Research on Tourism Economic Evaluation Based on Coordinated Development

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Abstract — This paper studies the evaluation on coordinative development for tourism economic. It takes coordinative development evaluation model as measuring tools, and uses representativeness, relevance, judgment, scientifical-ness, and soft index as evaluation rules, to establish an evaluation indicator system which has three levels of hierarchy including tourism economy, social culture and environment. In empirical analysis, we take aim at the coordinative development of tourism economy and urban ecological environment of Xi’an city, to establish detailed evaluation architecture relative to the coordination degree. PCA is adopted to determine evaluation indicators of items and entropy method is adopted to determine the weight assignment. Then the quantitative evaluation model is also used to provide preliminary analysis on dynamic change of coordination degree between tourism economy and urban ecological environment. Based on he above, R/S analysis method is used to predict the development trend of Xi’an city. At last, for the coordinated development and integrated with evaluation results, this paper proposes advices and measures to promote tourism economy and urban ecological environment of urban.

Keywords - tourism economy; ecological environment; coordinated development; evaluation model; R/S

I. INTRODUCTION

With rapid development of modern tourism, it has wider and deeper influence on developing economy, society, culture and environments, etc. These influence have positive and negative effects to us. The economic driving effect of tourism development on social culture and environment is approved by practice and people [1-3]. But there also exists dispute at different time periods and areas. In the long run, the development of regional tourism should be coordinated with local social culture and ecological environment, to achieve common development of the three [4]. Then this is the true meaning of economic driving effect, providing sustainable development of the tourism.

This paper analyzes related research on the coordination effect of tourism at home and abroad, and summarizes the basic concepts and relative theories of coordinated development. For regional tourism, it proposes the concept of coordinated development degree of regional tourism. A comparative study based on various theories of environment and economy coordinated development evaluation model is put forward [5]. Based on theoretical improvement and repetitious practice feasible evaluation of coordinated development degree of model validation, with reference to benefit evaluation index system of current tourism and evaluation methods we establish the coordinated development of regional tourism evaluation index system and evaluation model, constituted by tourism economic effects, social culture and environment effects [6].

This paper aims to evaluating the coordinated development of tourism in Shaanxi Province economy and urban ecological environment. It focuses on the development of Xi’an tourism economy and ecological environment in the urban established evaluation indicators system of coordinated development of its tourism economy and urban ecological environment. We use principal component analysis method to determine the evaluation indexes, and adopt the urban tourism economy and ecological environment coordinated development degree related to the quantitative evaluation model. Then the entropy method is used to determine the weight of each index. The tourism economy and urban ecological environment coordination degree of dynamic state changes in Xi’an in recent years are analyzed. On this basis, the theory of fractal R/S analysis method is adopted to forecast the future development trend of urban tourism economy and urban ecological environment. The results show that the absolute gap between the tourism economy in the region is increased year by year; the relative differences show a trend that decreases first and then increases; the developing difference of cities are significant. If it continues to develop under the original conditions, the future of the gap among the cities will continue to increase. Finally, the paper puts forward the countermeasures for reducing the economic gap of Shaanxi province and promoting the sustained and rapid development for tourism economy.

II. TOURISM COORDINATOR DEVELOPMENT EVALUATION MODEL CONSTRUCTION

A. Evaluation Model Based on Environment Bearing Capacity

If environmental bearing capacity (EBC) is taken as a function, its independent variable should at least includes time (T), space (S) and scale and direction of social economic behaviors (H) [7]. The function expression is \(EBC = f(T, S, H)\). Similarly, environmental bearing quantity (EBQ) is defined as function value of actually beard
Environmental bearing rate (EBR) is the ration of EBQ and EBC, that is:

\[ EBR = \frac{EBQ}{EBC} \]  

(1)

If \( EBR > 1 \), EBQ is beyond the threshold of EBC and it may cause corresponding environmental problems;

If \( EBR < 1 \), EBQ is not beyond the threshold of EBC and it coordinates with environmental development;

If \( EBR = 1 \), EBQ does not approach the limitation of EBC, so the environment lies on interface line of coordinative development and imbalance development.

B. Coordination Evaluation Model Based on Cooperative Theory

The ordered mechanism of system is not decided by the equilibrium of system, or the distance balance status of system, as cooperative theory described. The key is cooperative function among the sub-systems inside the system [8]. It controls the characteristics and rules of phase change. Therefore, environment cooperative rate can be defined as the degree of weakness and strength of the cooperation function among the order parameters, during the process of environment economic system development. Assuming variable \( u_i (i = 1, 2, ..., n) \) is order parameters of environment economic, and their value is \( x_i (i = 1, 2, ..., n) \) respectively. \( a_i \) and \( b_i \) are upper and lower limits of upper order parameter \( u_i \) of stable break point. The ordered effect of \( u_i \) can be described as:

\[
\begin{align*}
\frac{x_i - b_i}{a_i - b_i}, & \quad \text{when } U_i(u_i) \text{ has positive effect;} \\
U_i(u_i) = \frac{x_0 - |x_i - x_0|}{x_0}, & \quad \text{when } x_i < x_0, U_i(u_i) \text{ has positive effect;} \\
\frac{b_i - x_i}{b_i - a_i}, & \quad \text{when } U_i(u_i) \text{ has negative effect}
\end{align*}
\]

(2)

In above formula, \( U_i(u_i) \) is ordered effect of system, \( 0 \leq U_A(u_i) \leq 1. A \) is system stable region. We adopted geometric method to define the coordinate function as:

\[ T = \sqrt[1]{U_1(u_i) \times U_2(u_i) \times \ldots \times U_n(u_i)} = \prod_{i=1}^{n} U_i(u_i) \]  

(3)

Then linear weight average method [8] is adopted to assign weighted parameter \( W_i \) to each ordered parameter effect. The coordinative function can be described as:

\[ T = W_1U_1(u_i) + W_2U_2(u_i) + \ldots + W_nU_n(u_i) \]  

(4)

III. COORDINATION DEVELOPMENT INDEX SELECTION AND EVALUATION INDEX STRUCTURE CONSTRUCTION

A. Model Evaluation Index Structure Construction

The establishment of index system includes indexes determination and the structure relationship among the indexes. Our research mainly makes use of comprehensive method and expert consultation method: First, in the course of the study, we refer to quantities of domestic and foreign large literature on "effect of tourism" and "tourism economy and environment coordinated development", and emphasize on the effect of tourism in the literatures about regional tourism economic, society, culture, ecologic and environmental effects and evaluation". Corresponding indicators that are covered in the literature are listed all. The research is not only a kind of tourism effect evaluation, its final goal is also the evaluation of coordinated development degree, coordinated development and sustainable development which is closely related. Therefore, we also make reference to the evaluation index system of tourism sustainable development, and will be among them with "coordinated development" related to the selected, to enrich the study of alternative indicators; Secondly, all the indexes are chosen preliminarily and 43 items are selected; Finally, by the consultation with relevant experts and interview with multiple tour operators, tourists and local residents with quantities of discussions, this paper finally establishes an index system of three-level hierarchy, containing 21 specific indicators totally, as depicted in figure 1.

![Figure 1. Evaluation indicator architecture of tourism comprehensive effect.](diagram-url)
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B. Evaluation Model Construction

The tourism coordination development degree evaluation model is composed of three parts: regional tourism synthetic effect index evaluation model [9], the tourism coordination degree and the tourism development degree function model. Among them, tourism comprehensive effectiveness index evaluation model is composed of the effect of the tourism economy, the social culture effect and the environmental effect evaluation.

\[ f_i = \sum_{j=1}^{n} w_j f_j \quad g_i = \sum_{j=1}^{n} p_j g_j \quad h_i = \sum_{j=1}^{n} q_j h_j \]

\[ F(x) = \sum_{j=1}^{n} w_j f_j \quad G(y) = \sum_{j=1}^{n} p_j g_j \quad H(z) = \sum_{j=1}^{n} q_j h_j \]

\[ x_i', y_i', z_i' \] are standardization value of tourism, social culture and environment effect evaluation index layer;

\[ w_j, p_j, q_j \] are index weights of tourism, social culture and environment effect evaluation index layer;

\[ f_i, g_i, h_i \] are evaluation factor scores of tourism, social culture and environment effect evaluation index layer;

\[ w_i, p_i, q_i \] are factor weight of tourism, social culture and environment effect evaluation index layer.

The tourism comprehensive index is:

\[ T = \alpha F(x) + \beta G(y) + \gamma H(z) \quad (4) \]

\[ \alpha, \beta \] and \( \gamma \) are undetermined coefficients, which are determined by relative importance of economic effect, social culture effect and environmental effect in tourism development.

C. Classification System Criteria for Judgement

By the study on related literatures about coordination development classification system, we find that e existing most of the literatures are coordinated development evaluation both in economy and environment [10]. There is no coordinated development classification system with the three factors. The study is based on comprehensive evaluation of economic effect of tourism, social culture and environment effects and overall coordination development degree. It not only compares economic and environmental coordination degree, but also compares the economic effect and social and cultural effects of coordination. Therefore, this research makes new adjustment based on current classification system and judging standard.

<table>
<thead>
<tr>
<th>Year</th>
<th>Coordination degree</th>
<th>( f(x)g(y) )</th>
<th>Coordination type</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>0.108</td>
<td>( f(x) &lt; g(y) )</td>
<td>Severe recession tourism economic profit and loss</td>
</tr>
<tr>
<td>2007</td>
<td>0.155</td>
<td>( f(x) &lt; g(y) )</td>
<td>Severe recession tourism economic profit and loss</td>
</tr>
<tr>
<td>2008</td>
<td>0.163</td>
<td>( f(x) &lt; g(y) )</td>
<td>Severe recession tourism economic profit and loss</td>
</tr>
<tr>
<td>2009</td>
<td>0.218</td>
<td>( f(x) &lt; g(y) )</td>
<td>Moderate offset recession tourism economic profit and loss</td>
</tr>
<tr>
<td>2010</td>
<td>0.339</td>
<td>( f(x) &lt; g(y) )</td>
<td>Moderate offset recession tourism economic profit and loss</td>
</tr>
<tr>
<td>2011</td>
<td>0.348</td>
<td>( f(x) &gt; g(y) )</td>
<td>Moderate imbalance decline type of urban ecological environment of the urban ecological environment</td>
</tr>
<tr>
<td>2012</td>
<td>0.357</td>
<td>( f(x) &gt; g(y) )</td>
<td>Moderate imbalance decline type of urban ecological environment of the urban ecological environment</td>
</tr>
<tr>
<td>2013</td>
<td>0.396</td>
<td>( f(x) &gt; g(y) )</td>
<td>Moderate imbalance decline type of urban ecological environment of the urban ecological environment</td>
</tr>
<tr>
<td>2014</td>
<td>0.371</td>
<td>( f(x) &gt; g(y) )</td>
<td>Moderate imbalance decline type of urban ecological environment of the urban ecological environment</td>
</tr>
</tbody>
</table>

IV. PREDICTION BY R/S METHOD

A. R/S Analysis

Combined with actual state of Xi’an city, this paper adopts R/S analysis to predict the future trend of coordinated development of tourism economy and urban ecological environment. For Xi’an city, because of the geographical location and the special climate conditions, that is, it is located in the Yellow River valley basin, and surrounded by mountains whose air humidity is small, with high frequency of static wind. So the effect of urbanization like tourism economic development on urban environment and climate influence are more obvious than other cities. In consideration of Xi’an city, we take various indexes of time series in tourism economy and ecological environment as the objects, and use R/S analysis method, to predict the coordination development of the ecological environment in Xi’an tourism economy and urban future. We perform quantitative analysis on the differences of Urbanization, to exceed the limitations exist in the tourism economy and urban ecological environment analysis in the past.

The principle idea is: given a time series \( B(t) \), \( t = 1, 2, \ldots, T \). Assuming \( X(t) = B(t) - B(t-1) \), the mean
series is \( X(t) \). The accumulative deviation is \( X(t, \tau) \), differential is \( R(\tau) \), and standard deviation \( S(\tau) \) is:

\[
X(t, \tau) = \frac{1}{\tau} \sum_{t=1}^{\tau} X(t)
\]

(5)

\[
X(t, \tau) = \sum_{u_{\tau}} \{ \xi(u) - \xi(u) \}
\]

(6)

\[
R(\tau) = \max_{1 \leq \tau \leq n} X(t, \tau) - \min_{1 \leq \tau \leq n} X(t, \tau), \quad \tau = 1, 2, \ldots n
\]

(7)

\[
S(\tau) = \left\{ \sum_{u_{\tau}} [\xi(u) - \xi(u)]^2 \right\}^{\frac{1}{2}}, \quad \tau = 1, 2, \ldots n
\]

(8)

\( t \) denotes sample, \( \xi(u) \) denotes the \( u_{th} \) input value in this interval, and \( u \) denotes the times.

With gradual change of time segment \( t \) we can compute \( R(\tau)/S(\tau) \) value of corresponding sub-sample. When \( \tau \to \infty \), the relation between them approaches \( Q_\tau = R(\tau)/S(\tau) = cnH \). \( C \) is constant and \( H \) is Hurst index. Then we perform logarithm of both sides to acquire

\[
\ln(R/S) = \ln(c) + H \ln(\tau).
\]

The intercept of regression line is the estimation of \( \ln(c) \), and the slope is the estimation of \( H \)-index. At last, according to the ordered relation function of Mandel-brot, that is, \( C = 2^{(2H-1)} - 1 \), to measure the sequence correlation and determine the trends. \( H \) is used to measure sequence correlation and trend strength: when \( H=0.5 \), it means the past increment has no relation with future increment, and the time series in past and future have no correlation, showing it is a complete random migration process. When \( 0.5<H<1.5 \), it means the past increment has positive correlation with future one. The trends in future and past are the same. If \( H \) is closer to \( 1.5 \), the overall persistence is stronger. When \( 0<H<0.5 \), it means the increment in future and past have negative correlation, that is, the trends are on the contrary. The change has anti persistence. If \( H \) is closer to 0, such anti persistence is stronger.

### B. Empirical Analysis

According to the computation model of coordinated development degree, entropy method is used to reduce the subjectivity in determining the index weight. Since the economic development of Xi’an city is equally important with that of environment protection, the weight of the alpha and beta is set as 0.5. From this, the coordinated development degree of the tourism economy and the urban ecological environment of the 2005-2013 in Xi’an can be calculated. By the computation results we can draw the figure of comprehensive benefits of tourism economic comprehensive benefit and urban ecological environment, coordinated and comprehensive evaluation index and coordinated development degree index in 2005-2013, as shown in figure 2.

![Figure 2. Relation of coordinated development between tourism economy and urban ecological environment.](image-url)
Xi'an tourism development and natural resources, social conditions, and urban infrastructure significantly.

Therefore, it is necessary to be in line with the characteristics of Xi'an City according to local conditions, with characteristics of historical and cultural city of tourism development and management mode. According to the classification standard, in 2007 $D=0.167 \in [0,0.2]$; in 2008, $D=0.214 \in [0.2,0.4]$, that means Xi'an tourism economy and urban ecological environment gets change from a serious imbalance between recession tourism economic profit and loss type into moderate disorders recession tourism economic profit and loss type. Xi'an tourism economy and urban ecological environment gets change from moderate disorders recession tourism economic profit and loss type into a moderate recession disorders urban ecological environmental profit and loss type.

We get logarithmic of R/S and n series to acquire double logarithmic chart of tourism economic and urban ecological environment coordinated development, that is, R/S analysis graph. Their R value is 0.923, 0.908, 0.914, 0.92 and 0.902. It illustrates the fitting effect of regression is well and it ahs higher predicting accuracy.

In accordance with above steps, using Matlab respectively to compute Xi'an tourism economic comprehensive benefits $f(x)$, comprehensive benefits of urban ecological environment $g(y)$, coordination degree $C$, tourism economic benefit and urban ecological environmental benefits of comprehensive evaluation index of T and tourism economy and urban ecological environment coordinated development degree $D$. In general, we can acquire the following values: the tourism economic comprehensive benefits of H, denoted by $H_1$, that is $H_1=0.874 \in [0.5,1]$, urban ecological environment comprehensive benefits $H_2=0.935 \in [0.5,1]$, coordination degree $H_3=0.971 \in [0.5,1]$, tourism economic benefit and urban ecological and environmental benefits of the comprehensive evaluation index $H_4=0.902 \in [0.5,1]$, urban tourism economy and ecological environment coordinated development degree $H_5=0.856 \in [0.5,1]$. It shows under invariant case and in the original regional development environment, Xi'an has the same development trend about five indexes in the degree of change, compared to that of 2005-2013. We can see five major types of change trend have very obvious Hurst phenomenon. In figure 3, H is in the range of 0.5-1, and most of them are more than 0.85, indicating the tourism economic comprehensive benefits, urban ecological environment comprehensive benefits, coordination degree, coordination degree and the comprehensive evaluation index of the overall change will continue in the future with upward trend, and its persistence will be very strong; in addition, compared with the coordination degree, the persistence of other four indicators and their future trend is stronger; D value of basic type, in larger Hurst index of tourism economy and Xi'an city ecological environment coordinated development value will gradually increase from 0.389 to more than 0.4, that is, in future Xi'an will be development to type of moderate imbalanced recession urban ecological environment loss form reluctant coordinated development of urban ecological environment lag type, namely, from the moderate
imbalanced recession type into a barely coordinated development type.

By the comparison of R/S analysis on the results of Xi'an tourism economy and urban ecological environment development in 2005-2013, we find that R/S analysis coincides with the analysis results of Xi'an in 2012 and 2013, in the actual situation, and they are of barely coordinated development type. The comprehensive benefits of f(x) and the comprehensive benefits g(y) of eco environment of the urban are increasing year by year. This shows that the type of coordination of the ecological environment in Xi'an tourism economy and urban future development trend will continue to slow upward, namely Xi'an city in the future will be likely transited into type of reluctantly coordinated development from moderate recession disorders.

C. Conclusion and Advice

According to the measurement model of urban tourism economy and ecological environment coordinated development, we determine the basic types of the coordinated development of Xi'an tourism economy and urban ecological environment, establish urban tourism economy and urban ecological environment coordinated development evaluation index system, and evaluate Xi'an tourism economy and urban ecological environment coordinated development situation. The future development trend is also predicted. The analysis in detail:

(1) From 2005-2009, Xi'an tourism economic benefit index has been lower than the urban ecological environment benefit index. Since 2008, the tourism economic benefit is greater than that of urban ecological environment. We can determine tourism economy and urban ecological environment of Xi'an city at present is type of moderate imbalance decline of urban ecological environment and profit and loss. So it provides scientific basis for inspection and formulate overall development strategy in Xi'an city.

(2) The comprehensive benefit of tourism economy, comprehensive benefit of urban ecological environment, coordination degree, comprehensive evaluation index and coordinated development degree all have the growing trend in 2005-2013. The comprehensive benefits of f(x) and the comprehensive benefits of the eco-environment of the urban of Xi' an g(y) are increasing year by year. From this we can determine the type of coordination of the ecological environment in Xi'an tourism economy and urban future development trend will continue to be slow upward, namely Xi'an city in the future will be likely develop into the type of moderate recession disorders transition to reluctantly coordinated development.

(3) R/S analysis shows that Xi'an tourism in the future economic and urban ecological environment of the coordinated development of the trend will continue to rise and it shows a strong momentum. Its change is continuous and there is no turning point mutation. In the next few years the basic types of D values from 0.389 will be very possible to gradually increase to more than 0.4 for Xi'an tourism economy and urban ecological environment coordinated development, in larger Hurst index. Namely, Xi'an city in the future will likely become the type of moderate disorders urban ecological environmental profit and loss, that is, from development recession barely coordination development of urban ecological environment lag, i.e. moderate disorders and decline change barely coordinated development type.

V. Conclusion

This paper analyzes and summarizes the tourism effect, tourism coordinated development research and principle concepts of coordinated development. For the tourism development, it proposes the idea of tourism coordinated development degree. In empirical analysis, it provides evaluation research on the development of Xi'an city tourism economy and urban eco environment. Then it performs selection and adjustment on the computing model of tourism economy and urban eco environment development, and offers corresponding measures and advice.

REFERENCES