

# *On the Conceptual Framework of Tourism Complex Research from the Perspective of the Theory of Complex Adaptive System*

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**Abstract:** Tourism complex, a term initiated by China's scholars, is derived from the original terms of building complex and urban complex. At present, the research on the tourism complex is still in the initial stage. The main research agents involved are geography, industrial economics and tourism, while there are only a few interdisciplinary studies, and the concept of tourism complex remains to be explored. Based on this, this paper attempts to make a comprehensive overview of the tourism complex. From the perspective of interdisciplinary, it explores the internal relationship and logical system of research on tourism complex among disciplines, so as to form a research paradigm that can be commonly accepted by various disciplines. It is concluded that, first of all, most of the researches on the tourism complex in various disciplines are mainly descriptive studies, but only a few quantitative studies and most of the theoretical studies are summarized from practice. The theory lags behind the practice in the course of development so that the theoretical results obtained at this stage are unable to play a role in guiding the practice. Secondly, the tourism complex is a complicated system. So the system of its concept can not be built by merely piecing the concepts in various disciplines together. Instead, it is necessary to introduce the theory of complex adaptive systems for comprehensive reconstruction and analyze its formation process and mechanism in a more systematic way. In a word, based on the overview of the studies on the concept of tourism complex at home and abroad, this paper introduces the theory of complex adaptive system to construct a theoretical framework of interdisciplinary research from the perspective of system theory, so as to make up for the deficiencies in the research from a single discipline perspective. It is hoped to enrich the study of the tourism complex and provide a unified paradigm for further study of related disciplines.

## 1. Introduction

With the development of the national economy and social progress, people's disposable income and leisure time increase, thus providing a large number of markets and opportunities for the development of the tourism industry. According to the data released by the National Bureau of Statistics, China's tourism revenue has grown for five consecutive years, with 6.01 billion domestic tourists in 2019, an increase of 8.4% over the previous year. China's domestic tourism revenue reached 5.7251 trillion Yuan, with an increase of 11.7%, while China's inbound tourists reached 145.31 million, an increase of 2.9%. In 2018, the Guiding Opinions of the General Office of the State Council on Promoting the Development of All-for-one Tourism pointed out that "tourism is an effective means to develop the economy, increase employment and meet people's growing needs for a better life. And the tourism industry is an essential sector to improve people's living standards. In recent years, China's tourism economy has been proliferating, the industrial pattern has been gradually perfected, and the market scale and quality have been improved simultaneously. In this regard, the tourism industry has become a strategic pillar of China's national economy." Moreover, it was proposed that "we should speed up the supply-side structural reform of the tourism industry, and strive to transform the tourism industry from a ticketing economy to an industrial economy, from an extensive and inefficient approach to a sophisticated and efficient one, and from a closed tourism self-cycle to open 'tourism plus' pattern."

Nowadays, the demand for tourism is increasing rapidly, the demand for tourists is becoming more and more diversified, and traditional sightseeing tourism is shifting to vacation tourism. Under this general trend, the tourism complex, as a complex, efficient and intensive carrier of tourism activities, plays an increasingly significant role in driving the development of the tourism industry and occupies a more and more comprehensive position in China. Moreover, it plays an increasingly prominent role in meeting the tourism demand of the masses and alleviating the imbalance of regional economic development. The tourism complex has the advantages of big economic benefits, diversified product supply and great demand potential, attracting more and more governments and developers to shift their focus to the construction of the tourism complex. For this reason, the emergence and development of the tourism complex is the inevitable trend and direction of economic development. It is not only an important part of the new driving force of economic growth but also an important means and platform to effectively meet the people's demand for cultural and tourism products and services.

At present, the research on tourism complex mainly focuses on such disciplines as geography [1][2], industrial economics [3][4][5] and tourism science [6]. Moreover, there is no consensus on the nature of the concept of a tourism complex in the academic circle. And there is a lack of clear understanding of the definition of a tourism complex. Moreover, the research theory and development lag behind the practice, which cannot guide the practice. In the new era, artificial intelligence and big data industries are embedded in the service industry, and location-based intelligent services become the new driving force of the new tourism complex. It will become a key part of the construction of the next generation of tourism complex by conducting an in-depth study on tourism complex through the construction of a more comprehensive and systematic conceptual framework.

Therefore, this paper introduces the theory of complex adaptive system to re-organize and define the concept of tourism complex by comprehensively sorting out the context of the tourism complex research, in order to form a complete theoretical and conceptual framework. On the one hand, it can lay the research foundation for future empirical research, and on the other hand, it is hoped to provide theoretical guidance for the development and construction of the next generation of tourism complex.

## 2. Generation and Concept Evolution of Tourism Complex

The core documents involved in this study were mainly obtained by keyword searches through CNKI (China National Knowledge Infrastructure), a well-known academic database in China and Elsevier, an internationally renowned academic database. The keywords mainly include tourism complex, urban complex, building complex, mixed land use, industrial cluster, tourism industry cluster, tourism cluster, and resort complex. As shown in Table 1, from 2008 to 2020, 3190 articles have been published in CNKI and 218 in Elsevier. Among them, there are 252 papers published on core journals included in CNKI and 89 papers published on core journals included in Elsevier. By sorting out the contents of these papers, the author eliminated a total of 56 papers with repetitive content and 126 papers with weak relevance to this study. Finally, 158 papers published on core journals on related topics were obtained.

By combing the time sequence of literature publication (as shown in Figure 1), we found that the research on the tourism complex in China can be divided into two stages. The first stage is the research stage on the concept of tourism complex under the background of enterprise exploration (2008 - 2016). From 2008 to 2016, the number of papers on tourism complex published on CNKI continued to increase, reaching a peak in 2015. This period coincided with the boom decade of the tourism complex in China. OCT Group, Shenzhen Huaqiang Holdings Limited and Wanda Group built some tourism complex projects in the form of theme park, business complex and resort complex. Research in this period mainly focused on the definition of tourism complex <sup>[7]</sup>, the formation and evolution mechanism of tourism complex <sup>[8][9]</sup>, the classification of development types of tourism complex <sup>[10][11][12][13][14]</sup>, and case study and analysis <sup>[15][16][17]</sup>. The second stage is the research stage of the influence of tourism complex based on enterprise management after the maturity of the tourism complex project (2016 to present). At this stage, scholars began to pay attention to the external impact brought by the tourism complex. Then, the research on the impact of tourism complex on urban space <sup>[18][19]</sup>, the social and economic value of tourism complex <sup>[20]</sup>, the role of tourism complex on regional urbanization <sup>[21][22]</sup> and the research on other benefits gradually increased.

Summary:

*Table 1 Search results of literature related to tourism complex*

<b>Search keyword</b>	<b>CNKI</b>	<b>Elsevier</b>	<b>Core journals of CNKI</b>	<b>Core journals of Elsevier</b>	<b>After content filtering</b>
Tourism complex	321	-	27	-	27
Urban complex	2310	-	135	-	41
Building complex	168	-	12	-	9
Mixed land use	50	-	6	-	6
Tourism industry cluster	341	-	72	-	32
Tourism cluster	-	183	-	81	35
Resort complex	-	35	-	8	8
<b>Total</b>	<b>3190</b>	<b>218</b>	<b>252</b>	<b>89</b>	<b>158</b>

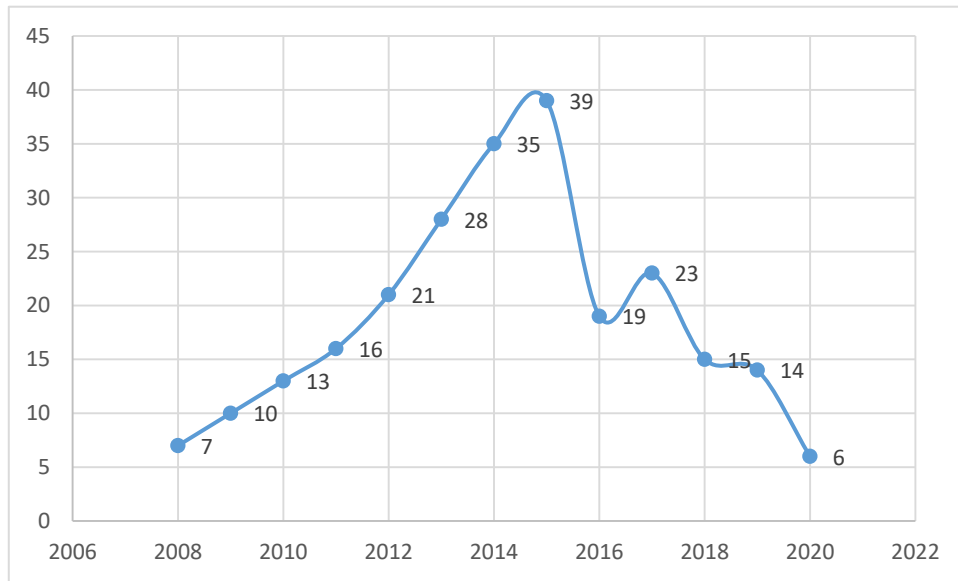


Figure. 1 Number of papers on tourism complex published on the core journals included in CNKI

## 2.1 Generation of the Concept of Tourism Complex in China

The birth of the tourism complex in China can be traced back to the first theme park, Splendid China, in Shenzhen, built by China Travel Service (Holdings) Hong Kong Limited in 1989. Later, in 1991, China Folk Culture Villages Shenzhen was built in 1991 and Window of the World was built in 1994. The Happy Valley, invested and constructed by Shenzhen Overseas Chinese Town Co., Ltd., divided from China Travel Service (Holdings) Hong Kong Limited, was put into operation in October 1998. Then in the Spring Festival of 1999, the Happy Line was completed and opened, which organically connected and integrated the theme parks under OCT Group, forming a theme park cluster. Moreover, around the theme park, a series of other related business forms, such as commerce, catering, entertainment, hotel and real estate, were developed, becoming the prototype of the early tourism complex. In 2008, it was expressly pointed out in the Fourth Plenary Session of the 10th CPC Hangzhou Municipal Committee that the strategic plan was to build a hundred tourism complexes in the city, which used the term "tourism complex" as the term of tourism development planning for the first time. After that, the tourism complex, as a new concept, attracted the attention of China's academic circles.

As a new development carrier, the tourism complex is an efficient, precise and intensive method of mixed land use. The construction of the tourism complex, on the one hand, has rapidly promoted the development of regional urbanization, created a large number of jobs, and advanced the construction of regional infrastructure and the improvement of environmental quality. On the other hand, it can meet the needs of tourists for diversified experience and high-quality service. With the development of urbanization in China, urban construction has gradually changed from the single emphasis on growth in the past to the pursuit of efficient and intensive smart growth of the land use method. At the same time, after entering the post-industrial society, people's demand for leisure and tourism is increasing day by day, and the attractions involving single sightseeing experience are gradually transitioning to the complex comprising the diversified experience of leisure, entertainment and vacation.

## 2.2 Concept Evolution of Tourism Complex

Tourism complex, a term initiated by China's scholars, is derived from the original terms of building complex and urban complex. Looking up the English literature, we can find that there is no term of tourism complex in it. The English abbreviation of urban complex is HOPSCA, which is the initials of the hotel, office, park, shopping mall, convention and apartment. It originally refers to a multi-functional and high-efficiency building community formed by an organic combination of more than three urban living elements, with urban living functions as the primary function and supported by multiple functional facilities<sup>[23][24]</sup>. Dong Hexuan and Lu Jiwei (2009) summarized the concept of the urban complex with intensiveness, openness, commonness and scale<sup>[25]</sup>. Liu Jingshan (2011) further defined the urban complex as an intensively used urban land unit formed by an efficient spatial combination of different functional elements from the perspective of land use mode<sup>[26]</sup>.

Comparatively speaking, both building complex and urban complex belong to the efficient and composite mode of intensive mixed land use. They are not only the product of the need for efficient urbanization but also a unique geospatial unit. In addition, both building complexes and urban complexes emphasize the continuous and interrelated building clusters formed in a specific urban space, which are characterized by an independent space and a fixed scope. However, the tourism complex, as a carrier of tourism life, has continuity and coherence in context with building complex and urban complexes. It is not only a special spatial form but also a unique industrial organization cluster and a dynamic organic system.

### 2.2.1 Tourism complex from the perspective of space

Jane Jacobs mentioned in the book *The Death and Life of Great American Cities* that "Diversity is Nature to Big Cities," which revealed the importance of complex functions in increasing urban vitality<sup>[27]</sup>. The concept of mixed-use proposed by the Urban Land Institute in 1976<sup>[28]</sup> is currently used in the study of land use and building entities in the field of urban planning. When applied to the complex, the concept of mixed-use can be understood as a functional composite space integrating office, entertainment, shopping mall, convention and residence and other elements through the comprehensive development of land. At that time, the spatial organization with the form of the tourism industry began to appear in the urban complex. That is to say, the tourism complex can be regarded as a derivative of urban complexes, which takes tourism as the core driving force of development and evolution when it continues the characteristics of the urban complexes such as intensive land use, functional combination and complete supporting facilities.

From the perspective of spatial characteristics, Mao Runze (2010) believes that the tourism complex is a multi-functional, multi-format, high-agglomeration and high-efficiency space for tourism, leisure and vacation<sup>[1]</sup>. Wang Wenjun (2010) pointed out that a tourism complex is a block group with a certain size formed on a certain spatial scale<sup>[29]</sup>, which clearly defined the common characteristics of the complex in physical space. What's different is that complexes with tourism as the core driving force are more complex and diverse in spatial distribution. They can not only develop into shopping tourism complexes in urban commercial centers with convenient transportation, but also become vacation tourism complexes in suburbs or coastal areas with the beautiful natural environment, or form entertainment tourism complexes relying on large theme parks. In short, any space with tourism resources is likely to develop into a tourism complex with the support of the external environment. Shen Lin (2013) mentioned that the tourism complex has broken through its regional and architectural constraints and expanded the complex from a city to any space suitable for tourism development<sup>[23]</sup>. In conclusion, the tourism complex is similar to the urban complex in terms of physical form and land use patterns. In terms of spatial distribution, it is more diverse than the urban complex. In terms of core functions, it is somewhat different from the

concept of an urban complex.

### 2.2.2 Tourism complex from the perspective of industry

From the perspective of industry, the author believes that tourism complex can be regarded as a high-level derivative product of tourism-related industrial clusters arising with tourism as the core driving force. The concept of an industrial cluster was proposed earlier by Porter (1998). An industrial cluster refers to the phenomenon in which a large number of enterprises and relevant supporting institutions with close industrial ties gather in a specific field to form interconnected and mutually supporting industrial clusters in space, so as to enhance the sustainable competitive advantage<sup>[30]</sup>. Based on the industrial cluster theory, the cluster economic theory, which emphasizes the scale effect, and the economies of scope theory, which emphasizes the spatial and industrial internal relations, are further derived.

The high-tech zone, traditionally centered on manufacturing clusters, is characterized by industrial zones and high-tech industrial clusters. However, the tourism industry cluster is different from the high-tech zone, which is a tourist resort based on the service-related industrial cluster<sup>[31]</sup>. The tourism industry clusters like tourism complexes emerged earlier in foreign countries. At that time, it was mainly represented by the resort complexes involving seaside recreation, skiing and golfing and theme parks. Therefore, the related industry research results of the tourism Complex in foreign countries are also abundant. It mainly focuses on three aspects: factor aggregation research, social network research and cluster benefit research<sup>[32]</sup>. Flowers and Easterling (2006) studied the competition and cooperation mechanism of enterprises engaged in tourism industry clusters. They took South Carolina as an example to define the tourism industry in four dimensions and put forward the development strategy of the tourism industry in this region<sup>[33]</sup>. Murphy and Jackson (2006) analyzed the role and current situation of a tourism industry cluster in the process of tourism destination evolution by using the Michael Porter diamond model and believed that the energy exchange within and outside the cluster is the key factor affecting the evolution of the tourism industry cluster<sup>[34]</sup>.

With the development of tourism cluster research, the theory is gradually used by international academic institutions or government consultation institutions to guide the practice of the development of tourism projects. In 1999, the Department of Environmental Affairs and Tourism (EDAT), the Department of Transportation (DOT), the Department of Trade and Industry (DTI) and the Industrial Development Community (DC) of South Africa jointly launched a study on tourism clusters in South Africa. Moreover, they prepared the Strategy in Action Report and the Accelerating Local Tourism to guide the development of local tourism. Phuket Island in Thailand introduced the concept of the cluster in 2002 to guide the development and transformation of the tourism industry in the region. South Carolina, USA, also introduced the concept of tourism industry cluster as a guide in the strategic plan of improving regional tourism competitiveness prepared in 2005. In the work report of the tourism industry cluster project in South Africa, the tourism industry cluster is divided into three layers: national level, thematic level and local level<sup>[35]</sup>, which indicates the uncertainty of the tourism industry cluster in scale and spatial dimension, and the possibility of crossing administrative boundaries in scope.

Comparatively speaking, the research on tourism industry cluster theory started late in China, and there is a lack of consensus among tourism scholars on the definition of tourism industry cluster. As for scholars' descriptions of the tourism industry cluster, it mainly includes such features as "it is generated around specific natural or artificial attractions<sup>[36]</sup>", "it enhances competitiveness through clustering"<sup>[35]</sup> and "it requires coordinated management"<sup>[37]</sup>. These perspectives can be used for reference in the formation of the concept of a tourism complex.

The spontaneity of the formation of the tourism industry cluster determines that the formation process is staged and covers a long cycle. Bian Xianhong (2011) divides the growth stage of the

tourism industry cluster into the gestation stage, rapid growth stage, gradual maturity stage and stability stage<sup>[38]</sup>. Based on the synergy theory, and with Hangzhou Xixi National Wetland Park as an example, Lu Lin et al. (2017) analyzed that the formation of resource-oriented tourism complex needs to go through three stages: the traditional tourism industry formed by the accumulation of traditional tourism elements depending on the original landscape, the new tourism industry formed by the mutual benefit and symbiosis between the new tourism elements and the original landscape, and the new tourism industry formed by the integration of tourism elements<sup>[9]</sup>.

To sum up, tourism-related enterprises improve regional competitiveness by spontaneously gathering to develop the economies of scale. There are both competition and cooperation among enterprises in the cluster. According to Porter, this synergy formed by competition and cooperation plays a key role in promoting the development of clusters and forming the overall image and function of clusters<sup>[30]</sup>. According to the dynamic characteristics of the evolution of the tourism industry cluster in China, the tourism complex should come into being in the stage of innovating new forms of the tourism industry. That is to say when enterprises within a cluster change from economies of scale based on aggregation to economies of scope based on mutual integration, the tourism industry cluster based on "competition and cooperation" relations among internal enterprises will be derived into a tourism complex based on cooperation, integration and innovation relations among internal enterprises.

### 2.2.3 Summary

Geography scholars and industrial economics scholars define the concept of tourism complex from their respective perspectives, but there are inevitably limitations in the study from a single perspective. So far, there is no consensus on the concept of tourism complex in academic circles. Ma Xiaolong and Li Weiwei (2016) analyzed the concept differences of urban tourism complex from different perspectives. They believe that if the tourism complex is defined from a geospatial perspective alone, it will be difficult to go deep into its industrial system to simulate its aggregation process and operation mechanism practically. If the tourism complex is defined only from the perspective of industrial organizations, it will lack the comparison of functional differences from a holistic point of view, which is not conducive to the intuitive expression of the geospatial attributes<sup>[19]</sup>.

Moreover, from several existing research perspectives, such as geographical space, industrial organization, cultural creativity, factor integration, and service economy, they are unable to make a complete interpretation of the formation and function mechanism of tourism complex from a dynamic perspective. Therefore, it is difficult to control the possible impact of the tourism complex and make an accurate judgment on its future development.

Because of the complexity of tourism complex, we are required to construct its concept system not merely to put together the concepts of various disciplines, but to analyze the formation process and the principle of function deeply and systematically, to excavate the internal relationship between the concepts of various disciplines, so as to form the concept expression accepted by all subjects. In studying the elements of the tourism complex, we should break away from the past view of elements as lifeless and dead substances, treat them from a dynamic and developmental point of view, and pay attention to the interrelationships between individuals and the external environment.

Therefore, from the perspective of the spatial system, the tourism complex is an interrelated physical whole composed of buildings, road network and landscapes. From the standpoint of the industrial system, a tourism complex is an industrial group consisting of the catering industry, entertainment industry, and residential industry and shopping industry. Each component of the tourism complex can be regarded as an organic whole made up of smaller parts, and a dynamic system with specific functions is formed between parts, materials and industries, which are

interrelated and interact with each other.

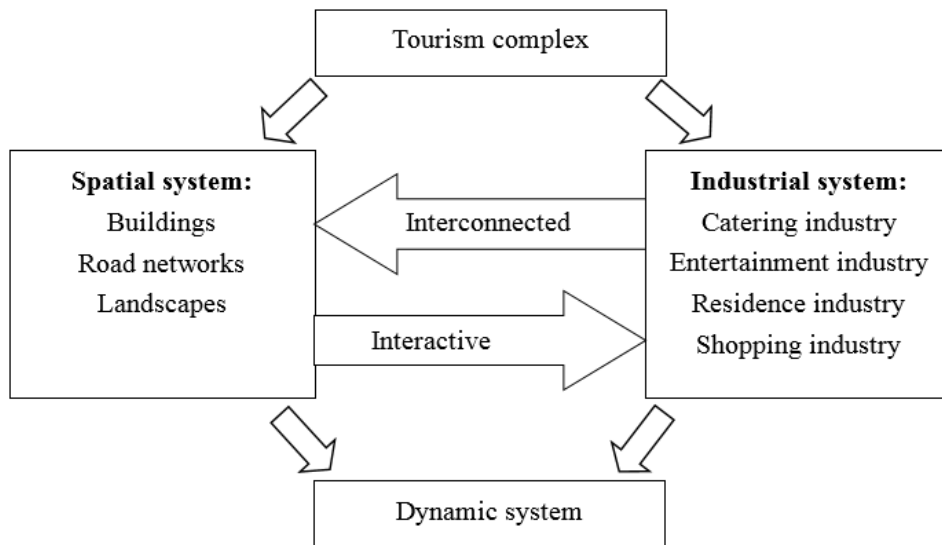


Figure. 2 Components of the tourism complex system

### 3. Application and Interpretation of the Theory of Complex Adaptive System to Tourism Complex

#### 3.1 Theory of Complex Adaptive System

Qian Xuesen believes that "the system is an organic whole with specific functions formed by the combination of several components that interact and depend on each other, and this organic whole is part of the larger system to which it belongs<sup>[39]</sup>." The theory of complex adaptive system (CAS) is the third generation system theory developed on the basis of the first generation of system theories (system theory, cybernetics, information theory) and the second generation of system theories (dissipative structure theory, synergism, and hypercycle theory). It was proposed by John Holland in the mid-1990s. Its theoretical core is that adaptability makes complexity<sup>[40]</sup>. That is to say, the agent in the system is no longer passively performing certain tasks as understood in earlier systems science. On the contrary, the agent has its own goal and orientation, each agent in the system will make an adaptive response to external interference, and various heterogeneous adaptive agents will also have complex interactions with each other. Moreover, both of the two will influence the evolution path and structure of the system. The characteristics of "learning" and "evolution" shown by the interaction between the agent and the environment allow the system to develop to a higher and more complex level, and the adaptive agents may aggregate to form a larger adaptive agent. Then the complexity of the system emerges in the course of adaptation, and ultimately, a CAS comes into being. John Holland believed that a complex adaptive system has seven features, namely, identification mechanism, aggregation feature, diversity feature, non-linear feature, flow feature, internal model mechanism and building block mechanism.

For tourism complex, in a complex adaptive system, tourism as a tag attracts tourism-related enterprises to gather. Each enterprise is the main body of a complex adaptive system. The diversity of the system is determined by the differences among the agents. In order to adapt to the continuous action between agents and between agents in the external environment system, the complex diversity of the external environment and the difference between agents lead to the non-linear character of the action. People flow, capital flow, information flow and technology flow conduct



material exchange among agents and between agents and the external environment in the form of flow through non-linear action. The agents have specific behavior norms and adaptive laws, which constitute the internal model of the agent. If each agent is considered as an independent and inseparable unit, the tourism complexes of different tourism destinations form a different system by combining them like building blocks, implementing different dominant functions to adapt to their own external environment.

The adaptability of the CAS means that the agent continuously learns or accumulates experience through continuous interaction with other agents and external environment, and changes the structure and behavior mode based on the experience they have learned, which eventually causes the evolution of the whole system. Emergent phenomena occur immediately, which makes the system developed to a higher and more complex level. Tourism-related enterprises gather in a specific space to form a tourism industry cluster. In terms of physical space, it is manifested as the mixed land space formed by the mutual echo between different types of buildings and landscapes. In order to improve the competitiveness and prolong the life cycle, the interaction between the enterprises in the space and between the enterprises and the external environment constantly takes place. Finally, the tourism industry cluster in the space accumulates experience in the process of continuous action, summarizes and learns, then changes its internal structure and competitive and cooperative mode, adapts to and affects the external environment, and produces the emergent phenomena so that it can eventually evolve into a high-level, complex adaptive system, also known as tourism complex.

### **3.2 Definition of Tourism Complex under the Theory of Complex Adaptive System**

The research on the concept of tourism complex has always been a hot topic. China's domestic research results show that the studies are carried out from diversified perspectives on the whole, but some individual studies are conducted from a single perspective. Some scholars defined the tourism complex as an effective combination of products with different functions from the perspective of factor integration (Mao Runze, 2010)<sup>[1]</sup>. Some scholars defined the tourism complex as a block group with the functional response, complementary value and spatial dependence (Wang Wenjun, 2010)<sup>[31]</sup>. Some scholars define tourism complex as the product of the integration of recreational elements into the construction of urban complex from the perspective of research on the formation of tourism complex (Xie Wen, 2011)<sup>[41]</sup>. Some scholars define tourism complex as the product of the integration of tourism and the real estate industry from the perspective of industrial integration (Zhao Jianwei, 2012)<sup>[42]</sup>. In addition, some scholars classify tourism complex into four types: theme parks, ecological leisure tourism, human culture tourism and rural tourism (Zhang Ruoyang, 2012)<sup>[43]</sup>. In order to study the concept of tourism complex, we need to have a global view first. From a macro perspective, we need to see it as a huge system, and integrate different perspectives as various components of the system, so as to avoid concluding based on a one-sided viewpoint.

In my opinion, tourism complex refers to a dynamically developing complex adaptive system that integrates hotels, scenic spots, conventions, catering, conferences, commerce, entertainment, real estate and other industries organically according to different leading functions and relies on tourism resources in a certain space range to adapt to the random impact of the external environment and meet diversified needs of tourists.

### **3.3 Explanation Framework of Tourism Complex Based on the Theory of Complex Adaptive System**

The tourism complex can be regarded as a complex adaptive system formed by the adaptive agent (the agent for short) in aggregation, which adapts to the changes of the external environment

through non-linear communication and interaction between them and the external environment. In the book *The Hidden Order of City: Complex Adaptive System Theory in Urban Studies* <sup>[44]</sup>, Liu Chuncheng redefined seven basic concepts of the complex adaptive system formed around the agent in the context of the city. Based on the seven basic concepts of aggregation, diversity, tagging, building block, internal models, flow and non-linearity, the author further defined the seven concepts in the context of tourism complex as enterprise aggregation, similarity tagging, product diversity, functional zone building block, operating model, element flow and non-linear action.

### **3.3.1 Enterprise aggregation**

The agent in the theory of complex adaptive system has the function of aggregation. After aggregation, the agent, as the smallest unit that cannot be split, forms a primary system through aggregation, also known as meta-agents. Due to the interaction between internal agents, the systems aggregate and constitute a higher-level system, also known as the meta-meta-agents. A complex adaptive system generates hierarchy through such a process. The aggregation function of the agent is the premise of other functions and the basis of system evolution. Aggregation is not merely the superposition of the agents, but the occurrence of the emergent phenomena on the system due to the function of aggregation, leading to qualitative changes.

In the tourism complex, a complex adaptive system, enterprises play the function of aggregation as the agent of the system. The enterprise aggregation related to tourism forms different functional blocks, such as residential area, catering area, shopping area, and entertainment area, thus creating a lower-level structure in the tourism complex. Each functional block generates further aggregation through the mutual association of service chains formed by industrial fusion and interaction among the enterprises in the functional block. Finally, the tourism complex emerges as a tourist attraction, which has multiple functions and regional competitiveness.

### **3.3.2 Similarity tagging**

Tagging is the basis and guidance mechanism for the agent to generate aggregation function and produce the boundary because the aggregation of any agent has to follow some rules. In the tourism complex, the aggregation of enterprise agents is based on certain similarities to select and identify the objects that can interact. At this time, this similarity plays the role of tagging to guide the relevant enterprise agents to aggregate. Similarity can be the same goal, the same type of service, the same brand products, the same culture, the same logo, or even the same architectural style. Different effects of aggregation may arise due to varying degrees of similarities. The choice of similarity affects the result of aggregation.

The tourism complex provides tourism services as similarity tagging to attract the aggregation of tourism-related enterprises. Enterprises in the tourism complex look for similarity to further aggregate according to their product types to form an orderly internal structure. The enterprises that provide shopping products aggregate to form shopping area with shopping as similarity tagging, the restaurants that offer food products gather to form catering area with food as similarity tagging, or the hotels that offer accommodation products converge to create an accommodation area with accommodation as characteristics tagging. Besides, the Walt Disney Company uses the head portrait of Mickey Mouse as a similarity tagging to guide hotels, restaurants, entertainment facilities and shopping malls, themed with Mickey Mouse elements to gather and then form some tourism complexes like Disneyland and Walt Disney World. Also, the Grand Tang Dynasty Ever-bright City in Qujiang New District, Xi'an, uses the culture of the Tang Dynasty as a similarity tagging to guide the relevant tourism enterprises that integrate Tang elements into their products to form a large-scale aggregation.

### **3.3.3 Product diversity**

According to the theory of complex adaptive systems, the system has diversity due to the differentiated development of the agents in different directions when the agents adapt to

environmental changes. The adaptability of the tourism complex also leads to differentiation. With the environmental changes and the increasingly diversified needs of tourists, enterprise agents should enhance their competitiveness through innovation. The essence of innovation is to create unique, novel and diversified products to seize the market and avoid homogenization. Enterprise agents have developed in different directions in the process of interaction and adaptation to the environment, resulting in multi-functional and diverse products with unique characteristics.

In order to meet the needs of national tourism pursuing personalization and experience, many enterprises begin to integrate the tourism and vacation industries with other fields and sectors, so that the tourism products can continue to be derived from various domains, presenting diversified and innovative features. Greentown China Holdings Limited integrates the health care industry and the tourism industry to form a tourism complex for old-age care and vacation. Vanke integrates the cultural industry and tourism industry into a cultural tourism city. Moreover, Vanke integrates the creative agriculture and tourism industry into a rural town vacation tourism complex. Shimao Group combines the real estate industry and the tourism industry to develop a mobile tourism complex<sup>[45]</sup>.

#### **3.3.4 Functional zone building block**

In the complex adaptive system, building block can be regarded as a higher-level unit of the agent after aggregation, and it is the outcome and manifestation of the agent after aggregation. The difference between the building block and the agent lies in that the building block can be split and re-organized, while the agent is the smallest unit in the system that can not be split. The application of the concept of building block allows the analysis of system structure to be more hierarchical and rational. In this way, it facilitates the scholars to focus on the rule of interaction between the building blocks when they study the higher-level internal models<sup>[46]</sup>.

The tourism complex tends to be a system composed of one or two core functional zones and several auxiliary functional zones as the building blocks. The function is the outcome and manifestation of the enterprise agent after aggregation. The characteristics of the enterprise agents that make up the functional zone determine the type of functions. The scale, quantity and competitiveness of the enterprise agents determine the importance of the functional zone in the tourism complex. The development and change of the tourism complex depend on the function change of each functional zone building block in the tourism complex. The primary functions of the functional zone building block and its importance in the system will be affected by the increasing vitality, attraction, quantity, scale expansion or the change of product type of the enterprises in the functional zone, thus leading to changes in the core functions of the tourism complex.

#### **3.3.5 Operating model**

Internal models are the rules that the agent interacts with other agents and environments in a complex adaptive system. Through the research of internal models, we can find the stimulus points where the agent reacts so as to predict the possible reaction and change of the agent.

The operating model of enterprise agents is the law that needs to be abided by when the enterprise agents interact with other enterprise agents and environments. Through the analysis of the recent operating model of an enterprise agent, we can gain knowledge about the development direction of the enterprise agent in order to predict which enterprise agents it may interact with. At the same time, we can judge which external stimuli the enterprise agent is vulnerable to and how it will react.

#### **3.3.6 Element flow**

The flow is the carrier of the interaction among the agents in a complex adaptive system. And the rate of flow transfer among the agents plays a decisive role in the evolution of the agents. Liu Chuncheng (2017) compared flow to the Qi and blood of the system. He believed that the smooth transfer of the flows among the agents would directly affect the vitality of the system, so flow is also non-severable<sup>[44]</sup>. Every agent in the system acts as a node. In each reaction, the flow will

select the agents that are beneficial to the interaction to be connected in series. But it will exclude the agents that are unfavorable to the reaction. Then, the nodes will be generated as the agents adapt or disappear as the agents do not adapt. Because the internal and external reactions of the system are continually occurring, the flow will go continuously among the agents, closely connecting the agents to form a networked system.

Enterprise agents in a tourism complex interact with each other based on the carrier of the element flows, which are composed of human flow, material flow, capital flow, technology flow and information flow. Enterprise agents can absorb, exchange, renew and metabolize with other agents and environment through the transmission of various element flows, and then develop and evolve continuously to produce overflow and emergence effect. The enterprise agents with the centralized inflow of element flows will present high vitality and strong competitiveness, and the adjacent enterprise agents will also be affected to cause some changes in the element flows. On the contrary, the excessive intensity of the flows outside the element flows may leave the enterprise agents in a depressed, less dynamic and less competitive state.

### 3.3.7 Non-linear action

In the system, the action between the agent and other agents is not a simple one-to-one action, nor a simple causal relationship. However, one agent may act separately or jointly with several agents at the same time, and the action of one agent with another or several of the agents may be affected by other agents. In the same way, the reaction of the agent to adapt to the external environment will also be affected by other agents. In turn, the external environment will also affect the action between the agent and other agents. As a result, the action of the agents in the system can not be regarded as simple partial addition but a non-linear action with complex changes.

The non-linear action of the system in tourism complex can be understood as that the competition or cooperation between the enterprise agents and an agent will affect the operation status, operation mode and product type of the agent, and then affect the competition or cooperation direction between the enterprise agent and other enterprise agents. In order to meet the diversified needs of tourists, multiple enterprise agents may work together to form an integrated service. And this synergy may change as external demand changes. When an enterprise agent is affected by the external environment, it may react with growth or depression, which will have a chain reaction on other enterprises. Each reaction of enterprise agents will cause more reactions in the system, so as to enable the system to adapt itself to the environment.

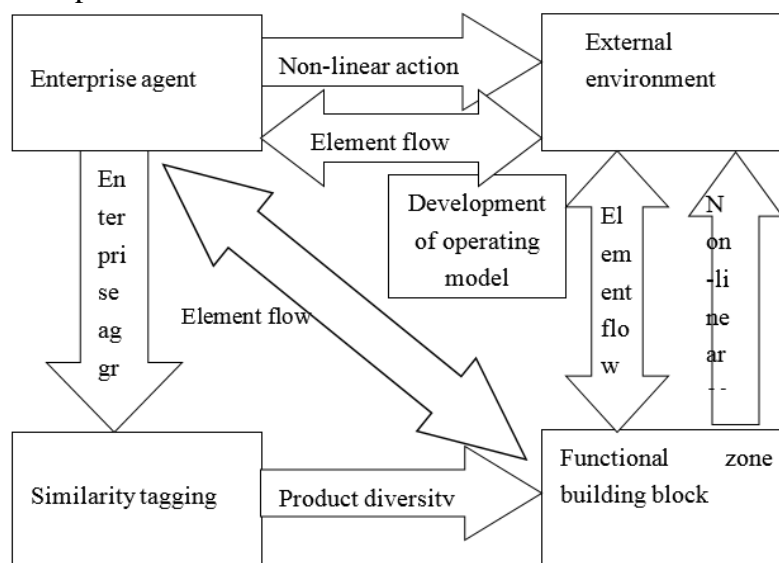


Figure. 3 Operating diagram of the tourism complex system

## 4. Clusion and Discussion

This study mainly solved the following three problems. First, it constructed an interdisciplinary conceptual framework and formed a conceptual system accepted by all disciplines. Second, it clarified the differences between the concepts of tourism complex and industrial cluster, tourism industry cluster, urban complex, characteristic town and theme parks, and eliminated the confusion of the conceptual cognition of the agent in the past. Third, it studied the tourism complex from the perspective of a complex adaptive system, which is dynamic, learning and evolving, so as to make more accurate control over its action mechanism and development.

The tourism complex is a dynamic organic system, which meets the seven characteristics of a complex adaptive system, namely, enterprise aggregation, similarity tagging, product diversity, functional zone building block, operating model, element flow and non-linear action. Under the influence of these seven characteristics, enterprise agents within the system organize, learn and upgrade through interaction, and make timely feedback and evolution to adapt to the changes in the external environment at the same time. In the tourism complex system, the relationship among the seven characteristics is described as follows: enterprise aggregation is the premise of all functions, and similarity tagging is the basis and guidance mechanism of aggregation of enterprise agents. The functional zone building block is the representation of enterprise agents after aggregation. Product diversity is the product of the constant action of the system. The operating model is the law followed by the action of enterprise agents, and the element flow is the carrier of the action of enterprise agents. Non-linear action is how the enterprise agents work.

The innovation of this study lies in the introduction of the theory of complex adaptive systems and the integration of the relevant research from the perspective of space and industry into the system theory. Through the study of the relationship among the agent (i.e., industry), environment (i.e., space) and system (i.e., tourism complex), it explained the dynamic evolution and functional mechanisms of the tourism complex. Thus, the interdisciplinary connection is constructed, and the conceptual framework of the tourism complex is improved. The author regards a tourism complex as a dynamic, living and energetic complex adaptive system, and regards the evolution of the tourism complex as active learning and evolution with a specific target rather than a passive change under the influence of environment. In the process of adapting to the diversified external environment, the complexity of the tourism complex is created, which is manifested as different leading functions, different industrial structures and different layouts in different spaces.

At present, the research on the tourism complex in China mainly focuses on the qualitative description, but less on quantitative research. In the future research, we can build a tourism complex evaluation system based on the seven characteristics of the tourism complex system under the existing conceptual framework, and carry out quantitative analysis on the development and maturity of the tourism complex project. Alternatively, we can also deeply dig the evolution process, action mechanism and action model of the agents that constitute the tourism complex as a complex adaptive system, and apply the theoretical research to the practical operations. Then, we can make an accurate prediction of the impact of a particular tourism complex project on its environment, to what extent and in what ways it affects, and in what trends it will develop.

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