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# Measurement and Interaction Analysis of Integration Development of Culture and Tourism Industry in Southwest Mountainous Provinces

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**Abstract** From the perspective of industrial integration, we constructed a systematic integrated development evaluation system of culture and tourism industry, and used the improved entropy value method and the integration degree model to measure and analyze the systematic integrated development level of culture and tourism industry in Southwest mountainous provinces from 2012 to 2020. The results found that: (1) the comprehensive development level and integration degree of culture industry and tourism industry in southwest mountainous provinces generally show a fluctuating upward trend. At the current stage, the integrated development of culture and tourism industry system is in a stable stage, and the evolution state is intermediate coordination tourism industry lagging type. (2) The integration process of culture and tourism industry system in southwest mountainous provinces has experienced three stages of development, namely, “starting - stabilization - maturity”, showing “on the verge of dissonance - barely coordinated -Primary coordination-Intermediate coordination-Good coordination”. (3) The regional heterogeneity of the comprehensive development level and integration degree of the cultural and tourism industry system in the mountainous regions of Southwest China is obvious, and the integration pattern as a whole shows the dynamic evolution characteristics of “on the verge of dysfunctional dominance, intermediate coordination aggregation, and interlacing of middle-secondary and high-level coordination”. On this basis, the deep integration strategy of culture and tourism industry system is proposed.

**Index Terms** integration development, cultural industry, tourism industry, southwest mountainous area

## I. Introduction

If the tourism industry can take culture as the connotation, the quality will naturally be improved; if the cultural industry takes tourism as the form, the vitality will naturally burst out [1]. With the deepening of the development concept of “green, innovation, coordination and sharing”, the proportion of the integrated consumption mode of “culture+tourism” in the modern service industry in the region is increasing, which gives a new connotation to the proposition of “integration of culture and tourism”. The proposition of “culture and tourism integration” has been given a new connotation. In the academic dimension, the concern about the integration of culture and tourism began at the end of the 20th century, Reinhard B and others [2] believe that the mutual integration of culture and tourism can enhance the quality and attractiveness of tourism, and promote the utilization and development of traditional cultural resources in the tourist places. Since the new century, the research on the integration of culture and tourism has been in the ascendant, and the foreign research mainly focuses on the analysis of the interactive impact of the cultural industry and tourism industry [3], [4], the exploration of the integration path [5], [6], the application of the integration results [7], [8] and the empirical case study [9], [10] and other aspects. Agba A M O et al. outlined the advantages and reasons for the growth of cultural tourism, explored the definition of cultural tourism, and proposed a method to maximize the potential of the tourism industry through the analysis of cultural elements [3]. Jordan L A used the theory of economic geography to analyze the characteristics of the location affecting the tourism economy related to the hosting of large-scale cultural activities and sports events, and discussed the path of integration of local economic development problems [5]. On the basis of elaborating the theory related to cultural tourism, Curran C et al. proposed the principles of cultural tourism resource development and designed several practical application cases of cultural tourism integration [8]. Joanne Connell regarded film tourism as a major growth area of tourism research and tried to provide a roadmap for the exponential growth of the social science literature in the areas related to the study or promotion of film tourism [9]. Overall, the above research results provide domestic scholars with ideas to draw on and methodological insights to study the integration of culture and tourism. Relatively speaking, the domestic research on the integration of culture and tourism industry started late,

and its results mainly focus on four dimensions: ① Integration mode. Xin Xin [11] takes system theory, innovation theory and industry chain theory as the theoretical basis, comprehensively utilizes the system analysis method, qualitative and quantitative methods to make research on the integrated development and mode of cultural industry and tourism industry, and theoretically enriches the theory of integration of culture and tourism industry. Zhang Haiyan et al [12] study that enterprise behavior orientation, diversified needs of tourists, government guidance, intermediary institutions development, the role of the market mechanism and other factors are the most important driving force for the integration of the tourism industry and the cultural industry, and summed up the operation mode of the integration of the tourism industry and the cultural industry. Based on the theory of industrial division of labor and industrial integration, Zuo Xugang [13] explored the feasibility and necessity of the integration and development of the two major industries of tourism and culture, as well as the intrinsic mechanism and extrinsic thrust of the integration and development of the two. Li Jinlai [14], Bai Lan [15], Li Xinjian et al [16], and Brendan Canavan [17] also analyzed the problem of the integration mode of culture and tourism by using quantitative methods. ② Integration evaluation. Chen Hongling et al [18] used benevolent cross DEA efficiency model, cold hot spot analysis, Tobit model and other methods to comprehensively explore the spatio-temporal dynamic evolution and driving mechanism of the integration efficiency of cultural industry and tourism industry. Liu Ling [19] took the relationship between cultural and tourism industry integration and regional economic growth as the core, analyzed the integration mechanism of cultural industry and tourism industry, and sorted out the path of interaction between cultural and tourism integration and regional economic growth. Xiao Liming et al [20] constructed a cultural and tourism integration index system from the concept of green development, and used ESDA, geographic detector and other methods to study the spatial and temporal characteristics and influencing factors of green cultural and tourism integration development in China. In addition, DONG Hongxia [21], WANG Li-juan [22], and ZHAO Yaowu [23] quantitatively study the issue of cultural and tourism integration, and make a useful exploration of the construction of evaluation indicators. ③ Integration optimization. Zhao Yan et al [24] address the main dilemmas faced by the rural industry along the Grand Canal, take the concept of cultural and tourism integration as an entry point, and construct integration optimization ideas from four aspects, such as resource integration, functional integration, industrial integration and technological integration. Zhai Linfeng [25] conducted an empirical study on the impact of the coupling level of culture industry and tourism industry on the optimization of tourism industry structure from the perspective of industrial integration through an econometric model. Feng Fei [26] used a combination of qualitative research and quantitative research to systematically study the optimization of the industrial structure of cultural and tourism integration in the Yangtze River Economic Belt with the research framework of "characteristic analysis-capability evaluation-regional difference-efficiency measurement- influencing factors-countermeasures". ④ Integration empirical evidence. Yin Huaguang et al [27] take the Wuling Mountain Area as the research object, and on the basis of analyzing the current situation of the integration and development of the cultural industry and the tourism industry, explore the problems in the integration and development of the two and put forward countermeasures such as scientific preparation of the development plan, focusing on building high-quality brands, and creating the mechanism of integration and development. Deng Yingbang [28] uses the combination of theory and actual cases to further improve the theoretical system of the integration of the two industries, and scientifically guides the development of the integration of the cultural industry and tourism industry. Hong Xueding et al [29] and Hou Bing et al [30] explored the coupling and integration of culture and tourism in the Yangtze River Delta region, providing high-quality cases for the empirical evidence of integration.

Throughout the existing results, from different disciplines and dimensions, using qualitative or quantitative or a combination of qualitative and quantitative methods to explore the causes, modes, mechanisms and performance of the integration of culture and tourism in a more in-depth manner, which is an important theoretical guidance for the subsequent systematic research on industrial integration and inspiration, and provides theoretical support for the systematic exploration of the integration of the cultural industry and the tourism industry in mountainous regions. However, in the process of "new normal" where cultural elements and tourism elements are constantly integrated into the integration and development of related fields, the discussion on the integration of culture and tourism in the academic world is still controversial, and people study the tourism issue by integrating the cultural genes and paying insufficient attention to the construction of the index system for the quantitative evaluation of the integration of culture and tourism industry, and the research on the integration of cultural industry and tourism industry in mountainous areas is still controversial. The empirical results on the integration of cultural industry and tourism industry are still insufficient, which urgently needs to inject new ideas for in-depth research. In addition, the research on the integrated development of culture and tourism industry is not only a single geographic issue, but also a "comprehensive issue" jointly decided by tourism, culture and geography, which is also an important foundation for the sustainable development of mountain economy. Therefore, under the perspective of high-quality development, guided by the integration theory, coordination theory and sustainable development theory, taking the

southwestern mountainous provinces as the empirical area, measuring and evaluating the integration development level of culture and tourism industry can provide useful reference for the scientific development and utilization of culture and tourism resources in the mountainous provinces and the construction of culture and tourism resource information system. This is a brand-new field, which needs to be explored and systematically researched.

## II. Materials and Methods

### II. A. Overview of the study area

The southwestern mountainous province is located at  $20^{\circ}54' \sim 34^{\circ}19'N$  and  $97^{\circ}21' \sim 112^{\circ}04'E$ , including Chongqing, Sichuan, Yunnan and Guizhou provinces and cities [31]. The area of the whole region accounts for 11.8% of the total land area of the country, across the combination of the three major terraces, mountainous landforms, complex and diverse geographic conditions, mountainous nature of the differentiation is significant, vertical changes in the natural landscape, the interplay of mountainous natural landscapes and cultural landscapes created a splendid and colorful "culture of thousands of islands", for the integration of the development of mountain culture and tourism to create a good endowment foundation. Good endowment foundation for the integrated development of mountain culture and tourism. The whole region has a wide range of tourism resources, many world natural heritages and cultural heritages, unique ethnic cultures and minority customs, and a complete range of mountain tourism resources, such as ornamental, exploratory, experiential, vacation and knowledge-based. Around the "mountain residence, mountain tour, mountain fun, mountain enjoyment" and other mountain culture has made a big article of tourism, but also make the colorful mountain tourism resources with more tourism functions, higher ornamental value and more special scientific research value, and the mountain landscape with beautiful geographical combination, the ecological, economic and social areas have a positive effect for the mountain tourism industry integration development provides the industrial conditions. It provides industrial conditions for the integrated development of mountain culture and tourism.

### II. B. Data and Methods

#### II. B. 1) Data sources

The basic data of the evaluation indicators of cultural industry and tourism industry are derived from the Statistical Yearbook of Chinese Cultural Relics, the Statistical Yearbook of Culture and Tourism of China, the Statistical Yearbook of Chinese Culture and Related Industries, the Statistical Yearbook of China Tourism, the Provincial (Municipal) Statistical Yearbook, the Provincial (Municipal) National Economic and Social Development Bulletin, the Provincial (Municipal) Cultural Industry Development Report, the National Macroeconomic Database, the official website of the Provincial (Municipal) Department of Culture and Tourism, the official website of the Provincial (Municipal) Bureau of Statistics, the colorful Guizhou network and field research.

#### II. B. 2) Research methodology

##### (1) Construction of indicator system

Culture is the soul of tourism, and the essence of tourism is a cultural activity, so there is an essential and natural internal connection between the tourism industry and the cultural industry. The inclusion of cultural elements in the tourism industry can expand its cultural value; As a carrier of culture, tourism provides a broader platform for the development of the cultural industry [30]. At the new level of the cultural and tourism industry, space is "all-domain", time is "whole-process", structure is "multi-level", variety is "full series", and status is "pillar industry" [32]. Taking this as a theoretical guide, the construction of the evaluation index system for the integrated development of the cultural and tourism industry system in mountainous provinces has certain exploratory value for solving the practical problems of measuring the deep integration of multiple industries. However, the connotation and characteristics of tourism industry and cultural industry are more complex, and the indicator system for measuring the two industries has not been completely unified [33]. Xie Xia et al. constructed the index system of integrated development level of tourism industry and cultural industry from the dimension of production factors and output performance [33]; Hou Bing et al. established the evaluation indexes of integrated development of cultural industry and tourism industry from the dimension of industrial performance level and industrial factor level [30]; Li Li et al. constructed the index system of integrated development of cultural industry and tourism industry from the perspective of production factors and output level [34]. In view of this, this paper, according to the definition of cultural industry [35] and tourism industry [36], based on the reference to the existing research literature [30], [33]-[34] and the current development status of the study area, utilizes the basic principles of input-output analysis method, follows the principles of science, relative independence and data availability, integrates the specific evaluation indexes that are used with a high frequency from the two major industries, and determines the evaluation indexes after merging and including. The evaluation index system of the integrated development of cultural and tourism industry system in mountainous provinces (Table 1) is used to evaluate the stage, degree and

level of the integrated development of the two subsystems. Among them, the indicator layer of cultural industry subsystem includes 10 specific indicators, such as value added of cultural industry, cultural utility fees, cultural market employees, etc., which mainly characterize the elements and performance level of the development of cultural industry; and the indicator layer of tourism industry subsystem includes 10 specific indicators, such as domestic tourism income, foreign exchange income from tourism, travel agency revenue, etc., which mainly characterize the elements and performance level of the development of tourism industry.

Table 1: Evaluation index system of integrated development of cultural and tourism industry system in mountainous provinces

	Indicator layer	Code	Level 1 indicators	Code	Secondary indicators	unit	Weighting
X	Indicators for the development of cultural industries	XA	Output performance	x1	Value Added of Cultural Industries	100 million yuan	0.105
				x2	Operating Profit of Cultural Market Operating Institutions	Thousand dollars	0.194
				x3	Operating Profit of Cultural Manufacturing Enterprises Above Scale	10,000 yuan	0.049
				x4	Operating Profit of Cultural Wholesale and Retail Trade Enterprises Above Scale	10,000 yuan	0.091
				x5	Operating Profit of Cultural Service Enterprises Above Scale	10,000 yuan	0.133
		XB	Factors of production	x6	Cultural Market Employees	person	0.091
				x7	Cultural Utilization Fee	10,000 yuan	0.099
				x8	Number of business organizations in the cultural market	piece	0.077
				x9	Number of cultural and related industry enterprises above designated size	piece	0.078
				x10	Number of performing arts organizations	piece	0.082
Y	Tourism Industry Development Indicators	YA	Output performance	y1	Value Added of Tourism	100 million yuan	0.043
				y2	Domestic Tourism Revenue	100 million yuan	0.129
				y3	Foreign exchange earnings from tourism	billion dollars	0.060
				y4	Domestic Tourist Arrivals	100 million people	0.125
				y5	Overseas, Hong Kong and Macau Tourist Arrivals	10,000 people	0.049
		YB	Factors of production	y6	Number of travel agencies	family	0.173
				y7	Number of star-rated hotels	family	0.113
				y8	Number of Tourist Attractions	piece	0.135
				y9	Employees	piece	0.114
				y10	Number of Catering Enterprises Above the Limit	piece	0.059

In this study, the original data standardization of secondary indicators was processed by applying the extreme difference method (Eq. 2), and the weights of specific indicators (Table 1) were measured by applying the improved entropy value method. This method is an objective assignment method mainly through standardized transformation, avoiding the bias caused by subjectively determined human factors [37].

## (2) Industrial Integration Model

There is a natural coupling between the cultural industry and tourism industry itself, the development of tourism industry promotes the prosperity of cultural industry, the prosperity of cultural industry promotes the development of tourism industry, the process of mutual integration of the two can be measured and evaluated by using the coupling coordination degree model [30]. Based on this, this paper constructs the industry integration degree model to measure and evaluate the integration process and evolution state of the culture and tourism industry system.

First, industry development index

Let  $x_1, x_2, x_3 \dots x_{10}$  be the indexes describing the development level of culture industry subsystem; let  $y_1, y_2, y_3 \dots y_{10}$  be the indexes characterizing the development level of tourism industry subsystem. Then the functional relationship formula is:

$$\begin{aligned} f(x) &= \sum_{i=1}^n w_i x_i \\ f(y) &= \sum_{j=1}^n w_j y_j \end{aligned} \quad (1)$$

where:  $f(x)$  represents the development index of culture industry subsystem, and  $f(y)$  represents the development index of tourism industry subsystem;  $w_i$  and  $w_j$  represent the weights of each micro-indicator of the two major subsystems, respectively;  $n$  denotes the number of years;  $x_i$  and  $y_j$  are the standardized values of each indicator of the two major subsystems, respectively, and the basic formula is:

$$\begin{aligned} X_{ij} &= \frac{X_{ij} - \min \{X_j\}}{\max \{X_j\} - \min \{X_j\}} + 0.01 \\ X_{ij} &= \frac{\max \{X_j\} - X_{ij}}{\max \{X_j\} - \min \{X_j\}} + 0.01 \end{aligned} \quad (2)$$

In Eq. (2),  $x_{ij}$  represents the value of the  $j$ th evaluation indicator in the  $i$ th year,  $x_{ij}'$  represents the value of the indicator after standardization, and  $\max\{x_{ij}\}$  and  $\min\{x_{ij}\}$  represent the maximum and minimum values of the  $j$ th evaluation indicator in the evaluation year, respectively. It should be noted that after the standardization process, 0.01 is added uniformly in order to prevent the individual data may be "0", which leads to the index is meaningless [33].

Second, the industrial integration degree model

The degree of industrial integration represents the degree of interaction between two or more industries and the strength of their influence on each other, and the larger the coefficient, the stronger the integration between the industries and the development in a benign direction [38]. In order to scientifically quantify the level of integration and development of culture and tourism industry system, this paper uses the degree of industry integration to characterize the degree of interaction and integration and development between two major subsystems in the culture and tourism industry system of mountainous provinces, which is denoted by  $D$ . The degree of industry integration is the degree of interaction and integration between two or more industries:

$$C = \sqrt{\frac{4f(x) \cdot f(y)}{f(x)^2 + f(y)^2}} \quad (3)$$

$$T = af(x) + bf(y) \quad (4)$$

$$D = \sqrt{C \cdot T} \quad (5)$$

where:  $T$  represents the comprehensive evaluation index of the two major subsystems in the mountainous provincial cultural and tourism industry system, and  $C$  represents the integration coefficient of the two major subsystems;  $a, b$  are the coefficients to be determined, taking into account that the contribution of the cultural industry subsystem and the tourism industry subsystem to the development of the cultural and tourism industry system in the mountainous provinces is equally important, so they are both set to 1/2;  $k$  is the adjustment coefficient, as the indicators of the evaluation system are divided into two major subsystems, the calculation of  $k=2$ . In order to make the degree of industrial integration correspond to the qualitative criteria, based on the existing



research results [30], [38], this paper sets the identification criteria for the integration of cultural and tourism industry system in mountainous provinces (Table 2).

Table 2: Identification criteria for systematic integration of cultural and tourism industries in mountainous provinces

Industrial integration	Integration stage	Characteristics	Level of integration and development	Remarks
0.00~0.09	germination stage	The two industries are not closely connected and are in a state of unorganized development.	Extremely dysfunctional	$f(x) > f(y)$ Indicates lagging tourism industry  $f(x) < f(y)$ Indicates lagging cultural industries
0.10~0.19			Severe Dissonance	
0.20~0.29			Moderate Dissonance	
0.30~0.39			Mildly dysfunctional	
0.40~0.49	Beginning Stage	The interaction between the two industries has begun to strengthen, and the development tends to be in an orderly state.	On the verge of becoming dysfunctional	
0.50~0.59			Barely coordinated	
0.60~0.69	Stabilization stage	The two industries promote and cooperate with each other, showing a benign upward trend.	Elementary coordination	
0.70~0.79			Intermediate coordination	
0.80~0.89	Mature stage	The two industries have a high degree of interdependence and are developing in an orderly manner.	Good coordination	
0.90~1.00			Quality coordination	

### III. Results and analysis

#### III. A. Analysis of the development level of the culture industry subsystem and tourism industry subsystem in the southwest mountainous provinces

Firstly, the improved entropy value method is applied to measure the micro-indicator weight values (Table 1) and it measures the sequence values of  $f(x)$  and  $f(y)$  in the southwest mountainous province through equation (1) (Table 3); secondly, Person correlation analysis [39] is conducted on the sequence values of  $f(x)$  and  $f(y)$ , with  $r=0.81$ , which indicates that they are in a high degree of correlation and are closely related, and the following fusion measurements and spatial-temporal evolutionary The analysis has significance; again, based on equations (3)~(5), the comprehensive evaluation index  $T$ , integration coefficient  $C$ , and integration degree  $D$  of the culture and tourism industry system are measured,  $T$ ,  $C$ , and  $D \in [0, 1]$ , and the closer they are to 1 indicates that the better the level of industrial development is, and the closer they are to 0 indicates that the worse the level of industrial development is. Finally, the value of  $D$  is judged and analyzed in correspondence with the integration development identification criteria (Table 2), and the evaluation results of the integration development of the cultural and tourism industry system from 2012 to 2020 in the southwestern mountainous provinces are obtained (Table 3).

According to the analysis in Table 3, the development index of cultural industry subsystem, tourism industry subsystem and comprehensive evaluation index of southwest mountainous province all show a fast growth trend,  $f(x)$  rises from 0.164 in 2012 to 0.619 in 2020, with an average annual growth rate of 18.03%, which indicates that the output performance of cultural industry grows at a fast rate, the industrial structure is optimized continuously, and the connotation advantages of national culture are enhanced. The overall development trend is good, which creates preconditions for the high quality integration of the subsystem of cultural industry and tourism industry;  $f(y)$  rises from 0.167 in 2012 to 0.559 in 2020, with an average annual growth rate of 16.33%, reflecting the steady growth of the development performance of the mountain tourism industry, accelerated upgrading and upgrading of the industry, and continued enhancement of the contribution capacity of the empowered mountain economy, which lays a solid foundation for the enhancement of cultural nature of the tourism industry.  $T$  rose from 0.166 in 2012 to 0.589 in 2020, with an average annual growth rate of 17.15%, indicating that the growth rate of the comprehensive level of the culture and tourism industry system is basically stable, and the benefits of the integration of culture and tourism are remarkable, which lays the foundation for the high-quality development of the mountain economy.

Table 3: Evaluation results of systematic integration development of cultural and tourism industry in southwest mountainous provinces

Year	f(x)	f(y)	T	C	D	f(x)VSf(y)	Integration stage	Level of integration	Type of integration
2012	0.164	0.167	0.166	0.999	0.407	$f(x)<f(y)$	Start-up phase	On the verge of becoming dysfunctional	Cultural Industry Lag
2013	0.174	0.274	0.224	0.951	0.461	$f(x)<f(y)$	Getting Started	On the verge of becoming dysfunctional	Cultural Industry Lagging
2014	0.205	0.326	0.265	0.948	0.501	$f(x)<f(y)$	Getting Started	Barely coordinated	Cultural Industry Lag
2015	0.310	0.413	0.361	0.980	0.600	$f(x)<f(y)$	Starting Stage	Elementary coordination	Cultural Industry Lagging
2016	0.572	0.458	0.515	0.988	0.713	$f(x)>f(y)$	Stabilization	Intermediate coordination	Tourism Industry
2017	0.536	0.550	0.543	0.999	0.737	$f(x)<f(y)$	Stabilization	Intermediate coordination	Lagging Cultural Industry
2018	0.635	0.566	0.601	0.996	0.774	$f(x)>f(y)$	Stabilization Stage	Intermediate coordination	Tourism Industry
2019	0.567	0.856	0.712	0.959	0.826	$f(x)<f(y)$	Mature stage	Good coordination	Lagging Cultural Industry
2020	0.619	0.559	0.589	0.997	0.766	$f(x)>f(y)$	Stabilization Stage	Intermediate coordination	Tourism Industry

In 2012~2015,  $f(x)>f(y)$ , indicating that the development level of the cultural industry subsystem in southwest mountainous provinces lags behind that of the tourism industry subsystem, and the tourism industry subsystem is in a dominant position in the integrated development process of the cultural and tourism industry system, and the tourism industry has a driving effect on the cultural industry. In 2016~2020  $f(x)$  and  $f(y)$ , the variable interaction is in the alternating state of overdevelopment or lagging development, in which  $f(x)>f(y)$  in 2016, 2018 and 2020, reflecting that the level of development of the tourism industry subsystem lags behind that of the cultural industry subsystem, and that the cultural industry has an obvious role in promoting the development of the tourism industry, and the creative ability of the cultural industry effectively makes up for the problem of product structure homogenization of tourism industry; In 2017 and 2019  $f(x)<f(y)$ , the development level of the tourism industry subsystem is significantly higher than that of the culture industry subsystem, indicating that in the process of integration and development of the culture and tourism industry system, the contribution ability of the tourism industry to support the culture industry has been increasing, but the depth of the integration of traditional ethnic cultural elements into the mountain tourism industry is in need of improvement.

In summary, from 2012 to 2020, the development index of the cultural industry subsystem, the development index of the tourism industry subsystem and the comprehensive evaluation index of the southwestern mountainous provinces have risen rapidly, showing a normal succession trend, and the tourism industry is in an advantageous state of development in general, and the role of its driving force for the cultural industry has continued to increase. However, in 2016, 2018 and 2020, the Southwest Mountain Province, which is famous for its mountainous boutique tourism, has seen the development level of the tourism industry subsystem lagging behind that of the culture industry subsystem, which is mainly due to the fact that the late investment in the protection, inheritance and development of many characteristic ethnic and cultural resources such as the red historical relics, the traditional villages of hereditary ethnic groups, and the ethnic non-heritages and cultures, etc. has been insufficient and the scientific integration of the ethnic original culture into the cultural system has not yet been completed. The scientific transplantation of the original national cultural elements and mountain ecological resources into the tourism industry, resulting in insufficient development of the cultural connotation of tourism activities, and the lack of a smooth mechanism for the integration of culture and tourism and the lack of in-depth integration of the content of the problem. Therefore, the economic and cultural integration of the tourism industry in the southwest mountainous provinces needs to be strengthened urgently, and the pace of mutual integration of cultural and tourism resource advantages and industrial foundation needs to be accelerated.

### III. B. Analysis of the integration and development of the cultural and tourism industry system in the southwestern mountainous provinces

#### III. B. 1) Analysis of the level of integration and development of the cultural and tourism industry system in the southwestern mountainous provinces

Combined with the analysis of the evaluation results in Table 3, the integration degree of the cultural and tourism industry system in the southwest mountainous provinces showed a continuous upward trend, with the D value

increasing from 0.407 in 2012 to 0.766 in 2020, with an average annual growth rate of 8.24%, and the integration degree of the cultural and tourism industry system lasted for 6 years in the coordinated development state, and the growth rate was only 1.81% in the stable stage and the mature stage. It shows that the integration process of the cultural and tourism industry system has gone through three stages of development: "start-stability-maturity", showing five evolutionary states of "on the verge of imbalance-reluctant coordination-primary coordination-intermediate coordination-good coordination", and the integration degree of the cultural and tourism industry system lasts the longest in the coordinated development state and grows the fastest in the initial stage.

Three stages namely: 2012~2015, the integrated development of culture and tourism industry system is in the initial stage, the interaction between the two industries begins to strengthen, the two industries are more closely related, the development tends to be in order, the overall level of the industry is slowly improving, but the cultural industry subsystem lags behind the tourism industry subsystem, the two industries have poor support capacity and synergistic effect between each other; 2016~2018, 2020 In 2016~2018 and 2020, the integrated development of culture and tourism industry system is in a stable stage, the two industries promote each other, cooperate with each other, and the development level is more balanced, showing a benign upward trend, but the overall state of the development level of the culture industry subsystem lagged behind and transitioned to the front, and its competitiveness gradually took the advantage of the culture and tourism industry system; In 2019, the integrated development of the culture and tourism industry system is in a mature stage, with a high degree of interdependence between the two industries, showing orderly development status, and the two industries are in a mature stage. In 2019, the integrated development of culture and tourism industry system is in a mature stage, the two industries have a higher degree of interdependence, presenting an orderly development state, but the gap between the development level of the culture industry subsystem and the tourism industry subsystem is widening and the development level of the culture industry subsystem is lagging behind, which is a greater coercion to the balanced development of culture and tourism industry.

The five evolution states, namely: 2012~2013, the integration evolution of the culture and tourism industry system is on the verge of dissonance, indicating that the two industries are weakly matched and the development level is low, and the integration development of the two is in a weak and unsustainable state; in 2014, the integration evolution of the culture and tourism industry system is in the type of barely coordinated, reflecting that the subsystem of the culture industry is gradually transformed from the crude development to the intensive and efficient way, and the subsystem of the tourism industry is significantly strengthened, and the structural optimization has achieved a significant improvement in strength. Strength significantly strengthened, structural optimization has achieved certain results, the degree of matching between the two industries is improved, and the overall level of development is gradually improved; in 2015, the evolution of the integration of the culture and tourism industry system belonged to the primary coordination type, indicating that the integration of the culture industry subsystem and the tourism industry subsystem has achieved significant results, and the two spatial layouts have begun to be optimized, and the contribution of the culture and tourism industry to the mountain economy has gradually increased; in 2016~2018 and 2020, the culture and tourism industry system will be integrated and coordinated. In 2018 and 2020, the system integration evolution of culture and tourism industry belongs to the intermediate coordination type, reflecting that the internal function repair of the two industries has achieved certain results, and the overall development level of the industry has been greatly improved, and the two have begun to check and balance each other and cooperate with each other, presenting a benign fusion situation. In 2019, the system integration evolution of culture and tourism industry belongs to the good coordination type, indicating that the two industries are mutually promoting and supporting each other and can meet the economic needs of the mountainous provinces in Southwest China. It can meet the demand for sustainable economic development of the southwestern mountainous provinces, and the functional integration and development of the two present a coordinated and orderly state.

Currently,  $f(x)=0.619$ ,  $f(y)=0.559$ ,  $f(x)>f(y)$ ,  $D=0.766$  in the southwest mountainous provincial area, indicating that the degree of integration of the culture and tourism industry system is 0.766, and the development of the integration of the two industries is in a stable stage, and the evolutionary state is the intermediate coordination of the tourism industry subsystem lagging type. However, in 2019,  $f(x)=0.567$ ,  $f(y)=0.856$ ,  $f(x)<f(y)$ ,  $D=0.826$  in the southwest mountainous provincial area, reflecting that the degree of integration of the culture and tourism industry system is 0.826, and the development of the integration of the culture and tourism industry system is in a stable stage, and the evolutionary state is a well-coordinated culture industry lag type. Through comparison, it is found that the comprehensive evaluation index and integration degree of the industry system in 2020 are lower than that in 2019, and the value of the  $f(y)$  variable decreases by a larger side, but the difference between  $f(x)$  and  $f(y)$  gradually narrows, and the development level of the culture industry and tourism industry presents a balanced situation. The reason for this is that, due to the great influence and impact of the new crown epidemic in 2020, the



culture and tourism industry has entered the “frozen period” of the epidemic, resulting in serious suppression of the demand market and the supply market, which has exerted a greater coercion on the industry's resilience and risk-resistant ability, and the performance loss of the cultural industry subsystems and the tourism industry subsystems has been greater. For example, according to statistics, the loss of the national culture and tourism industry will reach 40% in 2020. During the Spring Festival holiday, the loss of the epidemic to the cultural industry and tourism industry is expected to be more than 500 billion yuan; during the Qingming holiday, the total number of people received by domestic tourism decreased by more than 60% year-on-year, and the realized tourism revenue decreased by more than 80% year-on-year [40]. Therefore, it is of great significance to realize the balanced development of the subsystems of the culture and tourism industry system, and to enhance the integration of the culture industry and tourism industry in order to realize the sustainable recovery and transformation and upgrading of the industry.

### III. B. 2) Interactive analysis of the integrated development of the cultural and tourism industry system in the southwestern mountainous provinces and regions

According to Eq. (1), the sequence values of  $f(x)$  and  $f(y)$  are measured for each province and domain in the southwest mountainous region (Table 4), and based on Eqs. (3) to (5), the comprehensive evaluation index  $T$ , the integration coefficient  $C$ , and the degree of integration  $D$  of the cultural and tourism industry system of each province and domain in the southwest mountainous region are measured, which leads to the results of the evaluation of the integration development of the cultural and tourism industry system of the southwest mountainous region in 2012, 2016, and 2020 (Table 4).

Table 4: Evaluation results of systematic integration development of culture and tourism industry in provinces and regions in southwest mountains

Province	Year	$f(x)$	$f(y)$	$T$	$C$	$D$	$f(x)/Vf(y)$	Integration stage	Level of integration
Guizhou	2012	0.186	0.180	0.183	0.999	0.428	$f(x)>f(y)$	Start-up phase	On the verge of becoming dysfunctional
Yunnan		0.350	0.137	0.243	0.808	0.444	$f(x)>f(y)$	Getting Started	On the verge of becoming dysfunctional
Sichuan		0.304	0.179	0.242	0.934	0.475	$f(x)>f(y)$	Starting Stage	Nearly Dysfunctional
Chongqing		0.044	0.290	0.167	0.4600	0.277	$f(x)<f(y)$	Sprouting Stage	Moderate Dissonance
Guizhou	2016	0.651	0.463	0.557	0.971	0.736	$f(x)>f(y)$	Stabilization Stage	Intermediate level of coordination
Yunnan		0.515	0.473	0.494	0.998	0.702	$f(x)>f(y)$	Stabilization Stage	Intermediate coordination
Sichuan		0.464	0.382	0.423	0.991	0.647	$f(x)>f(y)$	Stabilization Stage	Elementary coordination
Chongqing		0.600	0.599	0.599	1.000	0.774	$f(x)>f(y)$	Stabilization Stage	Intermediate coordination
Guizhou	2020	0.706	0.588	0.647	0.992	0.801	$f(x)>f(y)$	Mature stage	Good coordination
Yunnan		0.373	0.502	0.438	0.978	0.654	$f(x)<f(y)$	Stabilization Stage	Elementary coordination
Sichuan		0.764	0.604	0.684	0.986	0.822	$f(x)>f(y)$	Mature stage	Good coordination
Chongqing		0.638	0.510	0.574	0.988	0.753	$f(x)>f(y)$	Stabilization Stage	Intermediate coordination

Combined with the analysis of the results in Table 4, in the spatial dimension, the evolution of the integration of the cultural and tourism industry system in the mountainous regions of southwest China is characterized by obvious geographic heterogeneity, and the spatial distribution of the integration stage and the integration level has a strong correlation, with the high value area of the integration stage basically coinciding with the high value area of the integration level. The integration pattern of the cultural tourism industry system in each province and region as a whole presents the dynamic evolution characteristics of “near-disordered dominance, intermediate-level coordinated aggregation, and interlaced middle and high coordination” (Table 4), and the average annual growth rate of the integration degree of the cultural tourism industry system of Guizhou, Yunnan, Sichuan and Chongqing is 8.15%, 4.96%, 7.10% and 13.32% in that order, with obvious differences and significant heterogeneity. The differences are obvious and the heterogeneity is significant, but the level of integration of the cultural and tourism

industry system in each mountainous province tends to evolve towards the coordination level and the maturity or stability stage. In the time dimension, the D value increases from the lowest value of 0.277 in 2012 to 0.822 in 2020, indicating that the integration level of the cultural and tourism industry system in the mountainous regions of southwest China as a whole exhibits a smooth upward trend from dysfunctional to coordinated development. 2012, the integration level of the cultural and tourism industry system of the mountainous regions of southwest China,  $D \in [0.277, 0.475]$ , with the lowest value in Chongqing Municipality, and the highest in Sichuan Province, and the type of integration stage is the start-up level and maturity or stabilization stage. Sichuan Province, the type of integration stage is the starting stage and the budding stage, the level of integration is dominated by the verge of dysfunction, and its overall level of integration and development is low. This reflects that the output function of the cultural and tourism industry system of the southwestern mountainous provinces is insufficient, resulting in the mutual constraints of the cultural industry factor and the tourism industry factor, the poor foundation conditions of the mountainous industry, and the tourism ecological environment problems that need to be repaired urgently. In 2016, the degree of integration of the cultural and tourism industry system of the southwestern mountainous provinces was  $D \in [0.647, 0.774]$ , with the lowest value in Sichuan Province and the highest value in Chongqing Municipality, and the integration of the cultural and tourism industry system of the southwestern mountainous provinces was  $D \in [0.647, 0.774]$ . The integration development of culture and tourism industry system in each province is in the stable integration stage and coordination state, and is dominated by the intermediate level of coordination, and the level of integration development is significantly improved compared with that of 2012. This indicates that the culture industry subsystem and tourism industry subsystem promote each other and cooperate with each other, showing a benign upward trend, the culture and tourism industry system is gradually transformed into an intensive and efficient production mode, and the tourism ecological environment problems have been repaired to a certain extent. In 2020, the integration degree of the culture and tourism industry system of all provinces and regions in the Southwest Mountainous Region  $D \in [0.654, 0.822]$ , with the lowest value in Yunnan Province, and the highest in Sichuan Province, and the type of integration stage is the stable stage and mature stage. stage type is the interlacing of stabilization stage and maturity stage, the integration development is in a coordinated state, and the proportion of good coordination reaches 50%, the cultural industry subsystem and tourism industry subsystem have a high degree of interdependence, presenting an orderly development state, and the industrial output performance lays the foundation for meeting the high-quality development of mountain economy. However, compared with 2016, the integration degree of the culture and tourism industry system in Yunnan Province and Chongqing Municipality showed a small rebound phenomenon, mainly due to the impact of the Xin Guan epidemic, the culture industry and tourism industry suffered a heavy blow, mainly covering scenic spots, travel agencies, hotels, performing arts, etc., which resulted in the decline of the value of the secondary indicators of the culture and tourism industry system of the southwestern mountainous provinces and regions and the release of the vitality of the industry system was inhibited.

To summarize, the level of integrated development of cultural and tourism industry system in all provinces and regions in the southwest mountainous area is in an upward stage, the development of cultural industry subsystem and tourism industry subsystem is not balanced, and the geographical and spatial differences in the integration and evolution of cultural and tourism industry system in all provinces and regions are obvious, and the Xin Guan epidemic is the main influencing factor leading to the comprehensive level of the cultural and tourism industry system and the integrated development in 2020.

## IV. Conclusions and recommendations for response

### IV. A. Main findings

On the basis of constructing the evaluation index system for the integrated development of culture and tourism industry system in mountainous provinces, this paper determines the identification standard for the integrated development of the industry, and applies the industry integration model and the improved entropy value method to measure and interactively analyze the level of integrated development of the culture and tourism industry system of the southwestern mountainous provinces from 2012 to 2020, and arrives at the following conclusions:

(1) The comprehensive development level and integration degree of culture and tourism industry system in the southwest mountainous province area show a fluctuating upward trend in general, but the capriciousness and risk-resistant ability of the culture and tourism industry in 2020 are coerced by the new crown epidemic, resulting in small fluctuations in the comprehensive development level and integration degree of the culture industry and tourism industry. At present, the integrated development of culture and tourism industry system in southwest mountainous provinces is in a stable stage, and the evolution state is intermediate coordination tourism industry lag type.

(2) The integration process of cultural and tourism industry system in the southwestern mountainous provinces has gone through three stages of development, namely, "starting - stabilization - maturity", showing "on the verge of dysfunction - barely coordinated", "primary coordination - intermediate coordination - intermediate coordination", and "intermediate coordination". Primary coordination - intermediate coordination - good coordination", the integration of cultural and tourism industry system lasts the longest in the coordinated development state, and grows the fastest in the start-up stage.

(3) The regional heterogeneity of the comprehensive development level and integration degree of the cultural and tourism industry system in the southwest mountainous provinces and regions is more obvious, and the integration pattern as a whole presents the dynamic evolution characteristics of "on the verge of dysfunctional dominance, intermediate coordination aggregation, and interlacing of middle-secondary and high-level coordination", and the current integration level of the cultural and tourism industry system of Sichuan is higher, and is in the maturity stage, with an evolution state of good coordination. The evolution state is good coordination level, while the integration development of cultural and tourism industry system in Chongqing, Guizhou and Yunnan provinces is in a stable stage, and the evolution state is intermediate coordination level.

#### **IV. B. Recommendations for countermeasures**

As a giant system with openness, complexity and interactivity, the mutual integration of its components is a compound process of gradual and dynamic evolution. In order to further enhance the degree of in-depth integration of the culture and tourism industry system and orderly promote the high-quality development of the culture and tourism industry, according to this conclusion, the following in-depth integration strategies are proposed:

(1) Integration of culture and tourism resources, with tourism recognizing culture. Enhance the organic integration and conversion efficiency of national cultural resources and mountain ecotourism resources, accelerate the census identification and scientific development and utilization of national special cultural resources, and realize the development goal of "cultural tourism".

(2) Integration of cultural and tourism industries and balanced development. Strengthen the in-depth integration of the ethnic multicultural industry and the mountain boutique tourism industry, maintain the ecological background of the "Thousand Islands of Culture", innovate the development chain of the culture and tourism industry, create a composite and innovative culture and tourism demonstration base with dual-industry attributes, and realize the goal of balanced development of the two industries.

(3) Integration of mountainous regions, culture and tourism to promote the region. Break the administrative and geographical restrictions of the new thematic mountain culture and tourism in Yunnan, Guizhou, Sichuan and Chongqing, strengthen the regional integrated management, and empower new technology to create a borderless multi-functional ethnic culture and tourism industry area, so as to realize the goal of mountain-wide culture and tourism integration and development.

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