

# Study on the influencing factors and measurement of high quality development level of tourism industry in Guizhou

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## ABSTRACT

With the gradual improvement of the resilience and vitality of the tourism market, promoting the high-quality development of the tourism industry with the new development concept has become an important fundamental issue for the sustainable growth of the regional green economy. The article measures and analyzes the level of high-quality development of Guizhou's tourism industry from 2012 to 2021 on the basis of constructing an evaluation index system for high-quality development of tourism, using methods such as entropy value method and gray correlation analysis. The results found that: the average value of the development index of Guizhou's tourism high-quality development subsystem is ranked in the order of GD, ED, ID, SD, OD and CD, the level of green development and effective development of Guizhou's tourism industry is higher, while the level of coordinated development of the tourism industry and the level of openness are insufficient; HQD, ID, GD, OD, SD and ED show a fluctuating upward trend, while CD is in a fluctuating downward state, and the tourism high-quality development system of Guizhou has gone through a fluctuating upward trend. Guizhou tourism high-quality development system has experienced three stages of evolution, namely, "stable rise, rapid rise and fluctuating rise", and the level of Guizhou tourism high-quality development and the development level of its various sub-systems have been affected by the New Crown Epidemic to varying degrees, with a greater impact on the level of open development of the tourism industry. GDP, per capita park green space area and tourism high-quality development index correlation is larger, while the total amount of SO<sub>2</sub> emission and tourism high-quality development index correlation ranked at the bottom, tourism industry R & D funding is the most important factor affecting the level of high-quality development of Guizhou's tourism industry, and the total amount of SO<sub>2</sub> emission has the smallest impact on it. On this basis, countermeasures for the high-quality development of Guizhou's tourism industry are proposed.

**Keywords:** Tourism, high-quality development, Guizhou

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## 1. Introduction

China's economy has shifted from the stage of high-speed growth to the stage of high-quality development, and the status of tourism in social development and the national economic system has been rising, and it is increasingly becoming a new driving force to promote economic and social development, and an important hand to enhance the soft power of the region [1-3]. Guizhou is located in southwestern China, with unique natural scenery and cultural resources, known as "China's landscape is the best in the world", and in recent years, the tourism industry has shown a momentum of rapid development [4]. In the context of increasingly fierce competition in the tourism market, Guizhou, as a region with unique landscape scenery and ethnic cultural characteristics, rich and diverse tourism resources, has begun to develop a variety of types of tourism, and has achieved certain results [5-8].

Natural ecology and ethnic culture have formed a variety of tourism characteristics such as pure natural landscape, primitive and simple lifestyle, simple and diverse ethnic minority customs in Guizhou, which are not available in fast-paced cities and tourist attractions in other provinces [9-12]. These make Guizhou's tourism industry have more significant resource advantages, and constantly attract a large number of domestic and foreign tourists to go sightseeing and play [13-14]. At the same time, the development of tourism not only improves the employment rate of ethnic minority areas, the coverage rate of infrastructure in ethnic areas, but also effectively promotes the rapid economic and social development of local poverty-stricken ethnic minority areas [15-17]. However, the tourism industry in Guizhou is still in the stage of development of "high input, low output", without a good image and strong market competitiveness, lack of tourism products, the overall quality of the industry is not high [18-20]. Obviously, the transformation from tourism resource advantages to economic advantages is not rapid, and the pulling effect of tourism areas on the economy is not obvious [21-22]. In this context, there is an urgent need to construct a tourism development measurement model to study the efficiency of Guizhou's tourism industry, to analyze the influencing factors that restrict the efficiency of Guizhou's tourism industry. Effectively transform the tourism resource advantages into industrial and economic advantages, and realize the healthy and stable development of Guizhou's tourism industry.

A large number of scholars have summarized and analyzed the current situation and influencing factors of Guizhou's economic development and tourism development. Literature [23] explored the influence of many factors on the development of Guizhou's tourism industry, such as traffic and travel, the current situation of the industry, and foreign investment, and constructed an analytical model with tourism income as the dependent variable, to obtain the relevant factors that promote the development of Guizhou's tourism, and to provide a reference for accelerating the efficiency of Guizhou's tourism industry's high-quality development. Based on the historical data of Guizhou tourism, literature [24] analyzes the problems and shortcomings in the process of its high-quality development, points out that the development efficiency of Guizhou tourism industry at this stage is relatively low, and the objectives and means of development are relatively single, and points out the optimization direction for the construction of high-level Guizhou tourism industry. Literature [25] examined the economic impact of Guizhou tourism business environment on tourism activities based on the computable general equilibrium (CGE) model, which helps to improve the urgency of Guizhou's tourism business environment and promotes the high-quality development of Guizhou's tourism industry. Literature [26] shows that there is significant spatial heterogeneity in tourism efficiency within Guizhou province, and by constructing a spatio-temporal pattern analysis model, it is possible to fully understand the key factors that drive tourism efficiency in Guizhou counties and propose targeted measures such as optimization of resource allocation, to achieve rapid and stable development of regional tourism efficiency. Literature [27] used coupling and attribution analysis to measure the evolutionary characteristics of the spatial distribution of A-class scenic spots and the

influencing factors in Guizhou province, which provided valuable references for the spatial development and regulation strategies of Guizhou's tourism industry. Literature [28] studied the spatial coupling correlation between highway network and distribution of tourist attractions in Guizhou, and formulated reasonable service and function development strategies for different types of clusters, which can effectively promote the comprehensive and coordinated sustainable development of transportation and tourism. Literature [29] used the improved gravity model ArcGIS combined with transportation accessibility to explore the interaction mechanism and influence relationship between traditional villages and the development of tourism industry in Guizhou, which helps to activate the tourism value of traditional villages and provide new ecological location products for Guizhou tourism industry. Literature [30] established an evaluation model for the harmonious symbiotic development of tourism towns modeled on the Lotka-Volterra model as a way to explore the key elements for the development of high-quality tourism in Guizhou towns. The above study provides a multi-angle analysis for comprehensively recognizing and understanding the influencing factors of tourism efficiency in Guizhou tourism industry, and provides insights for carrying out the measurement of the level of high-quality development and influencing factors of Guizhou tourism industry.

Throughout the existing results, from different disciplines and dimensions, qualitative or quantitative methods have been used to solve the academic problems related to the high-quality development of tourism in a more in-depth manner, providing theoretical guidance and empirical references for this study. However, the index system for measuring and evaluating the high-quality development of tourism still needs to be further optimized, and the results of measuring and evaluating the high-quality development of tourism in Guizhou, a large province of ethnic tourism, are still rare, and the research on the high-quality development of tourism in Guizhou has not yet been systematically carried out in depth, and is in urgent need of injecting new ideas and methods.

## 2. Overview of the study area

Guizhou is an inland province that lacks the support of plains and is dominated by highland mountains, with the high and steep Wumeng Mountains in the west, the Dalou Mountains in the north, the Wuling Mountains in the east, the Miao Ridge stretching across a vast area of central China, and mountains and valleys distributed throughout the whole region. Within the territory of the mountain sex differentiation is significant, the natural landscape is vertical change, widespread karst landforms, high terrain environment and "mountain living, mountain tourism, mountain interesting, mountain enjoyment" as the characteristics of the national "culture of thousands of islands" together nurtured a unique mountain tourism resources, Guizhou The high-quality development of tourism in Guizhou has created resource conditions. In recent years, a series of ethnic culture and tourism activities with the theme of "Colorful Guizhou" have been held, resulting in the development of tourism showing a good trend of optimizing the environment, strengthening the strength, accelerating the transformation and making outstanding contributions, and laying a foundation for the development of Guizhou's tourism industry. People's Government, the State Ministry of Culture and Tourism and the State Administration of Cultural Heritage have issued "Ten Measures to Support the Recovery and High-Quality Development of Cultural Tourism", "Opinions on Promoting High-Quality Development of Tourism and Accelerating Tourism Industrialization to Build a Strong Tourism Province in Colorful Guizhou" and "Implementation Plan to Support the High-Quality Development of Guizhou's Culture and Tourism", which created a policy environment for the high-quality development of Guizhou's tourism industry. In 2021, Guizhou's tourism The work is remarkable, the annual reception of 644 million tourists, realizing tourism revenue of 664.216 billion yuan, year-on-year growth of 8.03 %, 15.91%, the added value of tourism and related industries exceeded 100 billion yuan, the initial realization of the requirements of the larger tourism industry, and the high-quality development of the tourism industry to provide the industrial conditions. However, the problems of real estate, homogenization, insufficient

development depth, and excessive replication of festival tourism still exist, which have become obstacles restricting the high-quality development of tourism. In view of this, taking Guizhou as the study area, measuring the level of high-quality development of the tourism industry, analyzing its evolution characteristics and influencing factors, and exploring countermeasures to improve quality and efficiency have become scientific problems that need to be solved urgently, and have certain theoretical significance and practical value.

### 3. Research methodology and data sources

#### 3.1. Research methodology

3.1.1. Construction of Evaluation Indicator System for High-Quality Development of Tourism Industry in Guizhou. High-quality development of tourism refers to the quality-oriented development guided by the new development concept, realizing strong innovation-driven capability, regional and industrial coordination, low pollution emission, green environmental protection, high-quality products and services, reasonable resource allocation, economic stability, and efficiency enhancement. Scientific construction of tourism high-quality development evaluation index system is the key to measurement and analysis, only according to the scientific, comprehensive, operable, systematic, forward-looking system design principles such as the selection of indicators, the conclusions drawn can be accurate quantitative study area tourism high-quality development status. Based on the definition of high-quality development of tourism and the principles of indicator system design, following the new development concept, according to the characteristics of tourism and the connotation of high-quality development, referring to the existing research literature, combining with the actual situation of the development of tourism in the study area, and consulting with the experts, this paper integrates the specific evaluation indicators that are used more frequently, and merges and excludes the relevant evaluation indicators through qualitative analysis, and finally starts from The evaluation index system of Guizhou tourism high-quality development is constructed in six dimensions of “innovation, coordination, green, openness, sharing and effectiveness” (Table 1), which is used to measure the level of high-quality development of the tourism industry. “The meaning of the six-dimensional subsystems is analyzed as follows:

**Innovation subsystem:** In the process of high-quality development, improving the creation and protection of intellectual property rights in tourism, giving full play to the investment effect of tourism assets in scenic spots, and fostering intelligent tourists with certain innovative thinking have become effective modes of innovative development in tourism. Therefore, the important role of the innovation subsystem cannot be ignored in the evaluation index system of Guizhou tourism high-quality development. In the paper, we mainly select specific indicators to characterize the level of tourism innovation and development, such as tourism industry R & D funding, the number of tourism academic papers published, and fixed asset investment in tourism industry.

**Coordination subsystem:** Coordination is both the method and purpose of high-quality development of tourism, as well as the standard for evaluating the degree of its development, which not only highlights the important role of coordination in the process of tourism development, but also indicates that the high-quality development of tourism can not be without the evaluation of the level of coordination. Guizhou, as a region of “ethnic customs + mountain tourism”, enhances the coordination of tourism development, which is conducive to promoting the cooperation and balanced development of tourism in various regions. In this paper, the coordinated development level of tourism is mainly characterized by the growth rate of total tourism income, the ratio of disposable income per capita of urban and rural residents, and the regional gap in passenger turnover.

**Green subsystem:** The high-quality development of tourism should adhere to the principle of green development and realize the organic unity of economic and ecological benefits. Good ecological endowment is a unique advantage for the high-quality development of tourism, however, in the

process of tourism development, ecological problems such as resource destruction, environmental pollution and energy overconsumption will also seriously affect the conservation of tourism environment. In order to enhance tourists' awareness of environmental protection, optimize the tourism ecosystem, and promote the high-quality development of tourism, specific indicators such as the forest coverage rate, per capita green area of parks, and the rate of harmless treatment of domestic waste are selected to characterize the level of green development of tourism.

**Openness subsystem:** opening up to the outside world not only enhances the influence of the tourism industry, but also is of great significance in promoting Chinese and foreign tourism and cultural exchanges. Continuously improve the level of tourism openness, promote the internationalization of national tourism, so as to drive the economic development of Guizhou. Therefore, international tourism foreign exchange income, passenger turnover and the number of foreign tourists coming to Guizhou are selected to characterize the level of openness of the tourism industry.

**Sharing subsystem:** Sharing development is the realization of the ultimate value of tourism, and the construction of tourist attractions, tourist transportation, travel agencies, tourist toilets and other infrastructures all need to be scientifically managed from the perspective of sharing development, so as to create benefits for the high-quality development of tourism. Therefore, the sharing status is also a necessary condition to measure the high-quality development of tourism. In the paper, the number of travel agencies, the number of star-rated hotels and the number of public toilets are selected to characterize the level of shared development of the tourism industry.

**Effective subsystem:** effective development is an important element in evaluating the quality and efficiency of tourism development, and diagnosing the relationship between tourism and the level of economic development is conducive to better promoting the high-quality development of the regional economy. Introducing the effective subsystem of tourism can objectively reflect the utility status of high-quality development of tourism. Therefore, indicators such as GDP per capita, the contribution rate of tourism to GDP, and the elasticity coefficient of the tourism economy to the number of tourists are selected in the paper to characterize the level of effective development of tourism.

**Table 1.** Evaluation index system for high-quality development of tourism in Guizhou

| system level                                                  | Subsystem Layer (Code)      | Indicator Layer                   | Code | Unit        | Properties | Description of indicators                                                                                                                                |
|---------------------------------------------------------------|-----------------------------|-----------------------------------|------|-------------|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| High-quality development of mountain tourism in Guizhou (HQD) | Innovative Development (B1) | Tourism Industry R&D Expenditures | B11  | 10,000 yuan | +          | Reflects the investment in "tourism+" innovation and development based on regional advantages, highlighting the policy support and development benefits. |
|                                                               |                             | Number of tourism academic papers | B12  | Chapter     | +          | Reflecting the capacity of regional intellectual                                                                                                         |

|  |                              |                                                                    |     |                           |   |                                                                                                        |
|--|------------------------------|--------------------------------------------------------------------|-----|---------------------------|---|--------------------------------------------------------------------------------------------------------|
|  |                              | published                                                          |     |                           |   | property creation and protection, indicating that mountain tourism resources have good research value. |
|  |                              | Fixed Asset Investment in Tourism                                  | B13 | Billions of dollars       | + | Reflecting the strength of investment in regional tourism assets                                       |
|  | Coordinated Development (B2) | Growth Rate of Total Tourism Income                                | B21 | %                         | + | Reflecting the growth rate of regional tourism economy                                                 |
|  |                              | Ratio of disposable income per capita of urban and rural residents | B22 | %                         | - | Reflecting the coordinated development of urban and rural tourism development in the region            |
|  |                              | Regional disparity in passenger turnover                           | B23 | Billion person-kilometers | - | Reflecting the gap between the regional passenger transportation workload and the national level       |
|  | Green Development (B3)       | Forest Coverage Rate                                               | B31 | %                         | + | Reflecting the degree of regional forest cover                                                         |
|  |                              | Green space per capita                                             | B32 | m2                        | + | Reflecting the construction of regional parks and green spaces and the                                 |
|  |                              |                                                                    |     |                           |   |                                                                                                        |

|  |                      |                                                      |     |                           |   |                                                                                                                                                                         |
|--|----------------------|------------------------------------------------------|-----|---------------------------|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |                      |                                                      |     |                           |   | ecological environment situation                                                                                                                                        |
|  |                      | Harmless treatment rate of domestic garbage          | B33 | %                         | + | Reflecting the strength of ecological environmental protection in the context of promoting the sustainable and healthy development of the tourism economy in the region |
|  |                      | Total SO2 emissions                                  | B34 | 10,000 tons               | - | Reflecting the quality of the regional atmospheric environment and the conditions for the creation of ecological space for tourism                                      |
|  | Open Development(B4) | Foreign exchange earnings from international tourism | B41 | US\$ 10,000               | + | Reflecting the foreign exchange earning capacity of tourism in the region                                                                                               |
|  |                      | Number of foreign tourists coming to Guizhou         | B42 | 10,000 visits             | + | Reflecting the scale of tourism into the region, highlighting the status of tourism and cultural exchanges.                                                             |
|  |                      | Passenger turnover                                   | B43 | billion person-kilometers | + | Reflects the volume of passenger transportation and the level of tourism                                                                                                |
|  |                      |                                                      |     |                           |   |                                                                                                                                                                         |

|  |                           |                                                                     |     |      |   |                                                                                                                                                                                                      |
|--|---------------------------|---------------------------------------------------------------------|-----|------|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |                           |                                                                     |     |      |   | development in the region                                                                                                                                                                            |
|  | Shared Development(B5)    | Number of travel agencies                                           | B51 | Home | + | Reflecting the scale of construction of travel agencies in the region                                                                                                                                |
|  |                           | Number of star-rated hotels                                         | B52 | one  | + | Reflecting the scale of opening star-rated hotels in the region                                                                                                                                      |
|  |                           | Number of Tourist Public Restrooms                                  | B53 | Seat | + | Reflecting the scale and capacity of public restroom construction in the region                                                                                                                      |
|  | Effective Development(B6) | GDP per capita                                                      | B61 | yuan | + | Reflecting the living standard of the people in the region                                                                                                                                           |
|  |                           | Contribution of tourism to GDP                                      | B62 | %    | + | Reflecting the status of the tourism industry, effectively measuring the quality and efficiency of tourism development, and demonstrating the relationship between tourism and economic development. |
|  |                           | Elasticity coefficient of tourism economy to the number of tourists | B63 | /    | + | Reflects the sensitivity of the tourism economy to changes in the number of                                                                                                                          |

|  |  |  |  |  |  |           |
|--|--|--|--|--|--|-----------|
|  |  |  |  |  |  | tourists. |
|--|--|--|--|--|--|-----------|

3.1.2. Entropy method. The entropy value method is an objective assignment method that determines the weight of indicators based on the size of the information provided by the observed value of each indicator. In the indicator evaluation system, the greater the gap between the indicator values, the greater the role played by the indicators in the comprehensive evaluation, that is, the greater the weight. The advantage of entropy value method is that it avoids the bias brought by human factors. Therefore, this paper applies the entropy value method to measure the level of high-quality development of Guizhou's tourism industry. The specific steps are as follows:

Step 1: Indicator setting. With  $n$  years,  $m$  indicators, then  $y_{\delta j}$  is the value of the  $j$  indicator in the first  $\delta$  year.

Step 2: Raw data normalization processing to eliminate the effect of magnitude.

The method of standardization processing for positive indicators is shown in Equation 1, and the method of standardization processing for negative indicators is shown in Equation (2).

$$y'_{\delta j} = \frac{y_{\delta j} - \min\{y_{\delta j}\}}{\max\{y_{\delta j}\} - \min\{y_{\delta j}\}} + 0.01 \quad (1)$$

$$y'_{\delta j} = \frac{\max\{y_{\delta j}\} - y_{\delta j}}{\max\{y_{\delta j}\} - \min\{y_{\delta j}\}} + 0.01 \quad (2)$$

In order to avoid the occurrence of 0 in the standardized data, the standardized results are uniformly added 0.01.

Step 3: Determine the weight of the indicator  $y_{\delta j}$ .

$$P_{\delta j} = \frac{y'_{\delta j}}{\sum_{l=1}^m y'_{\delta l}} \quad (3)$$

The constructed judgment matrix is dimensionless according to equation (3), and the standard matrix is obtained as  $P = [y'_{\delta j}]_{n \times m}$ .

Step 4: Calculate the entropy value of the  $j$ th indicator.

$$e_j = -k \sum_{l=1}^m (P_{\delta l}) * \ln(P_{\delta l}) \quad (4)$$

Step 5: Calculate the redundancy coefficient  $g_j$  between the  $j$  indicators.

$$g_j = 1 - e_j \quad (5)$$

Step 6: Calculate the weight of indicator  $j$ .

$$w_j = g_j / \sum_{j=1}^l g_j \quad (6)$$

Step 7: Calculate the development index of tourism high-quality development system and sub-systems by linear weighting method to measure their development level. For the convenience of measurement, this paper makes HQD, ID, CD, GD, OD, SD and ED characterize the level of high-quality development of tourism, the level of innovative development of tourism, the level of coordinated development of tourism, the level of green development of tourism, the level of open development of tourism, the level of shared development of tourism, and the level of effective development of tourism, and the method of calculation is shown in equation (7).

$$Q_{\partial i} = \sum_{j=1} w_j y_{\partial ij}' \quad (7)$$

In the formula, when  $Q_{\partial i}$  is  $ID_{ij}$ , it indicates the level of innovative development of tourism,  $w_j$  is the weight of each indicator of the subsystem of innovative development of tourism, and  $y_{\partial ij}'$  is the standardized data after panning of the indicator describing the innovative development of tourism. Development subsystem in year  $i$   $j$  of the standardized data after shifting the indicators. The measurement is the same when  $Q_{\partial i}$  is  $CD_{ij}$ ,  $GD_{ij}$ ,  $OD_{ij}$ ,  $SD_{ij}$ ,  $ED_{ij}$ , and  $HQD_{ij}$ , in that order.

3.1.3. Gray correlation analysis. This paper uses gray correlation analysis to analyze the factors affecting the high-quality development of tourism in Guizhou, taking the sample data as the standard, and using the gray correlation degree to describe the strength and ranking of the relationship between the factors. The specific calculation method is:

$$\xi_i(k) = \frac{\min_i \min_k |x_0(k) - x_i(k)| + \rho \max_i \max_k |x_0(k) - x_i(k)|}{|x_0(k) - x_i(k)| + \rho \max_i \max_k |x_0(k) - x_i(k)|} \quad (8)$$

Substitute the correlation coefficient  $\xi_i(k)$  into the formula to find the degree of correlation, Eq:

$$r_i = \frac{1}{n} \sum_{k=1}^n \xi_i(k) \quad (9)$$

Where  $i$  is the subscript of the comparison column,  $k$  is the serial number of the comparison column,  $n$  is the total number of data in the comparison column, and  $\rho$  is the resolution coefficient, which takes the value of 0.5.

### 3.2. Data sources

The data used in this paper are mainly from Guizhou Statistical Yearbook 2012-2022, China Statistical Yearbook 2012-2022, Guizhou Provincial Statistical Bulletin of National Economic and Social Development 2012-2021, China Tourism Statistical Yearbook 2012-2018, China Cultural Relics and Tourism Statistical Yearbook 2019-2021, and Guizhou Provincial Bureau of Statistics Official website, Guizhou Provincial Department of Culture and Tourism website, etc. The data on R&D expenditure of tourism industry, the number of academic papers published on tourism, the regional disparity in passenger turnover, and the contribution rate of tourism to GDP are obtained by referring to the existing research results measurements. Similarly, the elasticity coefficient of tourism revenue to tourist arrivals is also calculated according to the principle inference of existing research results, i.e., the ratio of the growth rate of total tourism revenue to the growth rate of total tourist arrivals, which is used to reflect the impact of tourism revenue on the change of regional tourist arrivals.

## 4. Comprehensive analysis of the high-quality development of tourism in Guizhou

### 4.1. Analysis of the weights of evaluation indexes for the high-quality development of Guizhou tourism industry

The raw data of specific indicators of Guizhou tourism high-quality development are substituted into equation (1) and equation (2) to obtain the standardized results. On this basis, the weights of the specific indicators of high-quality development of Guizhou's tourism industry were calculated using equations (3) to (6) (Table 2).

**Table 2.** Weight of high-quality development indicators of mountain tourism in Guizhou

| System | Subsystem (Code) | Subsystem | Code | Index Weight | Ranking |
|--------|------------------|-----------|------|--------------|---------|
| HQD    | ID(B1)           | 0.1719    | B11  | 0.0664       | 4       |
|        |                  |           | B12  | 0.0490       | 10      |
|        |                  |           | B13  | 0.0564       | 7       |
|        | CD(B2)           | 0.1041    | B21  | 0.0171       | 19      |
|        |                  |           | B22  | 0.0267       | 16      |
|        |                  |           | B23  | 0.0603       | 5       |
|        | GD(B3)           | 0.1656    | B31  | 0.0528       | 8       |
|        |                  |           | B32  | 0.0376       | 15      |
|        |                  |           | B33  | 0.0234       | 18      |
|        |                  |           | B34  | 0.0518       | 9       |
|        | OD(B4)           | 0.1027    | B41  | 0.0381       | 14      |
|        |                  |           | B42  | 0.0395       | 13      |
|        |                  |           | B43  | 0.0251       | 17      |
|        | SD(B5)           | 0.1827    | B51  | 0.0581       | 6       |
|        |                  |           | B52  | 0.0434       | 11      |
|        |                  |           | B53  | 0.0812       | 2       |
|        | ED(B6)           | 0.2731    | B61  | 0.0398       | 12      |
|        |                  |           | B62  | 0.0750       | 3       |
|        |                  |           | B63  | 0.1582       | 1       |

According to the analysis in Table 2, the evaluation indicators of Guizhou's high-quality development of tourism in terms of utility value are B63, B53, B62, B11, B23, B51, B13, B31, B34, B12, B52, B61, B42, B41, B32, B22, B43, B33 and B21, of which the top three are the elasticity coefficients of the tourism economy to the number of tourists, the number of public toilets and the contribution of tourism to GDP, indicating that they are influenced by the function of the tourism sharing subsystem, tourism effective subsystem and the tourism effective subsystem, The number of public toilets in tourism and the contribution rate of tourism to GDP, indicating that B63, B53 and B62 are the factors with the fullest utility value for the high-quality development of tourism in Guizhou, suggesting that they are more influenced by the functions of the tourism sharing subsystem and the tourism effective subsystem. On the other hand, the open tourism subsystem and the weight of specific indicators are ranked at the back, reflecting that the utility value of the open tourism subsystem is relatively weak, and the external attractiveness of the tourism industry needs to be improved. The reason for this is that the spillover effect of tourism is relatively lagging behind due to the mountainous environment, location characteristics, historical factors and the new crown epidemic, and the spillover elasticity of integration with other industries is not sufficiently utilized.

#### 4.2. Analysis of the level of high-quality development of Guizhou's tourism industry

By applying equation (7), the values of *ID*, *CD*, *GD*, *OD*, *SD*, *ED* and *HQD* can be measured from 2012 to 2021, and the results are shown in Table 3 and Figure 1.

**Table 3.** Evaluation results of high-quality development level of tourism in Guizhou

| Years | ID     | CD     | GD     | OD     | SD     | ED     | HQD    |
|-------|--------|--------|--------|--------|--------|--------|--------|
| 2012  | 0.0061 | 0.0229 | 0.0017 | 0.0534 | 0.0494 | 0.0114 | 0.1449 |
| 2013  | 0.0060 | 0.0481 | 0.0200 | 0.0517 | 0.0560 | 0.0144 | 0.1962 |
| 2014  | 0.0161 | 0.0559 | 0.0375 | 0.0579 | 0.0550 | 0.0223 | 0.2447 |
| 2015  | 0.0269 | 0.0521 | 0.0522 | 0.0596 | 0.0430 | 0.0396 | 0.2733 |
| 2016  | 0.0599 | 0.0521 | 0.0819 | 0.0707 | 0.0499 | 0.0436 | 0.3580 |
| 2017  | 0.0986 | 0.0468 | 0.0978 | 0.0811 | 0.0633 | 0.0644 | 0.4519 |
| 2018  | 0.1241 | 0.0411 | 0.1144 | 0.0947 | 0.0401 | 0.0889 | 0.5033 |
| 2019  | 0.1630 | 0.0380 | 0.1385 | 0.1037 | 0.0722 | 0.1550 | 0.6704 |
| 2020  | 0.0816 | 0.0865 | 0.1613 | 0.0080 | 0.0996 | 0.0537 | 0.4906 |
| 2021  | 0.1077 | 0.0977 | 0.1669 | 0.0013 | 0.1484 | 0.2119 | 0.7338 |
| AVG   | 0.0690 | 0.0541 | 0.0872 | 0.0582 | 0.0677 | 0.0705 | 0.4067 |

4.2.1. Analysis of the level of innovative development of the tourism industry. In 2012~2021, the ID increased from 0.0061 to 0.1077, with an average annual growth rate of 37.58%, and the overall level of innovation and development of Guizhou's tourism industry showed a fluctuating upward trend (Figure 1), indicating that with the increase in the input and output of indicators such as R&D funds in the tourism industry, investment in fixed assets in the tourism industry, and academic research results, the innovation driving ability of the tourism industry has been effectively cultivated and the innovation level of the tourism industry has been promoted rapidly. For example, the construction of innovative projects such as the "Colorful Guizhou" national tourism marketing platform, intelligent tourism towns, the integration of "big tourism + multiple industries", the "Red Army Village" and the "Long March Trail" research and education have improved the level of innovation and development of the tourism industry. The mean value of ID in 2012~2021 was 0.0690, but the mean value of ID in 2012~2016 was lower than 0.0690, while the mean value of ID in 2017~2021 was higher than 0.0690, of which the ID in 2019 was 0.1630, which was the highest value in the study period, and the ID in 2020 was 0.0816, which decreased significantly (as shown in Table 3). The results show that the innovation and development of Guizhou's tourism industry has experienced three evolutionary stages: steady rise, rapid rise and fluctuating rise during the study period, and the level of innovation and development of tourism has been significantly improved, especially the cultivation of innovative tourism products and the introduction of innovative tourism talents have promoted the innovation capacity building of the tourism demonstration zone, but the new crown epidemic has had a great pressure on the resilience and anti-risk ability of the tourism innovation subsystem.

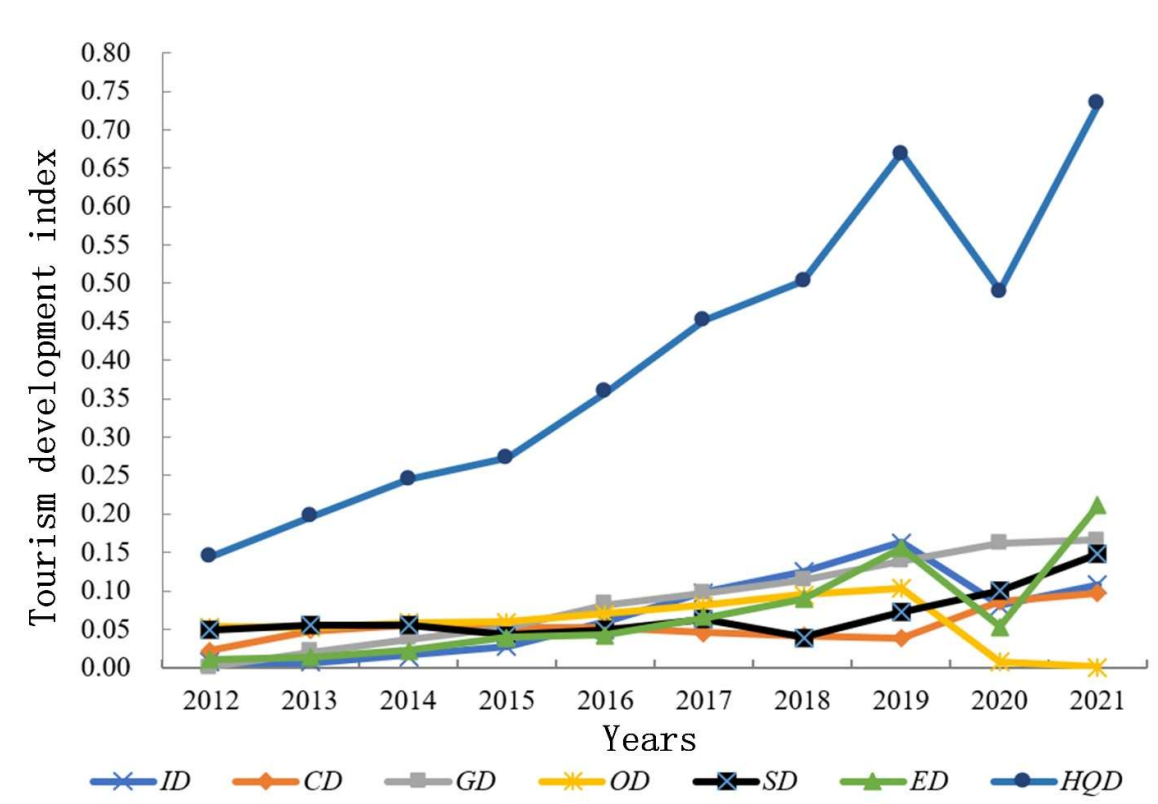


Fig. 1. Trend of high-quality comprehensive development level of tourism in Guizhou

4.2.2. Analysis of the level of coordinated tourism development. From 2012 to 2021 CD rose from 0.0229 to 0.0977, with an average annual growth rate of 17.49%, and the coordinated development level of Guizhou's tourism industry generally shows a fluctuating upward trend (Figure 1), indicating that the interaction between the components of the tourism coordination subsystem and the tourism subsystem is gradually strengthened, and the coordinated development tends to be in an orderly state, although the CD from 2015 to 2019 shows a small fluctuation phenomenon, but does not affect the elements to promote each other, cooperate with each other, and tend to the harmonious and consistent correlation state. 2012 to 2014 CD shows a slow growth trend, the curve changes gently; 2015 to 2018 CD shows a small downward trend, the curve changes are steeper; 2019 to 2021 CD is obviously rising, the growth rate is faster, and the curve is steadily rising (as Figure 1). The reason for this is that the tourism industry, as a pillar industry in Guizhou, has continued to increase its support capacity for the economy, but it has neglected the issue of balanced development of the tourism subsystem. In particular, the imbalance of the income gap between urban and rural residents has led to the phenomenon of a small decline in the level of coordinated development of the tourism industry from 2015 to 2018. The mean value of the CD from 2012 to 2021 is 0.0541, of which the CD from 2012 to 2019 is lower than its mean value, and the CD from 2020 to 2021 is higher than its mean value, with the lowest and the highest values of the CD occurring in 2012 and 2021 respectively (Table 3), indicating that the coordinated development of Guizhou's tourism industry in the study period has experienced two evolutionary phases: fluctuating upward and stable upward, with obvious differences in the level of coordinated development of the tourism industry, and that the coordination mechanism of the tourism industry and the coordination planning need to be optimized in depth.

4.2.3. Analysis of the level of green development of the tourism industry. From 2012 to 2021, the GD increased from 0.0017 to 0.1669, with an average annual growth rate of 66.47%. The level of green development of Guizhou's tourism industry has shown a steady upward trend, in which the level of

green development of the tourism industry from 2012 to 2020 increased at a faster rate, with a steeper curve, and the growth rate from 2020 to 2021 slowed down, with a more moderate curve (as shown in Figure 1). It shows that Guizhou tourism industry can follow the development concept of “green mountains are golden mountains”, continuously improve the ecological environmental protection mechanism of tourism development, basically form a green operation mode, especially in the field of mountain ecological conservation, green industry development and tourism environment construction and other fields of multi-dimensional integration with remarkable results, which promotes the tourism industry's green development. The average value of GD from 2012 to 2021 is 0.0872, GD from 2012 to 2016 is lower than the average value, GD from 2017 to 2021 is higher than the average value, and the lowest and highest values of GD appeared in 2012 and 2021, respectively (as shown in Table 3), reflecting that the green development of Guizhou's tourism industry in the study period has gone through the evolution stages of steady rise and rapid rise, and the overall level of green development of tourism has increased significantly. The overall level of green development has been significantly improved, the effectiveness of tourism environmental conservation is good, three-dimensional ecological restoration and governance has been accelerated, and the composite operation of agriculture, culture and tourism has been diversified, which provides an important condition for the sustained growth of the tourism industry's green innovation efficiency.

4.2.4. Analysis of the level of open development of the tourism industry. OD decreased from 0.0534 to 0.1037 from 2012 to 2019, with an average annual growth rate of 9.95%, and OD decreased from 0.0080 to 0.0013 from 2020 to 2021, with an average annual decreasing rate of 83.75%, and the level of Guizhou's tourism industry's open development showed a fluctuating and decreasing trend, in which the OD growth rate from 2012 to 2015 was slower, and the curve change was more flat; OD growth rate increased from 2015 to 2019, and peaked in 2019, and OD declined significantly from 2020 to 2021, and reached its lowest in 2021 (Figure 1). It shows that Guizhou's tourism industry promotes development by opening up, builds a well-known ethnic tourist destination adapted to international development, continuously optimizes the tourism system and mechanism, gradually forms an open and inclusive tourism market environment, and the big development trend of big opening leading to big tourism has been formed. However, in 2020, the sudden outbreak of the new crown epidemic, seriously affecting and impacting the global tourism market, resulting in inbound tourism forced to enter the “frozen period”, the resilience of the tourism industry and the restoration of greater inhibition, resulting in the short-term tourism industry, the level of openness of the development of a substantial decline in the OD. 2012-2021 OD average value of 0.0582, the average of 2012-2014, 2020-2021, the average value of 0.0582, the average value of the OD. The average value of OD from 2012 to 2021 is 0.0582, of which OD from 2012 to 2014 and 2020 to 2021 is lower than the average value, and OD from 2015 to 2019 is higher than the average value. The lowest and highest values of OD appeared in 2021 and 2019, respectively (e.g., Table 3), reflecting that the open development of tourism in Guizhou during the study period showed an evolutionary trajectory of steady rise, rapid rise and continuous decline, and the new crown epidemic became a key factor restricting the improvement of the level of open development of tourism.

4.2.5. Analysis of the level of shared tourism development. SD from 2012 to 2021 rose from 0.0494 to 0.1484, with an average annual growth rate of 13.00%, the level of shared development of Guizhou's tourism industry showed a fluctuating upward trend, in which the SD fluctuation variance from 2012 to 2018 was larger, and the curve change showed a spiral upward trend; SD growth rate from 2019 to 2021 continued to increase, with an average annual growth rate of 43.37%, the The curve is steeper (Figure 1). It reflects that the shared services of Guizhou tourism industry has passed the development and exploration stage, the problems of management supervision and investment risk have been effectively solved, the shared innovation construction capacity of tourism industry has been improved, and the tourism with shared talents, resources and management has become a development trend.

The average value of SD in 2012~2021 was 0.0677, of which SD was lower than the mean in 2012~2018, higher than the average in 2019~2021, and the lowest and highest values of SD appeared in 2018 and 2021 respectively (as shown in Table 3), indicating that the shared development of Guizhou's tourism industry has experienced an evolutionary process from "spiral forward orientation" to "continuous upward growth orientation", and the level of shared development of tourism has been continuously improved, and the shared results have benefited all people. It has promoted the improvement of people's sense of well-being. Therefore, it is important to accelerate the formation of the service resource sharing mechanism of "ethnic flavor + mountain tourism", highlight the main position of "shared tourism", and create a special tourism shared development demonstration area based on the rich ethnic culture tourism resources and excellent ecological tourism resources of Qiandi. It is of great significance to enhance the comprehensive benefits of shared tourism development.

4.2.6. Analysis of the effective level of tourism development. From 2012 to 2021, the ED rose from 0.0114 to 0.2119, with an average annual growth rate of 38.36%, and the level of effective development of Guizhou's tourism industry showed a fluctuating upward trend, in which the ED growth rate from 2012 to 2019 and 2021 was faster, and the curve change was steeper, and there was a significant decline in the ED from 2020 to 2021 (as shown in Figure 1). Reflecting the high efficiency of high-quality development of the tourism industry, the rich ethnic customs, diverse ecological environment, unique tourism landscape for the effective development of the tourism industry provides a good endowment of resources and competitive advantages, and lays the foundation for the promotion of the tourism industry's "mechanism + mode + mode" innovation and empowerment of effective development. Although the new crown epidemic has impacted and inhibited the development of Guizhou's tourism industry in the short term, the country's "anti-epidemic" work has achieved remarkable results, and the recovery and revitalization of the tourism industry have boosted the steady recovery of the effective development level. The mean value of ED in 2012~2021 was 0.0705, of which the ED was lower than the mean in 2012~2016, higher than the mean in 2018~2019, and the lowest and highest values of ED appeared in 2012 and 2021, respectively (Table 3). Reflecting the effective development of Guizhou's tourism industry shows a steady rise, rapid rise and fluctuation of the upward trajectory, the overall level of effective development of the tourism industry is higher, and the growth rate is faster, and the vitality and resilience of the tourism industry's effective development in the post-epidemic period can be repaired more quickly.

4.2.7. Analysis of the level of high-quality development of the tourism industry. From 2012 to 2021, HQD rose from 0.1449 to 0.7338, with an average annual growth rate of 19.75%, the level of high-quality development of Guizhou's tourism industry has shown a fluctuating upward trend, in which the HQD growth trend was slow in 2012-2015, and the curve change was relatively flat; the HQD growth rate accelerated overall in 2015-2019, and the curve was relatively steep; and the HQD growth rate was accelerated overall in 2020 by the New Crown Epidemic, HQD showed a straight-line decline phenomenon, and began to rebound in 2021 (Figure 1). It reflects the synergy between Guizhou's tourism innovation and development subsystem, tourism coordinated development subsystem, tourism green development subsystem, tourism open development subsystem, tourism shared development subsystem and tourism effective development subsystem gradually strengthening and gradually developing in an orderly direction, and the performance level of high-quality tourism development has been continuously improved, and Guizhou's tourism industry innovation, service upgrading, market cultivation and project efficiency have been promoted. The mean value of HQD from 2012 to 2021 was 0.4067, in which HQD from 2012 to 2016 was lower than the mean value, and HQD from 2017 to 2021 was higher than the mean value, and the lowest and highest values of ED appeared in 2012 and 2021, respectively (e.g., Table 3), with a difference of 0.5889 in the extremes over the 10-year period. It shows that the high-quality development of Guizhou's tourism industry has experienced three evolutionary stages: steady rise, rapid rise and fluctuating rise, and the high-quality

development effect of tourism has been significantly improved, especially in the digitalization of tourism resources, the "intelligent manufacturing" of tourism equipment and the integration of cultural tourism formats, which has promoted the creation and creation of a high-quality national tourism brand with high-quality characteristics of "Mountain Park Province • Colorful Guizhou Style".

## **5. Analysis of factors affecting the high-quality development of Guizhou's tourism industry**

This paper uses the correlation analysis method to compare the geometric relationship between the time series data of Guizhou tourism industry, according to the formula (8) and (9) to calculate the correlation  $r_i$ , and sort them, the results (such as Table 4) found that the correlation between the 19 selected factors and the Guizhou tourism industry high-quality development index is mainly distributed in the range of 0.60 to 0.80, the mean value of 0.68, and the difference does not exceed 0.18, indicating that they are in the medium correlation or above, the factors are more closely related to each other, and it is meaningful to use them to judge the main factors affecting the high quality development of Guizhou tourism. It shows that they are above medium correlation, and the factors are more closely related to each other, which is meaningful to judge the main factors affecting the high-quality development of Guizhou tourism.

**Table 4.** Correlation degree and correlation order of influencing factors for high-quality development of tourism in Guizhou

| Influencing Factors                                                 | Unit                      | Code | Correlation | Correlation order |
|---------------------------------------------------------------------|---------------------------|------|-------------|-------------------|
| Tourism Industry R&D Expenditures                                   | million yuan              | B11  | 0.7777      | 1                 |
| Number of academic papers published on tourism                      | piece                     | B12  | 0.7181      | 6                 |
| Fixed Asset Investment in Tourism                                   | Billions of dollars       | B13  | 0.7409      | 4                 |
| Growth rate of total tourism income                                 | %                         | B21  | 0.6206      | 18                |
| Ratio of disposable income per capita of urban and rural residents  | %                         | B22  | 0.6248      | 16                |
| Regional disparity in passenger turnover                            | Billion Kilometers        | B23  | 0.6256      | 15                |
| Forest Coverage Rate                                                | %                         | B31  | 0.6594      | 12                |
| Green space per capita                                              | m2                        | B32  | 0.7469      | 3                 |
| Harmless treatment rate of domestic garbage                         | %                         | B33  | 0.7391      | 5                 |
| Total SO2 emissions                                                 | million tons              | B34  | 0.6060      | 19                |
| Foreign exchange earnings from international tourism                | million dollars           | B41  | 0.6858      | 10                |
| Number of foreign tourists coming to Guizhou                        | Million passengers        | B42  | 0.6928      | 9                 |
| Passenger turnover                                                  | billion person-kilometers | B43  | 0.6298      | 14                |
| Number of travel agencies                                           | home                      | B51  | 0.6836      | 11                |
| Number of star-rated hotels                                         | number                    | B52  | 0.6245      | 17                |
| Number of public toilets for tourism                                | seat                      | B53  | 0.7100      | 8                 |
| GDP per capita                                                      | Yuan                      | B61  | 0.7477      | 2                 |
| Contribution rate of tourism to GDP                                 | %                         | B62  | 0.7157      | 7                 |
| Elasticity coefficient of tourism economy to the number of tourists | /                         | B63  | 0.6571      | 13                |

According to the analysis in Table 4, the correlation between B11 and the index of high-quality development of tourism reaches 0.77, and the correlation order is in the first place, indicating that this influence factor is most closely related to the high-quality development of tourism, and that the input of B11 is conducive to the innovative development of tourism. The correlation between the seven influencing factors of B12, B13, B32, B33, B53, B61 and B62 and the index of high-quality development of the tourism industry is between 0.70 and 0.75, but only the correlation of all the factors of the tourism industry's innovative development subsystem is above 0.70, which indicates that Guizhou's tourism industry has a good prospect for innovative development and is more closely related to high-quality development of the tourism industry. The correlation between the five influencing factors B31, B42, B41, B51 and B63 and the index of high-quality development of the tourism industry ranges from 0.65 to 0.70, and they are more distributed at the level of the open development subsystem of the tourism industry. The correlation between the five influencing factors B21, B22, B23, B43 and B52 and the index of high-quality development of the tourism industry is between 0.62 and 0.63, and the correlation with the parent series is gradually weakening, and it is more distributed at the level of the coordinated development of the tourism industry subsystem. B21, B22 and B23 are all located in the coordinated development sub-system, and the overall correlation order is at the back of the list, indicating that the coordinated development sub-system of tourism has a low correlation with the

tourism quality development index. B34 reflects the status of atmospheric quality, which has the lowest correlation with the tourism quality development index, and has the smallest impact on the quality development of the tourism industry.

In summary, the top three influencing factors are B11, B61 and B32, indicating that B11 is the most important factor influencing the level of high-quality development of tourism in Guizhou, while B34 has the lowest correlation with the index of high-quality development of tourism in Guizhou, reflecting that B34 is the factor with the least influence.

## 6. Conclusions and development responses

### 6.1. *Conclusions of the study*

Based on measuring and analyzing the level of high-quality development of Guizhou's tourism industry, this paper compares the geometric relationship of its factors affecting the high-quality development of tourism and draws the following conclusions:

- 1) The average value of the development index of Guizhou's tourism high-quality development subsystem from 2012 to 2021 is ranked in the order of GD (0.0872), ED (0.0705), ID (0.0690), SD (0.0677), OD (0.0582) and CD (0.0541). The level of green development of tourism and effective development of tourism in Guizhou is high, while the level of open development of tourism and coordinated development is insufficient.
- 2) From 2012 to 2021, HQD, ID, GD, OD, SD and ED all show a fluctuating upward trend, while CD is in a fluctuating downward state, Guizhou's tourism high-quality development has gone through three stages of evolution: "stable rise, rapid rise and fluctuating rise", and the overall level of high-quality development of the tourism industry is relatively high. The overall level of high-quality development of tourism is high, and the effect of performance output is relatively significant. However, affected by the Xin Guan epidemic, the level of high-quality development of Guizhou's tourism industry has been constrained to different degrees, especially for the level of open development of the tourism industry has a greater impact.
- 3) From 2012 to 2021, Guizhou's tourism industry R & D expenditure has the greatest correlation with HQD, followed by per capita GDP, then per capita green space area, and finally investment in fixed assets in tourism; the total SO<sub>2</sub> emissions have the least correlation with the tourism industry high-quality development index. Tourism industry R&D expenditure is the most important factor influencing the level of high-quality development of mountain tourism in Guizhou, and total SO<sub>2</sub> emission is the factor with the least influence on it.

### 6.2. *Development responses*

Guizhou's tourism industry is currently in a new stage of rapid development, and its overall level of high-quality development is high, but there is still the problem of the low level of coordinated tourism development and the low level of open development. According to this conclusion, the following countermeasures are proposed.

- 1) Promote the integration of culture and tourism at the resource, industry and geographical levels, and enhance the coordination level of high-quality development of tourism. Strengthening the integration of cultural and tourism resources, cultural and tourism industry integration and cultural and tourism regional integration is conducive to the construction of a new pattern of cultural and tourism, cultural and tourism and cultural and tourism to promote the coordination of the new pattern of regional coordination, which can effectively empower the coordinated development of tourism high-quality development of the various subsystems. In Guizhou around the "four new" main attack "four" to push forward the new stage of high-quality development, the tourism sector must improve the quality of the tourism industry between the regional integration of planning and differentiated management level, and constantly strengthen the regional tourism cooperation, and gradually form a

large-scale effect and multi-core effect, the establishment of the integration and mutual promotion and benign effect. Establishing a coordinating mechanism of integration, mutual promotion and benign interaction. At the same time, it should also promote the technological innovation of Guizhou mountain tourism, realize scientific and technological innovation to continuously empower the coordinated development of tourism sub-systems, do a good job in the spatial layout and positioning of functional areas for the integration and development of the "ethnic customs + mountain tourism" featured culture and tourism, enhance the organic integration and conversion efficiency of ethnic cultural resources and mountain ecotourism resources, and promote the resources, industry and geographical level, build a platform for information exchange and scientific and technological cooperation among the tourism industry, gradually narrow the gap between the various sub-systems of high-quality development of the tourism industry, and coordinate the high-quality and coordinated development of the regional culture and tourism industry.

2) Promote the integration of market players, regulation and services, and enhance the openness of high-quality tourism development. Strengthening the integration of domestic and foreign market entities, market regulation and services in the tourism industry is conducive to the creation of a policy environment, the coordination of the cultural and tourism market and the optimization of resource allocation, which can sustainably enhance the openness of the high-quality development of the tourism industry. In the context of the industrialization of "ethnic customs + mountain tourism" in Guizhou, the tourism department should adhere to the open development of tourism, continuously improve the international competitiveness of tourism, promote the organic combination of ecological benefits and tourism benefits, and create an international brand of green Guizhou "ethnic customs and mountain tourism". Continuously expanding opening-up efforts, adding fresh vitality to the market, promoting better adaptation of the tourism industry to international development patterns, enhancing domestic and international influence and the openness of the tourism consumer market, and realizing the organic integration of the tourism industry's multi-factor market. The main manifestation of this is to focus on promoting the multi-dimensional integration of the food and beverage factor market, upgrading the shopping factor market, innovating the tourism factor market and developing a new factor market, creating an international high-level supply market, and giving full play to the effects of market integration at the level of the main body, regulation and service. At the same time, the open service level of the tourism market should be continuously optimized to improve the service quality of Guizhou's tourism open development and the satisfaction of tourists. In addition, it should also break through the institutional, policy and regionalization barriers between regions, and build a whole-area high-quality and open cultural and tourism brand and international tourism market, so as to further improve the level of Guizhou's tourism industry's open development.

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