

Research on the Construction of a Smart Tourism Service System in the Southern Sichuan Economic Zone under the Digital Economy Context

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Abstract: With the rapid advancement of digital technologies, the digital economy has become a core driver of regional transformation and high-quality development. As a major growth pole in western China, the Southern Sichuan Economic Zone is endowed with abundant tourism resources but faces persistent challenges such as fragmented assets and low service efficiency. Against the backdrop of deep integration between the digital economy and the cultural–tourism industry, building a smart tourism service system is not only a key pathway to enhancing regional competitiveness, but also an important lever for promoting green and low-carbon transition and advancing coordinated urban–rural development. A pressing question lies in how digital technologies and new productive forces can be harnessed to integrate fragmented resources, optimize the all-region tourism service chain, and innovate benefit-sharing mechanisms. Drawing on digital economy theory, smart tourism ecosystem theory, and collaborative governance theory, and taking into account the development realities and digital transformation needs of the Southern Sichuan Economic Zone, this study employs the Analytic Hierarchy Process (AHP) method to construct an evaluation index system for high-quality smart tourism services. The findings offer both a theoretical paradigm and a decision-making reference for building regional smart tourism systems in the digital economy era, supporting the Southern Sichuan Economic Zone in shaping a new hub for smart cultural tourism.

Keywords: Digital economy; Smart tourism; Southern Sichuan Economic Zone.

1. Introduction

The Southern Sichuan Economic Zone, located in the heart of Sichuan Province, is one of the five major tourism areas designated in the province's development plan. It comprises four prefecture-level cities—Zigong, Luzhou, Neijiang, and Yibin—and benefits from a solid economic foundation and a favorable geographic position. The region is endowed with abundant natural landscapes, such as the Shunan Bamboo Sea and the Xingwen Stone Sea geological wonder, coupled with a beautiful ecological environment. In addition, the zone is rich in distinctive cultural resources, including Zigong's salt industry heritage and its world-renowned Lantern Festival, Luzhou's liquor culture, Neijiang's Zhang Daqian cultural legacy, and the local cultural identities embedded in scenic sites such as Yibin's Xingwen Stone Sea. Together, these natural and cultural assets underpin the profound historical and cultural heritage of Southern Sichuan. Building on these advantages, the tourism industry in the region has made remarkable progress in recent years, establishing itself as one of Sichuan's most important tourist destinations.

In recent years, rapid economic and social development, accompanied by a notable rise in per capita income, has raised people's expectations for higher-quality lifestyles. Increasingly, tourism has become a preferred form of leisure and recreation, fueling the rapid growth of the domestic tourism market. For the urban agglomeration of Southern Sichuan, the regional tourism market offers vast potential for both urban and rural residents [1]. However, as China's tourism industry moves toward diversification and personalization, internal disparities within the Southern Sichuan region have become increasingly evident. Tourist attractions are relatively scattered, resource integration

remains weak, and effective linkage mechanisms are lacking. As a result, visitors spend excessive time and effort on travel and planning [2], and traditional tourism models can no longer meet the demand for high-quality experiences.

The rapid rise of the digital economy, however, has brought both new opportunities and challenges to tourism development in the Southern Sichuan Economic Zone. Defined as economic activity based on digitized knowledge and information, the digital economy encompasses the application of advanced technologies such as the Internet, artificial intelligence, big data, blockchain, and the Internet of Things. It has now become a core driver of China's economic growth. Within this context, industrial structures are undergoing continuous optimization and upgrading, production efficiency is steadily improving, and a new form of productive forces—one that emphasizes not only quantitative growth in production factors but also innovation in technology, management, and business models—has emerged. This new productive force is characterized by high technology, high efficiency, and high quality, aligning with the principles of China's new development paradigm [3]. Its fundamental purpose is to propel traditional productive forces toward a higher-quality trajectory defined by technological sophistication, efficiency, and sustainability [4].

The key to this transformation lies in advancing industrial systems toward greater intelligence, greenness, and integration. This developmental trajectory corresponds directly to both the challenges and strategic directions currently faced by the tourism industry in Southern Sichuan. As such, the new productive force demonstrates tremendous potential in the tourism sector. It not only provides the technological foundation for innovation but also accelerates the construction of smart tourism service systems, injecting new dynamism into the industry. This transformation enables

traditional tourism to make qualitative leaps in information acquisition, service enhancement, resource optimization, and enriched visitor experiences. It significantly improves the overall efficiency, service quality, and sustainability of the tourism sector, while driving industrial innovation and upgrading—a critical factor for strengthening China’s core competitiveness in the global economic system [5].

As digital technologies continue to penetrate deeply, intelligent transformation has become an inevitable pathway for reshaping the tourism industry ecosystem. In the resource-rich Southern Sichuan Economic Zone, ongoing technological progress and the expansion of application scenarios will further enhance the role of smart tourism, positioning it as an increasingly central driver of tourism-led economic development.

2. Literature Review

2.1. Digital Economy

With the rapid development of the digital economy, its conceptual scope continues to evolve, and scholars have approached its definition from diverse perspectives. In its early stage, the digital economy was largely understood as economic activities based on digital technologies. However, this definition is overly simplistic. With technological advances and expanded applications, the concept of the digital economy has been enriched and deepened. From the perspective of technological drivers, it is regarded as economic growth and transformation driven by the effective application of information and communication technologies (ICT) [6]. From the perspective of industrial integration, Ma Huateng (2017) argued that the digital economy is a new economic model emerging from the deep integration of the Internet and traditional industries [7]. From the perspective of data as a production factor, Xu Xianchun et al. (2020) emphasized that the digital economy is an economic activity in which data serves as a key production element, leveraging digital technologies to optimize resource allocation and promote high-quality economic development [8]. Overall, most scholars view the digital economy as an economic form arising from the development and application of information technologies.

2.2. Smart Tourism

At present, there is no universally accepted definition of smart tourism in China or abroad. Generally, two perspectives dominate academic discussions. The first is the ICT-driven perspective, which defines smart tourism as the process of creating, managing, and delivering intelligent tourism services and experiences by leveraging data analytics, the Internet, artificial intelligence, and other technologies. This technology-driven approach emphasizes four major systems: smart services, smart business, smart management, and smart governance, encompassing functions such as navigation, guiding, touring, and shopping [9]. Jing Shaobo et al. (2024) argued that smart tourism, enabled by new-generation information technologies, entails the systematic integration and deep development of both physical and informational tourism resources, serving the needs of the public, enterprises, and governments as a forward-looking new model of tourism [10]. Similarly, Fang Yihui (2024) described smart tourism as a new form of tourism that applies advanced technologies such as the Internet of Things (IoT), cloud computing, 5G, and high-performance information processing to optimize the

coordination of tourism resources and information [11].

On the other hand, some scholars maintain that when the notion of “smartness” is embedded in tourism, it should be understood in a broader sense. Beyond technology, institutional arrangements and human factors must also be considered. This value-function perspective defines smart tourism as a modernized tourism activity or model built upon generalized information services, enabling rapid dissemination of information, innovative tourism management, improved services and experiences, and more efficient resource utilization. Min Jiayao (2024) emphasized that smart tourism, as an integrated application of IoT, big data, and cloud computing, provides customized and efficient services, transforming traditional management practices [12]. Its key features—comprehensive processes, spatiotemporal coverage, cross-media integration, multi-terminal access, and institutional collaboration—enhance tourism competitiveness, improve service accessibility, foster interactions between visitors and residents, enrich destination experiences, and simultaneously promote residents’ quality of life and the sustainable development of destinations.

2.3. Digital Economy and Smart Tourism

With the rapid development of the digital economy and the ongoing transformation of the tourism industry, the integration of the digital economy and smart tourism has become a focal point of current research. This convergence not only presents new development opportunities for the tourism sector but also raises higher demands for innovation and sustainable growth. Tourism in the digital era is expected to be more competitive, as digital technologies such as big data, artificial intelligence, and cloud computing play crucial roles in smart tourism, enhancing both the quality and efficiency of services. The widespread application of these technologies has laid a solid foundation for the digital transformation of the tourism industry [13].

At the same time, rising consumer expectations regarding service quality and travel experiences are prompting tourism enterprises to leverage digital tools to improve service delivery and operational efficiency. However, integrating the digital economy with smart tourism also faces significant challenges, including data security and privacy protection, the digital divide, and difficulties in aligning technology with business operations. The collection, storage, and utilization of massive amounts of tourist data involve security risks and privacy concerns, which have become critical factors limiting the development of the digital economy [14]. Moreover, variations in digital technology access and usage across regions and demographic groups may prevent some tourists from fully benefiting from technological integration. Therefore, the deep integration of digital technologies with tourism operations requires careful adaptation to the specific characteristics of the industry.

Overall, existing studies rarely explore the deep integration of the digital economy and smart tourism, especially in terms of constructing and evaluating smart tourism service systems, leaving a research gap that this study seeks to address.

3. Design of the Smart Tourism Evaluation System

The construction of a smart tourism evaluation system is a critical step in measuring the intelligent transformation of the tourism industry. The quality of this system directly affects

the scientific validity of the assessment results. Existing research has addressed principles for indicator selection and hierarchical structuring. Scholars such as Yao Guozhang and Chen Fei have proposed a three-tier indicator framework following conventional design logic: the goal layer (primary indicators) at the top assesses overall development; the system layer (secondary indicators) in the middle comprises four relatively independent supporting subsystems; and the status layer (tertiary indicators) at the bottom reflects the implementation outcomes of secondary indicators through multidimensional observation points. This framework adopts differentiated weighting to ensure both synergy and distinction in indicator importance [15].

In terms of methodological innovation, Deng Chaotian (2018) proposed a four-stage hierarchical evaluation model with practical value, dividing development into the initial, basic, developmental, and advanced stages. This progressive evaluation framework facilitates phased achievement of construction goals and enhances the feasibility of

implementation [16]. With the rapid growth of smart tourism projects, the value of related evaluation systems has become increasingly evident, though current research remains insufficient. Notably, conducting empirical studies on evaluation indicators in leading regions of smart tourism development and establishing effective feedback mechanisms can simultaneously enhance visitor experiences and optimize industry promotion strategies [17].

Considering the diverse needs of tourists for convenience, safety, and experience quality, this study, in the context of the digital economy, systematically constructs a smart tourism service evaluation system for the Southern Sichuan Economic Zone, drawing on the frameworks developed by Zhang (2016) and Lu (2020) [18][19]. The system evaluates six key dimensions: Smart Tourism Visiting Services, Smart Tourism Information Services, Smart Tourism Safety Services, Smart Tourism Transportation Services, Smart Tourism Supervision Services, and Smart Tourism Catering and Accommodation Services. The detailed indicators are presented in Table 1.

Table 1. Smart Tourism Service Evaluation Indicators in the Southern Sichuan Economic Zone

Primary Indicator	Secondary Indicator	Tertiary Indicator
Construction of Smart Tourism Service System in the Southern Sichuan Economic Zone under the Digital Economy	Smart Tourism Sightseeing Services	Urban Self-service Shopping Infrastructure
		Urban Cultural Literacy
		Urban Cultural Development Index
		Intelligent Environmental Quality Monitoring
	Smart Tourism Information Services	Real-time Monitoring of Scenic Area Capacity
		Intelligent Promotion of Alcohol Culture or Cultural & Creative Products
		Free Wi-Fi Coverage in Tourist Concentration Areas
		Communication Signal Coverage in Tourist Concentration Areas
	Smart Tourism Safety Services	Public Broadcasting System Availability in Tourist Concentration Areas
		Tourism Information Push Capability
		Querying and Ordering Tourism-related Products
		Development and Operation of Mobile Apps
	Smart Tourism Transportation Services	Cloud Service Platform Operational Quality
		Food Safety Traceability Management
		Digitalization of Safety Data Collection
		Full Coverage of Video Surveillance
	Smart Tourism Regulatory Services	Dynamic Monitoring of Tourist Flow
		Intelligent Safety Risk Alerts
		Accuracy of Urban Tourism Navigation
		Personalized Urban Tourism Route Planning
	Smart Tourism Dining and Accommodation Services	Intelligent Parking System
		Smart Guide System
		Connectivity Between Smart Transport and Landmark Sites
		Online Processing of Tourism Administrative Approvals
	Smart Tourism Supervision Services	Digital Management of Travel Agency and Tour Guide
		Digital Management of Tourism Complaints
		Digital Management of Tourism Law Enforcement
		Smart Dining Services
	Smart Tourism Catering and Accommodation Services	Smart Hotel Room Control System
		Smart Hotel Check-in/Check-out System

4. Determination of Weights for the Evaluation Model

One of the key steps in evaluating smart tourism services in the Southern Sichuan Economic Zone is the determination of indicator weights. The accuracy and objectivity of the

evaluation results largely depend on the rationality of the constructed weighting system. In this study, the Analytic Hierarchy Process (AHP) is employed to determine the weights, following the steps outlined below:

(1) Establish the hierarchical structure model for AHP evaluation.

(2) Construct the judgment matrix A.

In this study, the 1–9 scale method shown in Table 2 is employed to assign values. The elements of the comparison matrix reflect the relative importance of different factors, resulting in the formation of the judgment matrix A.

$$A = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{bmatrix}$$

Table 2. 1–9 Scale Method

Scale	Meaning
1	The influence of element Ci is equal to that of element Cj
3	The influence of Ci is slightly stronger than that of Cj
5	The influence of Ci is stronger than that of Cj
7	The influence of Ci is significantly stronger than that of Cj
9	The influence of Ci is absolutely stronger than that of Cj
2,4,6,8	The relative influence of element Ci over element Cj falls between the two adjacent levels mentioned above Intermediate values between the two adjacent judgments
1,1/2,...,1/9	The relative influence of element Ci over element Cj is the reciprocal of the value given above.

(3) Weight Calculation and Consistency Test

Taking the primary indicators of the Southern Sichuan Economic Zone Smart Tourism Service Evaluation System as an example, this study calculates the eigenvector and the maximum eigenvalue, and performs a consistency test. The detailed steps are as follows:

Let the judgment matrix of the primary indicators be A:

$$A = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{bmatrix} \quad (1)$$

Normalize the column vectors of matrix A to obtain matrix B:

$$B = \begin{bmatrix} b_{11} & b_{12} & \cdots & b_{1n} \\ b_{21} & b_{22} & \cdots & b_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ b_{n1} & b_{n2} & \cdots & b_{nn} \end{bmatrix} \quad (2)$$

$$\text{Where, } b_{ij} = \frac{a_{ij}}{\sum_{i=1}^n a_{ij}} (i, j = 1, 2, \dots, n).$$

Calculate the eigenvector:

$$W = \begin{bmatrix} w_1 \\ w_2 \\ \vdots \\ w_n \end{bmatrix} = (w_1, w_2, \dots, w_n)^T \quad (3)$$

$$\text{Where, } w_1 = \frac{1}{n} \sum_{j=1}^n b_{ij} (i, j = 1, 2, \dots, n).$$

Compute the maximum eigenvalue of the judgment matrix:

$$\lambda = \frac{1}{n} \sum_{i=1}^n \frac{(Aw)_i}{w_1} = \frac{1}{n} b_{ij} \sum_{j=1}^n \frac{a_{ij} w_j}{w_1} \quad \text{max} \quad (4)$$

Calculate the consistency ratio (CR). Due to differences in subjective judgments, inconsistencies may arise. To ensure the accuracy and reliability of the calculation, a consistency test is applied to determine whether the matrix deviates excessively from consistency. The test is conducted as follows:

$$CI = \frac{\lambda_{max} - n}{n - 1} \quad (5)$$

$$CR = \frac{CI}{RI} \quad (6)$$

If $CR < 0.1$, the matrix passes the consistency ratio test. If not, it is necessary to consult experts again and adjust the judgment matrix until the consistency ratio meets the acceptable threshold. The values of RI are shown in Table 3.

Table 3. RI Values for Matrices of Orders 1–9

Orders	1	2	3	4	5	6	7	8	9
RI	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45

5. Indicator Weighting

Based on data reliability, this study employs the expert scoring method. Fifteen experts with extensive experience in the tourism industry were invited to score the pairwise importance of indicators at all levels within the Smart

Tourism Service Evaluation System of the Southern Sichuan Economic Zone. After multiple rounds of discussion and revision, a final scoring sheet was established, with consensus reached among the majority of experts.

Table 4. Indicator Weights of the Smart Tourism Service System in the Southern Sichuan Economic Zone

Primary Indicator	Secondary Indicator	Weight	Tertiary Indicator	Comprehensive Weight
Construction of Smart Tourism Service System in the Southern Sichuan Economic Zone under the Digital Economy	Smart Tourism Sightseeing Services	0.111	Urban Self-service Shopping Infrastructure	0.009
			Urban Cultural Literacy	0.025
			Urban Cultural Development Index	0.030
			Intelligent Environmental Quality Monitoring	0.018
			Real-time Monitoring of Scenic Area Capacity	0.010
			Intelligent Promotion of Alcohol Culture or Cultural & Creative Products	0.019
			Free Wi-Fi Coverage in Tourist Concentration Areas	0.022
			Communication Signal Coverage in Tourist Concentration Areas	0.027
	Smart Tourism Information Services	0.272	Public Broadcasting System Availability in Tourist Concentration Areas	0.025
			Tourism Information Push Capability	0.046
			Querying and Ordering Tourism-related Products	0.053
			Development and Operation of Mobile Apps	0.047
	Smart Tourism Safety Services	0.246	Cloud Service Platform Operational Quality	0.052
			Food Safety Traceability Management	0.043
			Digitalization of Safety Data Collection	0.038
			Full Coverage of Video Surveillance	0.037
			Dynamic Monitoring of Tourist Flow	0.068
			Intelligent Safety Risk Alerts	0.060
			Accuracy of Urban Tourism Navigation	0.048
			Personalized Urban Tourism Route Planning	0.043
	Smart Tourism Transportation Services	0.172	Intelligent Parking System	0.025
			Smart Guide System	0.023
			Connectivity Between Smart Transport and Landmark Sites	0.033
			Online Processing of Tourism Administrative Approvals	0.014
	Smart Tourism Regulatory Services	0.101	Digital Management of Travel Agency and Tour Guide	0.018
			Digital Management of Tourism Complaints	0.036
			Digital Management of Tourism Law Enforcement	0.033
	Smart Tourism Dining and Accommodation Services	0.098	Smart Dining Services	0.040
			Smart Hotel Room Control System	0.026
			Smart Hotel Check-in/Check-out System	0.032

From the perspective of indicator-level weights, there is considerable variability among the 30 indicators. Specifically, the indicator with the highest weight, “Dynamic Monitoring of Tourist Flow” (0.068), contrasts sharply with the indicator with the lowest weight, “Urban Self-service Shopping Infrastructure” (0.009), indicating that certain factors have a more prominent impact on the evaluation of smart tourism services, while others are relatively less significant. This variability reflects the differing priorities and practical needs across various service domains. Overall, the selection of indicators demonstrates a clear degree of differentiation, enabling the evaluation system to accurately capture the complexity and multidimensionality of the smart tourism service system.

6. Summary

This study focuses on the Southern Sichuan Economic Zone, providing an in-depth analysis of the recent

development and future prospects of the tourism markets in its four cities. In light of the rapid growth of the digital economy and under the impetus of national policies, the study proposes the construction of a smart tourism service system for the Southern Sichuan Economic Zone and establishes a comprehensive evaluation framework encompassing six dimensions. The aim is to help the cities within the region leverage their respective strengths in tourism, correctly balance cooperation and competition, and achieve a mutually beneficial outcome.

To ensure the effective implementation of the smart tourism service evaluation system, the Southern Sichuan Economic Zone must continue to enhance its infrastructure and strengthen core tourism competitiveness. From the perspective of regional coordinated development, municipal and county administrative bodies also need to deepen collaborative mechanisms, build a cross-regional policy coordination network, and improve the governance system and institutional framework for smart tourism. Accelerating

the integrated allocation of tourism resources across the urban cluster is essential. Such institutional innovation not only unleashes the agglomeration effect of the regional tourism economy but also provides a strategic paradigm for the upgrading of the tourism industry in Sichuan as a whole and nationwide.

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