a$_1$,a$_2$,a$_3$,a$_4$) = (0.558, 0.122, 0.057, 0.263).

The results of the fuzzy evaluation of the total factor is as follows.
$$C = A \circ R$$

$$= (0.558, 0.122, 0.057, 0.263) \circ \begin{bmatrix} 0.0678 & 0.2295 & 0.1800 & 0.1789 & 0.3438 \\ 0.1000 & 0.1717 & 0.3431 & 0.1640 & 0.2212 \\ 0.0770 & 0.1648 & 0.2648 & 0.3122 & 0.1812 \\ 0.0999 & 0.2737 & 0.4003 & 0.1259 & 0.0992 \end{bmatrix}, \quad (12)$$

$$C = (0.0807, 0.2304, 0.2627, 0.1707, 0.2552).$$

On the basis of the maximum subordination principle, this study has found that the current effects of the eco-cultural tourism development in Fujian Province are still in an average level, scoring between 60 and 74. This result indicates that although Fujian Province is endowed with abundant eco-cultural resources, the eco-cultural tourism development still needs to be further explored and optimized.

5 Conclusion and prospects

This study focuses on the performance of eco-cultural tourism development as the research object, and designs the key indicators of performance evaluation in the eco-cultural tourism development based on the balanced score card. This method has especially taken into account the dimensions of public benefits, financial performance, internal process and learning and growth, and the results of AHP indicate that the weights of the aforementioned four dimensions amount to 0.558, 0.122, 0.057, and 0.263 respectively. Based on the evaluation indicators, the method of fuzzy comprehensive evaluation is adopted to assess and analyze the performance of eco-cultural tourism development in Fujian Province. Scores are shown to fall within the range between 60 and 74. It is concluded that currently Fujian Province is endowed with abundant resources of eco-cultural tourism, but the effects of development are still in an average level, whereas more in-depth studies need to be conducted on the eco-cultural tourism development.

Based on the above analytical results, the following policy recommendations are provided. First, to select optimal indicators for assessing the performance of eco-cultural tourism development, subsequent studies need to further expand the design of evaluation indicators and improve the compatibility and tolerance of indicators so as to provide reference for the development of varying eco-cultural tourism areas in Fujian Province as much as possible. Second, to select the optimal methods of performance evaluation, more reasonable systems of performance evaluation shall be identified. In terms of research methods, other statistical methods shall be adopted to demonstrate and analyze the evaluation indicators so as to enhance the applicability and reliability.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary Material, further inquiries can be directed to the corresponding author.

Author contributions

QZ wrote the draft of the manuscript and contributed to data curation and analysis. QC, DK contributed to manuscript revision. All authors approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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References

Bampatsou, C., Halkos, G., and Astara, O. H. (2022). Composite indicators in evaluating tourism performance and seasonality. *Oper. Res. Int. J.* 22 (22), 2373–2396. doi:10.1007/s12351-020-00610-5

Burger, J., Gochfeld, M., Kosson, D. S., Brown, K. G., Salisbury, J., Greenberg, M., et al. (2022). Combining ecological, eco-cultural, and environmental justice parameters to create Eco-EJ indicators to monitor cultural and environmental justices for diverse communities around contaminated sites. *Environ. Monit. Assess.* 194 (3), 177. doi:10.1007/s10661-021-09535-8

Corne, A., and Peypoch, N. (2020). On the determinants of tourism performance. *Ann. Tour. Res.* 85 (11), 103057. doi:10.1016/j.annals.2020.103057

Dwyer, L., Forsyth, P., and Spurr, R. (2004). Evaluating tourism's economic effects: New and old approaches. *Tour. Manag.* 25 (3), 307–317. doi:10.1016/s0261-5177(03)00131-6

Fu, A. P. (2021). Research on the performance evaluation system of cultural and ecological reserves. *China Intang. Cult. Herit.* (03), 104–107.

Guri, E. A. I., Osumanu, I. K., and Bonye, S. Z. (2020). Eco-cultural tourism development in Ghana: Potentials and expected benefits in the lawra municipality. *J. Tour. Cult. Change* 19 (4), 458–476. doi:10.1080/14766825.2020.1737095

Hadad, S., Hadad, Y., Malul, M., and Rosenboim, M. (2012). The economic efficiency of the tourism industry: A global comparison. *Tour. Econ.* 18 (5), 931–940. doi:10.5367/te.2012.0165

Kaplan, N. (2022). *Balanced scorecard strategy practice*. Hangzhou: Zhejiang Education Press.

Li, D. Y. (2000). On the construction of eco-tourism in nature reserves. *Hebei For. Fruit Res.* 1, 1–3.

Li, K., Shen, W., and Huang, Z. S. (2019). Evaluation of cultural service performance of urban green space ecosystem Taking Qianlingshan Park in Guiyang City as an example. *Urban issues.* 8 (03), 44–50.

Liu, Y. S., Wang, Z. Y., and Shan, Z. R. (2021). Research on evaluation and optimization strategies of cultural ecosystem services of rural water spaces in suzhou. *Landsc. Archit. Front.* 9 (02), 38–49. doi:10.15302/j-laf-1-020044

Rita, S. G. E., Fernando, A. F. F., Álvaro, A. R., Govindan, K., and Meidute-Kavaliauskiene, I. (2019). A socio-technical approach to the assessment of sustainable tourism: Adding value with a comprehensive process-oriented framework. *J. Clean. Prod.* 236 (1), 117487. doi:10.1016/j.jclepro.2019.06.318

Shi, L. L., Li, M., and He, L. (2021). The status quo and problems of China's ecological civilization system. *Environ. Sustain. Dev.* 46 (03), 127–133. doi:10.19758/j.cnki.issn1673-288x.202103021

Spyros, N., and Dimitrios, T. (2019). Assessing the tourism performance of the mediterranean coastal destinations: A combined efficiency and effectiveness approach. *J. Destination Mark. Manag.* 14 (12), 100379. doi:10.1016/j.jdmm.2019.100379

Su, J., Gao, F., and Lu, X. S. (2022). Research on the development mode and approach of grassland eco-cultural tourism under the background of rural revitalization. *Caoxue* (01), 82–86.

Ted, S. (1995). Cultural tourism and business opportunities for museums and heritage sites. *Tour. Manag.* 16 (5), 361–365. doi:10.1016/0261-5177(95)00039-q

Tsung, H. L. (2013). Influence analysis of community resident support for sustainable tourism development. *Tour. Manag.* 34 (34), 37–46. doi:10.1016/j.tourman.2012.03.007

Wang, X. M., Su, J. J., and Song, Y. M. (2021). Knowledge Graph Analysis of China's tourism poverty alleviation research based on Cite Space. *J. Leshan Normal Univ.* 36 (06), 58–66. doi:10.16069/j.cnki.51-1610/g4.2021.06.010

Wei, J. (2021). The design of index system for performance evaluation of eco-cultural tourism construction. *J. Guiyang Univ. Nat. Sci. Ed.* 16 (03), 28–33. doi:10.16856/j.cnki.52-1142/n.2021.03.007

Wei, M. (2015). Construction and evaluation of a performance model of the tourism industry. *Tour. Anal.* 20 (6), 653–664. doi:10.3727/108354215x14464845878039

Yang, Y. J., Lv, J. X., and Zhao, F. F. (2021). An empirical study on the ecological performance of tourism poverty alleviation inShangluo City. *Hubei Agric. Sci.* 60 (02), 180–183. doi:10.14088/j.cnki.issn0439-8114.2021.02.037

Yuan, L. (2022). Ecotourism justice and realization path based on "balance of interests. *Ecol. Econ.* 38 (03), 149–156.

Zheng, W. (2012). Current situation and improvement countermeasures of eco-tourism enterprise accounting. *Environ. Eng.* 40 (03), 304.