Research on the Evolution Mechanism of the Integration System of Culture and Tourism Industry based on Self-organization Theory

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Abstract

With the birth of the Ministry of Culture and Tourism, the integration of China's culture and tourism industry has become a major national strategy. Based on the self-organization theory, this paper analyzes the self-organization characteristics and dynamic mechanism of the integration system of culture and tourism industry, and constructs the evolution model of the integration system of culture and tourism industry by using the method of selecting order parameters based on principal component analysis. The system observation variables are based on the panel data of China from 2007 to 2019. Then empirically analyzes the evolution of the integration system of culture and tourism industry in China. The results show that: (1) the integration system of culture and tourism industry is a self-organization system, which promotes the self-organization evolution of the integration system of culture and tourism industry under the interaction of competition and collaboration. The key to the development of the integration system of culture and tourism industry from disorder to order lies in the non-linear interaction between the self-organizing factors such as the transformation and development needs of the cultural industry itself, the market demand, the strong spillover effect of the tourism industry, the scope economy pursued by tourism enterprises and other organizational factors such as the policy strength of the culture and tourism industry, the technological innovation level of culture and tourism, and the level of economic development; (2) The external variables of industrial development are the slow variables and order parameters of the integration system of culture and tourism industry in China. The external variables of industrial development serve other fast variables and dominate the operation of the integration system of culture and tourism industry; (3) In the process of cultural and tourism industry integration, attention should be paid not only to the role of order parameters, but also to the distance between the internal development of the industry and the external environment of the industry.

Keywords*-self-organization theory; cultural industry; tourism industry; industrial integration; system evolution*

1.INTRODUCTION

The concept of the combination of culture and tourism has been clearly put forward in the Guiding Opinions of The Ministry of Culture and National Tourism Administration on Promoting the Combined Development of Culture and Tourism in 2009. Due to their natural coupling and similar attribute characteristics, the phenomenon and research of the integration of culture and tourism industry have become a general trend. Foreign studies on culture and tourism industry mainly focus on the mutual influence between culture and tourism industry[1], integration approaches[2], and development of cultural tourism products[3]. Domestic studies on the integration of culture and tourism industry mainly focus on dynamic mechanism[4], integration path[5], integration mode[6], integration effect[7], integration degree[8]and integration strategy[9]. Studies at home and abroad have laid a certain theoretical foundation for this paper, but few studies have analyzed the integrated development of culture and tourism

industry from the perspective of systematic evolution. Prior to the study of industrial convergence, self-organization theory is mainly applied to the study of industrial clusters[10] and industrial structure[11]. At present, a small number of studies have been applied to the integration of cultural industry and tourism industry. Song Lin believes that cultural industry integration is a self-organizing integration process[12]. Wei Yan regards the structural system of tourism industry as a self-organizing system[13]. Bohua Li et al. analyzed three paths of tourism industry integration of agricultural cultural heritage sites, namely, internal system integration, external system extension and spatial system expansion[14]. Zaijun Li and Yaqin Cui believed that the integration of ice and snow industry and tourism industry had the characteristics of self-organizing dissipative structure[15]. Shimin Fang et al. regarded the integration of agriculture and tourism as a self-organizing system with dissipative characteristics[16]. These research results show that the cultural industry and tourism industry have the characteristics of self-organization, and the integration between the two industries also has the characteristics of self-organization, which provides theoretical support for this paper to study the integration of culture and tourism industry from the perspective of self-organization theory.

In this paper, self-organization theory is adopted to analyze the evolution mechanism of culture-tourism integration system, the evolution model of culture-tourism integration system is constructed based on the method of principal component selection of order parameters, and the observation variable indexes of culture-tourism integration system are constructed according to the qualitative analysis of evolution mechanism, and the panel data from 2007 to 2019 are used to empirically analyze the evolution model of culture-tourism integration system. The order parameter potential function and order parameter equation of Culture and tourism integration system are determined to provide theoretical support and data reference for Cultural and tourism integration in China.

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2. ANALYSIS ON EVOLUTION MECHANISM OF CULTURE-TOURISM FUSION SYSTEM

2.1. The self-organization characteristic of culture and tourism fusion system

The integration system of culture and tourism industry is a self-organizing system, which has the characteristics of openness, far from equilibrium, nonlinear interaction and fluctuation among subsystems. Openness is refers to the culture and tourism industry integration system only by constantly exchange with the outside world, talent resources, market, technology, capital, management, and other elements, can drive system is introduced into a steady stream of negative entropy flow offset system itself is the generation of entropy flow, while to adapt to the external environmental challenges beyond its shackles, makes the culture and tourism industry integration system to orderly way; Far from equilibrium means that the original equilibrium relationship is broken due to the uneven distribution of various elements in the integration system of culture and tourism industry and the constant exchange with external environmental elements, which makes the integration system of culture and tourism industry far from equilibrium and the industrial structure gradually loses stability. Nonlinear interaction refers to the culture and tourism industry integration system of each subsystem in the elements, there exists a complicated nonlinear interaction between these elements are in competition and synergy, always has the positive and negative feedbacks, which leads to a resultant force, guiding the direction of the evolution of culture and tourism industry integration system; Fluctuation is refers to the culture and tourism industry integration system is affected by the nonlinear interaction of randomness in the process of running, the system structure is not enough to change fundamental change, this change is accumulating led to a qualitative change, make the culture and tourism industry integration system has had the fundamental change, so as to realize the leap of system from low level to high level, A new form of cultural tourism industry.

2.2. Order parameters of culture-tourism fusion system

Haken refers to the "order parameter" in phase transition theory to describe the degree of ordering and self-organizing evolutionary power of the system, and calls the fundamental influencing factor of system innovation as the order parameter, which is a kind of slow variable, macro variable and command variable. As the product of nonlinear competition and synergy, the order parameter leads the cooperative evolution among subsystems and controls the direction and process of the whole system evolution. The order parameter dynamic

mechanism of the cultural and tourism integration system has the comprehensive characteristics of self-organization factors and other organization factors, and under the joint action of the self-organization factors and other organization factors, it controls the evolution process of the cultural and tourism integration system. Therefore, the order parameter of cultural and tourism integration system is the main dynamic characteristic of the evolution of the cultural and tourism integration system.

2.2.1. Analysis of self-organizing factors in the evolution of culture-tourism fusion system

The self-organization factor is the main factor that affects the evolution and development of the cultural and tourism integration system, which is mainly manifested in the characteristics of the industry itself, the diversification of enterprises and the change of market demand. In the process of its development, cultural industry has encountered problems such as single industrial function, serious trend of industrial structure and unsmooth investment channels, which have seriously affected its development. Therefore, the transformation and upgrading demand of cultural industry is the initial driving force inside the system and drives the evolution of the system. Tourism industry is a comprehensive industry with great openness, wide penetration and strong compatibility, covering primary, secondary and tertiary industries and closely related to other national economic sectors[17]. Therefore, the strong correlation of tourism industry is also an important factor affecting the evolution of cultural and tourism integration system. From the perspective of enterprise operation, tourism enterprises' objective pursuit of economy makes tourism enterprises carry out diversified business and develop diversified tourism products, so as to find the characteristics of other industrial products and promote the integration of tourism industry with other industries [18]. In the process of the integration of the tourism industry with other industries, the diversified business of the tourism enterprise disperses the business risk of the enterprise, the diversified operation forms the overall synergistic effect, a variety of resources are fully utilized, and the tourism enterprise can obtain more economic returns. Therefore, the pursuit of diversification of tourism enterprises is also one of the important factors affecting the integration of culture and tourism. From the perspective of market demand, with the improvement of people's material living standard, people are no longer satisfied with traditional sightseeing, but regard tourism as a cultural journey from which they can absorb cultural nutrition and improve their own civilization[17]. Visible, market demand pull force is also important logical starting point of the development of culture and tourism industry integration, the formation of culture and tourism industry convergence is in the form of market competition, relying on its own, don't need the intervention of the external forces, is the result of self-organizing selection.

2.2.2. Analysis of other organizational factors in the evolution of cultural and tourism integration system

In addition to self-organization factors, the evolution of cultural and tourism integration system is also affected by other organizational factors of external environment such as technology, policy and economy. The continuous progress of science and technology makes the culture and tourism industry more simple and gives birth to a new industrial chain. Through advanced technologies, the cultural industry combines tourism production capacity and cultural interpretation to form a form of tourism with cultural characteristics. The tourism industry uses Internet, big data analysis, VR, AR and other technologies to form new smart tourism projects[19]. Technological innovation factors can bring new vitality to the system of cultural and tourism integration. Secondly, policy and institutional support for industrial convergence means that the threshold for other industries to enter the industry is lower, and industrial convergence is more likely to occur. Therefore, policy and institutional support is one of the external catalytic forces for industrial convergence[20]. With the support of policies and institutions, culture and tourism-related industries will gradually move towards their own industries, thus gradually moving towards integration. Over the years, many guiding opinions and development plans on the development of culture and tourism have pointed out that culture and tourism should be integrated and the integration of exposition tourism has received more and more attention and support from the state. In addition, the level of regional economic development is closely related to the development situation of China's culture and tourism industry[21]. Regional economic development level is the foundation of the integration of culture and tourism industry. The higher the level of regional economic development, the more developed the infrastructure, management measures, transportation network and other aspects, which is more conducive to the integration of culture and tourism industry development.

3. EVOLUTION MODEL CONSTRUCTION AND VARIABLE SELECTION OF CULTURE-TOURISM INTEGRATION SYSTEM

As an important tool to analyze system evolution mechanism, how to select the order parameter becomes the key to study the evolution mechanism of culture-tourism fusion system. The existing methods for selecting order parameters include principal component selection[22], b-Z model selection[23] based on qualitative

analysis, and Haken model selection[24]. In this paper, the method based on principal component selection order parameters is used to construct the evolution model of culture-tourism fusion system.

3.1. Model building

3.1.1. Model assumes

The culture-tourism integration system and the observed variable indexes should meet the following four assumptions:

Hypothesis 1: There is a certain degree of correlation between observed variables;

Hypothesis 2: The system has Markov property, that is, the future state of the system is only related to the current state, and has nothing to do with the past state;

Hypothesis 3: there is no direct correlation between principal component variables, and the interaction between principal component variables is realized by changing the change rate of dependent variables.

Hypothesis 4: When all principal component variables are 0, the influence between principal component variables also disappears.

3.1.2. Principal component model construction

In view of the System's Markov hypothesis, the relationship between principal component variables can be expressed by the difference equation:

$$z_i(k+1) = \tilde{f}_i\left(z_1(k), z_2(k), \dots, z_q(k)\right) \quad (1)$$

$$i = 1,2,\cdots,q; \ \ k = 1,2,\cdots,n-1$$

Where I is the principal component variable, k is the time series variable,

Equation (1) is continuous, and the nonlinear differential equation is obtained:

$$\dot{z}_i(t) = f_i\left(z_1(t), z_2(t), \dots, z_q(t)\right) \ i = 1,2,\cdots,q \quad (2)$$

According to hypothesis 3, the influence of the principal component variable on the dependent variable can be reflected by the rate of change of the dependent variable. Therefore, the nonlinear function f_i has the following expression:

$$f_i\left(z_1(t), z_2(t), \dots, z_q(t)\right) = [r_i +$$
$$g_i\left[\left(z_1(t), z_2(t), \dots, z_q(t)\right)\right]z_i(t) \quad i = 1,2,\cdots,q \quad (3)$$

r_i show $z_i(t)$ inherent rate, r_i for $z_i(t)$ damping coefficient, and meet the $r_i \neq 0$, $g_i\left[\left(z_1(t), z_2(t), \dots, z_q(t)\right)\right]$ is the characterization function of the interaction of principal component variables on $z_i(t)$. According to hypothesis 4,

$g_i(0,0,\dots,0) = 0$.

The linear term is separated from the right end of Equation (3) to obtain the dynamic evolution model equation of the system:

$$\dot{z}_i = f_i\left(z_1, z_2, \dots, z_q\right) = r_i z_i +$$
$$g_i\left(z_1, z_2, \dots, z_q\right)z_i \ i = 1,2,\cdots,q \quad (4)$$

Take $\dot{z}_i = 0$, obviously the origin $z_i = (0,0,\dots,0)$ is the balance point.

3.1.3. Order parameter determination method, order parameter equation

In combination with hypothesis 4 and the equilibrium point, the linearized equation of (4) $\dot{z}_i=0$ is obtained by using the partial derivative matrix.

$$\dot{z}_i = r_i z_i, \ \ i = 1,2,\cdots q \quad (5)$$

The eigenvalues $\lambda_i = \gamma_i \neq 0$ of the coefficient matrix of (5) are all real numbers. Combined with the basic principle of Lyapunov stability judgment to distinguish between slow and fast variables: if all $\gamma_i < 0$, $|\gamma_i|$ closer to 0 is the slow variables; If $\gamma_i > 0$ exists, the corresponding variable $z_i(t)$ is slow variable, and other variables are fast variables. In this case, the slow variable dominates the fast variable, so that the order parameter can be approximated. According to the synetics servo principle, slow variable is used to represent fast variable, adiabatic approximation is used to eliminate fast variable, and the order parameter equation is obtained:

$$\dot{z}_u = r_u z_u + g_u(z_u, z_s(z_u))z_u \quad (6)$$

Where z_u is the slow variable and z_s is the fast variable; $u = 1,2,\cdots,p$; $s = m+1, m+2,\cdots,q$. The order parameter equation can describe the evolution path of the system.

3.1.4. Construct and simulate potential functions

By introducing the function $V(z_1)$ and making it satisfy $-\dfrac{\partial v}{\partial z_1} = \dfrac{dz_u}{dt}$, $V(z_1)$ is the potential function of the order parameter equation, and using MATLAB software to simulate the potential function of the order parameter equation, we can describe the trajectory of the virtual particle of the order parameter and analyze its evolution path.

3.2. Variable acquisition and data sources

According to the qualitative analysis of the main factors of the cultural and tourism integration system mentioned above, it is proposed to construct the observation variable index of the cultural and tourism integration system.

Table 1. Index system of observed variables of culture-tourism integration system

Observation variable	Characterization of indicators	Indicators show
Demand for cultural transformation and upgrading	X_1:Speed of cultural industry transformation and upgrading	Reflect the speed of the cultural industry transformation and upgrading, through the industrial structure changes in the average value of a given period of time to cultural industry structure change, the cultural industry is divided into cultural manufacturing, wholesale and retail trade, cultural services, through cultural industrial structure changes in the average value reflect the cultural industry transformation speed characterization of industry transformation and upgrading demand variable[25]
Strong interconnectedness of the tourism industry	X_2:Spillover effect of tourism industry	It reflects the correlation effect between the tourism industry and other sectors and is calculated based on China's input-output table. By calculating the spillover effect of the tourism industry as the representation variable of the strong correlation of the tourism industry, the values of 2007 and 2012 are derived from the research on the equality of inspection and construction[26]. Due to the limitations of China's input and output table, the data from 2007 to 2011 are based on the 2007 data. Data from 2012 to 2016 are based on the data of 2012; Data from 2017 to 2019 are based on the values of 2017
The market demand	X_3:Per capita disposable income of urban residents	Reflect the market consumption power
Scope economy pursuit	X_4:The mean value of economic coefficient of tourism enterprise scope	To reflect the diversified operation effect and scope economy pursuit of tourism enterprises, the annual report data of 13 listed tourism companies in China from 2007 to 2019 are calculated to obtain the scope economy coefficient of each tourism enterprise every year, and then the mean value of scope economy coefficient of all enterprises every year is calculated as the representation variable of scope economy pursuit[27]
Industrial policy	X_5:Cultural and tourism policies	The intensity of tourism policy is divided into five levels according to laws, administrative regulations, administrative normative documents of The State Council, departmental regulations and departmental administrative normative documents, with values of 5, 4, 3, 2 and 1 respectively. The intensity values of culture and tourism policy represent industrial policy variables[28]
Technology innovation	X_6:Cultural and tourism science and technology innovation	To reflect the situation of culture and tourism science and technology, using "tourism" and "culture" as keywords, the patent information published by each province and city from 2007 to 2019 was retrieved by the abstract item of patent application by prefecture level. Data mainly include the total number of patent applications for invention, utility model and appearance design. This paper represents technological innovation variables through the number of cultural and tourism patents[29]
Level of economic development	X_7:Per capita GDP value	It reflects the overall level of economic development and is calculated using GDP/ year-end total population

This paper selects the integrated development of culture and tourism industry in China from 2007 to 2019 as the research object, satisfying the mathematical logic of the model. The data mainly come from China Statistical Yearbook, China Cultural and Related Industries Statistical Yearbook, Input-Output Table, China Patent Full-text Database (CNKI edition), China Legal Knowledge Resources Database and stock Exchange annual Report from 2007 to 2019. The data of per capita disposable income and PER capita GDP of urban residents come from China Statistical Yearbook. Cultural and tourism patents come from China Patent

Full-text Database (CNKI edition). The spillover effect of tourism industry comes from the Table of Input and Output. The mean value of economic coefficient of tourism enterprise scope comes from the annual reports of listed tourism companies published on the website of Shanghai Stock Exchange and Shenzhen Stock Exchange. Industrial policy data comes from China Legal Knowledge Resources General Database.

4. EMPIRICAL ANALYSIS ON THE EVOLUTION OF CULTURAL AND TOURISM INTEGRATION SYSTEM

Before data correlation analysis, in order to eliminate the influence of dimension and order of magnitude,

EXCEL software was used to process the original data with Z standardization. After Z data standardization processing, correlation analysis and testing are needed. SPSS23.0 was used for correlation analysis of Z standardized data. It can be seen from Table 5.1 that the correlation degree between X_1、X_2、X_3、X_6 and X_7 is above 0.4, and only X_4 and X_5 have low correlation degree with other variables. It is generally believed that, Correlation coefficient greater than 0.3 indicates that there is a high degree of correlation between variables, so it can be seen that there is a strong correlation between some variables, which satisfies hypothesis 1. The motion process of the culture-tourism fusion system is a random trajectory, which obviously satisfies Markov hypothesis, namely satisfies hypothesis 2.

Table 2. Mean, standard deviation and variable correlation coefficient matrix

variable	The mean	The standard deviation	X_1	X_2	X_3	X_4	X_5	X_6	X_7
X_1	3.26	1.43	1	.627[*]	-.723[**]	.129	-.184	-.456	-.716[**]
X_2	0.92	0.18	.627[*]	1	-.931[**]	.174	.471	-.931[**]	-.930[**]
X_3	26950.28	8907.32	-.723[**]	-.931[**]	1	-.174	-.330	.929[**]	.999[**]
X_4	-7.90	0.62	.129	.174	-.174	1	-.092	-.123	-.176
X_5	97.23	41.12	-.184	.471	-.330	-.092	1	-.538	-.310
X_6	551.69	481.16	-.456	-.931[**]	.929[**]	-.123	-.538	1	.930[**]
X_7	43838.69	15521.27	-.716[**]	-.930[**]	.999[**]	-.176	-.310	.930[**]	1

Note: *. In P < 0.05 (two-tailed), the correlation was significant; **. In P < 0.01 (double tail), the correlation was significant.

SPSS23.0 software is used to conduct KMO and Bartlett tests on the standardized Z data to verify whether it is suitable for principal component analysis. It is generally believed that KMO less than 0.5 is not suitable for principal component analysis. Table 5.2 shows that KMO value is 0.656. It indicates that the observed variables of the culture-tourism fusion system are suitable for principal component analysis. According to the Bartlett sphericity test sig. 0.000 < 0.001, the correlation between the selected variables is significant and suitable for principal component analysis.

Table 3. KMO and Bartlett tests

KMO sampling suitability quantity		.656
Bartlett sphericity test	The approximate chi-square	128.985
	Degrees of freedom	21
		.000

According to hypothesis 3, two components with a cumulative rate of 82.413% were selected as candidate

order parameters (Table 4). Obviously, when the principal component variables become 0, the influence between the principal component variables will also disappear, which satisfies hypothesis 4. From rotating load matrix (table 5) can be seen after the main component, the corresponding relationship between observation variable index of the first principal component mainly load index for urban per capita disposable income, the level of culture and tourism industry policy, culture and tourism science and technology innovation and the per capita GDP value, this kind of index on characterization of culture and tourism industry development in the external environment faced by, Therefore, the first principal component variable is the external variable of industrial development. The main load of the second principal component is the transformation and upgrading speed of the cultural industry, the spillover effect of the tourism industry and the mean value of the economic coefficient of the overall range of tourism enterprises. These indicators represent the internal breakthrough of the cultural and tourism industry, so the second principal component variable is called the internal variable of the industrial development.

Table 4. Total variance of principal component interpretation

Composition	Initial eigenvalue			Sum of squares of rotational loads		
	Total	Percentage of	The	Total	Percentage of	The

		variance	cumulative%		variance	cumulative%
1	4.475	63.926	63.926	4.451	63.587	63.587
2	1.294	18.487	82.413	1.318	18.826	82.413
3	.919	13.128	95.541			
4	.227	3.247	98.788			
5	.072	1.028	99.816			
6	.012	.178	99.994			
7	.000	.006	100.000			

Table 5. Load matrix after rotation

	Composition	
	1	2
X_1:Speed of cultural industry transformation and upgrading	-.655	.610
X_2:Spillover effect of tourism industry	-.965	.075
X_3:Per capita disposable income of urban residents	.985	-.126
X_4:The mean value of economic coefficient in the overall scope of tourism enterprises	-.148	.469
X_5:Cultural and tourism policy strength	-.453	-.812
X_6:Innovation of culture and tourism science and technology	.964	.163
X_7:Per capita GDP value	.982	-.136

According to the score coefficient matrix (Table 6), principal component expressions and time series of principal component values can be obtained (Table 7). Principal component expression is as follows:

$$z_1 = -0.120x_1 - 0.216x_2 + 0.218x_3 - 0.011x_4 - 0.141x_5 + 0.227x_6 + 0.217x_7 \quad (10)$$

$$z_2 = 0.438x_1 + 0.012x_2 - 0.050x_3 + 0.353x_4 - 0.645x_5 + 0.171x_6 - 0.058x_7 \quad (11)$$

Table 6. Score coefficient matrix

	Composition	
	1	2
X_1:Speed of cultural industry transformation and upgrading	-.120	.438
X_2:Spillover effect of tourism industry	-.216	.012
X_3:Per capita disposable income of urban residents	.218	-.050
X_4:The mean value of economic coefficient in the overall scope of tourism enterprises	-.011	.353
X_5:Cultural and tourism policy strength	-.141	-.645
X_6:Innovation of culture and tourism science and technology	.227	.171
X_7:Per capita GDP value	.217	-.058

Table 7. Time series of principal components

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
z_1	-1.21	-0.99	-1.02	-0.96	-0.85	-0.42	-0.14	0.01	0.42	0.61	1.27	1.53	1.77
z_2	1.50	1.43	0.11	-0.27	0.10	-1.01	-1.95	-1.55	0.45	-0.44	0.35	0.56	0.72

As can be seen from Table 7, the external variables of industrial development from 2007 to 2019 kept rising as time went by, while the internal variables of industrial development fluctuated, indicating that market demand, industrial policy, scientific and technological innovation, economic development level and other external variables of industrial development played an increasingly strong driving role in the cultural and tourism integration system.

5.ANALYSIS ON THE EVOLUTION MODEL OF CULTURE-TOURISM FUSION SYSTEM

Assuming that the interaction between principal component variables is proportional to the value of variables, MATLAB software is used to fit the principal component time series to obtain the difference equation:

$$z_1(k + 1) = 1.02z_1(k) - 0.02z_1(k)z_2(k) + 0.15z_1{}^2(k) \quad (12)$$

$$z_2(k + 1) = 0.71z_2(k) + 0.40z_1(k)z_2(k) - 0.07z_2{}^2(k) \quad (13)$$

After continuous, the differential equation is as follows:

$$\dot{z_1} = 0.02z_1(k) - 0.02z_1(k)z_2(k) + 0.15z_1{}^2(k) \quad (14)$$

$$\dot{z_2} = -0.29z_2(k) + 0.40z_1(k)z_2(k) - 0.07z_2{}^2(k) \quad (15)$$

The linear coefficients explain the self-growth rate of the variables $\frac{\dot{z}_i}{z_i}$ drivers, the external drivers show self-growth, while the internal drivers show the opposite. The positive interaction term z_1z_2 indicates that the external development variables and the internal development variables promote each other, while the negative interaction z_1z_2 indicates the opposite. The positive coefficient of the square term indicates that the external development variable of the industry has a self-growth effect with the evolution, while the negative coefficient of the square term indicates that the internal development variable of the industry has a self-retarding effect with the development of time.

For the $\dot{z}_1 = 0$, for the $\dot{z}_2 = 0$, (12) and (13) are easily obtained with the equilibrium point (0, 0). If there are eigenvalues $r_i > 0$, then the system is in an unstable state at the origin. The characteristic values $r_1 = 0.01 > 0$ and $r_2 = -0.29 < 0$ are obtained by using partial derivative matrix, which can identify $(0, 0)$ as an unstable target. The variable z_1, namely the external development variable of the industry, is a slow variable, which has gradually evolved into a sequence parameter in the unstable state of the system structure, forcing the evolution of the system. The external variables of the industry are mainly composed of policy intensity, scientific and technological innovation, per capita disposable income of urban residents, and per capita GDP, which is basically consistent with the practice of cultural and tourism integration development in China. With the relaxation of government regulation and continuous policy support, the integrated development of culture and tourism industry in China is guaranteed and further catalyzed. As the main driving force leading the integrated development of industries, scientific and technological innovation provides diversified forms of expression and combination approaches for cultural tourism, thus promoting the integrated development of culture and tourism industry. The per capita disposable income and per capita GDP of urban residents represent the market demand capacity and the level of social and economic development, and affect the depth and breadth of the integrated development of culture and tourism industry.

Adiabatic approximation is applied to eliminate the fast variables by making $\dot{z}_2 = 0$. The relationship between external variables and internal variables of industrial development is obtained:

$$z_2(0.29 - 0.40z_1 + 0.05z_2) = 0 \qquad (16)$$

Since both the external and internal variables of industrial development are far from the equilibrium state, considering only the case of $z_2 \neq 0$, the servo equation expressed by the fast variable and the slow variable can be obtained from (16) :

$$z_2 = -5.8 + 8z_1 \qquad (17)$$

Equation (17) shows that the internal variable of industrial development, as a fast variable, is forced by the external variable of the slow variable of industrial development. By substituting (17) into (14), the order parameter equation with logical evolution can be obtained:

$$\dot{z}_1 = 0.14z_1 - 0.01z_1{}^2 \qquad (18)$$

Introducing the function $V(z_1)$, make it meet $-\frac{\partial v}{\partial z_1} = \frac{dz_u}{dt}$, order parameter equation for the potential function of $V(z_1) = -0.07z_1{}^2 + 0.003z_1{}^3$. The potential function refers to the potential energy per unit mass in the physical sense and can be used to represent the dynamic characteristics of the system. MATLAB software was used to simulate the potential function diagram of the order parameter equation (FIG. 1) and describe the trajectory of the virtual particle of the order parameter z_1 The slight fluctuation makes the order parameters deviate to the right, and the huge fluctuation makes the order parameters get away from the origin attraction, which makes the system have the characteristics of dissipative structure. There are two internal dynamic mechanisms in the text travel fusion system. The first is that the system returns to the origin due to its own inertia. The second dynamic mechanism is driven by uncertain factors, which makes the cultural and tourism integration system get rid of the origin attraction and forms dissipative structure characteristics under the constant influence of uncertain factors. Obviously, under the action of the current order parameters, the system has broken away from its own inertia attraction and realized self-organization evolution with the drive of uncertain factors.
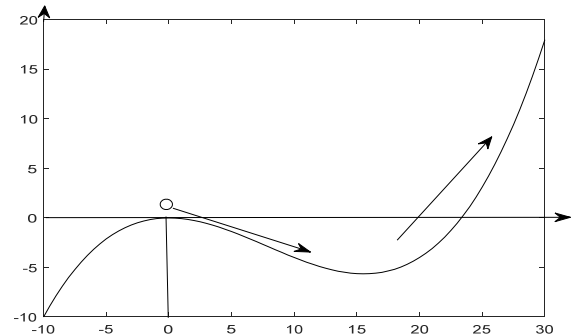

FIG. 1 Potential function of order parameter equation

According to the characteristics of the linear coefficients of the order parameter equation, the coefficient of the first term is positive. The quadratic coefficient is negative, indicating that the order parameter will produce self-retarding effect with the evolution process. In general, the growth rate of order parameters firstly accelerates and then slows down gradually, and finally tends to a non-zero stable state, as shown in FIG. 2. In other words, under the condition that the model and observation variables remain constant, with the gradual evolution of the self-organization evolution of the system, the self-blocking effect of the system becomes more and

more obvious, and the system will return to a new equilibrium state again. The current development of the system also gradually faces a development bottleneck, so new order parameters are needed to break the equilibrium.
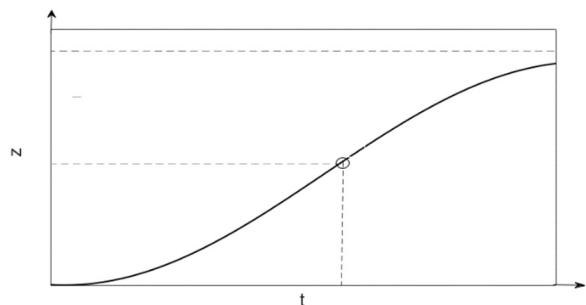

FIG. 2 Evolution path of order parameters

6.CONCLUSIONS

The potential function and evolution path of the order parameter equation are determined by analyzing the culture-tourism integration system in China from 2007 to 2019. Combined with potential function and evolution path diagram, the following suggestions are put forward for the integrated development of China's culture and tourism industry:

(1) Make a reasonable plan for the development of China's culture and tourism industry according to the proportion of order parameter expression. According to the dominant role of order parameters on the system evolution, China should give priority to the development of external variables of industrial development at the present stage to guide the rapid development of cultural and tourism industry integration in China. To protect cultural and tourist industry benign fusion, according to industry external variables of four main variables in the expression of the coefficient of 0.218, 0.141, 0.227 and 0.217, culture and tourism policy strength variable proportion is low, the present stage in our country should further strengthen cultural and tourism policy support, makes the indicator by property heavy flat, To ensure the coordinated development of China's cultural and tourism industry integration in these four aspects, to achieve a reasonable allocation of industrial resources and grasp the current stage of development, to guide the rapid increase of order parameters to improve the orderly degree of cultural and tourism integration system, so as to enhance the competitiveness of the industry.

(2) Pay attention to the role of order parameters. It can be seen from the analysis that the system of cultural and tourism integration has been far from the equilibrium state, and the external development variable of industry has become the order parameter that governs the evolution of the system. However, with the continuous evolution of the system, the system will return to the equilibrium state from far away, and new order parameters are needed to break the equilibrium and return to the dissipative structure. Therefore, importance should

be attached to the effect of order parameters on CFLS.

(3) The internal development of the industry should timely follow up the external development of the industry and maintain the coordinated development of the integration of culture and tourism. Under the condition that both the model and the observed variables remain unchanged, the self-blocking effect will gradually increase with the evolution of the system, which makes the system in a new equilibrium state. Therefore, new order parameters are needed to break the new equilibrium state. It is also match with culture and tourism industry actual situation, with the constant improvement of the external development strength (government policy tilt, the promotion of technological innovation, the disposable income of urban residents and per capita GDP increase), along with the development of the industry within their own lagging behind, will inevitably become the main bottleneck of culture and tourism industry integration. Therefore, in the process of culture and tourism integration development, should focus on products supply and demand of don't match, the resources development and protection of incompatible, culture and tourism cooperation, product quality and service by the uneven inconsistent problems, make industry within their own changes in the external environment and to keep up with industry do go hand in hand.

REFERENCES

[1] John P. Taylor. Authenticity and sincerity in tourism[J]. Annals of Tourism Research, 2001, 28(1): 7-26.

[2] Greg Richards and Julie Wilson. Developing creativity in tourist experiences: A solution to the serial reproduction of culture? [J]. Tourism Management, 2006, 27(6): 1209-1223.

[3] A.M. Ogaboh Agba et al. Tourism industry impact on Efik's culture, Nigeria[J]. International Journal of Culture, Tourism and Hospitality Research, 2010, 4(4): 355-365.

[4] Chunbo Zhou. Dynamic mechanism and synergistic effect of cultural and tourism industry integration [J]. Social Scientist,2018(02):99-103.

[5] Rui Huang, Dan Hou. The dynamic mechanism and development path of cultural and tourism industry integration in the three provinces of Northeast China [J].Contemporary Economic Research,2017(10):81-89.

[6] Huaguang Yin, Huangru WANG, Yungui Yao. Research on integrated Development mode of Cultural industry and tourism Industry in Wuling Mountain area [J]. Journal of south-central university for nationalities (humanities and social sciences edition),2015,35(04):39-43.

[7] Yanlian Huo. Integration effect, mechanism and path of cultural industry and tourism industry from the perspective of industrial integration [J]. Journal of Commercial Economics,2015(12):126-127.

[8] Gangmin Weng, Li Lingyan. Analysis on the coupling coordination degree and spatial correlation of Tourism and cultural industry integration in China[J]. Economic geography,2016,36(01):178-185.

[9] Yang Liu, Lan Yang. Technology integration, function integration and market integration: optimization strategy of cultural tourism industry chain -- Based on the typical experience of "colorful Guizhou"[J]. Business Economics,2019(08):125-131.

[10] Xianhong Bian. Research on the evolution stage and mechanism of tourism industry cluster based on self-organization Theory: A case study of Hangzhou International Tourism Complex [J]. Economic geography,2011,31(02):327-332.

[11] Yanli Fan, Binggen ZHOU, Yongping Lv. Research on the coordinated development of tourism industry structure based on self-organization theory [J]. World regional studies,2009,18(01):143-149.

[12] Lin Song. Research on the dynamic mechanism of cultural industry integration: Based on self-organization Theory and cultural consciousness perspective [J]. Journal of hunan university (social science edition),2020,34(05):71-77.

[13] Wei Yan. The integration mechanism of tourism industry from the perspective of self-organization theory [J]. Social Scientist,2016(01):91-96.

[14] Bohua Li, Peilin LIU, Yindi Dou. Research on integrated development of tourism industry in agricultural cultural heritage area based on self-organization Theory: A case study of Zique Terrace in Xinhua County, Hunan Province [J]. Journal of central south university of forestry and technology (social science edition),2015,9(06):60-66.

[15] Zaijun Li, Yaqin Cui. Research on the mechanism and Promotion path of integrated development of China's ice and snow Tourism Industry [J]. Journal of Capital University of Sport, 2021,33(03):299-307.

[16] Shimin Fang, Haiyan WANG. Research on the Integration of agriculture and tourism Industry [J].Journal of xiangtan university (philosophy and social science edition),2019,43(02):63-68.

[17] Maoqian Meng. Research on the integration development of cultural industry and tourism Industry [J]. Zhongzhou Journal,2017(11):37-40.

[18] Yin Yang. Industry integration: A new perspective of tourism Development Trend[J]. Tourism Science,2008(04):6-10.

[19] Shengqing Ma. Integration mechanism and economic effect of cultural industry and tourism industry [J]. Social Scientist,2021(05):101-106.

[20] Yulian Ding, Yuan Zhao. Analysis on the motivation, path and Main Body of tourism industry integration: A case study of Shenzhen Huaqiang Group integrated development of tourism theme park [J]. Human geography,2013,28(04):126-131.

[21] Anle Liu, Chengyue Yang, Qingzhong Ming, Hongmei Zhang, Baoyi Lu. Research on the Relationship between Cultural industry and tourism industry in China [J]. Economic geography,2020,40(06):203-213.

[22] Dingjuan Wu, Yanming Sun, Rong Ding. Integration evolution Model of Manufacturing Enterprises under Transformation and Upgrading: A Method based on Principal Component Selection of Order Parameters [J]. Systems engineering, 2016, 34(09):44-51.

[23] Xiyang Zhao, Lei Shi, Qian Yu. Research on sequential Co-evolution Model and Simulation of enterprise innovation System [J]. Journal of Management, 2021,18(03):402-409.

[24] Lin Li, Ying Liu. Driving factors of regional economic synergy in China: A hierarchical empirical study based on Hakan Model [J]. Geographical research,2014,33(09):1603-1616.

[25] Hongfu Ma, Shouyi Hao. Industrial transformation and upgrading level measurement and its impact on labor productivity: A case study of 26 cities in the Middle Reaches of the Yangtze River Urban agglomeration [J]. Economic geography, 2017,37(10):116-125.

[26] Jianping Zha, Ting Tan, Yuanyuan Li, Lamei He. Research on the relationship between tourism industry and tourism industry in China [J]. Journal of shanxi university of finance and economics, 2018,40(04):62-74.

[27] Lu Dou. Research on scale economy and scope economy of China's listed tourism companies [J]. Tourism Tribune,2015,30(02):13-23.

[28] Xiaoyun Tang. The historical evolution of China's tourism development policy (1949-2013): A Quantitative Research perspective [J]. Tourism Tribune,2014,29(08):15-27.

[29] Gang Xiao. Spatial-temporal pattern evolution of tourism science and technology innovation

differences in the Yangtze River Economic Belt [J].
World regional studies,2020,29(04):825-.