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Construction of a Measurement Index System for the High-Quality Development of Tourism Leisure Street Blocks Based on Multi-Source Big Data

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Abstract

Promoting the high-quality development of tourism leisure street blocks is an important path for all provinces in China to realize the upgrading of the cultural and tourism industry and the transformation of cultural resources. Investigating and evaluating the high-quality development level of tourism leisure street blocks is a crucial prerequisite for formulating block optimization measures and achieving the high-quality development of tourism leisure street blocks. At present, most investigations and evaluations of tourism leisure street blocks rely on on-site inspection models, and there exists the problem of unclear content in investigation and evaluation, which makes it difficult to provide timely and accurate support for decision-making. Combined with national policy orientations, this paper, based on theories such as the 3D built environment, takes 87 evaluated tourism leisure street blocks in Shaanxi Province as examples to explore the measurement index system for the high-quality development of tourism leisure street blocks. This paper adopts methods such as literature review and focus group discussion, and based on multi-source heterogeneous data, constructs a measurement system consisting of 35 indicators covering four dimensions: built environment, economy, culture, and tourist experience, laying a foundation for investigating and evaluating the high-quality development of tourism leisure street blocks.

Keywords: TOURISM LEISURE STREET BLOCKS, 3D INDICATORS OF BUILT ENVIRONMENT, MULTI-SOURCE BIG DATA, HIGH-QUALITY DEVELOPMENT, INDEX SYSTEM

1 Introduction

As key cultural tourism spaces, leisure blocks' quality development is crucial. Traditional evaluation methods are inefficient. This study constructs a multi-source big data index system to assess blocks' built environment, economy, culture, and tourist experience, using Shaanxi as a case to support sustainable, differentiated development.

2 Research Progress on the Evaluation of High-Quality Development of Tourism Leisure Street Blocks

Evaluation of tourism leisure street blocks' high-quality development is evolving towards multi-dimensional frameworks, integrating built environment, economy, culture, and tourist experince. Researchers utilize novel data sources like GIS, POI, and social media. However, a critical gap remains: the lack of a unified evaluation system and a dedicated database, hindering standardized assessment.

3 Research Methods

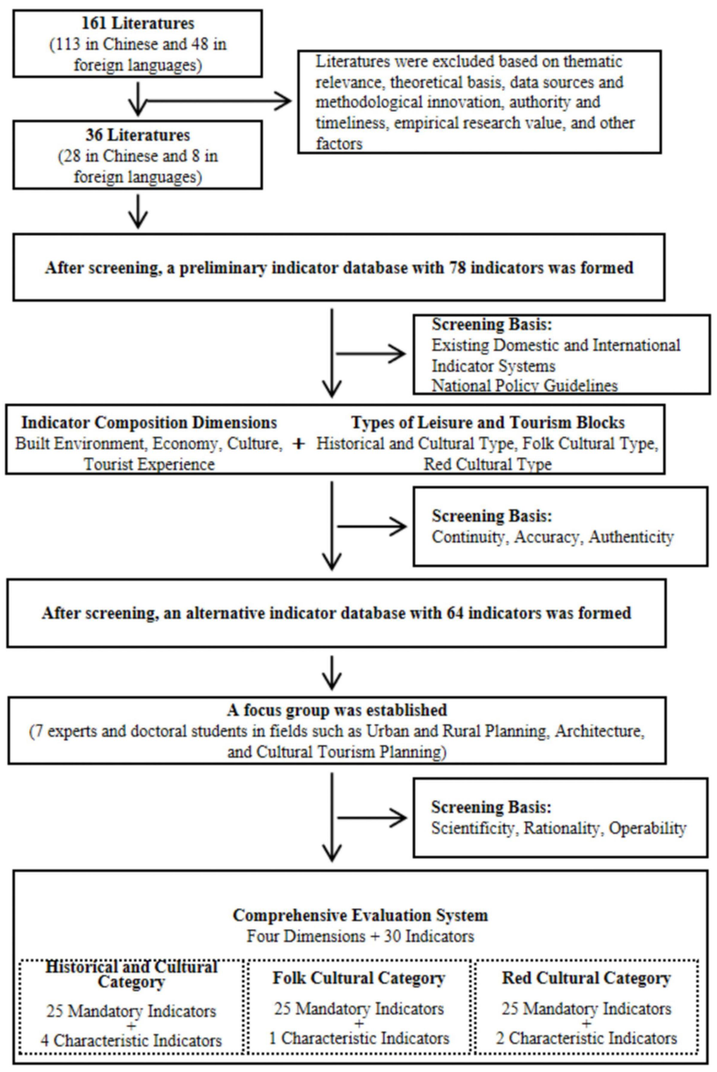

Fig.1 Flow Chart of Indicator Screening Methods

4 Evaluation Index System for the High-Quality Development of Tourism Leisure Street Blocks

•**The indicator system is divided into four dimensions:** environmental carrying, economic driving, cultural empowerment, and experience valueadded, which work synergistically to support the high-quality development of the blocks(Figure 3).

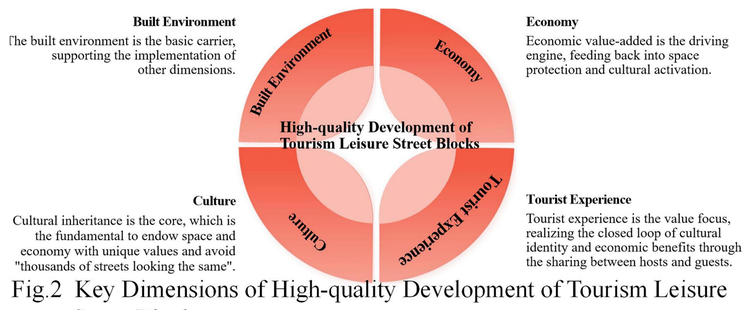

Fig.2 Key Dimensions of High-quality Development of Tourism Leisure Street Blocks

•**Block Classification:**The tourism leisure street blocks in Shaanxi Province are primarily categorized into three types: historical and cultural blocks, red cultural blocks, and folk cultural blocks. Each type possesses its own distinct core values and features.

•**Selection and Measurement Methods of Indicators**

Table1 Evaluation Indicator System for the Built Environment Dimension

Evaluation Item Level	Dimension	Factor	Operational Definition	Measurement Method	Indicator Nature
Built Environment	Density	On-site Active Population Density	It refers to the number of permanent residents and tourists per unit area, and is used to measure the degree of population agglomeration in the block	Open-source WORLD POP data is adopted, and GIS software is used to calculate the total population in the area divided by the total land area of the area. It can be divided into two sub-indicators: the annual visitor volume of the block (VQy) and the visitor load during peak hours (VL). The former is obtained through the annual statistical data of the management department, while the latter is characterized by the number of visitors per 1 m² space in the block during a specific period to represent residents.	Mandatory Indicator
		Building Density - Proportion of Building Base Area	It refers to the ratio of the floor area of the first floor of a building to the area of the land parcel, and is used to measure the building coverage rate	GIS software is used to process the vector data of building outlines (obtained from OpenStreetMap or Amap API), calculate the sum of the base areas of all buildings, and then divide it by the total area of the block's land parcel. The formula is: Building Density = (Total Building Base Area / Total Land Parcel Area) × 100%	Mandatory Indicator
		Building Density - Construction Intensity	It refers to the ratio of the total building scale to the land use area, and reflects the development intensity	Combine the vector data of building outlines with building height information (extracted from lidar or oblique photography 3D real-scene models), calculate the total building area, and then divide it by the total area of the land parcel. The formula is: Floor Area Ratio (FAR) = Total Building Area / Total Land Parcel Area. Among them, Total Building Area = Σ (Base Area of a Single Building × Number of Floors)	Mandatory Indicator
	Diversity	Point of Interest (POI) Density	It refers to the ratio of the number of POI points in a block to the land use area, and reflects the degree of land use mixing	Open-source POI (Point of Interest) data from Amap is adopted, and GIS software is used to extract the number of POI points within the block scope	Mandatory Indicator
		Business Format Diversity	Business Format Diversity refers to the richness, quantity distribution and functional mixing degree of business formats such as commerce, culture and leisure in a block. It evaluates the richness and balance of the block's commercial and service functions, and reflects consumption attractiveness and spatial vitality.	The location entropy of major categories of POI within the street buffer zone. First, standardize the business format classification of POI data; then calculate using the information entropy formula.	Mandatory Indicator
	Public Space Accessibility	Amenities	Amenities are used to represent facilities, services or environments that make people feel pleasant and satisfied, and they are the basic elements that constitute a scene	Open-source POI (Point of Interest) data from Amap is used to capture and manually clean the amenities in the first block	Mandatory Indicator
		Shop Proportion	It is a direct measurement indicator for the degree of commercialization of a block	It refers to the ratio of the number of shop buildings to the total number of buildings in a block. Specifically, basic data is collected through time-phased and zoned surveys combined with spatial annotation methods, which are then input and integrated into the GIS system to establish spatial mapping associations for the corresponding indicator values.	Mandatory Indicator
		Branch Road Network Density	It refers to the total length of branch roads per unit area, reflecting the micro-circulation capacity, pedestrian accessibility, spatial permeability and vitality of a block. It is a core indicator for measuring the pedestrian accessibility and traffic connectivity of a block.	GIS spatial analysis is adopted to screen branch roads and lanes with moderate width that allow pedestrian access, and calculate the ratio of their total length to the block area. The formula is: Branch Road Network Density = Total Length of Branch Roads (km) / Block Area (km²)	Mandatory Indicator
		Number of Public Spaces	It refers to the total number of public spaces such as squares, green spaces and auxiliary open spaces within the block scope. It is a basic indicator for measuring the leisure carrying capacity and social interaction opportunities of a block.	GIS spatial analysis is adopted to identify and count the locations of squares, parks, green spaces and auxiliary open spaces within the block scope	Mandatory Indicator
		Public Space Scale (Green Space Rate)	It refers to the total area, per capita area, proportion of land occupation and spatial distribution balance of the public space in the block, reflecting the spatial carrying capacity and ecological regulation ability.	Vectorize and outline the boundary contours of all public spaces in the GIS platform, and count the total area, per capita area and proportion of land occupation	Mandatory Indicator
	Aesthetics / Beautiful / Pleasing to the eye	The coordination degree of the landscape environment	It refers to the unity of the overall landscape of the block and the architectural landscape, as well as the tidiness of the space, reflecting the continuation of the historical context of the block and the level of landscape quality	Adopt public scoring of photos, artificial intelligence image analysis and expert scoring to comprehensively quantify the landscape coordination degree	Mandatory Indicator
		The proportion of historical and cultural resources in the block	It is used to measure the enrichment degree of its cultural heritage and characteristic endowments. This indicator reflects the inheritance strength of the local context and the unique competitiveness of tourism development by quantifying the proportion of the quantity and area of historical relics and cultural carriers in the total resources of the block.	Based on multi-source POI data, identify and count the cultural resource points (such as cultural relic protection units, historical buildings, museums, intangible cultural heritage sites) that are included in the official protection list or have significant historical value	Characteristic indicators of historical and cultural categories
		The number of national historical buildings	It refers to the total number of historical buildings recognized by the state within the block, which is a key yardstick for measuring the depth of cultural value, brand uniqueness and core tourism attraction of the block	Count the quantity according to the national official list	Characteristic indicators of historical and cultural categories
		The number of provincial historical buildings	It refers to the total number of historical buildings recognized at the provincial level within the block, reflecting the local historical value, cultural characteristics and resource endowment of the block	The number is counted according to the provincial official list	Characteristic indicators of historical and cultural categories
		Identifiability	The qualities of spatial recognizability, identifiability and distinctiveness, as well as the imagery of landmarks and activities	Extracted by using Baidu Street View images	Mandatory Indicator
		Sky openness	The average value of the proportion of the sky within the street, reflecting the visual openness of the space	Extracted by using Baidu Street View images	Mandatory Indicator
		Spatial enclosure degree	The proportion of buildings, walls, columns, fences and trees within the street in the street view image, reflecting the enclosure degree of the street space	Extracted by using Baidu Street View images	Mandatory Indicator
		Street green vision rate	The proportion of green plant pixels within the street in the total pixels of the street view image, reflecting the greening degree of the space	Extracted by using Baidu Street View images	Mandatory Indicator

Table2 Evaluation Indicator System for the Built Environment Dimension

Evaluation Item Level	Factor	Operational Definition	Measurement Method	Indicator Nature
Economy	Business Format Operation Status	Reflects the operation situation of shops in the block	Adopts shop evaluation data from Dazhong Dianping (a Chinese consumer review platform)	Mandatory Indicator
	Rental Price	Neighborhood Rental Price (HRb) and Block Rental Price (HRd) are measured and represented by the monthly rental price per 1 m² of housing space. This study specifically uses the Rent Premium Index (RPI) as a discriminant indicator to measure the actual impact of the block's commercial development on its housing rental prices. Specifically, it is represented by the quotient of the rental price of commercial shops in a certain area of the block divided by the rental price of commercial shops in ordinary urban areas during the same period (HRn), i.e., RPId (RPIb) = HRd (HRb) / HRn.	Adopts housing price data of residential communities from Lianjia and Beike (Chinese real estate platforms)	Mandatory Indicator
	Passenger Flow Heat Analysis	Conducts quantitative analysis on the passenger flow heat in the evaluation area to reflect the passenger flow volume	Baidu heat map data is technically processed using ArcGIS 10.2 software to form a time-period distribution analysis map of heat values. The heat values for workdays and rest days are calculated separately.	Mandatory Indicator
	Business Format Scale	The ratio of the land area occupied by shops of various commercial business formats to the total land area of the block	The shop area is extracted and calculated using ArcGIS 10.2 software	Mandatory Indicator
Culture	Irreplaceability	Whether the block culture has irreplaceability	Subjective Evaluation	Characteristic Indicators for Historical and Cultural Category
	Cultural Activities	The block has profound cultural heritage and a high degree of richness in cultural activities	The number of relevant cultural activities is extracted using platforms such as Douyin and Xiaohongshu	Characteristic Indicators for Folk Cultural Categories
	Popularity	The media mention rate of block culture	The Google Books Ngram Corpus is used as the source database for measuring the popularity of block culture	Mandatory Indicator
Tourist Experience	Adequacy of Tourism Infrastructure	The adequacy of infrastructure such as tourist centers and public toilets	The ratio of infrastructure (including tourist centers and public toilets) to the block area in the block	Mandatory Indicator
	Tourist Stay Time	Average Per Capita Tourism Stay Duration	On-site Survey	Mandatory Indicator
	Tourist Impression	Whether a deep impression is left	Subjective Evaluation	Mandatory Indicator
	Recommendation Intention	Whether one is willing to recommend traveling to this block to relatives and friends	Subjective Evaluation	Mandatory Indicator
	Revisit Intention	Whether one is willing to revisit	Subjective Evaluation	Mandatory Indicator

5 Research Results and Conclusions

This study develops a comprehensive evaluation system for tourism and leisure street blocks, encompassing four dimensions and 30 indicators. Recognizing the distinct differences among historical, folk, and red cultural blocks, the system innovatively includes 25 mandatory and 5 characteristic indicators. This design aims to guide each block type to accurately anchor its core value, fostering characteristic development and differentiated competition while avoiding homogenization. By balancing commonality and individuality, the system provides a scientific basis for government decision-making and refined operational management, ultimately driving high-quality development in the cultural tourism sector.