



## DEVELOPMENT AND MODE INNOVATION OF CULTURAL TOURISM RESOURCE BASED ON INDUSTRIAL INTEGRATION

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**Abstract.** The cultural tourism industry contributes to the growth of both cultural and tourism industries. Cultural Tourism Resource (CTR) is the prerequisite for the integrated development of the cultural tourism industry. Developing potential CTR can promote the new transformation and upgrading of the urban cultural tourism industry. Luoyang has the advantages of location and resources in the development of CTR, but its tourism industry develops slowly. Therefore, Luoyang City was taken as the research object and the relevant evaluation index system was established. The entropy method and grey correlation model were used to analyze the development trend and influencing factors of the city's CTR. The entropy values of the eight indicators of the evaluation system of CTR established in the study were all above 0.96, indicating that the evaluation system was relatively stable. The grey correlation degree of CTR of historical culture and folk customs was high, which was 0.668 and 0.642, respectively. The grey correlation degree of religious culture and calligraphy and painting CTR was low, which was 0.625 and 0.617, respectively. The CTR of historical culture and folk customs have developed well, but the resources of religious culture, calligraphy, and painting need to be improved. The knowledge of cultural tourism location theory and regional economic growth theory are applied. According to the evaluation results and problems of the development of CTR in Luoyang, this paper puts forward targeted strategies for CTR.

**Key words:** Industrial integration, Cultural resources, Tourism industry, Development mode, Grey correlation degree model

**1. Introduction.** The integration of cultural tourism is a strategic concept of tourism development put forward in recent years, which is innovative [1]. In the current environment of industrial integration, promoting the integrated development of culture and tourism is also a major decision made by China in the 14th Five-Year Plan period. This kind of tourism not only has the recreational attributes of tourism, but also has rich and positive cultural attributes, which can better meet people's spiritual and cultural needs. The integrated development of culture and tourism has been further deepened in the aspects of concept, decision-making, and public service, which helps China's tourism to promote the direction of coordinated development of commerce and industry [2]. The culture itself has the characteristics of diversification, and the rich Cultural Tourism Resource (CTR) also makes the cultural tourism products show different characteristics. However, there are still many problems in the development of CTR when it comes to cultural tourism integration. It mainly shows that tourism has a shallow understanding of local culture and fails to deeply show regional characteristics by simply adding cultural elements. However, the introduction of non-local culture in some scenic spots has damaged tourists' real feelings and cognition of local culture. Meanwhile, the lack of innovation and effective inheritance in the integration of industry, culture, and tourism leads to serious homogenization and dilution of traditional charm. At present, the market is profit-oriented and pursues rapid consumption culture, which further weakens the uniqueness and depth of culture. In addition, the current theoretical development system of CTR lacks some practical support. Its content needs to be enriched, and its reliability and guidance need to be strengthened [3]. CTR can become an effective driving force for the local economy, attracting tourists to travel and spend money and promoting the development of the local economy. Meanwhile, it can also promote cultural inheritance and protection through tourism activities [4, 5]. Luoyang City has a long history of culture with rich CTR, but its tourism development has been slow. The development of CTR in this region lacks unified planning, and CTR cannot be optimized and integrated. Therefore, it is of great significance to accelerate the CTR development of Luoyang. For the current development of Luoyang's tourism industry, the focus is on the in-depth development of CTR based on market demand. Therefore, this paper innovatively

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uses grey correlation model to evaluate the CTR of Luoyang City quantitatively and qualitatively. The future development trend of urban CTR is calculated, and the influence of different factors on it is measured. The purpose of this study is to provide a decision-making basis for the development of CTR in Luoyang city and provide a theoretical basis for the development of CTR in other cities.

**2. Related works.** The development of CTR is the prerequisite for the upgrading of cultural tourism. Its potential market demand and development prospects are extremely broad, which has attracted many scholars to study and discuss it. Su Z et al. constructed an interdisciplinary comprehensive analysis framework from the perspective of efficiency evaluation [6]. There are certain problems in the integration of the cultural tourism industry in Tai'an. In this regard, Dong et al. put forward the choice path and policy guarantee for the integrated development of culture and tourism in Tai'an based on the theory of industrial integration dynamic mechanism. This study was of great significance to promote the coordinated development of culture and tourism in Tai'an [7]. Mao M W et al. designed specific implementation plans for ecological resources and agricultural cultural tourism based on the rural landscape design theory in the landscape architecture. The study provided an important theoretical basis for rural construction and regional cultural and tourism integration development [8]. Peng Ju et al. analyzed the coupling and coordinated development of Shenzhen's culture and tourism industry from 2008 to 2017. The main driving factors of the coupling and coordination of cultural and tourism industries were further discussed by using the grey correlation model. The research showed that there was a significant coupling development relationship between Shenzhen's culture and tourism industry [9]. Based on the tourists' comments on major tourism websites, Liang Feng et al. used semantic analysis and emotional analysis and other analytical techniques to study the cultural perception image of Wuxi by tourists. Research showed that there was an obvious structural mismatch between tourists' perception and the supply of local CTR [10].

The sustainability strategy of cultural and historical tourism needs to be further explored to produce specific economic and social benefits for the sustainable livelihood of residents in the Idanre community. For this reason, Ikusemiju T M et al. used field survey and questionnaire survey to collect data. The sustainable strategy of cultural and historical tourism resources could well promote the improvement of economic and social benefits [11]. Ibrahim AH et al. studied and analyzed the spatial distribution and characteristics of ethnic CTR in different ethnic communities. According to the field survey, the national cultural resources were divided into three categories, which were composed of historical relics, cultural and festival activities, and handicrafts [12]. Lin L et al. discussed the blurring of rural and urban boundaries in cultural heritage tourism. Huangpu Ancient Village had integrated local historical and cultural resources, thus promoting local economic development [13]. The current situation of the development of the organizational culture of tourism enterprises and the improvement of the development mechanism of cultural resources need to be discussed in depth. For this reason, Kalntska et al. proposed an analytical method to evaluate and investigate the tourism market. The competitiveness elements of tourism operators included organizational resources and organizational culture in cultural resources [14]. Based on the grounded theory, Yaqing et al. established an evaluation index system for the potential of agricultural cultural heritage tourism resources, taking *Torreya grandis* as the research object. The research showed that the potential of tourism resources was large and suitable for the development of tourism resources. However, there was a problem of combining resources with folk customs and culture. Therefore, the study put forward targeted suggestions on this issue [15].

To sum up, at present, the academia mainly focuses on the analysis of cultural and artistic resources and heritage resources. However, few academic achievements have been made to study the development of CTR in Hengyang City alone from the perspective of industrial integration. In the development of CTR, Luoyang has the advantages of location and resources, but the development of the tourism industry is slow. Therefore, Luoyang is adopted as a target based on the perspective of industrial integration. Combined with relevant theories and practical knowledge, the current situation and problems of the development of Luoyang CTR are discussed in depth. And corresponding strategies are put forward for the development and optimization of CTR.

### **3. The development of CTR and mode innovation methods based on industrial integration.**

Firstly, the theory and method of cultural and tourism resources development under industrial integration are deeply analyzed. The calculation method of cultural and tourism industry integration is proposed based on the

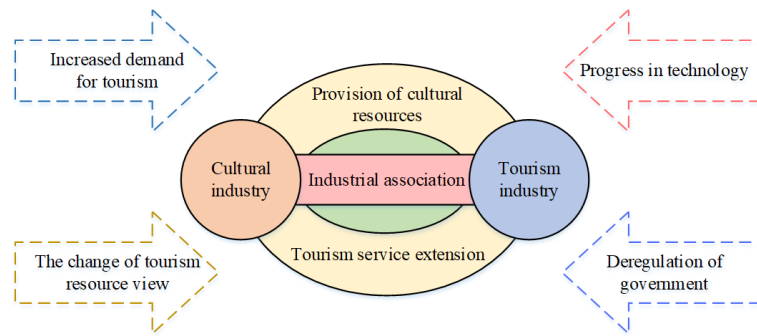


Fig. 3.1: Integration mechanism

cultural and tourism industry integration mechanism. Secondly, Luoyang city is taken as the research object, and the comprehensive evaluation system of CTR evaluation index of Luoyang City is established. Finally, the entropy method and grey relational model are used to calculate the development situation of CTR in the city and the weight of influencing factors. Some suggestions on the development of CTR are put forward according to the experimental results.

**3.1. The theory and method of cultural resources and tourism resources development under the industrial integration.** Industrial integration means that multiple industries integrate and grow together. The cultural and tourism industries are both service industries closely concerned about the quality of people’s livelihood. The integration of them will bring innovative transformation and upgrading opportunities for the sustainable development of cultural tourism. So the full integration of cultural industry and tourism industry in terms of form, content, and development direction can be achieved. And it can improve the innovation and industrial competitiveness of the cultural tourism industry in different regions [16]. Fig. 3.1 shows the cultural tourism industry integration mechanism under the background of industrial integration.

The integration of culture and tourism is the development with the change of market demand and the division of labor in Fig. 3.1. The cultural industry and tourism industry are constantly penetrating and merging based on the strong correlation and complementarity in resources, technology and market. It gradually forms an industrial organization process. The cultural industry provides cultural resources for the tourism industry and promotes the development of the tourism industry. The tourism industry provides extended tourism services for the cultural industry to promote the cultural industry. They promote mutual development and form a regional integration model. The steps to measure the integration of the two industries are to standardize the data first, and then calculate the difference sequence. The calculation process is shown in (3.1).

$$X_0 = \{x_0(1), x_0(2), \dots, x_0(n)\} \tag{3.1}$$

(3.2) is the comparison sequence.

$$X_1 = \{x_i(1), x_i(2), \dots, x_i(n)\} \tag{3.2}$$

In (3.2),  $n = 1, 2, 3, \dots, 11$ . (3.3) is the difference sequence.

$$\Delta_i(l) = |x_0(l) - x_i(l)| \tag{3.3}$$

$l$  represents constant, and  $l = 1, 2, 3, \dots, 13$  in (3.3). Then (3.4) is used to find the extreme values of the two levels.

$$\begin{cases} \Delta(max) = \max_i \max_l \Delta_i(l) \\ \Delta(min) = \min_i \min_l \Delta_i(l) \end{cases} \tag{3.4}$$

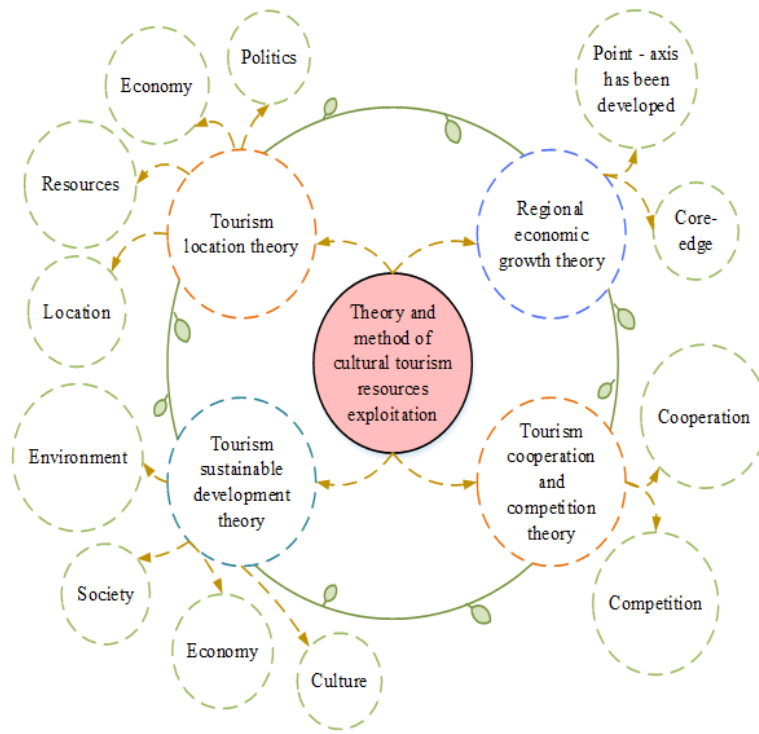


Fig. 3.2: Theories and methods of CTR development

In (3.4),  $\Delta(max)$  and  $\Delta(min)$  represent the extreme high and low value. The calculation expression of fusion degree is shown in (3.5).

$$\begin{cases} \gamma_{0i}(l) = \frac{\Delta(\min) + \nu \Delta(\max)}{\Delta_i(l) + \nu \Delta(\max)} \\ \gamma_{0i} = \frac{1}{n} \sum_{k=1}^n \gamma_{0i}(l) \end{cases} \quad (3.5)$$

$\nu$  is a variable value, and the value range is (0, 1) in (3.5). Cultural resources are unique or relatively beneficial cultural factors in a region, which are more reflected in the important impact of cultural resources on regional tourism development. The development of the tourism industry depends on rich tourism resources. The type, accessibility, and development value of tourism resources have a great impact on tourism. Therefore, CTR exists in geographical space and has unique value. This is the sum of the material and social spirit that attracts tourists. The fundamental purpose of developing CTR is to achieve certain economic benefits. It is necessary to tap potential CTR to form tourism products with economic benefits, and ultimately promote the development and construction of regional cultural and tourism [17]. Fig. 3.2 shows the theory and method of CTR development.

The research will integrate the cultural tourism location theory, regional economic growth theory, and tourism cooperation and competition theory in Fig. 3.2. And sustainable development theory is applied to the resource development of the industry. For tourism location, CTR is proposed, and target cultural tourism routes are designed, according to the economy, politics, resources, and geographical location of the location. Based on regional growth theory, the study regards tourist attractions or cities with development conditions as "points". When it develops to a certain scale, it radiates to the surrounding areas, thus forming a complete tourism route. Secondly, the core area of tourism and implement the comprehensive integration of resources

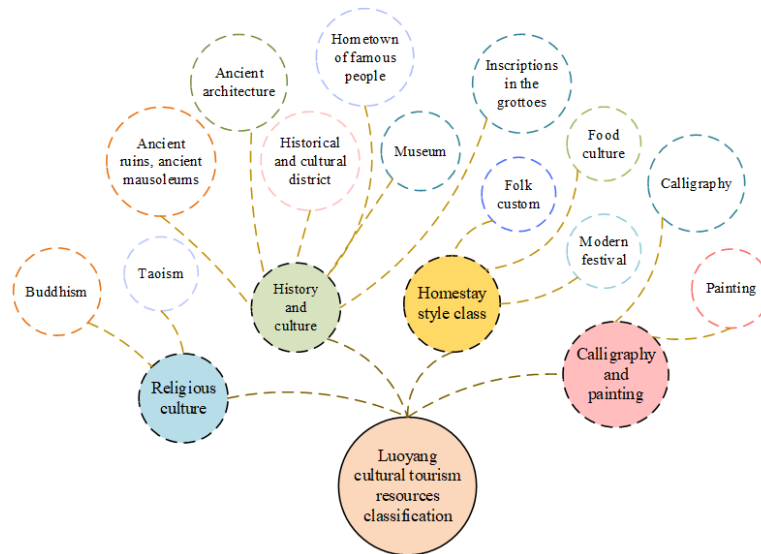


Fig. 3.3: Types of CTR in Luoyang

can be found out through this area. With the increasing influence of the core area, it needs to further expand its influence by means of route integration, scenic spot cooperation, and other forms. Based on the theory of tourism cooperation and competition, tourism cooperation is used to realize the integration and optimization of tourism resources in the region. It can better promote regional tourism through competition in cooperation. The core content of tourism sustainability is to promote the comprehensive and coordinated development of economic, cultural, social, environmental, and other benefits. Sustainable development is also a core theoretical support for the development of CTR.

Luoyang is located in the Central Plains of China, which has profound cultural connotation and extremely rich CTR [18]. Luoyang is closely connected with Chinese Confucian culture, Buddhist culture, Taoist culture, and Neo-Confucianism culture. In addition, it is also the starting point of the Silk Road. From the Shang Dynasty to the Sui and Tang Dynasties, there has been frequent political, economic, and cultural exchanges with many countries. This study takes Luoyang City as an example to conduct an in-depth analysis of its CTR development model. In Fig. 3.3, the types of Luoyang CTR are sorted and divided.

In Fig. 3.3, the research divides Luoyang's CTR into four categories: historical culture, religious culture, folk customs, and calligraphy and painting. Under the four branches, there are also various places of interest and cultural arts. Luoyang has a large number of human tourism resources, and the types of tourism resources in Luoyang are also very rich, with different formal values. In addition, Luoyang's CTR are of high quality and large quantity according to relevant data. Luoyang has great potential in the development of CTR.

**3.2. Comprehensive evaluation method of CTR development from the perspective of industrial integration.** This paper makes an in-depth analysis of Luoyang's urban CTR through field investigation and data collection. According to the local situation of Luoyang, its CTR is divided into three evaluation items and eight evaluation factors. The comprehensive evaluation system of Luoyang CTR evaluation indicators is established, as shown in Fig. 3.4.

The study makes a comprehensive evaluation of the system according to the common factors of tourism resources in Fig. 3.4. Resources are evaluated from three aspects: resource influence, resource element value, and added value through the quantitative evaluation of assigned value. According to the common factor scoring value, the paper quantitatively evaluates the various factors of the classification of Luoyang's existing CTR. Finally, the common comprehensive factor evaluation score is obtained. Entropy is a measurement mode specially calculated for uncertainty, and its characteristics can be used to calculate the randomness of an event

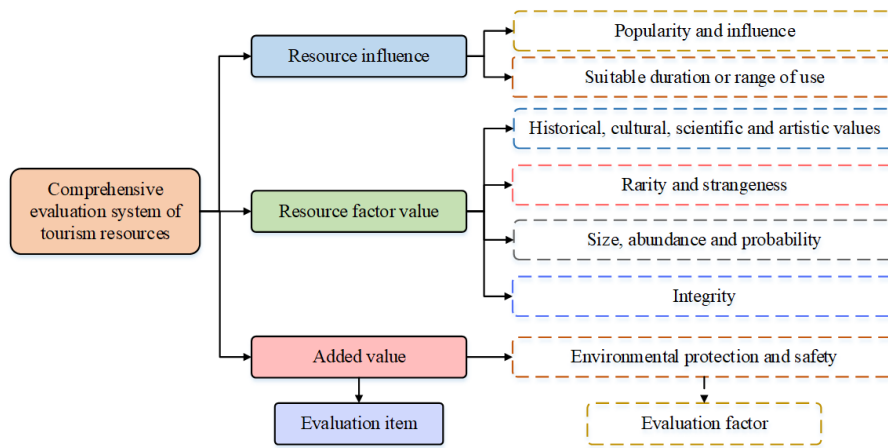


Fig. 3.4: Comprehensive evaluation system of Luoyang CTR evaluation index

and its degree of disorder [19]. In addition, the current dispersion degree of an indicator can also be determined with the help of entropy value. Therefore, the research calculates the rights of different indicators with the help of information entropy tools. Before calculation, it is necessary to carry out dimensionless processing on the data to complete the weighting of indicators. First, it needs to standardize the initial data so that the range of indicator values is 0-1. The calculation method of positive indicators is shown in (3.6).

$$x'_{ij} = (x_{ij} - \min x_j) / (\max x_j - \min x_j) \tag{3.6}$$

$i$  is the year. The index number is  $j$ , and  $x_{ij}$  represents the original value in (3.6).  $x'_{ij}$  represents the normalized value of positive indicators.  $\max x_j$  and  $\min x_j$  represent the extreme values of the indicators in the study year. The calculation method of negative indicators is shown in (3.7).

$$x'_{ij} = (\max x_j - x_{ij}) / (\max x_j - \min x_j) \tag{3.7}$$

After the standardization of some indicator values, the data may be small or even negative. Therefore, the standardized values will be translated to ensure convenient and uniform calculation. The calculation expression is shown in (3.8).

$$x'_{ij} = H + x'_{ij} \tag{3.8}$$

$H$  represents the range of index translation, which is generally 1 in (3.8). The research uses the entropy to find the weight of index. The entropy represents the measure of uncertainty. Smaller value means higher variation degree of an index value. This means that the indicator provides more information and it has larger weight value [20]. The proportion of standardized sample indicators in the indicator system is calculated as shown in (3.9).

$$y'_{ij} = x'_{ij} / \sum_{i=1}^m x'_{ij} \tag{3.9}$$

$y'_{ij}$  represents the proportion of  $x'_{ij}$  in (3.9). However, a value of 0 may appear after the indicator is standardized during the processing. Therefore, the research will shift the processed data to 0.0001 units to the right as a whole to make the 0 value after standardization meaningful. Then, in (3.10), it needs to determine the information entropy value of index  $j$ .

$$e_j = -k \sum_{i=1}^m y_{ij} \ln y_{ij} \tag{3.10}$$

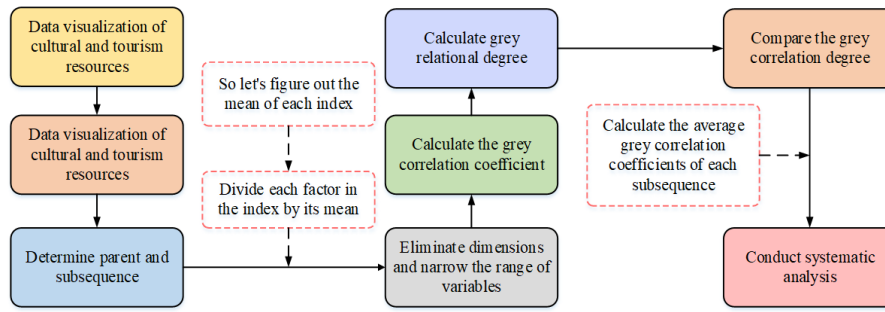


Fig. 3.5: Calculation steps of correlation degree of cultural and travel resource indicators based on grey correlation analysis

In (3.10),  $e_j$  represents the information entropy value of each indicator, and  $m$  represents the sample number of each indicator.  $k$  represents a constant, which is related to the number of samples  $m$  in equation (3.11).

$$k = 1/\ln m \tag{3.11}$$

Information entropy  $e_j$  can be used to measure the information utility value of index  $j$ . When the information is out of order,  $e_j = 1$ .  $d_j$  is the indicator of  $e_j$  to the comprehensive evaluation, which is the utility value. It equals 0. Then, in (3.12), the relationship between the information utility value  $e_j$  of the indicator and the information entropy  $e_j$  of the indicator is displayed.

$$d_j = 1 - e_j, j = 1, 2, \dots, p \tag{3.12}$$

When the entropy method is used to calculate the weight of each evaluation index, higher coefficient reflects greater importance for the evaluation in the evaluation process. On the contrary, it is less important for evaluation. (3.13) is the expression of index weight  $j$ .

$$w_j = e_j / \sum_{j=1}^n d_j \tag{3.13}$$

The number of indicators in equation (3.13) is  $n$ . The vulnerability and sensitivity of the tourism city's economic system are positively correlated, and the response capacity of the system is inversely correlated. In the evaluation of CTR, small sample data are adopted, and the data in recent years only prevail. However, such data cannot fully and accurately reflect their overall information, so they have the characteristics of gray. The grey correlation model is to determine the relevance of different factors with the help of the similarity and dissimilarity of the development trend of different factors. Therefore, it can deeply reveal the degree of dynamic correlation of things and analyze the characteristics of their dynamic correlation. In Fig. 3.5, the correlation degree of CTR indicators is calculated and measured.

Firstly, the collected CTR data are visually expressed and simply analyzed in Figure 5. Then the current sequence of each factor and its comparison sequence should be clarified first, and the data of CTR should be processed dimensionless and non-polar. On the premise of ensuring its unity, it needs to calculate the grey correlation coefficient and clarify the weight and vector of CTR indicators. If there is a high degree of correlation between the two factors, it means that they have a high degree of synchronous variability. On the contrary, it means that the synchronous variability between the two is low. In (3.14), the calculation of the absolute difference between the comparison and sequence is shown.

$$(|x_{ij} - x_{0j}| \Delta_{0i}(j))_{n \times p} \tag{3.14}$$

$i = 1, 2, \dots, n$  and  $j = 1, 2, \dots, p$  in (3.14). The comparison sequence consists of system behavior affecting factors that combined as a data sequence, which is composed of the evaluation indicators selected by each evaluated

object. When using the grey correlation analysis method, the correlation coefficient specifically refers to the geometric distance between the parameter sequence and the comparison sequence at different time points [21]. If the value of the correlation coefficient is relatively large, it means that there is a greater degree of correlation between the two. (3.15) is the calculation expression of the correlation coefficient.

$$\zeta_{0i}(j) = \frac{\min \Delta_{0i}(j) + \rho \max \Delta_{0i}(j)}{\Delta_{0i}(j) + \rho \max \Delta_{0i}(j)}, 0 < \rho < 1 \quad (3.15)$$

$\rho$  represents a constant, generally 0.5 in (3.15). The correlation degree of the two sequences refers to the correlation coefficient. Because the correlation coefficient is the degree of correlation at different time points, it cannot be uniformly compared and analyzed. Therefore, it is necessary to solve the grey correlation degree to complete the unification of the correlation coefficient and obtain the corresponding value. (3.16) is the calculation formula of grey correlation degree.

$$r_{0i} = \sum_{j=1}^p w_j \zeta_{0i}(j) \quad (3.16)$$

In (3.16),  $i = 1, \dots, n$  is the value of grey correlation degree. The higher value of  $r_{0i}$ , the better indicator system. In this study, the entropy method and grey relational degree model are used to analyze the development situation and the factors influencing the CTR in Luoyang. However, both of them need a lot of complete and effective data support. In special cases, these two models may not be able to fit the actual data well, resulting in a bias in the results. Appropriate methods can be selected according to the actual situation to improve the overall accuracy of the research and analysis. For example, regression analysis can be used to establish a mathematical model between variables and analyze the correlation between the development of urban CTR and influencing factors. Analytic Hierarchy Process (AHP) can be used to analyze and evaluate each factor of urban CTR in a hierarchical manner to determine the weight and correlation degree among the factors.

**4. Result analysis.** Luoyang has a long cultural history and rich CTR. It has location and resource advantages in the development of cultural tourism. Luoyang City was taken as the experimental object, and the current situation of its CTR was analyzed by calculating the degree of integration. Figure 6 shows the integration degree of cultural tourism industry and development and utilization of CTR in Luoyang.

Luoyang's cultural tourism industry is divided into four categories: historical culture, religious culture, folk customs, and calligraphy and painting in Fig. 4.1. Their average integration degree of CTR development was 0.433, 0.27, 0.477, and 0.430, respectively. The resources of religious culture and calligraphy and painting had a low integration with the cultural tourism industry, so the integration and utilization of these two aspects of resources should be promoted. In general, the cultural tourism industry of Luoyang and its CTR development had a low degree of integration, meaning that the CTR development was low and the utilization was not high. The evaluation of tourism resources was based on the comprehensive tourism resources evaluation of the common factors, and the quantitative evaluation of assigned points was adopted. In Table 4.1, the research evaluated Luoyang's CTR from three aspects: resource element value, resource influence, and added value.

The overall evaluation score of historical and cultural resources changes in Luoyang was high, while the overall score of calligraphy and painting resources was low in Table 4.1. This showed that Luoyang had a high degree of development of historical and cultural resources, but a low rate of development and utilization of calligraphy and painting resources. Among the four categories of CTR in Luoyang, the value of sightseeing and recreation was the highest, with an average score of 21.345. This showed that the appreciation and recreation value of CTR had received the highest attention, and its development should be strengthened. The weights of eight evaluation index factors were determined by calculation, as shown in Fig. 4.2.

The entropy value of the eight evaluation indicators in Luoyang selected in the study was above 0.96, and the coefficient of difference of each indicator was below 0.04 in Fig. 4.2 (a). It showed that the dispersion degree of each indicator data was normal, and the comprehensive evaluation system of Luoyang CTR evaluation indicators established in the study was more stable. In Fig. 4.2 (b), the weight of environmental protection and safety was the largest, 0.172, while the weight of suitable travel period or use range was the smallest, 0.098. It



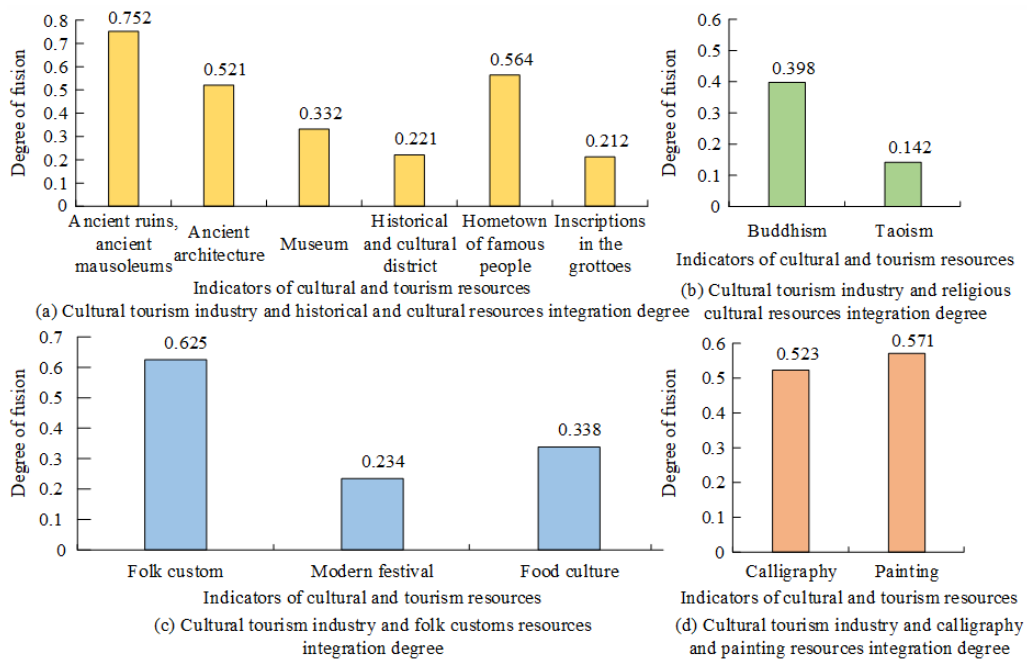


Fig. 4.1: Integration degree of cultural tourism industry and CTR development in Luoyang city

Table 4.1: Results of CTR types in Luoyang

Evaluation object	History and culture	Religious culture	Folk customs	Calligraphy and painting
Ornamental recreation value	30.29	18.95	27.78	8.36
Historical, cultural, and artistic value	19.88	17.76	16.35	14.92
Degree of preciousness	15.74	12.64	10.57	15.34
Size, abundance, and probability	6.58	9.64	6.47	5.36
Integrity	3.52	4.36	1.61	5.23
Popularity and influence	9.32	9.54	9.53	6.82
Suitable duration or range of use	3.31	4.25	5.63	4.21
Environmental protection and safety	-3.42	-4.13	3.25	3.08

showed that environmental protection and safety were the most important in the evaluation system. Table 4.2 is the results of dimensionless treatment of the evaluation factors.

After the non-dimensional processing, the effective factors of different indicator data had been eliminated in Table 4.2. The study used the initialization index data obtained in Table 4.2 to calculate the absolute difference between the comparison and sequences in Luoyang. Fig. 4.3 is the results.

According to the results in Fig. 4.3, the grey coefficient of the evaluation index was calculated with the grey system theory. Table 4.3 shows the results.

The historical and CTR of Luoyang are closely related to the value of sightseeing and recreation, historical and cultural science, and artistic value. Table 4.3 showed that religious and cultural resources were greatly affected by the scale, abundance and probability, popularity, and influence of these two indicators, and their grey correlation coefficients were all 1. Folk customs had the strongest correlation with popularity and influence, suitable travel period or scope of use, environmental protection and safety. Calligraphy and painting were

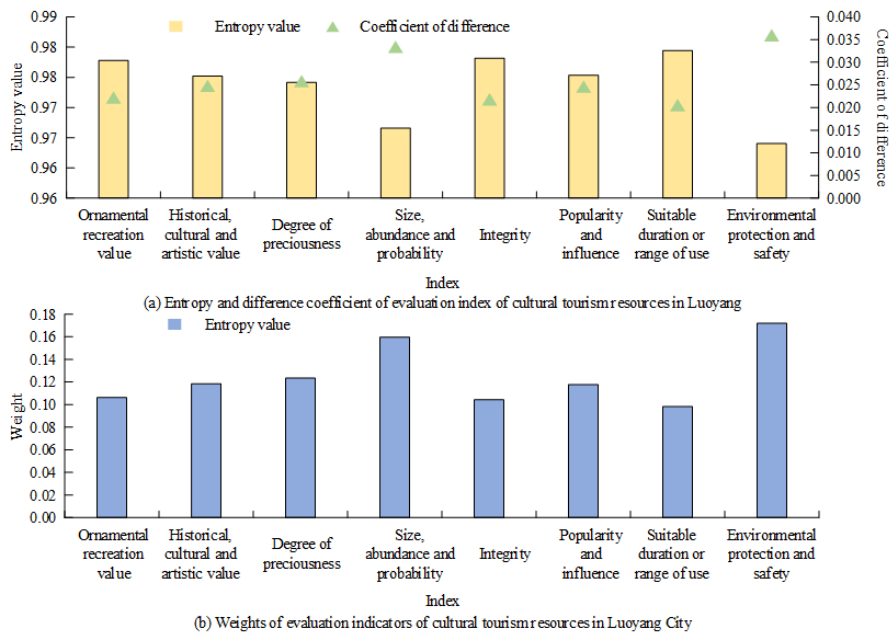


Fig. 4.2: Entropy, difference coefficient and weight of Luoyang CTR evaluation index

Table 4.2: Results of dimensionless treatment of the evaluation factors

Evaluation object	History and culture	Religious culture	Folk customs	Calligraphy and painting
Ornamental recreation value	1	0.467	0.804	0
Historical, cultural, and artistic value	1	0.317	0.225	0
Degree of preciousness	1	0.248	0	0.771
Size, abundance, and probability	0.930	1	0.066	0
Integrity	0.543	0.827	0	1
Popularity and influence	0.974	1	1	0
Suitable duration or range of use	0	0.485	1	0.480
Environmental protection and safety	0.952	0	1	0.996

Table 4.3: Grey coefficient of evaluation index of CTR type in Luoyang City

Evaluation object	History and culture	Religious culture	Folk customs	Calligraphy and painting
Ornamental recreation value	1	0.483	0.718	0.333
Historical, cultural, and artistic value	1	0.422	0.392	0.333
Degree of preciousness	1	0.399	0.333	0.686
Size, abundance, and probability	0.355	1	0.3349	0.333
Integrity	0.522	0.743	0.333	1
Popularity and influence	0.951	1	1	0.333
Suitable duration or range of use	0.333	0.493	1	0.491
Environmental protection and safety	0.355	0.333	1	0.992

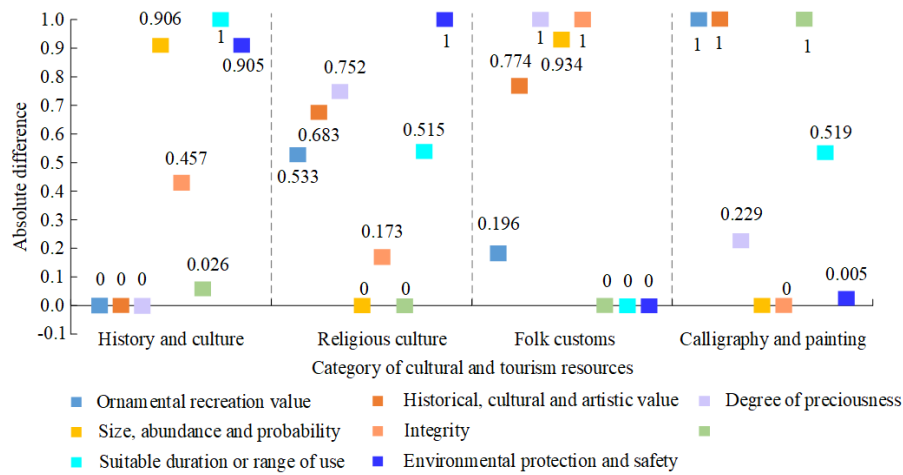


Fig. 4.3: Calculation results of absolute difference between the two sequences in Luoyang City

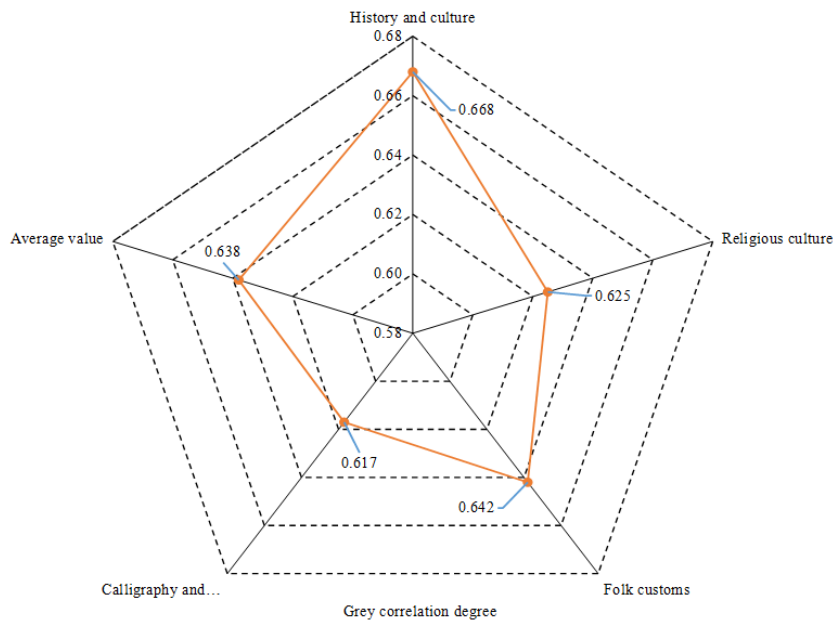


Fig. 4.4: Comprehensive grey correlation degree of CTR types in Luoyang

closely related to integrity, environmental protection and safety, and the degree of rarity and oddity. Fig. 4.4 shows the calculated result of the comprehensive grey correlation degree of Luoyang CTR type.

The grey correlation degree of historical and CTR was the highest, 0.668 in Fig. 4.4. The grey correlation degree of CTR of folk customs was higher, which was 0.642 after that of historical culture. The grey correlation degree of religious CTR was close to the average value, 0.625. The gray correlation degree of CTR of calligraphy and painting was the lowest and lower than the average, only 0.617. The CTR of historical culture and folk customs had developed well, but the resources of religious culture, calligraphy, and painting needed to be improved.

To sum up, the development of CTR should take a reasonable and scientific way to develop some historical

relics, cultural relics, and other resources. In the process of development, the image-type tourism resources such as historical and cultural relics and spiritual connotation should be organically integrated. And the principle of paying equal attention to development and protection should be followed. Secondly, its unique regional characteristics should be deeply explored and highlighted in the development of CTR. Cultural tourism products with strong market competitiveness were formed based on regional uniqueness and development and innovation. In addition, the resource allocation should be paid enough attention when developing CTR. So the rationality and scientific of allocation can be ensured, and the mutual sharing of resources and complementary advantages can be realized. Finally, the principle of participation should be fully considered when developing CTR. Tourists were required to better participate in tourism projects, making them have a personal understanding of the spiritual connotation of CTR and form a more long-term and interesting memory. To sum up, the overall development trend of CTR in Luoyang city was good. The development of historical culture and folk customs was more prominent. The grey relation degree of historical and CTR was the highest, and its overall view value and artistic value were higher. Meanwhile, cherish the strangeness, popularity and so on were good, so that the historical and cultural resources of Luoyang city had a good competitive advantage in other similar cities. However, there were some problems such as small scale and single-form of national customs and CTR exploitation in the process of development. In addition, the resource development of religious culture and calligraphy painting needed to be improved, and its deep ornamental value had not been excavated. The gray correlation degree of calligraphy and painting CTR was lower than the average. On the whole, the competitiveness of Luoyang's CTR needed to be further improved, and the environmental protection and diversified development of resources still needed to be strengthened.

**5. Discussion and suggestion.** With the increase in tourism demand in Luoyang city, the demand for cultural products is also increasing. Therefore, it is necessary to dig deeply into the CTR of Luoyang and transform them into products to attract tourists. The sustainable development of its cultural tourism can be promoted by exploring the rich cultural resources of Luoyang. There are many kinds of CTR in Luoyang, and their distribution is relatively concentrated. The quantitative evaluation results by using grey correlation degree method showed that the CTR of Luoyang city as a whole had high development value, especially in the aspect of historical and cultural resources, which was closely related to the numerous scenic spots in Luoyang City. Although the overall development of culture and tourism resources in Luoyang was good, there were also some problems, such as low protection degrees, short travel period, and low ornamental leisure value. The development strategy of CTR had important practicability and relevance. CTR could be better utilized and managed through the formulation of effective development strategies, and managers could realize the optimal allocation of resources and promote the benign development of cultural tourism. According to the development status and existing problems of CTR in Luoyang City, Luoyang city as the center, divided into the new district and the old city cultural tourism center in the development space layout. The core area should focus on the experience of Central Plains folk customs, history, and culture. The new district was fully dependent on the Luoyang new urban area, with business exhibitions, leisure and entertainment, and other tourism products as the key development content. The regional cooperation was strengthened and the domestic tourism market space was expanded in terms of market competitiveness. Secondly, the cultural tourism publicity should be strengthened and the international market should be opened up. Finally, it is necessary to establish the concept of knowledge-intensive tourism industry, introduce high-quality tourism talents, and build a perfect personnel training mechanism. The first is to establish a national Luoyang CTR reserve in terms of protection. Secondly, the management system of CTR was improved and the management ability of the leading team was enhanced to promote the unified management and protection of CTR.

**6. Conclusion.** This study took Luoyang CTR as the research object. A comprehensive evaluation system of Luoyang CTR evaluation indicators was established in the experiment. And the grey correlation model and entropy method were used to evaluate the CTR of Luoyang City, and the shortcomings in the development process of its CTR were analyzed. The average integration of Luoyang's cultural tourism industry with historical culture, religious culture, folk customs, and calligraphy and painting was 0.433, 0.27, 0.477, and 0.430, respectively. The degree of integration indicated that the city's CTR were less developed and less utilized. The entropy values of the eight indicators of the evaluation system of CTR established in the study were all above 0.96, indicating that the evaluation system was relatively stable. The index of environmental protection

and safety had the largest weight of 0.172, indicating that the index was the most important one. The grey correlation degree of CTR of historical culture and folk customs was high, 0.668 and 0.642, respectively. The grey correlation degree of religious culture and calligraphy and painting CTR was low, 0.625 and 0.617, respectively. The CTR of historical culture and folk customs had developed well, but the resources of religious culture, calligraphy and painting needed to be improved. Some measures are put forward in the study according to the evaluation results and problems of CTR development in Luoyang. They include following the development strategies of CTR that pay equal attention to development and protection and highlight the regional, holistic, participatory, and experiential nature. The quantitative evaluation of CTR is realized based on entropy method and grey relational degree model. In general, the overall development of CTR in Luoyang is very good. The development of historical and CTR is the best, but the development of religious culture and calligraphy and painting resources is still sufficient. The research provides a good theoretical basis and time value for the mining of the same type of CTR cities. In addition, the research also makes a deeper discussion on the existing problems based on the current situation. Aiming at the development of CTR in Luoyang city, this paper puts forward the principle of equal emphasis on development and protection, highlighting regionalism, integrity and participation. And the corresponding development strategies are put forward from the aspects of development space layout, market competitiveness, and protection. Although the research has achieved certain results, the evaluation results obtained may have slight deviation due to the limited data collected. In the future, the research methods will be further improved.

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