

Evaluation of Problems in Tourism Systems and Their Evolutionary Status Based on Self-Organization Theory

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Abstract

With the rapid development of the tourism economy, large-scale construction of tourist attractions to achieve resource utilization and ensure the healthy development of the tourism industry has become a hot topic. However, there are still issues with resource utilization and coordinated management in the economic development of the tourism industry, which in turn affects the coordinated development of the tourism industry economy. Therefore, this study utilizes self-organization theory to explore the structure, organizational mechanism, conditional driving force of evolution, and evolutionary operation mechanism of the tourism system, analyze the current tourism situation in Hunan Province and related regions, and construct a self-organization evolution model of the tourism system. The result shows that the cumulative variance contribution rate of tourism areas in Hunan Province is 78.8%, with Zhangjiajie having the highest industrial management factors and tourism resource levels in the province, with 1.6 and 3.2 respectively. Hunan Province has abundant tourism resources but overall uneven development, with a comprehensive score of -1.03. Therefore, it is necessary to leverage the coordination advantages of various departments and industries to promote sustainable and healthy development of tourism areas. The self-organizing evolution of the tourism system not only discovers the current problems of the tourism industry, but also provides theoretical support and mechanism suggestions for the tourism system.

Keywords: Current Strategies, Evolutionary Mechanisms, Organizational Mechanisms, Self-Organization Theory, Tourism System.

1. Introduction

In response to the process and development issues of the evolution mechanism of the tourism system, it is proposed to use self-organization theory to study complex tourism systems. Due to the complex and cumbersome factors contained in the system and the close correlation between various subsystems, Self organizing Theory with nonlinear execution characteristics combined with dynamic open systems can help explore the evolution mechanism of tourism systems. There is a lot of theoretical knowledge mixed in self-organization theory, and it is necessary to analyze the important theories and characteristics, and apply them to the evolution mechanism of the tourism system to enrich the research theory, and then observe the evolution laws of the tourism system to grasp the future development direction of the tourism industry. Tourism system also includes unique tourism resources and geographic environment factors, according to the world heritage tourism research to build a database to support the development of heritage tourism [1]. The database will be constructed to support the development of heritage tourism based on World Heritage tourism research. The development of tourism and entertainment areas, as well as the tourism management framework related to the development of national tourism and island tourism, have also been deeply developed and studied to assist in tourism health management [2-3]. Moreover, as a province of tourism development, Hunan Province's natural scenery, historical and cultural heritage, as well as revolutionary culture, have provided a rich material and spiritual foundation for the development of Hunan's tourism industry. To vigorously develop the comprehensive benefits of the tourism province in Hunan Province, the tourism market will be systematically integrated and transformed to ensure the adaptive and coordinated development of the local tourism system. Based on this study to explore the self-organization theory of dissipation theory, synergism and hypercyclic theory, etc., to put forward the internal and external factors and dynamics of the evolution of tourism system, and then find its operating mechanism and mode for the development of tourism in the field to provide the current status of the problem, and the development of tourism to provide economic and social strategic measures.

The research is carried out in four parts, the first part is to explain the current theory of tourism system evolution and self-organization. The second part is to analyze the internal and external influencing factors on the mechanism of tourism self-organized system evolution, and to discover the law of system evolution operation mechanism. The third part is to analyze the tourism system evolution of Hunan Province in the light of its tourism development status, and to propose evaluation indicators and relevant development countermeasures. The fourth part is a narrative summary of the whole study.

2. Related Works

The development of tourism has become a new industrial pillar of the national economy, and the construction of a strong tourism province provides a market basis for promoting national consumption and economic development [4]. The construction of a strong tourism province provides a market basis for promoting national consumption and economic development. The rise of the tourism market provides direction for the transformation and upgrading of related industries, which in turn guides the sustainable and healthy development of tourism. Domestic scholars have carried out a lot of research on the tourism system. Aguiar-Barbosa et al. analyzed the evolution of tourism competitiveness, and then provided a new field of tourism competitiveness to promote the development of tourism management [5]. Valeri and Baggio on tourism systems proposed the use of a network science approach to construct numerical

scenarios to improve efficiency and information exchange capabilities for the tourism industry [6]. Yang et al. proposed a comprehensive evaluation model to analyze the spatial and temporal evolution of tourism under the new development concept [7]. Postma and Yeoman proposed to introduce strategic foresight and scenario planning to reduce external interventions and thus maintain a sustainable tourism system in response to tourism system disruptions [8]. Zhang et al. on the relationship between tourism and ecological environment indicators, proposed to construct a combination model to determine the obstacles and coupling coordination between tourism and ecological environment [9]. Bellato et al. on the issue of sustainable tourism development, proposed a regenerative tourism approach and thus provide a direction for the development of tourism benefits and revenues [10]. Dredge on regenerative tourism concepts and systems, proposing three key areas for reshaping tourism to promote sustainable tourism and its systems [11]. Becken and Kaur on the issue of governmental governance of tourism, proposed the development of a tourism framework and a tourism book tree and the integration of a regenerative tourism model to assist governmental decision-making and the positive development of the tourism industry [12]. The study of tourism systems focuses on the factors that affect tourism and the ecological environment. Tourism system research focuses on the factors affecting tourism and promotes tourism development by constructing models and methods.

As for the specific ways and models of tourism development, the research field is wider to provide theoretical help and technical reference for sustainable regenerative tourism development. Liguó and Hai on the development of tourism in Jiangxi Province, proposed the forecasting of carbon emissions from tourism and the corresponding carbon peak neutralization target to promote the healthy development of tourism [13]. Hou et al. studied the evolutionary model of regional tourism integration, using the gravity model of regional tourism economic linkage and the transportation accessibility method to construct an evolutionary model of tourism integration, which provides a reference for the sustainable development of regional tourism integration at home and abroad [14]. Farsari, on the issue of sustainable tourism, proposes to use resilience to study the relationship between tourism governance, and then promote the development of sustainable tourism governance [15]. Park, on the issue of smart tourism, proposes the use of big data technology to predict the evolution of tourism researchers through technical reference [16]. Although there are not many studies on tourism accommodation or hotel tourism, the results are important as they are intrinsic to the tourism system and as basic services. Kozlov on tourism accommodation proposes a system of tourism statistics and a classification of regional economic activities in order to improve the classification system for the development of hotel tourism [17]. Lee on hotel and tourism technology research, proposed the use of software analysis technology process to assist the development of hotel tourism with computer technology [18]. Santos et al. on the new framework of wine tourism system, proposed the use of systematic mapping study to construct a systematic framework for global wine development [19]. Wu et al. conducted an in-depth study on environmental climate change and actively explored green low-carbon economics [20]. The results of this research can provide a model for the future development of natural resources and tourism economy in the tourism system.

In summary, domestic and foreign scholars have conducted many theoretical studies on the relevant influencing factors of tourism development and constructed models to discuss development models. Valeri and Baggio utilized information technology to provide advanced management models for the development of the tourism industry [6], while Hou et al. proposed building an integrated evolution model of economic and transportation connections in regional tourism development to promote sustainable development of the tourism industry [14].

However, there is relatively little research on the evolution mechanism of the tourism system. Yang et al. used evaluation models to analyze the spatiotemporal evolution characteristics of tourism, but lacked practical indicator analysis on the development direction of its industrial model [7]. In addition, most of the remaining tourism statistical research analyzes external impact indicators to adjust the development mode of the tourism industry, and lacks understanding of the structure and function of its own organizational mechanism. Therefore, the research innovatively combines self-organization theory to analyze the internal and external impacts, organizational mechanisms, and evolutionary mechanisms of the tourism system and propose corresponding countermeasures for the current development status of the tourism industry in tourism areas.

3. Mechanisms of self-Organized Evolution of Tourism Systems

Based on existing research analysis and the perspective of utilizing the tourism industry system, consider tourism destinations as the research object and limit the composition of the tourism system from the perspective of tourism functions. Self organization is a process of internal interaction within a system that automatically generates, maintains, and evolves, and can also reverse evolve; So self-organizing systems are defined as systems that can self-organize, generate, and evolve without external intervention, and can also autonomously form structured systems.

3.1 Organizational Mechanisms and Expressions of the Tourism System

With the rapid development of the social economy, people's consumption concepts and levels are constantly changing. Among the factors of continuous progress in transportation and accelerating urbanization, leisure tourism activities are also increasing. The development of modern tourism is not only a product of socio-economic development to a certain stage, but will also continue to move towards a stage of self evolution with economic and social development. Self organization theory refers to a collection of theories that study self-organizing phenomena and laws, including dissipative structure theory, synergetics, catastrophe theory, hypercycle theory, etc. It presents the development and evolution of nonlinear complex systems far from equilibrium, from disorder to order, and from low-level to high-level order. It also provides a series of methods for system formation and evolution laws, enriching modern system evolution theory and deepening people's understanding of life and social systems. The modern system evolution theory has been widely applied to the tourism industry system, where the demand system, supply system, and support system jointly form a dynamic and open complex tourism system with specific structure and functions, as shown in Fig. 1.

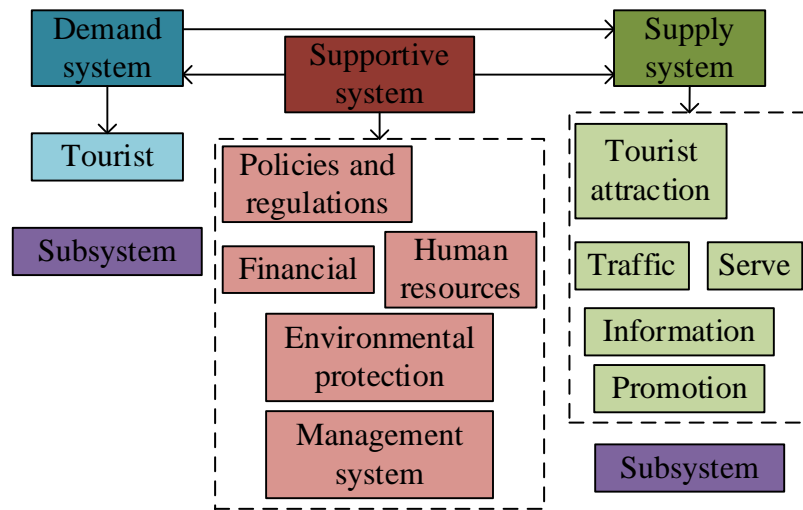


Fig. 1. Structure and composition of the tourism system.

From Fig. 1, it is found that the tourism system is mainly composed of three major parts: demand system, supply system, and support system, and each part contains subsystems. Due to the fact that modern tourism has developed into a stable consumer market and combined with various departments and enterprises to form a stable tourism system, which in turn will drive the development of related industries and departments, relevant departments and enterprises will reverse the development of tourism, improve tourism facilities, environment, and transportation, and promote the increase of tourism demand. This circular assistance can promote the sustainable development of the tourism industry's self evolution. The self evolution of the tourism industry also requires the improvement of self-organizing systems. During the self-organizing process, there are four periods. The first is the process of system organizational level transition, which is called "self creation", that is, the evolution from a relatively low and simple organizational state to a relatively high and complex organizational state; The second is the process of system organizational expansion, known as "self expansion", which refers to the process of relatively increasing organizational complexity when the organizational hierarchy of the system remains unchanged; The third is that the system remains unchanged at both the organizational level and complexity, and only maintains the status quo, which is called "self-sustaining"; The fourth is the process of system degradation to a lower level or towards disintegration, which is called "self degradation", where the energy and information obtained by the system are lower than the requirements for maintaining the operation of the existing system. The first three steps together constitute the process of self-organizing evolution of the system, which is also a research focus. The evolutionary process of a dynamic and open complex tourism system is also consistent with the self-organization process, which is divided into three periods as shown in Fig. 2.

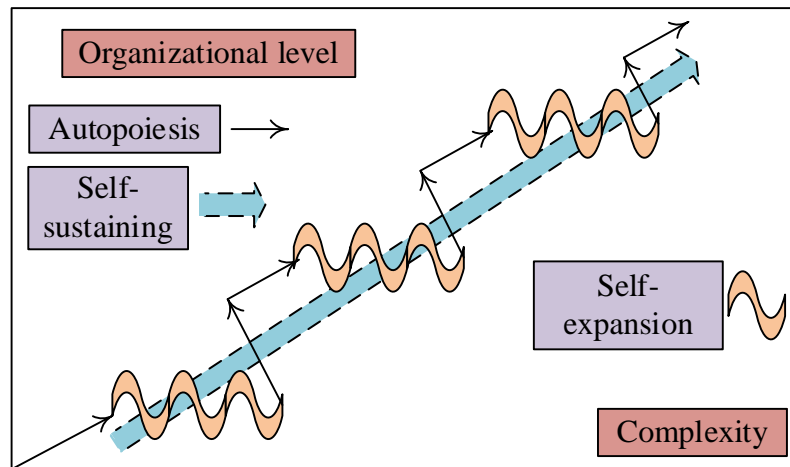


Fig. 2. Self organization evolution process.

From **Fig. 2**, it can be seen that the evolution process of the tourism system shows a spiral upward trend. The self creation of the system structure independently coordinates the win-win relationship between various departments in the tourism market, spontaneously engages in benign competition and resource protection, and thus forms a reasonable and efficient system structure. After the formation of the system structure, it will enter a period of self-sustaining, maintaining the existing state and not causing system structure imbalance due to new influencing factors, so that the organizational level and complexity of the tourism system will not change to maintain stability. The self-expansion stage is mainly during the period of rapid socio-economic development, and the tourism industry mainly relies on the level of economic development and consumption to gradually expand to industries with complete structures and mature forms. The self-expansion of the system is mainly manifested in the expansion and integration of related industries, which in turn promotes the increase of total tourism volume and overall economic growth. In short, the three periods of the system overlap with each other, and during a hierarchical transition, the three periods may occur simultaneously, indicating that the system is in a state of self creation at a new level, self maintenance at an old level, or self expansion. After the period of self expansion, the functions and factors of the system will undergo new changes, including the improvement of people's consumption concepts and levels, the expansion of the tourism market, and the upgrading of infrastructure, which in turn affect the emergence of the new system structure. As a result, the upgrading of its functions and the self-organization of the system will shift from disorder to order.

3.2 Conditions and Dynamics of Tourism System Evolution

According to the concept of self-organization theory, its content contains dissipative structure theory, synergetics, syncretism, mutation theory, hypercyclic theory, chaos theory and fractal theory, while some of the theories affect the evolution of self-organization of tourism systems. Among them, dissipative structure theory refers to the science that studies the conditions, nature, evolution laws and mechanisms of the formation of dissipative structures and exposes that systems can self-organize to form dissipative structures under specific conditions; the specific conditions include open systems, systems far from equilibrium, nonlinear interactions between subsystems within the system, and up and down effects. Among them, the open system is expressed in the dissipation theory using the relevant formula of entropy, which is

shown in (1).

$$Ds = D_f s + D_p s \quad (1)$$

In (1), Ds represents the total entropy change of the system; $D_f s$ is entropy flow, which is the exchange connection between the system and the outside world; $D_p s$ is entropy generation, which is caused by the irreversible process inside the system. Among them, the entropy flow can be positive or negative by the environment, and the entropy generation is always positive, which indicates that the openness of the system is the basic condition for the evolution of the system. Far from the equilibrium of the system is relative to the equilibrium and near-equilibrium state, far from the equilibrium state of the system will be non-stop with the outside world for the exchange of material, energy and information, when the external entropy flow is greater than the entropy generation within the system when the system will be in order when the system will occur in the new state changes, so the system is far from the equilibrium on behalf of the system's non-equilibrium is the system self-organization of the necessary conditions for evolution. The state describing the movement of the tourism system is shown in (2).

$$\frac{DX}{Dt} = f(t, \varphi, X) \quad X = (x_1, \dots, x_n) \quad (2)$$

In (2), X is the variable of the system motion state; t is the time; $\frac{DX}{Dt}$ represents the derivative of the state with respect to the time, and φ is the covariate subject to external influence. And when the derivative is independent of time becomes autonomous system, the system is far from equilibrium state variable is zero, and it will evolve to new steady state properties. Synergetics also belongs to the important theory, the proposer Haken expressed mathematically the process which leads to the evolution of the system as shown in (3).

$$\begin{cases} \dot{Q}_1 = -\eta_1 Q_1 - a Q_1 Q_2 \\ \dot{Q}_2 = -\eta_2 Q_2 + b Q_1^2 \end{cases} \quad (3)$$

In (3), Q_1 , Q_2 are the state variables; η_1 , η_2 are the damping coefficients, and a , b denote the strength of interaction between the variables. The state variable Q_2 is close to zero as shown in (4).

$$Q_2 \approx \frac{b}{\eta_2} Q_1^2 \quad (4)$$

In (4), η_2 is the damping coefficient, and then (4) is shown in (5) when substituted into (3).

$$\dot{Q}_1 = -\eta_1 Q_1 - \frac{ab}{\eta_2} Q_1^3 \quad (5)$$

In (5), Q_1 , Q_2 are the state variables and η_1 , η_2 are the damping coefficients. At this point, the state variable Q_1 with long period and small damping is the order parameter, which governs the system evolution and leads to the potential function as shown in (6).

$$v = 0.5 \eta_1 Q_1^2 + \frac{ab}{4\eta_2} Q_1^4 \quad (6)$$

In (6), v is the potential function. In addition, the tourism system has a typical non-equilibrium, i.e., imbalance in the regional structure and industrial structure. The internal conditions, i.e. dynamics, that affect the self-organized evolution of the system include nonlinear interactions, rise and fall effects. Nonlinearity is the system itself all the internal

mechanism can coordinate the role between the various subsystems, and determine the direction of system evolution; nonlinearity can also coordinate the system and the external environment to promote the system evolution. The final role of rise and fall refers to the deviation from the stable average state of the system, but also the difference in the process of system evolution; so rise and fall is a kind of driving force or called stochastic force of the system's self-organized evolution, which concerns the development of the system, and belongs to the constructive factors of the system's self-organized evolution under specific conditions. In order to explore the rise and fall of the system due to the deviation of individuals from the average behavior, the stochastic introduction method is used and Master's equation, Fokker-Planck equation and Langevin equation are applied to describe the stochastic process of the system's evolution, where Master's equation is shown in (7).

$$P(j,t) = \sum_{i \neq j} [\omega(i \rightarrow j)P(i,t-1) - \omega(j \rightarrow i)P(j,t-1)] \quad (7)$$

In (7), ω is the migration probability; $P(j,t)$ represents the probability that the system is in the state j at the time t , and $\omega(i \rightarrow j)$ is the transfer probability that the system migrates from the state i to the state j . When the time is continuous, it is shown in (8).

$$\frac{DP(j,t)}{Dt} = \sum_{i \neq j} [\omega(i \rightarrow j)P(i,t) - \omega(j \rightarrow i)P(j,t)] \quad (8)$$

In (8), $\omega(j \rightarrow i)$ is the transfer probability of the system migrating from the state j to the state t . If the state is also continuous use the Fokker-Planck equation to account for the evolution of the distribution function as shown in (9).

$$\frac{\partial P(x,t)}{\partial t} = -\frac{\partial}{\partial x}(a_1(x)P(x,t)) + \frac{\partial^2}{2\partial x^2}(a_2(x)P(x,t)) \quad (9)$$

In (9), $a_1(x)$ and $a_2(x)$ are associated with transfer probabilities. Langevin's equation was used to explain the system evolution when incorporating environmental parameters into the impact factor, as shown in (10).

$$\frac{Dx}{Dt} = f\left(x, \bar{\lambda}\right) + g(x)\xi(t) \quad (10)$$

In (10), $\bar{\lambda}$ is the average value of the parameter; $\xi(t)$ represents the random rise and fall of the environment, and $g(x)$ is the function of the interaction between the system and the environment. It is expressed in Fokker-Planck equation as shown in (11).

$$\frac{\partial P(x,t)}{\partial t} = -\frac{\partial}{\partial x}\left(f\left(x, \bar{\lambda}\right)P(x,t)\right) + \frac{\theta^2 \partial^2}{2\partial x^2}(g^2(x)P(x,t)) \quad (11)$$

In (11), θ is the variance. The three equations are interconnected, and the stochastic approach of self-organization theory can explain the connection between macroscopic results and microscopic mechanisms, thus deepening the understanding of system evolution [21-22]. The relevant formulas of entropy and the process equation of tourism system evolution provide a computational basis and theoretical conditions for system openness. At the same time, the relevant equations can coordinate the relationship between the system and the external environment, promote tourism self-organization evolution, and respond to the operational mechanism and development mode of tourism system self-organization evolution.

3.3 Operational Mechanisms and Modes of self-Organized Evolution of the Tourism System

Synergetics in self-organization theory uses an ordinal covariate concept and expresses it in terms of entropy as a general data to deal with self-organized orderliness. Tourism system evolution is influenced by ordinal covariates to govern the subsystems and external environmental factors as shown in Fig. 3.

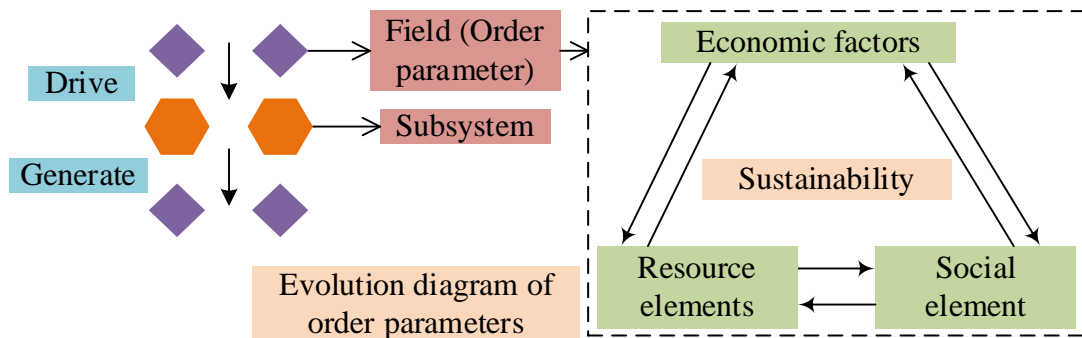


Fig. 3. Schematic diagram of the dynamics of self-organizing evolution of the system.

From Fig. 3, it can be seen that the driving force behind the self-organizing evolution of the system is the order parameter, which originates from and drives the subsystems. The order parameter is the result of the interaction between many subsystems within the system, and its interaction comes from the collaborative competition between subsystems, which then dominates the entire system evolution process. In addition, economic, social, and resource factors emerge with the emergence of the tourism system during its evolution process. The three are important forces that dominate the self-organizing evolution process of the system, and their interaction promotes the driving force of the tourism system's evolution and development, which is called sustainable development capability. The nonlinear relationship between the internal and external environments of a system is called collaboration and competition, which are opposed and transformed to promote the overall evolution and development of the system. Therefore, the interaction between collaboration and competition is the driving force behind the self-organizing evolution of the system. Afterwards, the self-organizing evolution mechanism of the tourism system is applied to the development of tourism regions, which are usually divided into six development processes: exploration period, participation period, development stage, consolidation period, stagnation period, and decline or recovery stage, as shown in Fig. 4.

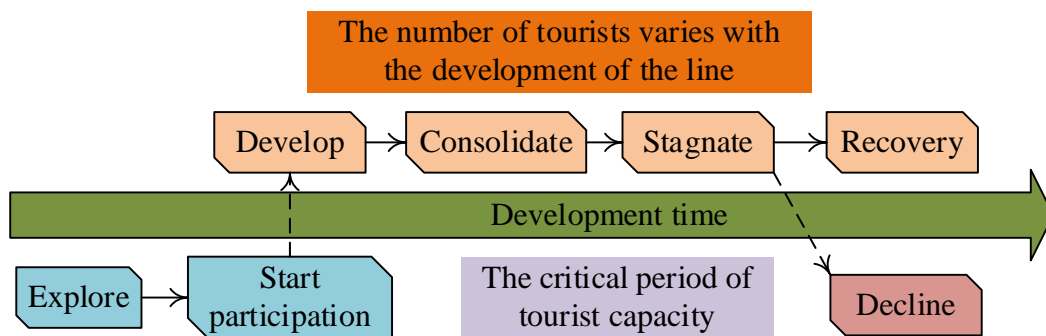


Fig. 4. Life cycle development of tourist destinations.

As seen in Fig. 4, the life cycle development of a tourist site changes, and at the end the system will face two directions, one is that tourism is difficult to recover until it declines, and the other is to change the strategy to revive the tourism economy so that it will return to a prosperous scene and enter the next stage of the cycle. The self-organized evolution of tourism system also abides by the super-cycle theory model, when the external material, energy and information enter the subsystem, and then through the synergistic competition within the system to produce new material, energy and information, this process becomes a reaction cycle. When the reaction cycle reaches a certain scale, each sub-system will be connected to each other, and then form a cycle network called catalytic cycle; after that, the cycles of each sub-system and the cycles between them will work together to form a spatial cycle, so that each cycle will contain a huge amount of matter, energy and information, thus forming a super-cycle; the tourism system will evolve continuously according to this cycle process. The establishment of evaluation indexes of tourism system evolution is related to the evaluation results of the current status of tourism system evolution, due to the complexity, dynamics and comprehensiveness of the tourism system, selecting typical evaluation indexes and observing the principles of science, operability and systematicity when actually establishing them, firstly, collecting experts' opinions in order to establish the index system according to the functional structure of the tourism system, and then questionnaires, experts' opinions and data statistics in order to form three-level indicator factors, as shown in Fig. 5.

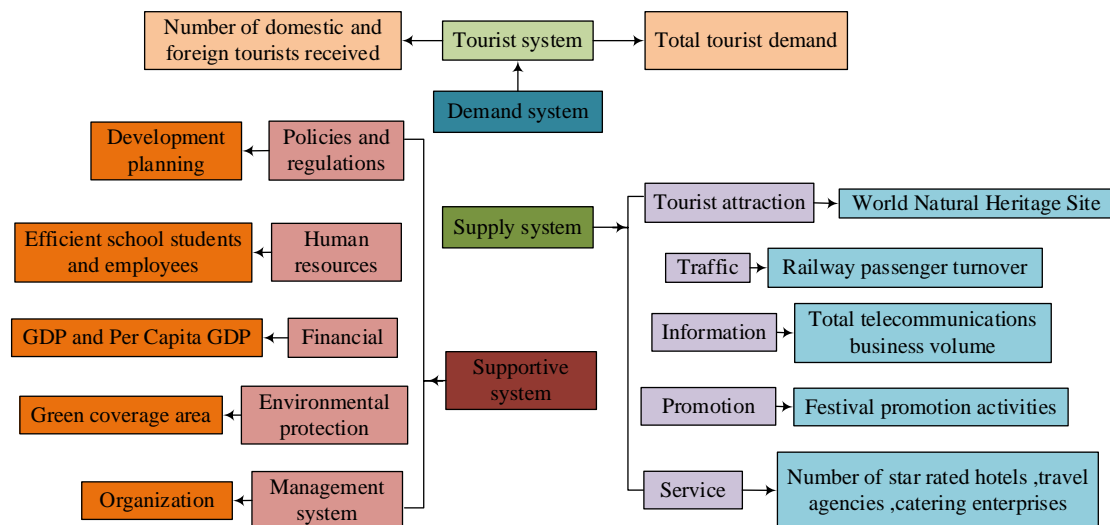


Fig. 5. Evaluation index system for tourism system evolution.

From Fig. 5, it is found that the evaluation indicators are divided into three levels of criteria, starting with the demand, supply and support systems, and then hierarchically dividing the indicators and specific evaluation factors among these three subsystems. Each of these factors involves many specific tourism-related tourism resources, the type and number of tourists received, the number of people and vehicles in transportation, the number of businesses in each industry, and other actual indicators, which in turn demonstrates the authenticity and objectivity of the evolution of the system. The influencing factors are represented by the symbols F1-F3, and then regression analysis is applied to derive the matrix and score function, as shown in (12).

$$F1 = 0.045ZX1 + 0.006ZX2 + \dots + 0.017ZX38 \tag{12}$$

In (12), F_1 is the support factor and $ZX_1 - ZX_{38}$ is the standardized data of each factor indicator. The score function of the influence factor F_2 is shown in (13).

$$F_2 = 0.045ZX_1 + 0.113ZX_2 + \dots + 0.066ZX_{38} \tag{13}$$

In (13), F_2 is the industry management factor. The F_3 score function is shown in (14).

$$F_3 = 0.018ZX_1 + 0.000ZX_2 + \dots - 0.093ZX_{38} \tag{14}$$

In (14), F_3 is the attractiveness factor. After that, the score function is synthesized with a tourist place as shown in (15).

$$F = \frac{0.49}{0.79} F_1 + \frac{0.22}{0.79} F_2 + \frac{0.85}{0.79} F_3 \tag{15}$$

In (15), F is the overall score of the status quo of a tourist place. Based on the scores of the influencing factors, the effectiveness of the economic indicators, resource and environmental conditions, and human resources of a tourist site on the evolution level of the tourism system is analyzed.

4. Analysis of Current Problems and Countermeasures of Self-Organized Evolution of Tourism System

According to the systematic evaluation indexes to select the factors affecting tourism in Hunan Province, the principal component analysis and cumulative variance contribution ratio were performed, and then the three main factors were obtained to express most of the information of all the variables, as shown in Fig. 6.

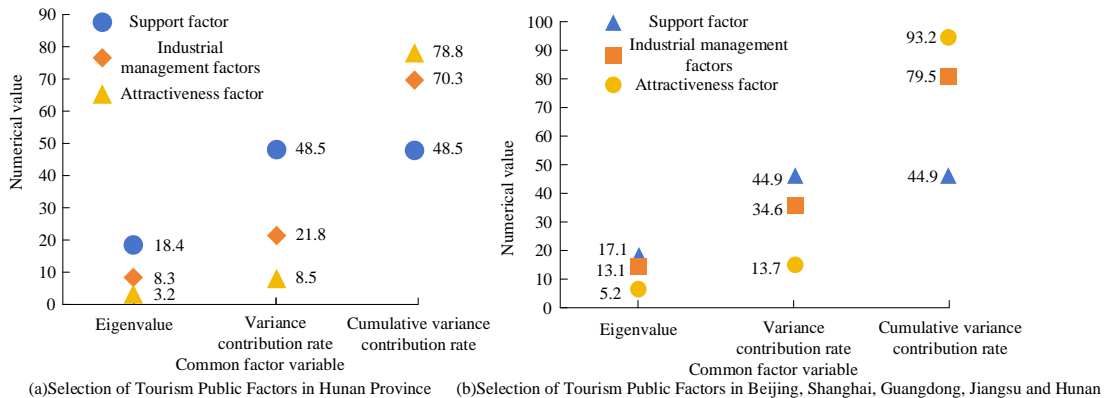


Fig. 6. Selection of common factors.

From Fig. 6, it is seen that the cumulative variance contribution rate of Hunan Province and the five regions is 78.8% and 93.2% respectively, that is, it can illustrate 78.8% of the variable information in Hunan Province, so as to respond to the current situation of the evolution of the tourism system in Hunan Province. The industrial management factor in Hunan Province tourism system mainly consists of the indicators of policies and regulations, organization and market promotion, which also belong to the important factors affecting the evolution of the tourism system; the attractiveness factor includes the resource conditions of the tourist places, transportation indicators and other factors. The scores of the support factor and industry management factor of nine cities and towns in Hunan Province are thus analyzed, as shown in Fig. 7.

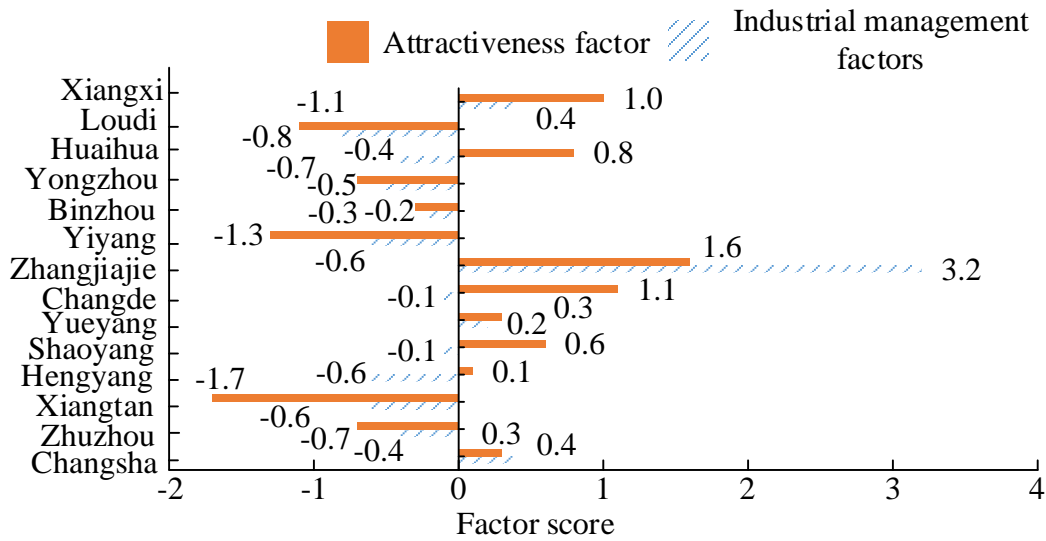


Fig. 7. Comparison of tourism destination management factors and attraction factors.

From Fig. 7, it is found that the industrial management factors and tourism resource level in Zhangjiajie are 1.6 and 3.2, respectively. It is necessary to improve the industrial management level and strengthen tourism promotion. The supporting factors include important aspects such as economic level, human resources, information transmission, natural environment, and basic services, and are represented by 1-14 according to the above figure, supporting the development of local tourism industry. The three factors are combined to compare the comprehensive scores of Hunan, Beijing, Shanghai, Guangdong, and Jiangsu, as shown in Fig. 8.

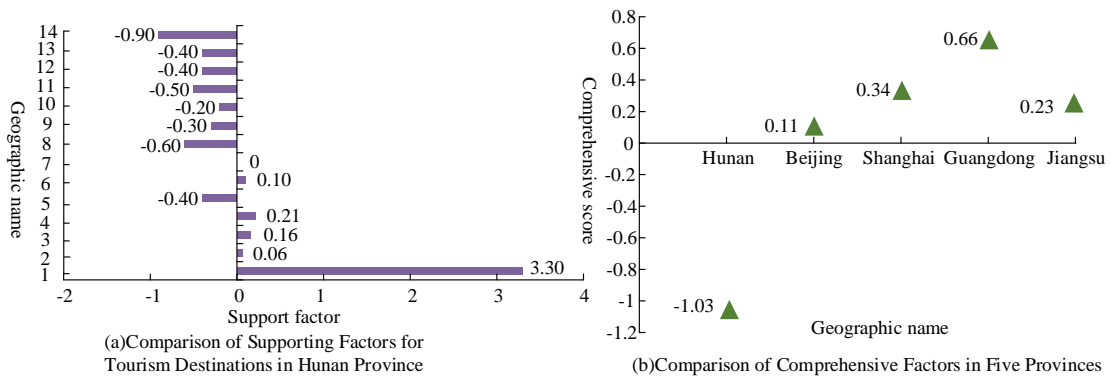


Fig. 8. Comparison of supporting factors for tourism destinations in Hunan Province and comprehensive factors of five provinces.

From Fig. 8, it can be seen that there are significant differences in the main supporting factors for the development of tourism in various regions of Hunan Province. The support factor score for Changsha is 3.30, while for Xiangxi it is -0.9. The overall development level needs to be further improved and improved. Compared with the other four major tourism provinces, Hunan Province has a comprehensive score of -1.03, while Beijing, Shanghai, Guangzhou, and Jiangsu have scores of 0.11, 0.34, 0.66, and 0.23, respectively. This indicates that the development of tourism in the internal regions of Hunan Province is uneven, with the eastern and northern regions developing better. Subsequently, an analysis of the total tourism

revenue of Hunan Province in recent years is shown in Fig. 9.

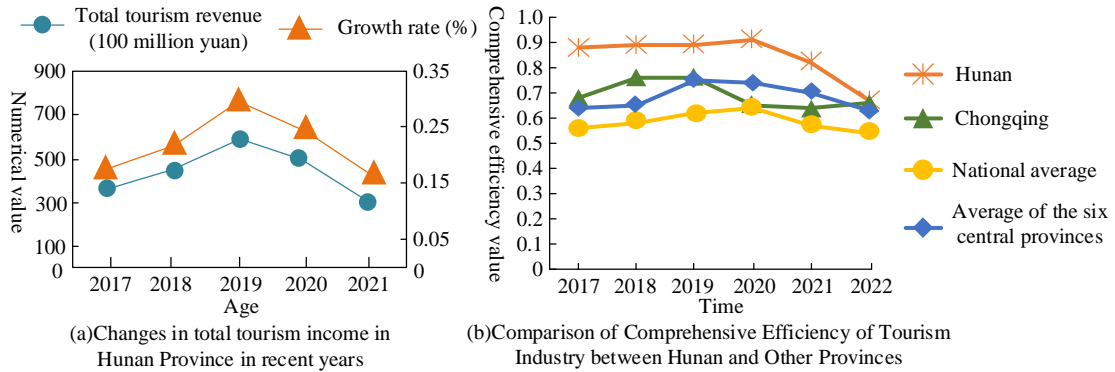


Fig. 9. Changes in total tourism income and comprehensive efficiency in Hunan Province in recent years.

From Fig. 9, it was found that the total tourism revenue in Hunan Province was on an upward trend from 2017 to 2019, after which it declined due to external force majeure factors, indicating that the tourism system is extremely sensitive. Then compare it with the level of development of logistics industry in Hunan Province as shown in Fig. 10.

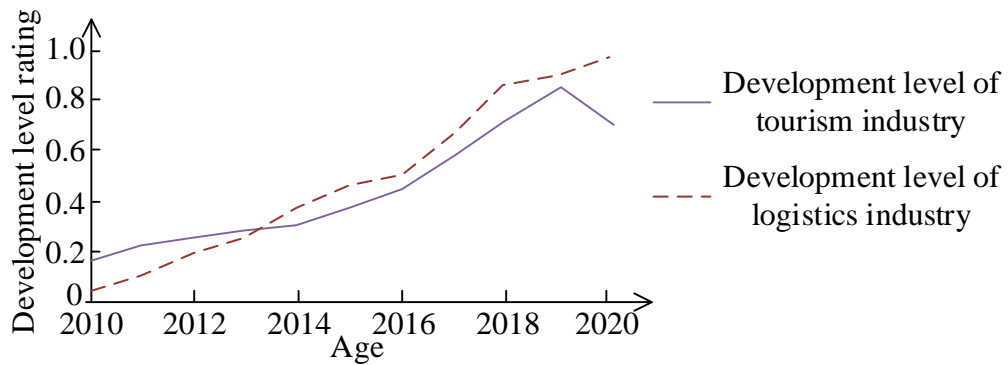


Fig. 10. Development status of tourism and logistics industry in Hunan Province from 2010 to 2020.

Fig. 10 shows that the overall development of tourism in Hunan Province in recent years has been slightly lower than the development level of the logistics industry, indicating that its tourism industry needs to strengthen its management and progress. Compare this with the growth rate of total tourism revenue and the efficiency of economic development in other provinces, as shown in Fig. 11.

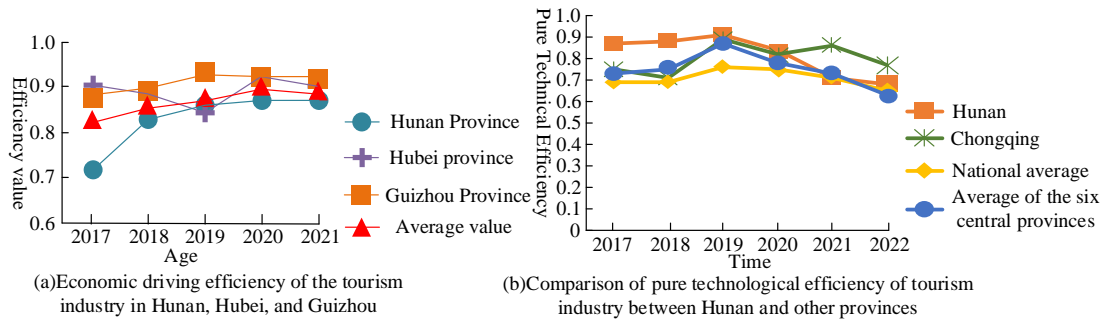


Fig. 11. Comparison of economic driving efficiency and pure technical efficiency in the tourism industry.

From Fig. 11, it can be seen that the tourism industry in Hunan Province as a whole drives a low economy, and it is necessary to change the development mode and improve the innovation ability to drive the development of related tourism industries. And then compare the number of tourism hospitality and its revenue growth rate, as shown in Fig. 12.

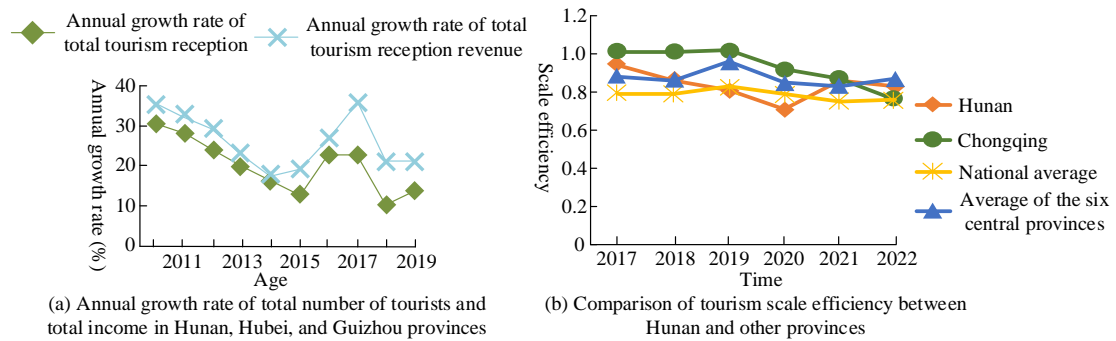


Fig. 12. Changes in the total number of tourists, annual growth rate of total income, and scale efficiency.

From Fig. 12, it can be observed that the number of tourists in the three provinces of Hunan, Hubei, and Guizhou is decreasing year by year, and the total income is also decreasing. Although the three provinces have abundant tourism resources, the tourism industry structure is single and lacks the driving force of characteristic economy. The tourism system in Hunan Province has the characteristics of openness, non-equilibrium, nonlinearity, and fluctuations. Its tourism industry has become a pillar industry in the province, with a growth rate of tourism income above 0.6. However, regional development is uneven and the tourism system is susceptible to external factors. Based on the existing problems, it is necessary for various departments and industries to cooperate and leverage their advantages to assist in the development of tourism. Firstly, the role of government coordination should be fully utilized, which not only implements policies and regulations, increases investment in funds, but also examines the development of tourism in various states and cities. Secondly, promote cooperation and healthy competition to achieve resource complementarity and improve the overall level of development. Then create a sustainable circular development model for the tourism system to save costs and improve efficiency. Finally, we will accelerate the integration of the tourism and information industries, strengthen the construction of infrastructure, service standards, and information management in various regions, and continuously improve the service level of the tourism industry.

5. Discussion

Regarding the tourism system and its data analysis model, this study uses self-organization theory to analyze the current situation of Hunan's tourism industry. Combined with the operating mechanism and evolution process of the tourism system, an evaluation index analysis of the influencing factors of the development of Hunan's tourism industry was conducted, and the lowest score of comprehensive development of its tourism industry was -1.03, indicating a relatively low overall development level. Finally, comparing the number of tourists and income growth in the three provinces of Hunan, Hubei, and Guizhou, it was found that the development of the tourism industry is unbalanced, but the growth rate of tourism income has reached over 60%. Therefore, utilizing the evolutionary mechanism of the tourism system, fully leveraging the coordination work of various departments, and reasonably arranging tourism resources, in order to achieve the sustainable development mechanism of tourism provinces. Compared with the current development of regional tourism economy, the tourism ecological evaluation model utilizes the spatiotemporal changes and dynamic evolution characteristics of tourism ecological security, and also reflects the harmonious and sustainable development of regional tourism economy [23]. Compared with the Jiangxi tourism comprehensive evaluation model proposed by Ligu and Hai [13], it uses a five dimensional tourism quality development evaluation system and combines Markov chain model and hotspot analysis to analyze the impact of spatiotemporal evolution characteristics on tourism provinces, thereby promoting the overall development level of the tourism industry under the new development pattern. However, this study combines self-organization theory to analyze tourism factors and dynamic openness systems. Taking tourism cities in Hunan Province as an example, an evaluation index analysis is conducted on their tourism systems. It is concluded that the current development of the tourism market is unbalanced, and it is necessary to coordinate various departments to support and build the local tourism economy, in order to promote the sustainable development of the tourism industry. Afterwards, in order to meet the needs of tourists in obtaining information about tourist cities and their resources, Park [16] proposed the use of big data analysis technology to develop technologies such as the Internet of Things (IoT) and infrared artificial intelligence in the intersection of tourism and hotels, in order to fully leverage the personalized advantages of the tourism industry. There is also research that combines computer technology and media software to conduct data analysis and location planning on the tourism market and resources, thereby achieving personalized user needs [24-25]. Therefore, the evolution mechanism of the tourism system is combined with user needs. On the one hand, the evolution mechanism of the tourism system caters to the needs of tourists while improving infrastructure and service standards. On the other hand, the abundant tourist resources also promote the healthy development of the local tourism industry.

However, in the analysis of the tourism system in Hunan Province, this study only considers the local tourism resources and industrial development. The factors that contribute to the development of the tourism market in other regions are also unique, and the proportion of tourism revenue to the economic development of different cities varies. Therefore, in future work, the evolution mechanism of the tourism system can only provide basic strategic means for the development of the tourism industry. Specific tourism development needs to be explored and analyzed according to local conditions.

6. Conclusion

In response to the current situation of tourism system evolution, this study delves into the theory of system self-organization and analyzes the scores of important tourism factors. Using tourism cities in Hunan Province for tourism system analysis, and comparing tourism related factors between Hunan Province and other provinces. The results show that the cumulative variance contribution rate of tourism areas in Hunan Province is 78.8%, while the support factor scores of Changsha and Xiangxi have a significant difference of 3.30 and -0.9, respectively. The comprehensive score for the development of the tourism industry in Hunan Province is -1.03, with an income growth rate of over 0.6, while the scores for Beijing, Shanghai, Guangzhou, and Jiangsu are 0.11, 0.34, 0.66, and 0.23, respectively. The cumulative variance contribution rate of the tourism industry in the five regions is 93.2%, which further indicates that the overall development of the tourism industry in Hunan Province is unbalanced and requires strategic division of labor among government departments and various industry participants, in order to promote the development of the tourism industry and contribute to the construction of a major tourism province Provide reference for promoting people's prosperity and improving the level of socio-economic development. However, due to the different tourism resources in different regions, there are also differences in the positioning of the tourism market. It is necessary to formulate practical strategic layouts for the development of the tourism industry in different regions according to local conditions, in order to improve the evolution mechanism of the tourism system in each region. The analysis factors of the tourism evolution mechanism in each region still need to be further investigated and analyzed in different regions.

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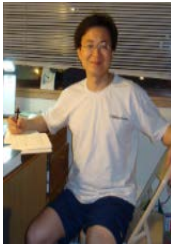
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