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Study on the construction of smart tourism ecosystem and polycentric governance mechanism

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ABSTRACT

Building a smart tourism ecosystem is an important means for the tourism industry to strengthen resource sharing, realize value co-creation and promote healthy development of the industry. Based on the ecological governance perspective and the theory of smart tourism, the connotation of smart tourism ecosystem is proposed and the structural framework of smart tourism ecosystem is constructed by using semi-structured interview method. The framework of smart tourism ecosystem consists of smart tourism platform, smart government, smart tourism suppliers, smart tourism destination marketing organization, smart tourism consumers and external environment, defines the role of each element in the structural framework, and analyzes the characteristics of data flow between each element. The polycentric governance mechanism of the smart tourism ecosystem, including the ecological governance mechanism of smart government, smart tourism suppliers, smart tourism destination marketing organizations and smart tourism consumers, is proposed to provide a reference for the construction and development of regional smart tourism ecosystem.

Keywords: smart tourism; ecosystem construction; multi-center governance mechanism

1. Introduction

In the "Thirteenth Five-Year" tourism development plan, the National Tourism Administration emphasizes promoting the construction of "smart tourism cities, smart tourism scenic spots, smart tourism enterprises, and smart tourism villages". Smart tourism is a new generation of information and communication technologies (such as cloud computing). Internet of Things, big data, virtual reality, augmented reality, mobile communication, artificial intelligence, blockchain, etc.) and the product of the integrated development of tourism. Koo et al. believe that smart tourism is to provide tourists with tourism destination, catering, transportation, reservation, tour guide and other tourism information and tourism related services through it equipment[1]. Li believes that smart tourism is a ubiquitous tourism information service accepted by individual tourists in the process of tourism activities[2]. Smart tourism can bring information-based, personalized, convenient and ubiquitous tourism services[3]. It has advantages in integrating tourism resources, promoting industrial integration, realizing fine and efficient tourism, upgrading the development mode of tourism[4]. With the continuous deepening of the

application of smart tourism, the tourism industry has gradually changed from scale economy to platform economy and ecosystem economy, and the smart tourism ecosystem has gradually become an important organizational form and development trend. Ecosystem refers to the community of interacting organisms and their environment. It is a complex network formed by the interdependence of resources. Benckendorff et al. discussed the technological innovation in tourism ecosystem. The introduction of intelligent technology can effectively establish the connection between nodes, so as to create a more active and intelligent network[5]. Although the development of smart tourism promotes the formation of smart tourism ecosystem, which crosses the boundary of a single organization, it also faces new problems in organizational ecological development, information sharing, stakeholder symbiosis, coordination mechanism[6] and other ecological management. Ecological governance can improve the risk resistance and competitiveness of the ecosystem as a whole. Ecological governance of smart tourism ecosystem is the only way to solve the above problems[7]. From the perspective of ecological governance, this study studies the construction and governance mechanism of smart tourism ecosystem, so as to promote the construction and sustainable development of regional smart tourism ecosystem.

2. Literature review

There is little research on smart tourism ecosystem (STE) in China, and the research perspectives are mainly smart tourism information ecosystem and smart tourism service ecosystem. Ling studied the connotation and constituent elements of smart tourism information ecosystem[8]. Zhang studied the concept, characteristics and construction of smart tourism service ecosystem[5]. Zhang proposed the feasibility of building smart tourism information ecosystem and smart tourism information ecological chain, and gave the ecological development path of smart tourism information[9]. The research of STE is mostly conducted in South Korea, Australia, Spain, the United States and other countries. Zhang believes

that STE can be defined as a tourism system that uses intelligent technology to create, manage and provide intelligent tourism services and experience, which is characterized by value co creation Buhalis and Amaranggana believe that the common goal of STE is to provide enhanced, rich, high-value, meaningful and sustainable tourism experience[10]. Koo et al. defined STE as an ecological environment based on information and communication technology, in which all elements and subjects develop together to make `smart tourism an overall environment. Set is composed of core industries, related industries, related institutions, tourists and external environment. Tourists, supply enterprises, circulation enterprises, government, community and other networks are organically connected and continuously evolved[11]. Gretzel et al. describe a typical STE as an interactive space supported by a digital ecosystem, which is composed of organizations with respective interests. They are divided into tourism consumers (TC), residential consumers (RC), tourism suppliers (TS), suppliers in other industries (OS), government agencies, destination marketing organizations (DMO)and intermediaries[10]. In this STE, there is a symbiotic relationship between species, so as to bring benefits to the whole system and each individual. Koo et al. believe that STE is composed of multiple interactive participants and participates in the system to varying degrees. All stakeholders, such as general enterprises, tourism companies, ICT companies, governments and residents, as well as individual travelers, are closely involved to jointly create value for each other[12]. Shin et al. believe that STE is based on the integration of tourism and ICT, which can enable tourists, suppliers, circulation enterprises, governments and communities in the tourism industry to create shared value and realize a virtuous circle STE uses intelligent technology to realize comprehensive information sharing and create shared value on this basis[13]. It can be seen that there are obvious differences in organization, technology, interaction and advocacy between smart tourism ecosystem and single smart tourism system and tourism industry ecosystem, as shown in the **Table 1** below.

Table 1. Differences between smart tourism ecosystem and

smart tourism system and tourism industry ecosystem

	Smart tourism system	**Tourism industry ecosystem**	**Smart tourism ecosystem**
Organization	Personnel and institutions	Organizational system	Stakeholder
Technology	Information and communication technology	Infrastructure	Smart tourism platform
Interactive	Information integration	Resource integration	Resource sharing
Opinion	Information sharing	Sustainable development	Value co-creation

The government plays an important role in building and regulating the interaction within the STE. Many species integrate into the STE and produce the attribute of wisdom. Gretzel et al. Emphasized the necessity of adopting cooperation strategy, which can achieve mutual benefit[3]. Under the necessary conditions of evolution, Gretz et al.[10] has not been found and created, but also played an important role in evolution. Therefore, the smart tourism ecosystem is essentially an ecological environment that enables the smart government, smart tourism suppliers, smart tourism destination marketing organizations, smart tourism consumers and other stakeholders in the smart tourism industry to actively participate in resource integration and information sharing through ecological governance, so as to enhance the co creation and innovation of value, so as to realize a virtuous cycle and sustainable evolution.

3. Research methods

3.1. Study design

There is little research on the construction and governance mechanism of smart tourism ecosystem. The theoretical method based on constructivism is the appropriate method for this research, and grounded theory is one of the qualitative research methods. Considering the exploratory nature of the research, semi-structured interviews are used to obtain in-depth information. This paper aims to define the connotation of smart tourism ecosystem from the perspective of ecological governance, put forward

the framework of smart tourism ecosystem, and give the multi center governance mechanism of smart tourism ecosystem. In order to determine the components and functions of the smart tourism ecosystem framework and the governance mechanism of each subject, semi-structured interviews were used to collect qualitative text data of government and enterprise technicians or managers, and qualitative methods were used for research.

3.2. Data collection and analysis

Based on the available data from Shandong Provincial Department of culture and tourism, this paper conducted a semi-structured interview. The respondents were 20 representatives from Jinan, Qingdao, Zibo, Dongying, Yantai, Weifang, Weihai, Rizhao, Jining and Tai'an regions. They were all technical or management personnel of tourism government and enterprises in Shandong Peninsula region and professionals in tourism management and smart tourism. The respondents in this study did not provide any new information after 16 interviews, so the data was saturated after the 16th interview. Each interview lasts 30 to 45 min, and all interviews are recorded with the consent of the respondents. Content analysis is used to identify the framework design and governance mechanism of smart tourism ecosystem from the interview data collected by respondents. Content analysis is an objective, systematic and quantitative method, which can convert non quantitative literature materials into quantitative data and identify patterns and themes in social science. In order to ensure the validity and credibility of the data analysis, the interview data and interpretation were checked by the participants, and five respondents were asked whether they agreed with the survey results. In addition, data collection runs through the whole research process, and the collected data comes from interviews, participatory observation, literature and tourism policy related documents.

4. Smart tourism ecosystem structure framework

Smart tourism ecosystem is the product of the continuous integration of information and communication technology (ICT)and tourism. In 1960, its technology began to be applied to tourism. In 1995, the concept of e-tourism appeared, which uses the Internet to provide commercial products and form a business model. In 2007, the concept of smart Tourism began to appear, promoting the integrated development of a new generation of ICT and tourism. After 2014, Smart tourism ecosystem has become an important organizational form and development trend. Park et al. analyzed that South Korean local governments use Facebook to promote tourism, so as to turn Facebook into a STE platform, so that all stakeholders can interact through Facebook, jointly produce service products, and jointly create value[14]. Boes et al. analyzed the construction of STE by using smart tourism destinations from the perspective of shared value creation[15], while Buonincontri and Micera analyzed the construction of STE from the perspective of tourism destination competitiveness[16]. Brandt et al. discussed that San Francisco uses mobile devices and social media to build STE. Mobile media can promote the connection and interaction between tourists and even between tourists and tourism enterprises, and bring together stakeholders, including government, tourism industry participants, it experts, equipment manufacturers, universities and research departments[17]. In Italy, Polese et al. analyzed the use of technology and institutions to form sustainable value co creation, and then build STE through social innovation[18]. In Spain, Arenas introduced four organizational capabilities based on its resources to promote the construction of design centered STE. The four organizational capabilities include public service provision, public participation, CO production and public sector innovation[19]. It can be seen that STE has received great attention and been widely used in South Korea, Spain, the United States and other countries. Ste is mainly constructed from the perspectives of tourism destination, social media, technology and system. Ste construction needs to be combined with the specific situation of smart tourism development, and institutions and systems have played an important role in the construction of smart tourism ecosystem.

Although the smart tourism ecosystem is still in the primary development stage in China, China has the advantages of 5g communication technology, which can promote the popularization and rapid transmission of data Internet of things, and smart phones and mobile payment applications also promote the development of STE. In addition, China has the institutional advantage of relatively centralized economic management, which can better coordinate different stakeholders. In the context of China, this paper examines the role of stakeholders from the perspective of ecological governance, constructs the structural framework of smart tourism ecosystem, evolves the ecosystem through ecological governance, and promotes the common development of all species in the system based on digital ecosystem and intelligent technology, so that all species can reposition resources and obtain the information generated in the ecosystem to adapt to the environment, so as to create greater shared value Smart tourism ecosystem is composed of smart tourism platform, smart government, smart tourism supplier, smart tourism destination marketing organization, smart tourism consumer and external environment, as shown in **Figure 1**.
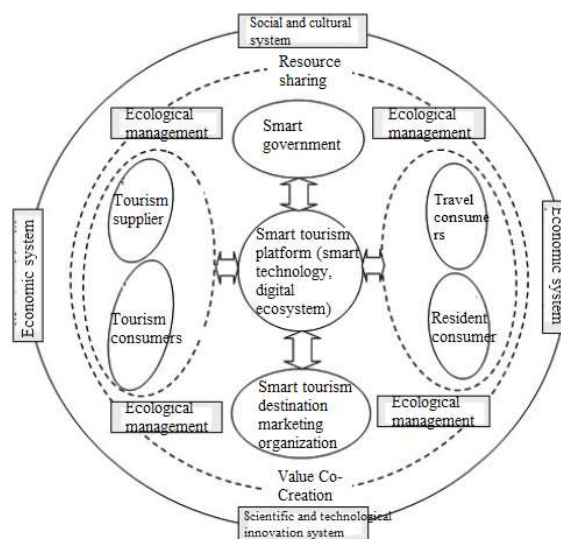

Figure 1. Structural framework of smart tourism ecosystem.

The smart tourism platform uses intelligent technology and digital ecosystem to process data, create valuable resources for other species in the system, and support the interaction between species through reputation mechanism and communication tools. Intelligent technology, application program, wireless communication technology, Internet and other information technologies play the role of "neural network" connecting various stakeholders in STE. Because consumer species have high mobility and high motivation to produce, share and consume social content, mobile technology and social media play an important role in STE. The smart tourism platform consists of three layers: network layer, cloud data layer and artificial intelligence layer[20]. The network layer connects different application systems and sensors in the ecosystem. Various data can interact between the application systems of tourism business partners to improve operation efficiency; The cloud data layer is used for data aggregation and storage, where relevant external data and selected internal data are integrated to form big data for ecosystem sharing; The artificial intelligence layer can select the required data from the big data on the cloud to complete intelligent analysis and assist decision-making.

Smart government mainly plays the role of macro management. It can coordinate the interests of tourism destinations, online travel agencies, telecommunications companies, big data analysis companies and other parties through investment in tourism infrastructure and formulation of tourism related laws and policies, so as to promote smart tourism cooperation. The government provides tourism information to tourism consumers and tourism suppliers through big data, and provides policy and institutional support to destination marketing organizations.

Smart tourism suppliers mainly include travel agencies, transportation industry, catering industry, entertainment industry, etc. They interact with each other in the supplier network through intelligent technology to create and provide new services. Other industry suppliers mainly appear as service supporters, such as telecom companies, banks, payers, etc.

They not only share interests in the smart tourism ecosystem, but also play a significant role in providing key information and services such as communication and mobile payment, and enhancing value creation.

Smart tourism destination marketing organizations perform the traditional functions of information brokerage, marketing and quality control, and promote transactions through innovative use of data and equipment through intermediaries. It should not only act as the coordinator and promoter of stakeholders in STE and promote strong cooperation, but also find deficiencies in the process of providing products and services according to government policies and tourism big data, so as to ensure that consumers are provided with products and services that meet their needs.

Smart tourism consumers become smarter, more knowledgeable, more perceptual and more dynamic. They share their own data and use intelligent technology to dynamically interact with other stakeholders and jointly create an enhanced personalized intelligent experience. Smart tourism consumers feedback information to the government and tourism destination marketing organizations through big data, share their tourism experience with other tourism consumers or resident consumers, and actively participate in the creation of shared value, so as to assume the role of business or governance. Resident consumers are both tourism consumers and tourism service providers. For example, they provide consumers with services such as house leasing through the smart tourism platform.

Changes in economy, politics, social culture, scientific and technological innovation and other environments affect the smart tourism ecosystem. Through ecological governance, all subjects continuously share and exchange information, forming an interactive and two-way information cycle. The operation law in the system continues to evolve, and finally a balanced ecosystem is generated. See **Figure 2** for data flow mode between entities[21].
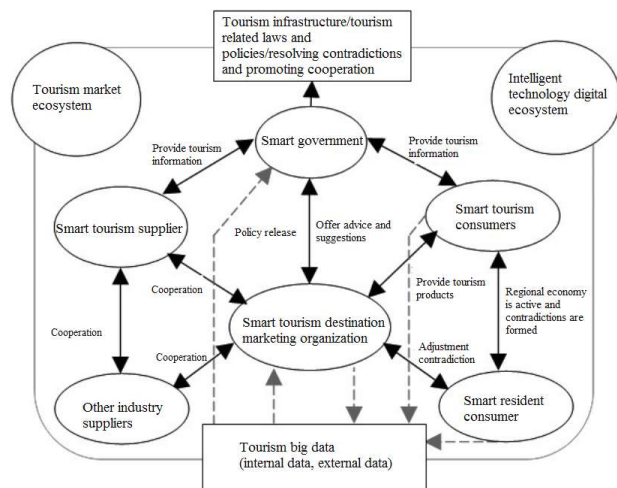
Figure 2. Data flow among subjects of smart tourism ecosystem.

5. Multi center governance mechanism of smart tourism ecosystem

Neither the government nor the market can completely solve the problem of smart tourism ecological governance alone. It is necessary to establish an interdependent and cooperative relationship between the government and society, the market and private people, find a new governance center outside the government, and ensure the vitality and efficiency of the governance system and realize shared value creation through different governance mechanisms[22]. Multi center ecological governance includes four governance centers: smart government, smart tourism supplier, smart tourism destination marketing organization and smart tourism consumer. All centers play a role in cooperation[23].

5.1. Smart government ecological governance

Guiding mechanism

The smart government should improve the policy system and formulate preferential policies such as moderately reducing taxes, financial subsidies, direct investment, capital and technical support. Smart government should increase investment in tourism infrastructure, strengthen tourism information construction, increase the coverage area of broadband network, especially wireless network, improve the construction level of Internet of things facilities, strengthen the construction of smart tourism

platform, and promote the innovation and application of intelligent technology. For example, in 2016, Tai'an promoted "Internet + tourism" to further improve the network platform of smart tourism cities. In 2019, Qingdao formulated the digital Qingdao development plan (2019-2022) to build a shared and open digital government and guide the development of STE.

Monitoring mechanism

Through the smart tourism platform, the smart government actively strengthens market supervision, supervises the relevant work of tourism management and tourism development and construction, carries out strict evaluation, timely monitors and analyzes the development of tourism, and ensures that its work is open, transparent, scientific and effective. Taking Shandong Province as an example, Shandong tourism data and information center began to build "Shandong scenic spot real-time monitoring platform" in 2017, which has accessed the real-time passenger flow data of all 5A scenic spots and some 4A scenic spots, realizing the real-time monitoring of passenger flow in scenic spots. Qingdao will improve the supervision system of smart tourism city and implement accountability system to ensure the healthy development of smart tourism city.

Overall coordination

Determine the strategic planning of regional smart tourism and coordinate the development and construction of scenic spots and scenic spots in the region. Through the information exchange and feedback of the smart tourism platform, coordinate the relationship between the overall interests of the region and various stakeholders[24]. For example, Rizhao establishes a smart tourism platform to realize online management and online scheduling, which improves the overall coordination efficiency.

5.2. Ecological governance of smart tourism suppliers

Information sharing mechanism

The essence of information sharing is to break

the mode of information transmission level by level among suppliers. The smart tourism platform enables multiple independent suppliers, customers and even competitors to form a temporary network organization through information technology to integrate tourist attractions, catering, accommodation, leisure shopping, entertainment, transportation and other resources. Qingdao introduced Ctrip, flying pig and other online travel platforms to realize the deep integration of ticket purchase, route, hotel, catering and other applications with the Internet.

Through the smart tourism platform, the two-way and real-time information interaction is realized, the information asymmetry between suppliers is solved, and the adequacy and accuracy of information communication are improved. At the same time, strengthen information security and preventive measures by formulating relevant contracts.

Incentive mechanism

In the smart tourism ecosystem, the price of tourism products and services can be reduced through revenue sharing contract, which greatly increases the demand of consumers for tourism products. Establish a business reputation mechanism with a wide audience and rapid transmission of reputation information[18], and timely update product quality information and corporate reputation. At the same time, the establishment of punishment mechanism can standardize suppliers and better coordinate their relations and conflicts of interest.

5.3. Ecological governance of smart tourism destination management organization

Community participation mechanism

Community residents are important influencers and participants in the smart tourism ecosystem. Relevant policies and systems should be formulated to guide the consumption enthusiasm of community residents. Give play to the enthusiasm of community residents as environmental supervisors and executors. In the process of tourism development, try not to affect the normal life of local residents, and establish an interest compensation mechanism to compensate

residents whose interests are damaged, so as to promote local residents to actively participate in local tourism development. For example, Tai'an scenic spot makes full use of the Internet big data analysis platform to explore and establish a big data assisted scenic spot management mechanism, and establish a tourism feedback platform to assist in the protection and management of smart scenic spots.

Interest coordination mechanism

The marketing organization of smart tourism destination should act as the interest coordinator, establish and maintain the technical infrastructure supporting communication and cooperation, increase the cooperation of stakeholders, use the interest compensation mechanism to compensate the injured parties in the cooperation, do a good job in data management, strengthen the trust in data processing, and ensure that consumer data is not abused[15]

Service innovation mechanism

Create an atmosphere of competition, cooperation and collaborative innovation in the smart tourism ecosystem, promote innovation in technology and services, improve existing products and services, or create new products and service modes, so as to improve consumers' satisfaction with tourism experience. For example, the smart tourism mobile platform established in Yantai enables tourists to realize various services through mobile terminals, so as to meet the travel needs.

5.4. Ecological governance of smart consumers

Feedback mechanism

Privacy and personal information protection are very important to consumers. The smart tourism ecosystem should create a data security environment for consumers to voluntarily make sharing choices and let them have control. Consumers should also learn to share data and gain value from it on the basis of information security. Consumers use social media, blogs and online travel to collect, adopt and share tourism information, which can easily obtain real-time information in the process of tourism and

improve tourism experience.

Consumers should accept and use smart technologies. Only by using smart technologies can consumers become smart tourism consumers[25]. Only when consumers feel that these technologies are useful and can make them more real-time, can they use these technologies. In the smart tourism ecosystem, consumers will actively search for information and use intelligent technology to make effective tourism decisions based on a large amount of information.

Value co-creation mechanism

Smart tourism consumers interact with stakeholders through smart technology and hope to participate more in products or services, so as to play a more important role in value creation. Smart tourism consumers are no longer passive audiences, but active participants. They are regarded as one of the key components of the value co creation process. For example, Tai'an uses the smart tourism platform to capture the internet evaluation related to the scenic spot, deeply analyze the factors affecting consumer satisfaction, and evaluate and improve the work of the scenic spot through objective, fair and accurate network evaluation data.

6. Conclusions

Smart tourism ecosystem is the product of the development of modern information technology, which provides a new platform and opportunity for regional tourism development. There are laws in the formation and evolution of smart tourism ecosystem. Recognizing its structure and governance mechanism is the key to the healthy development of smart tourism ecosystem. The smart tourism ecosystem needs ecological governance, and each subject plays a role in value co creation. Through the multi center governance mechanism, we can better promote the interaction between various subjects and further create shared value in the smart tourism ecosystem.

Based on the perspective of ecological governance, this paper puts forward the connotation, framework construction and multi center governance

mechanism of smart tourism ecosystem. It enriches the theoretical system of smart tourism ecosystem and the integration theory of information and communication technology and tourism. At the same time, through the structural framework and governance mechanism of smart tourism ecosystem, guide stakeholders to play a role in shared value creation, realize shared value creation, and provide consumers with maximum tourism service experience.

Conflict of interest

The authors declare no conflict of interest.

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