

# Evaluation of Red Tourism Development System Based on System Dynamics Taking Hunan Province as an Example

Chao Zhang<sup>1</sup> Ping Huang<sup>1,\*</sup> Rui Guo<sup>1</sup>

<sup>1</sup> School of Management, Chengdu University of Information Technology, Chengdu, Sichuan 610103, China

\*Corresponding author. Email: hping@cuit.edu.cn

## ABSTRACT

In the context of culture and tourism integration, red tourism has been highly valued and has been listed in national policy documents for many times. China's red tourism is in the ascendant. It is necessary to constantly promote the transformation of red cultural resources into tourism brands, and further strengthen the cross-industry integration of red tourism, promote the production of comprehensive benefits in the political, economic, social, cultural and ecological aspects of red tourist destinations. In view of the status quo, more and more cities take the red tourism as the pillar of urban tourism. How to evaluate the red tourism development system has also aroused the attention and thinking of many scholars. Hunan Province is rich in red tourism resources, and the development of red tourism ranks first in the country. The development is relatively early, distinct, typical and representative. By constructing a system dynamics model, this paper makes a reasonable evaluation of the red tourism development system in Hunan Province. It aims to analyze the status quo of the development of red tourism in Hunan Province, choose the best development model and development path, enhance the competitiveness of red tourism in Hunan Province, and brighten the red cultural business card of Hunan Province.

**Keywords:** System dynamics, Red tourism, Hunan Province.

## 1. INTRODUCTION

Red tourism is a new trend in today's tourism. Through the development and utilization of red culture and red resources, it carries forward red tradition and inherits red gene. It is a new type of cultural and economic form and thematic tourism activity with revolutionary history, revolutionary deeds and revolutionary spirit as its connotation, which is mainly carried by revolutionary cultural relics, monuments, landmarks and other carriers. Red tourism combines red cultural landscape with green natural landscape, and integrates revolutionary traditional education with the tourism development. It can not only make tourists enjoy the scenery, understand revolutionary history, increase knowledge of revolutionary struggle, learn revolutionary struggle spirit, but also promote the economic development of red tourism destination [2].

The concept of red tourism in China was first published in academic journals in 1998, and together with green tourism and white tourism, it has become a new type of special tourism product [3]. With the promulgation of "2004-2010 national red tourism development planning" [4], the research of red tourism has set off, and a large number of scholars have carried out special research on the concept, category, development countermeasures and development path of red tourism. The research on the evaluation of red tourism development system is mainly carried out from the perspective of symbiosis theory and stakeholder theory. The evaluation index system is constructed with AHP and fuzzy comprehensive evaluation method to evaluate the red tourism development system. But the above research will have some limitations in solving practical problems. First of all, the construction of the evaluation index has a certain subjectivity, which cannot bring all the factors into the index system. It pays attention to the weight and

strength of the evaluation factors, and ignores the inhibition relevance and feedback effect among the evaluation indexes. Secondly, in the process of data processing, the inconsistency of data acquisition dimensions will affect the results of evaluation and analysis. The data collected through the questionnaire cannot avoid the cognitive bias of the respondents, so the reliability and validity of the overall evaluation research need to be improved.

Through computer simulation, the system dynamics model attaches importance to the causal loop and feedback mechanism among systems [5], and deconstructs the system elements of the research objects. Then the corresponding system dynamics model generates, and the complex system and dynamic evolution process can be visually displayed. It has systematic characteristics, gives maximum consideration to the comprehensiveness of evaluation indicators, and at the same time attaches importance to the interaction between indicators and the dynamic evolution process, and incorporates the dynamic characteristics of the supply-demand relationship in the red tourism development process into the system. The analysis and evaluation is carried out from a system point of view.

## **2. THE SPECIFIC APPLICATION OF SYSTEM DYNAMICS IN THE EVALUATION OF RED TOURISM DEVELOPMENT SYSTEM**

Based on the literature review and the research results of the red tourism development system and the application of system dynamics in tourism, this paper makes a derivative analysis of the index system and index connotation of the red tourism development system. With the help of a systematic point of view, this paper analyzes the problems in the evaluation of red tourism development, constructs a system dynamics model, and uses data for simulation to visually evaluate and study the red tourism development system. In the red tourism development system, red cultural resources are the core attraction, ecological environment is the basic condition, infrastructure is an important factor, community participation is the endogenous driving force, urban function is the development background, and development conditions are the growth-promoting factors. Therefore, on the basis of fully considering the rationality, comprehensiveness and scientificity of the system

model, five subsystems of red cultural resources, ecological environment, infrastructure, community participation and development conditions are constructed to ensure the independence and relevance among the subsystems [6].

### **2.1 Red Cultural Resource Subsystem**

Red cultural resources are the development resource carrier of red tourism destination and the core attraction of red tourism. The scale, richness and popularity of red cultural resources, as well as its ornamental and experiential value, will affect its attraction [7]. Based on red cultural resources, it is suggested to develop red tourism products and expand the red cultural resources. In the current new situation of tourism, it is necessary to find the correct positioning of red culture resources, take the characteristics as the guide, further explore the red culture, and meet the diversity and personalized needs of tourists. In the process of red tourism development, red cultural resources change dynamically with tourism development [8], which is reflected in the causal return and feedback among red cultural resources, the number of tourists and tourism income. The specific transmission path is as follows: ("Figure 1")

(1) Red tourism revenue — red cultural resources — increase in the number of tourists — added value of the tertiary industry — GDP — increase in tourism revenue — tourism investment — quality of red scenic spots (positive feedback)

(2) Red tourism revenue — red cultural resources — increase in the number of tourists — number of tourist reception by red tourism — per capita tourist area — quality of red scenic spots (positive feedback)

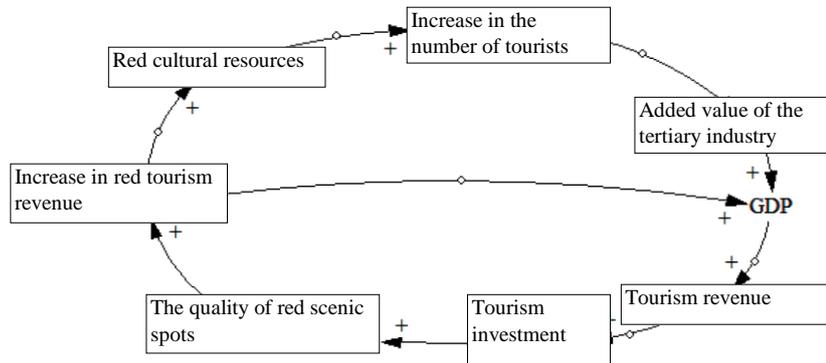


Figure 1 Red cultural resource subsystem.

### 2.2 Ecological Environment Subsystem

The ecological environment is the basic condition for the development of red tourism. The regionality and fragility of the ecological environment determine the upper limit of the development of red tourism destinations, as well as its tourism development policy and industrial path [9]. And there is also a correlation between the ecological environment capacity and the number of tourists. Good ecological environment promotes the development of red tourism. At the same time, with the increase in the number of tourists, it leads to the destruction of the ecological environment and the reduction of ecological benefits to a certain extent, and the destruction of the ecological environment will trigger the investment in environmental protection. Therefore, there are two causal paths in the ecological environment subsystem. The specific transmission path is as follows: ("Figure 2")

(1) Red tourism revenue — growth value of tertiary industry — GDP — fiscal revenue — tourism investment — Expenditure on ecological environment protection — quality of red scenic spots (positive feedback)

(2) Red tourism revenue — growth value of the tertiary industry — GDP — fiscal revenue — tourism investment — number of tourist reception by red tourism — per capita tourist area — environmental pressure — quality of red tourist attractions (negative feedback)

### 2.3 Infrastructure Subsystem

Tourism infrastructure is the sum of various material facilities built to meet the needs of tourists in the process of sightseeing, and it is an important carrier of tourism reception. Red tourism infrastructure endows the value connotation of red culture to all aspects of infrastructure [10]. When evaluating the red tourism development system, it is suggested to pay attention to the infrastructure construction, and bring the positive feedback loop in the infrastructure subsystem into the system dynamics model for analysis.

Red tourism infrastructure — red tourism revenue — growth value of tertiary industry — GDP — fiscal revenue — tourism investment — improvement of red tourism infrastructure — tourism revenue (positive feedback) ("Figure 3")

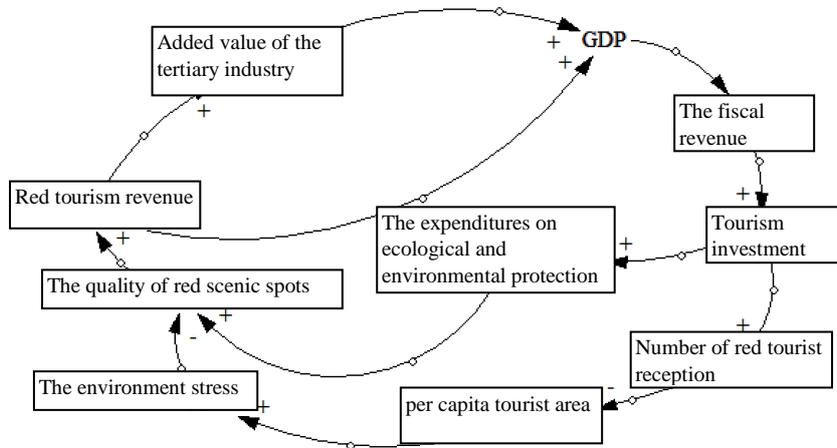


Figure 2 The ecological environment subsystem.

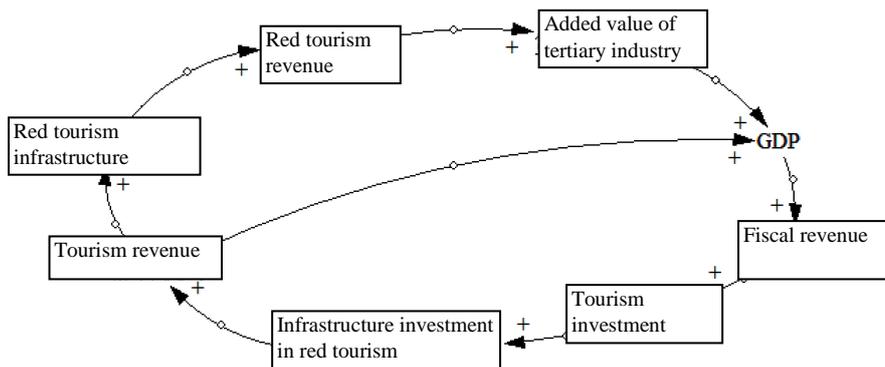


Figure 3 The infrastructure subsystem.

**2.4 Community Participation Subsystem**

Red tourism development is inseparable from community participation and support [11]. On the one hand, community participation provides human resources for tourism development, which is the main force for tourists to tell red stories, feel red atmosphere and improve tourism services. On the other hand, red tourism development provides jobs for community residents and drives local economic development. In the community participation subsystem, the causal loop is as follows: ("Figure 4")

(1) Community participation enthusiasm — red tourism revenue — growth value of tertiary industry — GDP — fiscal revenue — community

living standard — tourism revenue (positive feedback)

(2) Red tourism income — growth value of tertiary industry — GDP — tourism investment — local jobs — community residents' income — community residents' consumption — community residents' satisfaction — tourists' satisfaction — tourism income (positive feedback)

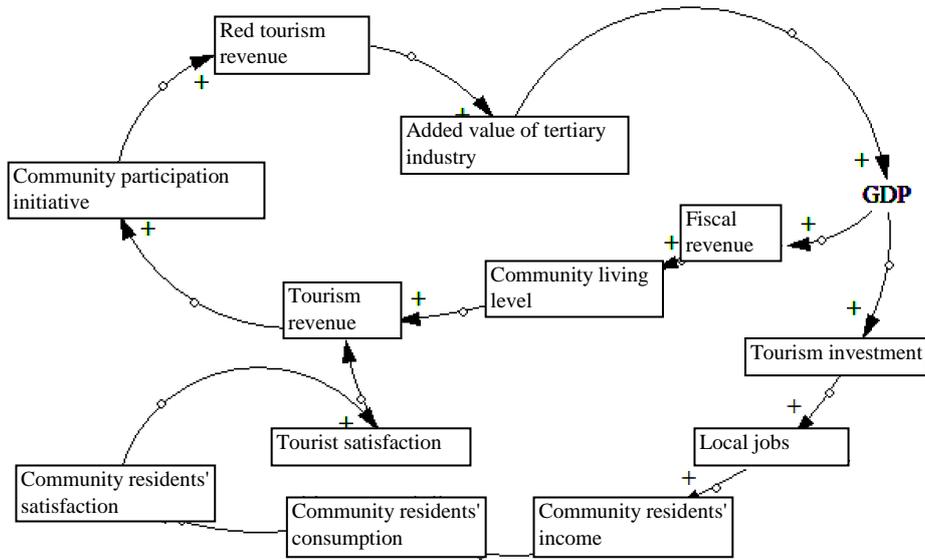


Figure 4 The community participation subsystem.

**2.5 Development Condition Subsystem**

The development of red tourism cannot be separated from the basic development conditions such as the economic background, social culture and living environment of the destination and the support of the government departments. Red tourism development helps to promote local economic development, while local support helps to improve tourism infrastructure and provide guarantee for the implementation of tourism

projects and tourism management. Therefore, in the development condition subsystem, the positive feedback causal loop is as follows: ("Figure 5")

Red tourism income — growth value of tertiary industry — GDP — tourism investment — tourism service facilities — number of tourist reception by red tourism — red tourism income (positive feedback)

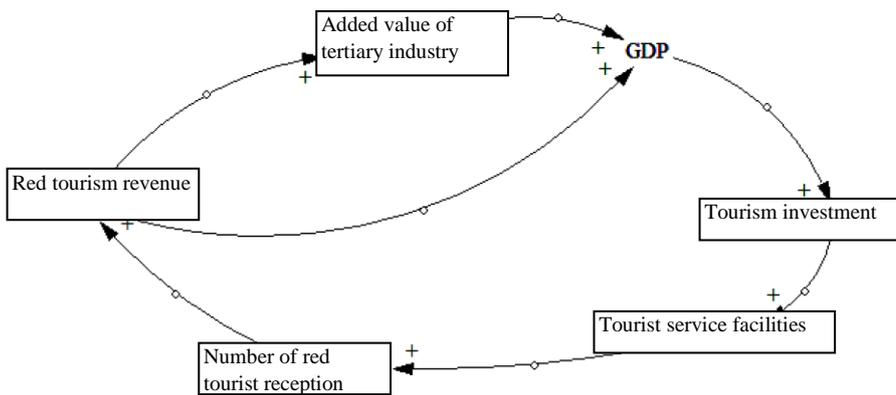


Figure 5 The development condition subsystem.

### 3. THE CONSTRUCTION OF SYSTEM DYNAMICS MODEL

#### 3.1 Case Selection and Data Source

Hunan Province has rich red cultural tourism resources. As the cradle of revolution and the hometown of great people, Hunan Province has a certain popularity and influence in China and foreign countries. Hunan Province has many red historical relics and rich structure, and many high-quality resources, including the great people's residence, martyr memorial hall, war site, Soviet regime site, which have great potential for development. Hunan Province has not only many red scenic spots, but also colorful natural landscapes, dense resource combination, etc., so the tourism routes are in good series and have great tourist attraction. In recent years, Hunan Province has deeply explored the value connotation and cultural elements of revolutionary cultural relics, used market mechanism to develop more cultural and creative products, and promoted the consumption of red culture. Red tourism has become the cultural card of Hunan Province.

#### 3.2 The Construction of System Dynamics Model

The evaluation of red tourism development system involves many related factors, the evaluation system is complex, and the subsystems are interrelated and variable. It is difficult to evaluate qualitatively and quantitatively, which makes it difficult to build and simulate the model. In this paper, the evaluation indexes and variables are simplified and adjusted to ensure the reliability of simulation results when building the dynamic model of red tourism development system. The system dynamics model is shown in the following figure. In addition, the data used in this paper can be obtained by statistical data review and field investigation, and the model simulation is carried out through dimensional processing.

Among them, the main state variables are red tourism income and the quality of red tourist attractions. The auxiliary variables include GDP, the growth value of the tertiary industry, the number of tourist reception, the investment in tourism, the per capita tourist area, and the expenditure of ecological environment protection. ("Figure 6")

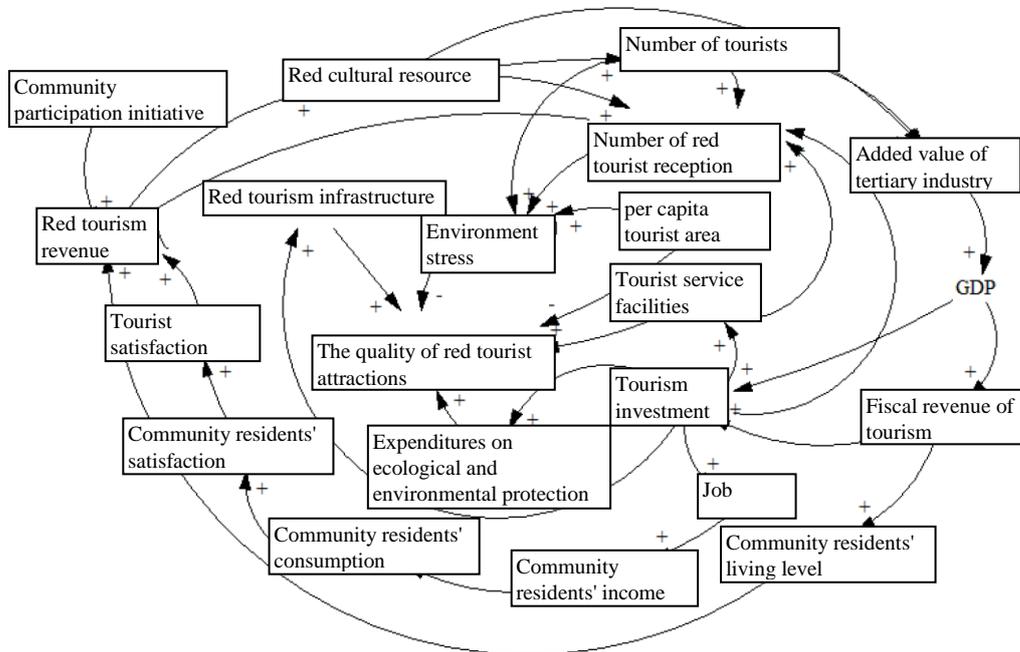


Figure 6 The system dynamics model of red tourism development.

### 3.3 Validation Analysis with Hunan Province as a Typical Case

Based on the analysis of the internal causality of the red tourism development system, this paper uses historical data from 2015 to 2019 to fit and

analyze the system dynamics model of the red tourism development. The data comes from the "Hunan Statistical Yearbook" (2015-2019). It is suggested to use Vensim Ple software for function editing and data processing. ("Table 1")

Table 1. Simulation results of the dynamic model of the red tourism development evaluation system in Hunan Province

variable	Number of Tourist Reception by Red Tourism /10,000 people	Red tourism revenue/100 million yuan	Number of direct employees in red tourism/ten thousand people	Per capita consumption of red tourism/yuan
2015 emulation value	9629	423.5	20.37	448
2015 historical data	9718	460	20	473
error	0.92%	7.93%	-1.85%	5.29%
2016 emulation value	9117	529	33.22	571
2016 historical data	9200	550	35	597
error	0.91%	3.82%	5.09%	4.36%
2017 emulation value	10012.3	615.8	49.8	637.1
2017 historical data	10000	630	52	630
error	-0.12%	2.25%	4.2%	-1.13%
2018 emulation value	11449.5	732	74.6	661
2018 historical data	11300	750	77	663
error	-1.32%	2.4%	3.12%	0.31%
2019 emulation value	13897	1319.1	96.4	908
2019 historical data	14000	1300	100	928
error	0.74%	-1.47%	3.6%	2.16%
average error	0.23%	2.99%	2.83%	2.20%

Through the fitting of historical data, it shows that the system simulation results are basically consistent with the actual situation of red tourism development system evaluation in Hunan Province, and the relative error is less than 3%. Therefore, it is considered that the dynamical model of red tourism development system constructed in this paper can reflect the actual situation of red tourism destination development more clearly. In the data fitting processing, it has high accuracy and reliability of simulation analysis, and can be used for the analysis and evaluation of red tourism development system.

growth of GDP and strengthened the development of local economy. However, in the development process, it is necessary to pay attention to the control of the number of tourists, avoid the environmental deterioration and the decline of tourism experience caused by the sharp increase of tourists, and avoid the damage to the quality of red tourist attractions and the core resources of red tourism.

### 4. EVALUATION OF RED TOURISM DEVELOPMENT SYSTEM IN HUNAN PROVINCE BASED ON SYSTEM DYNAMICS MODEL

On the basis of literature review and field research, this paper establishes a dynamical model of red tourism development system, and simulates and forecasts the prospect of red tourism development with the help of historical data. There are some problems worthy of attention.

As an important carrier of tourism development, ecological environment should be integrated into the overall situation of tourism development system. According to the dynamical model of red tourism development system constructed in this paper, with the increase of the number of tourists, it will bring negative feedback to the ecological environment subsystem, that is, to aggravate the deterioration of the ecological environment. Therefore, in the process of red tourism development, it is necessary to actively promote the "red + green" development mode, pay attention to ecological environment protection, and guide tourists and community residents to protect the ecological environment.

As an important engine of cultural tourism development in Hunan Province, red tourism has brought many red tourism tourists, promoted the tourism income of Hunan Province, improved the

Infrastructure is an important support for tourism development and plays an important role in improving the service level of tourist reception. Increasing tourism investment and improving tourism infrastructure can not only improve the

tourism image of the destination, enhance tourism attraction, but also increase the number of tourists and improve tourism income, so as to further stimulate tourism investment.

The advantages and disadvantages of community participation in tourism and development conditions directly affect the development level of red tourism. Good community participation promotes the cultural exchange between the host and the guest, strengthens the attraction of the tourism destination, and improves the tourism income by attracting tourists. The improvement of development conditions will further improve the quality of tourism destination, thus affecting tourism revenue.

## 5. CONCLUSION

Based on the theory of system dynamics, this paper analyzes the five subsystems of red cultural resources, ecological environment, infrastructure, community participation and development conditions of red tourism development, explores the relationship between the subsystems and the internal systems, and then constructs the dynamic model of red tourism development system. On this basis, the model is verified by the simulation measurement of the historical data of Hunan Red Tourism Development in 2015-2019, and the reliability of the model is proved. At the same time, the paper also analyzes the problems reflected in the red tourism development system and subsystem in Hunan Province by using the system dynamics model, which provides theoretical basis for further analysis and optimization.

According to the simulation results, the following points need to be noticed. First, it is necessary to pay attention to the excavation and protection of red cultural resources, find the correct positioning, take the characteristics as the guide, tell the red story well, innovate red products, update the means of communication, extend the stay time of tourists, and promote tourism consumption, so as to drive tourism income. At the same time, it is suggested to pay attention to the tourism capacity and ecological red line in the process of red tourism development, and avoid the damage to resources and ecological environment caused by blind development. Second, it is suggested to adhere to the development concept of "red + green", infiltrate the concept of sustainable development into all links of red tourism development, and strengthen the guidance of ecological values for tourists and community residents. one hundred and ninety-three

Third, it is important to strengthen the guidance and supervision of the competent government departments, promote policies conducive to the development of red tourism, strengthen infrastructure and service facilities, and encourage multiple subjects to participate in red tourism development, so as to realize development and co-construction and share achievements.

In conclusion, combining the theoretical advantages of system dynamics, this paper takes interdisciplinary cross-disciplinary research as the breakthrough to carry out innovation practice, explores the optimal development mode of red tourism development system, realizes the coordination and symbiosis of red tourism development system and internal subsystems, so as to improve the competitiveness of local red tourism and promote the local economic development.

## AUTHORS' CONTRIBUTIONS

Chao Zhang is responsible for experimental design, Rui Guo analysed data, and Ping Huang contributed to revising and editing.

## REFERENCES

- [1] General Office of the Central Committee of the Communist Party of China, General Office of the State Council. Opinions on the Implementation of the Revolutionary Cultural Relics Protection and Utilization Project (2018-2022) [EB/OL]. [http://www.gov.cn/xinwen/2018-07/29/content\\_5310268.htm](http://www.gov.cn/xinwen/2018-07/29/content_5310268.htm). 2018-07-30. (in Chinese)
- [2] Zhang Taicheng, Wang Weinian. Research on the Development of Red Tourism from the Perspective of Public Welfare [J]. *Jiangxi Social Sciences*, 2014, (1): 246-251. (in Chinese)
- [3] Zhou Meijing, Xu Chunxiao. Construction and Application of the Evaluation Index System of Symbiotic Development Level of Red Tourism [J]. *Tourism Tribune*, 2019, 34(9): 127-144. (in Chinese)
- [4] China Civilization Network. The Central Office and the State Council issued the "2004-2010 National Red Tourism Development Outline" (2004) [EB/OL]. <http://www.wenming.cn/ziliao/wenjian/jigou/zhonggongzhongyang>

- /201202/t20120222\_513800.shtml, 2012-02-22.
- [5] Wang Qipan. System Dynamics [M]. Shanghai: Shanghai University of Finance and Economics Press, 2009. (in Chinese)
- [6] Chen Xin, Zeng Chenming. Dynamic correlation prediction of the four effects in the tourism industry economy [J]. Statistics and Decision, 2013 (22): 128-130. (in Chinese)
- [7] Xiao Haiping, Gu Renxu, Huang Jingbo. On the Combined Developing Mode of the Red Triangle Region's Tourism Resources [J]. World Regional Studies, 2010, 19(3): 121-127. (in Chinese)
- [8] Xu Renli, Zhang Yongqi. Construction and Application of Evaluation System of Regional Red Tourism Economic Development Level [J]. Journal of Inner Mongolia Agricultural University (Social Science Edition), 2012, (6): 49-51. (in Chinese)
- [9] Su Yongbo. A Study on the Coupling Path of Tourism Development and Ecological Civilization Construction under the Perspective of Main and Auxiliary Embeddedness [J]. Chinese Journal of Systems Science, 2019 (03): 86-91. (in Chinese)
- [10] Zhu Dongguo, Jiang Xiaoyu, Zhou Yuan. Evaluation of Industry Integration of Shaoshan Red Tourism from the Perspective of Comprehensive Tourism [J]. Journal of Hunan Finance and Economics University, 2018, 34(1): 53-61. (in Chinese)
- [11] Xu Chunxiao, Zhu Xiangping, Zhang Huan. A Research into the Relationship of Red Cultural Atmosphere, Tourist Attitude and Advocacy [J]. Tourism Science, 2016, 30(5): 1-11. (in Chinese)