

# Development of Fuzzy Logic CRITIC Coupling Coordination Degree Evaluation Algorithm

Practice of Cultural and Tourism Integration Development in the Yangtze River Economic  
Belt, China

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**Abstract**—The integrated development of culture and tourism in the Yangtze River Economic Belt refers to a strategic initiative to push economic development and regional coordinated development with culture and tourism as the core. The purpose of this paper is to evaluate the coupling coordination degree of the integrated development of culture and tourism in the Yangtze River Economic Belt, by analysing the integrated development of culture, tourism and economy, and constructing an evaluation index system based on culture and tourism, in which 5 normative indicators and 19 basic indicators are constructed under the cultural perspective, and 4 normative indicators and 10 basic indicators are constructed under the tourism perspective, and its role and impact on regional economic development is explored based on the construction of the index system. Based on the construction of the indicator system, the role and influence of the indicators in regional economic development are explored. The CRITIC algorithm is used to calculate the importance of stratified indicators and stratified evaluation results, and finally, the coupling coordination degree of the research object is calculated through the coupling coordination degree model, which shows that the 13 provinces (municipalities directly under the central government) along the Yangtze River Economic Belt have a slightly different degree of coordination, but the least of them have reached the primary level of coordination, but it also proves that this paper proves the feasibility and necessity of the research method, and it can provide a good solution for the integrated development of culture and tourism in the Yangtze River Economic Belt. However, it also proves the feasibility and necessity of the research method of this paper, which can provide theoretical and practical guidance for the integrated development of culture and tourism in the Yangtze River Economic Belt, and provide new ideas and methods for the development of local tourism along the way.

**Keywords**—Cultural and tourism integration; Yangtze River Economic Belt; coupling coordination degree; CRITIC algorithm

## I. INTRODUCTION

In China, the integrated development of culture and tourism has become a topic of great concern and has made some progress in academic research and practice. As a country with a long history and rich cultural heritage, China is endowed with unique cultural and tourism resources. Therefore, the integrated development of culture and tourism has become an important way to promote the development of tourism, cultural heritage and cultural industry, and domestic research on the integrated development of culture and tourism has gradually gained attention and importance [1-3]. Scholars have explored the

theoretical basis, practice mode, policy support and other aspects of the integrated development of culture and tourism through field research, literature analysis and case studies, not only focusing on the impact of tourism on cultural heritage and the role of cultural resources in promoting tourism, but also putting forward a series of valuable ideas and suggestions [4-6]. Secondly, government departments and related institutions have also begun to pay attention to the integrated development of culture and tourism, and have issued a series of policies and measures to support the integration of culture and tourism, which aim to promote the sharing, complementation and integration of cultural and tourism resources, to promote the development of cultural and tourism industries, and to enhance the quality of tourism experience and cultural heritage. At the same time, some regions and scenic spots in China have begun to explore the development mode of integrating culture and tourism by organising cultural festivals, traditional performances, cultural experience activities, etc., integrating cultural elements into tourism products and services, which enriches the tourism experience, attracts more tourists, and promotes the development of the local economy [7-8].

It is believed abroad that such integrated development of culture and tourism can not only promote economic growth but also enrich people's spiritual lives and enhance international mutual understanding and friendship. In foreign countries, many scholars and research institutions have conducted in-depth research on the integrated development of culture and tourism and put forward many theoretical and practical results, which have made important contributions to the development of this field. Therefore, in foreign countries, many universities and research institutions have established interdisciplinary research teams to conduct in-depth research on the integrated development of culture and tourism, which has promoted the academic development of this field [9-10]. Foreign scholars have put forward many theoretical frameworks and models for the integrated development of culture and tourism, such as the theory of cultural tourism industry chain, the theory of cultural creative industry, the theory of cultural heritage protection, etc. [11-12]. These theoretical explorations have provided theoretical support and guidance for the integrated development of culture and tourism, and theoretical guidance for the relevant practices, and so along with this, many foreign research institutes have carried out in-depth studies on the practical cases of the integrated development of culture and tourism, and summarised the successful cases. In-depth study, summed up the

successful case experience and failed lessons, these practice case studies for the integration of culture and tourism development in other regions to provide reference and warning. Relevant research tasks cultural and creative industries as an important support for the integrated development of culture and tourism, so they have conducted in-depth research on the development path, innovation mode and policy support of cultural and creative industries, which provides important ideas for the integrated development of culture and tourism [13-15].

However, how to promote the deep integration and sustainable development of culture and tourism, and determine the degree of integration of culture and tourism at this stage, especially the degree of coordinated development of regional culture and tourism has become a new research hotspot, this paper considers that the Yangtze River Economic Belt, as one of the most important regions of China's economy, and the integration of culture and tourism development is of great significance to its economic development, so it adopts the CRITIC algorithm [16] to carry out a study on the degree of significance of the basic indicators in the indicator system of culture and tourism integration. Based on the coupling coordination degree [17] to determine the degree of cultural and tourism integration. In order to provide in-depth exploration and expansion of the concept of cultural and tourism integration, and to promote the continuous improvement and innovation of the theory of cultural and tourism integration.

## II. EVALUATION MODEL CONSTRUCTION

### A. Overview of the Study Area and Sources of Data

1) *Study area:* In this paper, the study area is selected as provinces and municipalities along the route, mainly considering that the Yangtze River Economic Belt is located in the economically developed areas of China, with rich resources and good industrial foundation, which is one of the important pillars of China's economy, and the study of the coupling and coordination degree of the development of culture and tourism fusion in this region can make full use of the economic advantages of the Yangtze River Economic Belt, and promote the development of the culture and tourism industry [18]. Secondly, the Yangtze River Economic Belt spans across the developed provinces and cities in eastern China, and is connected to the upstream, midstream and downstream areas of the Yangtze River Basin, with an advantageous geographic location, which in turn provides rich regional cultural and tourism resources for the integrated development of culture and tourism, as well as broad market space for the integrated development of the culture and tourism industry [19-20]. At the same time, the Yangtze River Economic Belt has rich natural and human resources, but also faces the challenge of ecological environmental protection and governance, the study of the coupling and coordination degree of the integrated development of culture and tourism can help to promote the green development of the Yangtze River Economic Belt, and achieve the coordinated development of the economy and ecology. In addition, the government has put forward the development strategy of the Yangtze River Economic Belt in recent years, which provides policy support and financial

guarantee for the development of the region, so the study of the degree of coupling and coordination of the integrated development of culture and tourism can be in line with the government's strategy, and better realise the integrated development of the regional economy and the culture and tourism industry [21]. The Yangtze River Economic Belt is a densely populated region in China, and its economic and social development level has an important impact on the whole country. By studying the coupling and coordination degree of the integrated development of culture and tourism, we can promote the economic and social development of the Yangtze River Economic Belt, and drive the development of the whole country's culture and tourism industry [22].

Studying the coupling and coordination degree of the integrated development of culture and tourism in the Yangtze River Economic Belt is of great practical significance and strategic significance, which helps to promote the regional economic development, cultural inheritance and the prosperity of the tourism industry, and fully demonstrates that the Yangtze River Economic Belt is suitable to be an ideal choice for studying the integrated development of culture and tourism.

2) *Research data sources:* Considering that this paper studies the development status of culture and tourism integration in the Yangtze River Economic Belt over the years, which is spatial in nature, the data for the indicators come from China Statistical Yearbook, China Environmental Statistical Yearbook, China Tertiary Industry Statistical Yearbook, China Tourism Statistical Yearbook, China Culture and Related Industries Statistical Yearbook, China Cultural Relics and Culture Statistical Yearbook, China Regional Economy Statistical Yearbook China Informatisation Statistical Yearbook", as well as the official website of the Ministry of Culture and Tourism, the database of the National Research Network, the Dawei Patent Search Engine, the official website of the State Civil Aviation Administration, the statistical yearbooks of provinces and districts along the Yangtze River Economic Belt and the annual statistical bulletin of national economic and social development, the mean value of the research data of the indexes is used to characterise the degree of development of the study area over the years, and at the same time it is dimensionless. The model is utilised to the extent that it can be utilised.

### B. Constructing a System of Research Characterisation Factors

Through relevant research, it can be seen that the coupling coordination degree evaluation of cultural and tourism integration development needs to consider the richness and characteristics of tourism resources such as natural landscape, human landscape, historical and cultural heritage, and the degree of development and utilisation of tourism resources, because tourism resources are an important factor in attracting tourists, and also the main support for the development of cultural and tourism integration. Secondly, the development level of the regional economy and industrial structure has a direct impact on the coupling coordination degree of the integrated development

of culture and tourism, mainly in the economic prosperity, industrial diversification will provide more support and demand for the integration of culture and tourism; in addition, the government's support for the integrated development of culture and tourism policies and regulations have a profound impact on the evaluation of the degree of coordination, the soundness of the policy or not, the support, guidance, etc., will have a direct impact on the coordination degree of the integrated development of culture and tourism. However, relevant scholars believe that national policy considerations can be weakened in the study of the Yangtze River Economic Belt, because the importance of the cities along the line for its development can be seen. Of course, the social and cultural background of the region, customs and traditions, cultural heritage, etc. will have an impact on the degree of coordination of the integrated development of culture and tourism, cultural heritage and innovation, social inclusion and sharing are for cultural recognition, tourism integration of the details of the factors. The slogan of "green water and green mountains are golden mountains" is familiar, so it can be considered that the overall quality of the regional environment, ecological protection and governance, resource utilisation and sustainable development is the basis for the integrated development of culture and tourism.

Based on the above, the influencing factor indicator system can be constructed initially, but for the evaluation model, the following principles need to be considered when constructing the influencing factor indicator system for evaluating the coupling coordination degree of culture and tourism integration and development:

1) *The principle of multi-dimensionality*: Consider the influence of multiple factors. The integrated development of culture and tourism involves culture, tourism, economy, society and other fields, so the evaluation indicator system should be multi-dimensional, including cultural value, tourism resources and other aspects of the indicators, in order to comprehensively evaluate the degree of coordination of the integrated development of culture and tourism.

2) *Principle of operability*: The indicators should be operable and measurable. Evaluation indicators should be measurable and observable for assessment and monitoring in practical application. At the same time, the design of the indicators should take into account the feasibility of practical operation and be easy to be used by the government, enterprises and research institutions.

3) *Principle of uniformity*: The indicator system should have a certain degree of uniformity, and the evaluation indicators should have a certain degree of coordination and consistency in the whole, in order to ensure the objectivity and comparability of the evaluation results, therefore, this paper has carried out a dimensionless processing for the collected data of the research objects in section 2.1.2 to complete the consistency of the measurements.

4) *Principle of sustainability*: Consider the sustainability factors of development. The integrated development of culture and tourism needs to consider long-term sustainability, and the evaluation index system should take into account sustainability factors such as environmental protection, resource utilisation,

social benefits, etc., in order to promote the sustainability of the integrated development of culture and tourism.

5) *Participatory principle*: Promote the participation of relevant stakeholders. The construction of the evaluation indicator system should take into account the opinions and needs of all stakeholders, and encourage them to participate in the selection of indicators and the evaluation process, in order to enhance the fairness and rationality of the evaluation.

The role of these principles is to ensure that the evaluation index system for integrated cultural and tourism development is scientific, practical and fair, so that it can comprehensively and objectively evaluate the degree of coordination of integrated cultural and tourism development and provide a scientific basis for decision-making and planning. At the same time, these principles also help to promote the participation and consensus of all stakeholders and promote the sustainability and coordination of integrated cultural and tourism development.

Based on this, this paper finally constructs the indicator system as shown in Table I.

As seen through Table I, based on the current research results, construction principles and visit records, this paper constructs a total of 29 basic indicators, of which a total of 19 indicators are constructed in the field of culture, and a total of 10 indicators are constructed under the tourism perspective, which can be seen that the indicators under the cultural perspective are higher than those under the tourism perspective, and analysed that the main reason is that how culture is embedded in the development of tourism is more concerned at the present time, i.e., how to promote the tourism Evolution into a harmonious win-win situation of culture and tourism is the current issue, which is not only a challenge to the inclusiveness of the tourism industry, but also a great challenge to the penetration and friendly integration of the cultural industry. And this also proves that it is more appropriate to adopt the degree of coupling coordination to analyse the degree of win-win between the two.

### C. Degree of Impact and Evaluation based on the CRITIC Approach

The CRITIC algorithm is a risk assessment methodology for evaluating and managing risk in projects and decisions. CRITIC is an acronym for "Criticality, Recoverability, Inherent Risk, Time Criticality, Impact, and Controllability", and it includes the following six risk factors:

- **Criticality**: The degree of importance of the event and its impact on the project objectives.
- **Recoverability**: The ability of a project or organisation to return to a normal state after a risk event.
- **Inherent Risk**: The likelihood of a risk event occurring and the magnitude of its impact, regardless of the controls already in place.
- **Time Criticality**: The degree to which a risk event affects the timetable and schedule of a project or organisation.
- **Impact**: The degree of impact on the project or organisation following the occurrence of a risk event, including financial, environmental and social impacts.

- Controllability: The degree of control and ability of a project or organisation to control risk events.

TABLE I. EVALUATION INDEX SYSTEM OF COUPLING COORDINATION DEGREE OF CULTURAL AND TOURISM INTEGRATION DEVELOPMENT IN THE YANGTZE RIVER ECONOMIC BELT [22, 23]

Target level	Normative layer	Indicator layer	Interpretation of indicators
Cultures	Cultural Services Facilities	Number of public libraries	For assessing the distribution and coverage of cultural and educational resources.
		Number of performing arts venues	The number of performing arts venues in a city or region, which is used to assess the abundance of performing arts activities and opportunities for cultural exchange.
		Number of museums	Number of museums in the city or region, used to assess the preservation and presentation of historical and cultural heritage.
		Number of mass cultural institutions	Number of mass cultural institutions in the city or region for assessing the transmission and development of cultural traditions and intangible cultural heritage.
	Cultural services staff	Public Library Practitioners	The number of staff in public libraries, which is used to assess the quality and efficiency of library services.
		Museum practitioners	The number of staff in museums is used to assess the level of heritage conservation and display management in museums.
		Practitioners of mass cultural institutions	The number of staff in mass cultural institutions is used to assess the transmission of cultural traditions and the implementation of intangible cultural activities.
		Performing arts organisations	The number of staff of performing arts organisations, which is used to assess the scale and professionalism of performing arts activities.
	Cultural Services Benefits	Museum income	The museum's income is used to assess the museum's own operations and economic performance.
		Income from mass cultural institutions	The income of mass cultural institutions is used to assess the economic efficiency and sustainability of cultural activities.
		Revenue from performances at performing arts venues	The performance income of performing arts venues is used to assess the market performance and audience feedback of performing arts activities.
	Cultural service recipients	Public library circulation	Circulation of books in the public library collection is used to assess the library's reading service and the utilisation of book resources.
		Audience at arts performance venues	Audience size of performing arts venues, which is used to assess the audience size and social impact of performing arts activities.
		Museum Visit	Visits to museums, which are used to assess the social engagement and cultural impact of museums.
	Inputs to cultural services	Training in mass cultural institutions	Information on training activities provided by mass cultural institutions is used to assess the transmission of cultural traditions and the teaching of intangible cultural skills.
		Total expenditure on public libraries	The total expenditures of public libraries are used to assess the operating costs and funding of libraries.
		Total expenditure on mass cultural institutions	The total expenditure of the mass cultural institutions is used to assess the efficiency of financial expenditure and management of cultural activities.
		Total museum expenditure	The total expenditure of the museum is used to assess the museum's financial commitment and heritage conservation work.
		Expenditure on performing arts venues	Expenditure on performing arts venues, which is used to assess the operating costs and management efficiency of performing arts activities.
	Journey	Tourism Service Facilities	Travel agents
Starred hotel			The number and services of star-rated hotels in the city or region are used to assess the quality and reception capacity of tourism accommodation services.
Scenic area			The number of attractions and visits within a city or region, which are used to assess the attractiveness of the attraction and the visitor experience.
Tourist service staff		Travel agents	The number of staff in travel agencies, which is used to assess the level of professionalism and service attitude of travel services.
		Star-rated hotel workers	The number of staff in star-rated hotels is used to assess the scale of the service and the level of management of the hotels.
		Scenic Area Practitioners	The number of staff in the scenic area is used to assess the level of scenic area management and visitor services.
Revenue from tourism services		Operating income from star-rated hotels	The operating income of star-rated hotels is used to assess the economic efficiency and market competitiveness of hotel operations.
		Gross tourism income from scenic spots	The total tourism revenue of the scenic spot is used to assess the economic efficiency and tourism attractiveness of the scenic spot.
Tourism service recipients		Number of domestic and foreign tourists received by travel agencies	The number of domestic and foreign tourist arrivals received by travel agencies is used to assess the capacity and market demand for tourism services.
		Scenic Area Reception	The number of tourists received by the scenic spot is used to assess the flow of tourists and tourism impact of the scenic spot.

This paper considers adopting the CRITIC algorithm, mainly because it can comprehensively consider the importance and interconnectedness of multiple criteria or factors, so as to comprehensively assess the degree of tourism integration and development, which can help to avoid one-sided and localised evaluations, and improve the comprehensiveness and comprehensiveness of the assessment. Moreover, the CRITIC algorithm is based on mathematical models and quantitative analysis, which can provide objective evaluation results and reduce the influence of subjectivity and personal bias. At the same time, for diverse samples, this paper also proposes in section II.B that it is necessary to consider a clear evaluation process and calculation method, so that the evaluation process is operable and replicable, and the evaluator using the CRITIC algorithm can carry out standardised processing according to the standards and data, so as to carry out effective evaluation and comparison. In addition, the CRITIC algorithm can flexibly adjust and weigh different criteria or factors according to the actual situation, which helps to provide a flexible and comprehensive assessment of different aspects of integrated tourism development.

Taken together, the CRITIC algorithm, as a multi-criteria decision analysis method, has the advantages and strengths of comprehensiveness, objectivity, operability, flexibility and visualisation in assessing the degree of coupled coordination of tourism integration and development. The calculation steps are shown below.

1) *Standardisation*: Let the number of objects to be evaluated be  $m$ , the number of evaluation indicators be  $n$ , and the matrix of data elements be denoted as  $X = (x_{ij})_{m \times n}$ .

$$x'_{ij} = \frac{x_{ij} - \min x_j}{\max x_j - \min x_j} \quad (1)$$

In Eq. (1), where:  $x'_{ij}$  - Data matrix elements after normalisation;

$x_{ij}$  -Initial element of the data matrix.

2) *Indicator variability*

$$\sigma_j = \sqrt{\frac{1}{N} \sum_{i=1}^N (x_i - \mu)^2} \quad (2)$$

In Eq. (2), where:  $\sigma_j$  - standard deviation;

$x_i$  -  $i$  data for the  $j$ th indicator;

$N$  - The number of  $x_i$  ;

$\mu$  - Arithmetic mean of  $x_i$  .

3) *Calculation of quantitative indicators of the conflicting nature of the indicators.*

$$R_{ij} = \sum_{i=1}^n (1 - r_{ij}) \quad (3)$$

In Eq. (3), where:  $R_{ij}$  - correlation coefficient;

$r_{ij}$  -Evaluate the correlation coefficient between indicators  $i$  and  $j$ .

4) *Calculation of the combined informativeness of the indicators.*

$$C_j = \sigma_j \sum_{i=1}^n (1 - R_{ij}) \quad (4)$$

In Eq. (4), where:  $C_j$  - the amount of information for the  $j$ th indicator;

$\sigma_j$  -standard deviation;

$R_{ij}$  -correlation coefficients.

$N$  -Number of quantities for the  $i$ th indicator.

5) *Calculation of indicator weights*

$$\omega = \frac{C_j}{\sum_{j=1}^N C_j} \quad (5)$$

In Eq. (5), where:  $\omega$  - Objective weight of the  $j$ th indicator;

$C_j$  -The amount of information in the  $j$ th indicator;

$N$  -Number of quantities of the  $j$ th indicator.

6) *Calculation of scores*

$$S_i = \sum_{j=1}^n (\omega_j x'_{ij}) \quad (6)$$

In Eq. (6), Where:  $S_i$  - Score.

#### D. Degree of Coupling Coordination

The Coupled Coordination Degree Evaluation Model (CCDEM) is a model used to assess the degree of coordination and coupling between parts of a system. It is usually used to analyse the degree of interaction and coordination between different parts of a complex system in order to identify potential problems and opportunities for improvement. In the coupled coordination degree evaluation model, three aspects are usually considered: degree of coupling, degree of coordination, and degree of coupled coordination [17, 27].

Coupling degree refers to the degree of interdependence between the parts of the system, high coupling degree means high complexity of the system; Coordination degree refers to the degree of synergy between the parts of the system, high coordination degree can promote the overall performance and efficiency of the system; Coupling Coordination Degree Index: evaluate the coupling degree and coordination degree between the parts of the system through the quantitative index, so as to provide the overall performance of the system to assess and improve the direction.

Coupling C:

$$C = \left( \frac{\prod_{i=1}^n U_i}{\left( \frac{1}{n} \sum_{i=1}^n U_i \right)^n} \right)^{\frac{1}{n}} \quad (7)$$

In Eq. (7):  $U_i$  -Cultural System and Tourism System Score;  
 $n$ -Number of systems.

Coordination T:

$$T = \sum_{i=1}^n \omega_i U_i \quad (8)$$

In Eq. (8):  $U_i$  -Cultural System and Tourism System Score;  
 $n$ -Number of systems;

$\omega_i$  -System weighting, this paper considers two systems equally important each with 0.5.

Coupling coordination degree D, Eq. (9):

$$D = \sqrt{CT} \quad (9)$$

In this paper, the grading of the coupling coordination degree is listed in the following Table II.

TABLE II. CRITERIA FOR CLASSIFYING THE DEGREE OF COUPLING COORDINATION

Interval of D-values for coupling coordination	Level of coordination	Degree of coupling coordination
[0.0-0.1)	1	extreme disorder
[0.1-0.2)	2	severe disorder
[0.2-0.3)	3	moderate disorder
[0.3-0.4)	4	mild disorder
[0.4-0.5)	5	on the verge of becoming dysfunctional
[0.5-0.6)	6	sue for coordination
[0.6-0.7)	7	primary coordination
[0.7-0.8)	8	intermediate level coordination
[0.8-0.9)	9	good coordination
[0.9 to 1.0]	10	quality coordination

### III. EMPIRICAL ANALYSES

#### A. Impact Level Analysis Based on the CRITIC Approach

This paper collects data from a total of 11 provinces (municipalities directly under the central government) in the study area to be analysed, and the degree of importance of the indicators is calculated by the equation (1-5) as shown in Table III and the evaluation scores are calculated according to the Formula (6) as shown in Table IV.

TABLE III. RESULTS OF THE CALCULATION OF THE IMPORTANCE OF IMPACT FACTORS

Indicator layer	Weights	Combined weights	Normative layer	Weights	Combined weights
Number of public libraries	0.0289	0.2028	Cultural Services Facilities	0.1427	0.2188
Number of performing arts venues	0.0374	0.2622			
Number of museums	0.0364	0.2552			
Number of mass cultural institutions	0.0399	0.2797			
Public Library Practitioners	0.0344	0.2515	Cultural services staff	0.1369	0.2099
Museum practitioners	0.0319	0.2333			
Practitioners of mass cultural institutions	0.0352	0.2571			
Performing arts organisations	0.0353	0.2581			
Museum income	0.0386	0.4045	Cultural Services Benefits	0.0954	0.1463
Income from mass cultural institutions	0.0285	0.2981			
Revenue from performances at performing arts venues	0.0284	0.2974			
Public library circulation	0.0301	0.2948	Cultural service recipients	0.1022	0.1567
Audience at arts performance venues	0.0394	0.3852			
Museum Visit	0.0327	0.3200			
Training in mass cultural institutions	0.0310	0.1772	Inputs to cultural services	0.1749	0.2682
Total expenditure on public libraries	0.0354	0.2025			
Total expenditure on mass cultural institutions	0.0366	0.2093			
Total museum expenditure	0.0378	0.2160			
Expenditure on performing arts venues	0.0341	0.1950			

Travel agents	0.0393	0.3427	Tourism Service Facilities	0.1145	0.3293
Starred hotel	0.0358	0.3122			
Scenic area	0.0395	0.3451			
Travel agents	0.0317	0.3268	Tourist service staff	0.0970	0.2788
Star-rated hotel workers	0.0360	0.3710			
Scenic Area Practitioners	0.0293	0.3022			
Hotel operating income	0.0304	0.4757	Revenue from tourism services	0.0639	0.1836
Gross tourism income from scenic spots	0.0335	0.5243			
Number of domestic and foreign tourists received by travel agencies	0.0364	0.5020	Tourism service recipients	0.0725	0.2083
Scenic Area Reception	0.0361	0.4980			

TABLE IV. CALCULATION OF EVALUATION SCORES AT THE NORMATIVE LEVEL

Normative layer	Cultural services	Cultural services staff	Cultural Services Benefits	Cultural service recipients	Inputs to cultural services	Tourism Service Facilities	Tourist service staff	Revenue from tourism services	Tourism service recipients
1. Shanghai	83.2869	84.5821	87.4249	96.6634	84.1007	89.6605	78.5996	86.4663	87.9603
2. Jiangsu	84.5421	85.3188	84.3863	76.6446	86.7828	91.9699	78.1524	80.8154	90.5059
3. Zhejiang	79.9165	86.7350	85.1465	91.9531	87.0892	85.9976	87.5799	91.9124	81.9722
4. Anhui	87.1009	81.1571	86.1479	80.9492	82.2495	89.7680	84.2653	85.4757	94.4901
5. Jiangxi	86.4581	84.7022	74.1042	91.6417	83.2003	81.6308	85.7542	83.1065	86.9485
6. Hubei	86.3460	95.8199	81.7004	88.7103	82.9198	80.8930	83.9925	82.1361	95.0000
7. Hunan	84.0908	87.7905	85.8790	77.3955	90.7249	74.7696	82.2110	84.1456	77.0278
8. Chongqing	85.6325	89.0495	75.6793	82.8763	84.0890	95.0610	87.9582	85.5148	82.5456
9. Sichuan	81.6045	90.6656	74.4052	90.5026	83.5206	78.8681	86.2626	75.9030	95.9921
10. Yunnan	83.3183	84.4954	88.5933	93.2479	82.3395	77.6426	82.5502	80.7183	93.0238
11. Guizhou	86.4300	90.8907	87.4380	82.8316	84.1804	93.8852	86.0219	83.7669	83.5059

TABLE V. CALCULATION OF EVALUATION SCORES AT THE TARGET LEVEL

Target level	Cultures	Journey
1. Shanghai	86.4791	85.6362
2. Jiangsu Province	84.0455	85.7647
3. Zhejiang Province	85.9233	86.6861
4. Anhui Province	83.4487	88.4296
5. Jiangxi Province	84.2203	84.1592
6. Hubei Province	87.1058	84.9243
7. Hunan Province	85.8589	79.0361
8. Chongqing	84.0469	88.7207
9. Sichuan Province	84.3610	83.9527
10. Yunnan Province	85.6311	82.7800
11. Guizhou Province	86.3462	87.6728

**B. Analysis of the Results of the CRITIC Method**

From Table VI, it can be seen that in the guideline layer results, the better development belongs to Shanghai Municipality and Guizhou Province, closely followed by Zhejiang Province and Hubei Province.

Observation of the economic zone research curve graph can be seen, the cultural perspective, to the best development of Hubei Province, based on the tourism perspective can be seen, Anhui Province, Sichuan Province, the development trend is better, to the worst development of Hunan Province, but the overall score is greater than 75, proving that the development of although compared with the high and low points, but there is no development of the bad provinces (municipalities).

### C. Coupled Coordination Degree Model

The model evaluation of the study area is carried out according to Eq. (7-9), and the degree of coupling, coordination, and coupling co-ordination are now listed in the Table VI shown.

TABLE VI. EVALUATION RESULTS OF COUPLING COORDINATION DEGREE

Target level	Cultures	Journey	Coupling C-value	Harmonisation index T-value	D-value of coupling coordination	Level of coordination	Degree of coupling coordination
1. Shanghai	86.4791	85.6362	0.9940	0.7640	0.8710	9	good coordination
2. Jiangsu	84.0455	85.7647	0.7720	0.5890	0.6880	7	Primary coordination
3. Zhejiang	85.9233	86.6861	0.9990	0.7560	0.8690	9	good coordination
4. Anhui	83.4487	88.4296	0.7240	0.5690	0.6420	7	Primary coordination
5. Jiangxi	84.2203	84.1592	0.9790	0.4380	0.6550	7	Primary coordination
6. Hubei	87.1058	84.9243	0.9710	0.7980	0.8800	9	good coordination
7. Hunan	85.8589	79.0361	0.8530	0.5530	0.6910	7	Primary coordination
8. Chongqing	84.0469	88.7207	0.8520	0.6500	0.7440	8	Intermediate level coordination
9. Sichuan	84.3610	83.9527	0.9900	0.4430	0.7440	7	Primary coordination
10. Yunnan	85.6311	82.7800	0.9660	0.5250	0.7120	8	Intermediate level coordination
11. Guizhou	86.3462	87.6728	0.9990	0.8520	0.9230	10	Quality coordination

Based on Table VI, the coupling coordination degree of the Yangtze River Economic Belt as a whole does not appear coordination degree imbalance phenomenon, but Jiangsu Province, Anhui Province, Jiangxi Province, Hunan Province, Sichuan Province only for the primary coordination, which indicates that the degree of integration of culture and tourism still needs to be further strengthened; at the same time, only the degree of integration of culture and tourism in Guizhou Province to achieve a high quality degree of coordination, which indicates that at this stage, the local culture, tourism, the degree of collaboration is relatively high, and the development of the development presents a good trend.

According to Table VI, although different provinces (municipalities directly under the central government) of the degree of coupling, degree of coordination, coupling degree of coordination there is a certain degree of variability, all show a high value of coupling degree, which indicates that the integration of culture, tourism is an extremely complex system, perhaps there are certain differences, but also just show the degree of difficulty of the differences between the places, but the degree of coordination exists there is a low phenomenon, indicating that the system's synergistic operation efficiency Low, especially in Jiangxi Province, but the coupling degree in Jiangxi Province is very high, which indicates that the more complex the system is, the less easy it is to coordinate the operation, so Jiangxi Province must put forward reasonable and feasible measures to strengthen the integration of culture and tourism.

### IV. CONCLUSION

As an important support region for China's economic development, the coupling and coordination degree of the integrated development of culture and tourism in the Yangtze River Economic Belt plays a crucial role in its development. By evaluating the coupling coordination degree of culture and tourism integrated development in the Yangtze River Economic

Belt, it can be seen that the coupling coordination degree of culture and tourism integrated development in the Yangtze River Economic Belt presents a good trend as a whole, and the coordination and cooperation and resource sharing among regions make the culture and tourism industry develop better and provide strong support for the comprehensive development of the economic belt. However, there are some problems and challenges in the evaluation of the coordination degree of culture and tourism integrated development in the Yangtze River Economic Belt. Some areas in the integrated development of culture and tourism still have deficiencies in the synergistic development between culture and tourism industries, the combination of cultural resources and tourism products is not high, and the depth and breadth of the integration of culture and tourism need to be strengthened. This requires strengthening the integration and sharing of resources for the integrated development of culture and tourism, increasing investment, optimising resource allocation, promoting the integration and sharing of culture and tourism resources, and improving the quality and level of integration of culture and tourism. At the same time, the coordination and cooperation among regions of the Yangtze River Economic Belt should be strengthened, the regional coordination of the integrated development of culture and tourism should be promoted, and the sharing and complementation of resources among regions should be facilitated, so as to achieve the synergistic development of the integrated development of culture and tourism.

In summary, the evaluation of the coupling coordination degree of the integrated development of culture and tourism in the Yangtze River Economic Belt is of great significance, and in the future, it is necessary to continuously strengthen the coordination and cooperation to promote the synergistic development of the integrated development of culture and tourism, to inject new vitality into the economic and social development of the Yangtze River Economic Belt, and to achieve the goal of high-quality development



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