Scale Development of Sustainable Tourism Development from The Perspective of Total Quality Management

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Abstract

Sustainable tourism development (STD) is an essential component of the circular economy and has garnered significant attention from governmental agencies and the academic community worldwide. However, existing research has mostly focused on the protective development of tourism resources, lacking breakthroughs in management methods, especially measurement indicators. This study adopts an innovative approach, integrating bibliometric analysis, interview, and questionnaire survey to construct a multidimensional item pool for the influence of total quality management (TQM) on STD, utilizing various methods including exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) to perform the validity verification of the TQM-STD scale. With the support of bibliometric analysis and expert knowledge, we construct a TQM-STD scale system consisting of five dimensions: full participation (FP), whole process management (WPM), comprehensive management (CM), overall perception (OP), and tourism benefits (TB), comprising 30 items. This system serves as an accurate and effective measurement tool. This research provides theoretical exploration for the effective identification of STD influencing factors and offers crucial insights for improving the management strategy of STD at the tourist attraction scale. This study represents an attempt to apply project management principles to the management of tourist attractions. The developed scale provides a practical measurement tool for sustainable development in tourist attractions, enriching concepts and methods in tourist attraction management and expanding the application of TQM.

Keywords: Sustainable Tourism Development; Total Quality Management; Scale Development Validation; Tourist Attraction Scale

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Introduction

In 2021, China proposed to establish an economic system of green, low-carbon, and cyclic development by 2025, which includes digital tourism and sustainable tourism. From 2018 to 2022, tourism revenue in Sichuan Province contributed 9.3% to the GDP, indicating its significant role in economic development. In 2023, the Development and Reform Commission of Sichuan Province (DRCSP) issued a decree emphasizing the need to innovate management methods to optimize STD. It is evident that both the central and local governments attach great importance to STD.

In recent years, researchers have employed both qualitative and quantitative analysis methods to study sustainable tourism development. For example, Yang et al. (2020) explored the impact of tourism poverty alleviation on sustainable tourism. López et al. (2021) and Tong et al. (2024) investigated the promotion of benign development of tourism destinations by tourist behavior and community participation. Gautam and Bhalla (2024) and Han et al. (2024) examined the influence of residents' support and economic development level on STD. Targeted development has been carried out in the aforementioned areas, leading to the creation of scales such as destination trust (Liu et al., 2019), destination quality (Chandralal & Valenzuela, 2015), and tourist perception (Mukherjee et al., 2018). Additionally, scholars have analyzed the constraining factors and management approaches affecting STD, including policy enforcement (Fernandez-Abila et al., 2024), green development concepts (Penjišević et al., 2024), environmental and social factors (de Bruyn et al., 2023), performance assessment levels (Wu & Yang, 2023), and low-carbon lifestyles (Peeters et al., 2024). The multidimensional and multi-perspective approaches have been employed to develop scales measuring the impact of community and tourist involvement on STD (Fatma et al., 2016; Jeong et al., 2021; Woosnam, 2012). However, there has been limited success in enhancing STD through the reinforcement of the tourist attraction lifecycle management. Total Quality Management (TQM) fundamentally emphasizes the comprehensive management of products life cycle (Witt & Muhlemann, 1994) and has been widely applied in infrastructure construction management (Akhmatova et al., 2022; Othman et al., 2020), corporate performance and innovation management (Anil & Satish, 2016; Singh et al., 2018; Yusr et al., 2017), accumulating significant experience and knowledge in scale development and design. Moreover, it has gradually played an important role in emerging industries such as environmental sustainability (Akhmatova et al., 2022; Jum'a et al., 2023) and renewable energy (Hussain et al., 2023). However, there is a scarcity of literature that utilizes the multidimensional aspects of TQM to study STD, particularly the lack of mature TQM scales tailored specifically for STD.

In this context, by mining existing relevant literature and expert knowledge, we aim to delineate the connotations of STD and the dimensions of TQM. We will design a multidimensional item pool to assess the impact of TQM on STD. Through exploratory factor analysis (EFA) and confirmatory factor analysis (CFA), we will refine and reduce the item pool, ultimately developing a scale that is both practically valuable and widely applicable.

Literature Review

Bibliometric analysis can utilize big data mining from specific literature databases to analyze the current research hotspots in a particular field, which is a highly effective method for literature reviews (Moed, 2006). We searched the article using 'sustainable tourism

development' and 'total quality management' as keywords in the Web of Science (WOS) database followed by literature screening. Bibliometric analysis was conducted on articles highly relevant to both STD and TQM. The results (Figure 2) showed numerous studies on STD, but few applying TQM to STD. Considering the literature's characteristics and our research focus, we divided the literature review into two parts. The first part is "Dimensions and Connotations of STD," section 2 is "Mechanisms of TQM Impact on STD," section 3 is "TQM & STD scale."

Dimensions and connotations of STD

Tourism, as an integral component of the circular economy (Gabor et al., 2023), is regarded as a crucial industry for China's implementation of the Sustainable Development Goals by 2030. Sustainable tourism development (STD) should address the current needs of tourist destinations and travelers, while also considering the future requirements of these stakeholders. According to the Sustainable Tourism for Development Guidebook, it involves achieving coordinated development among governments, businesses, communities, and tourist attractions, leading to a sustainable state characterized by expected quality of life, environmental standards, and ongoing benefits for governments and businesses. The Global Sustainable Tourism Council outlines five objectives for sustainable tourism development: enhancing ecological awareness, promoting fair tourism development, improving the quality of life for residents in tourist destinations, providing high-quality tourism experiences to travelers, and preserving environmental quality.

Previous research (Figure 1) on STD has primarily focused on three dimensions: economic benefits, social benefits, and ecological benefits (Czernek-Marszalek, 2020; León et al., 2021; Khan et al., 2020), and has explored aspects such as ecological awareness, fair development, resident livelihoods, tourism experiences, and environmental quality (Bramwell, B., 2015). Among them, the widely accepted connotation of STD is that it refers to "In a certain manner and scale, developing in specific areas, sustaining vitality over the long term without causing environmental degradation or alteration" (Boluk et al., 2019; Fernandez et al., 2024; Spenceley & Rylance, 2019; Zhao et al., 2024). This concept emphasizes the importance of advocacy and education, social participation, community culture, and green concepts in STD (Diallo et al., 2022; Marchi et al., 2023; Maziliauske et al., 2024; Penjišević et al., 2024; Stojanović et al., 2024;). Tourism management, tourism impact, and tourism relationships are also extensions of the connotations of STD. Some researchers believe that sustainable tourism development requires addressing the relationships between tourists, the environment, and local communities (Cheung, 2019). It involves long-term planning and layout (Angelevska & Rakicevik, 2012), broadening the perspectives of tourism managers (Ruhanen, 2008), innovating management concepts (Martínez-Martínez et al., 2023), and prioritizing the needs of stakeholders (Roxas et al., 2020). Additionally, STD's influencing factors and management approaches can also constrain the direction of future tourism development. For example, some scholars argue that factors such as economic development levels (Filipiak et al., 2023), tourism management strategies (Ziyadin et al., 2019), and green development concepts (Penjišević et al., 2024) may limit sustainable tourism development. To achieve sustainable tourism development, strategies may involve enhancing performance assessment levels (Wu & Yang, 2023), altering energy consumption patterns (Wu et al., 2023), reducing carbon emissions (Peeters et al., 2024), and enhancing overall tourism benefits (Tian et al., 2022).

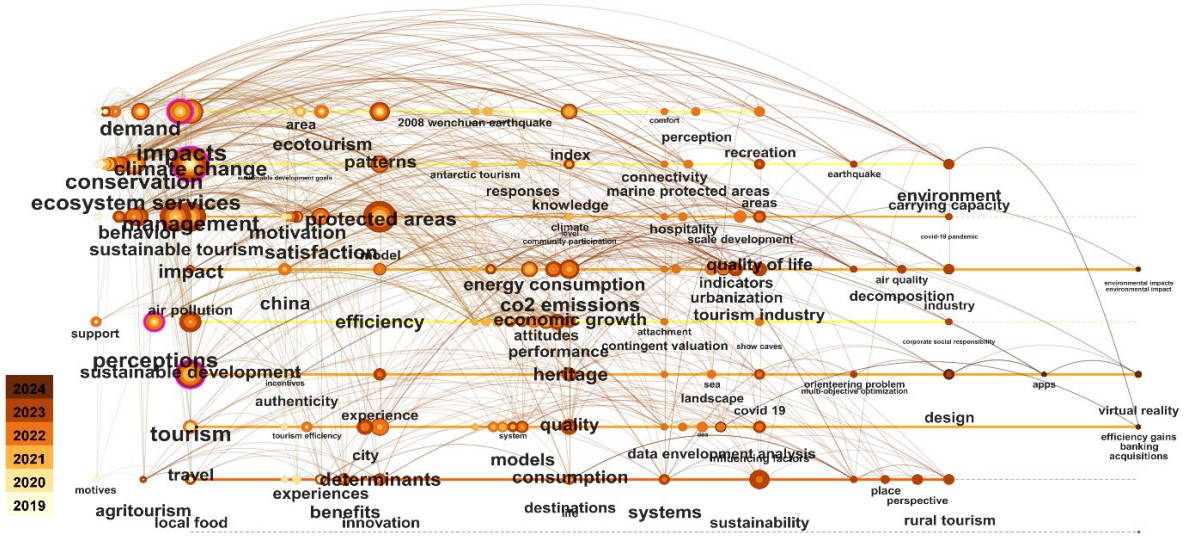

Figure 1: Bibliometric Analysis of Literature on TQM and STD in Recent Years (Web of Science)

Mechanisms of TQM impact on STD

Total Quality Management (TQM), as an important management approach (Witt & Muhlemann, 1994), has been widely applied in traffic management (Akhmatova et al., 2022), construction quality management (Othman et al., 2020), corporate performance management (Anil & Satish, 2016; Singh et al., 2018), and innovation management (Yusr et al., 2017). TQM emphasizes quality as its core (Ho et al., 2023), encompassing three dimensions: full participation, whole process management, and comprehensive management (Wang et al., 2024). In recent years, TQM has gradually begun to be applied in sustainability research, such as environmental sustainability (Akhmatova et al., 2022; Jum'a et al., 2023), renewable energy management (Hussain et al., 2023), and sustainable development opportunity studies (Isaksson et al., 2023). However, there is currently limited literature on TQM in the context of sustainable tourism development (Bhuiyan & Wahab, 2018). TQM consists of full participation, whole process management, and comprehensive management. Existing research results mainly analyze the impact of STD by studying single dimensions. For example, studies suggest that community involvement is a prerequisite for sustainable tourism destination development (Iqbal et al., 2023), different tourism stakeholders and residents have significant influences on sustainable tourism development (Gautam & Bhalla, 2024), emphasizing stakeholder participation in tourism management to enhance tourism experiences (Roxas et al., 2020), and asserting that local governments, tourists, residents, and employees are all stakeholders in sustainable tourism development (Liu et al., 2019). Some studies have explored the entire process of tourism area development based on the concept of the whole process management, revealing that tourism area development conforms to the lifecycle theory (Moore & Whitehall, 2005). Moreover, scholars have analyzed the impact of comprehensive management on STD from multiple perspectives. For instance, Li et al. (2024) suggests that community involvement, tourism certification, and public-private partnerships are important strategies for achieving sustainable tourism development. Ahmad et al. (2022) explores the impact of innovation management on sustainable development using panel data, while Roxas et al. (2020) employs systems thinking tools to establish causal relationships

between sustainable tourism variables and analyze the impact of leadership management on STD.

TQM & STD Scales

Through the literature review above, we have gained a clearer understanding of the essence of Sustainable Tourism Development (STD) and the influence mechanism of Total Quality Management (TQM) on STD. Based on this, we further analyzed the development of scales in the TQM and STD fields. We found that TQM has yielded scale development outcomes in areas such as manufacturing (Das et al., 2008), government management (Musenze & Thomas, 2020), and social responsibility(Wang et al., 2023; Khurshid et al., 2022), with the number of dimensions typically ranging from 3 to 8. Meanwhile, scale development in the STD field mainly focuses on aspects such as local residents (Lee, 2013), communities, tourism practitioners (Eslami et al., 2019), and environmental impacts (Chi & Liu, 2023; Rasoolimanesh et al., 2024) on STD, which is closely aligned with previous literature on STD's essence. However, through comparative analysis of the literature, we found a lack of mature scale systems for assessing the influence of TQM on STD, with related research being scarce. Moreover, through a direct comparison of our study with previous research results (such as in tables), we further discovered significant differences in the dimensions and content of similar studies and our own, highlighting the novelty of our perspective. We have developed a TQM-STD scale suitable for the scale of tourist attractions based on a comprehensive understanding of STD's essence and the potential impact of TQM on STD.

Literature conclusion

The literature analysis results reveal that the concept of STD emphasizes maintaining its long-term vitality while not compromising environmental improvement. Its connotations focus on the sustainability of tourism benefits and sustainable tourism perceptions, revolving around five major aspects: ecological awareness, fair development, resident livelihoods, tourism experiences, and environmental quality. STD underscores the construction of harmonious tourism relationships among stakeholders, including local governments, local communities, tourists, and tourism practitioners. It is crucial to identify the influencing factors of STD, particularly emphasizing the impact of tourism planning, tourism management, and community participation. Additionally, regional economic development levels, performance management approaches, and the promotion of green development concepts are considered important management approaches to achieve sustainable tourism development. TQM, as a significant management approach, has gradually been applied in various fields of sustainable development, encompassing dimensions of full participation, whole process management, and comprehensive management. However, there is currently limited comprehensive research on applying TQM to STD, with existing studies predominantly focusing on single dimensions and mainly concentrated on research into full participation and whole process management. Thus, it is evident that there is a lack of literature on utilizing TQM in sustainable tourism development research, indicating the need to encourage researchers to focus on TQM research in the context of STD. Both TQM and STD have rich scales in their respective research fields. However, there is a lack of applicable scales for integrating TQM into the STD field, especially concerning the impact of TQM on STD. Therefore, it is highly valuable to develop a TQM-STD scale that integrates the essence of STDs and the mechanisms of TQM's impact on STD. This scale will have guiding significance for optimizing management methods for sustainable tourism development at the tourist attraction level.

Table 1: Comparative Analysis between this Study and Relevant Research

This Study		Other Similar Studies		
Topic	**Scale dimensions**	**Topic**	**Scale dimensions**	**References**
TQM on STD	①Full participation ②Whole process management ③Comprehensive management ④Overall perception ⑤Tourism benefits	TQM on manufacturing industry	①Top management commitment②Supplier quality③Continuous improvement④Product innovation ⑤Benchmarking⑥Employee involvement ⑦Reward and recognition⑧Education and training	Das et al., 2008
		TQM on local government	①Leadership ②Customer ③Process design and management④Employee ⑤Continuous improvement	Musenze & Thomas, 2020
		TQM on Social Exchange	①Leader-member exchange ②Team–member exchange③Means of self-efficacy ④ Job satisfaction	Wang, 2023
		TQM on socially responsible	①Top management②Strategic planning ③Human resource ④Supplier⑤Customer ⑥Social community ⑦Environment	Khurshid et al., 2022
		TQM on customer loyalty	①Service quality ②Patients' Satisfaction ③Patients' Loyalty	Abu-Rumman et al., 2021
		TQM on education	①Participation/involvement in continuous improvement②teamwork ③empowerment④appraisal systems/recognition ⑤reward for quality ⑥training and development ⑦ leadership	Glaveli et al., 2022
		Resident support for STD	①Community attachment②Community involvement③Perceived benefits④Perceived costs	Lee, 2013
		Resident attitudes for STD	①Perceived impacts②Sense of place ③ Development potential	Zhu et al., 2017
		Community for STD	①Community attachment②Tourism impacts③Life quality④ Residents support	Eslami et al., 2019
		Businesses and government for STD	① Residents ②Tourists ③Businesses ④Government	Rasoolimanesh et al., 2024
		Environment for STD	①Tourism attractions②Ecological resilience ③Traffic accessibility and ④Accommodation capacity	Chi & Liu, 2023
		Ecotourism for STD	①Tourism growth②Ecotourism ③Environment and sustainability of ecosystem ④Government policy	Baloch et al., 2023
		Social Responsibility for STD	①Economic②Social ③Environmental fields	Achmad & Yulianah, 2022

Research Methodology

Data sampling

Leshan Giant Buddha (Figure 2A) and Lizhuang Ancient Tow (Figure 2B) are located in Yibin City and Leshan City, respectively, China. They are both UNESCO World Heritage Sites and attract a large number of visitors each year. The management level can represent the general characteristics of tourist attractions in the Chengdu-Chongqing Economic Circle and is very representative. Therefore, we selected Lizhuang and Leshan Giant Buddha as samples. Leshan Giant Buddha is a National 5A-level scenic area. Carved in the Tang Dynasty (713 AD), it stands at a height of 71 meters, depicting a seated Maitreya Buddha and ranking as China's largest cliff-carved stone sculpture. Li Zhuang Ancient Town is a National 5A-level scenic area. Established during the Southern Liang Dynasty (540 AD), it retains the layout and appearance of ancient towns from the Ming and Qing dynasties.

The data sampling for this study was conducted in three stages. In the first stage, interviews were conducted with tourists, scenic spot employees, and local officials to gather 66 interview records for the analysis of TQM-STD influencing dimensions. The second stage involved the pre-testing phase of the questionnaire, with 180 questionnaires collected (with an effective rate of 91.7%). The third stage was the formal testing phase, during which 700 questionnaires were collected (with an effective rate of 90.2%). The data collection was carried out at the Leshan Giant Buddha and Lizhuang Ancient Town scenic spots within the Chengdu-Chongqing Economic Circle (Figure 2). The data collection process was facilitated by the scenic area management departments and conducted through a combination of online and on-site methods.

Figure 2: Sampled Tourist Attraction.

Methodology

The research framework of this study is mainly divided into three sections (Figure 3). The first part is the item development stage, which involves constructing the item pool using three analytical methods: qualitative analysis (Kvale & Brinkmann, 2009), content-target consistency analysis (Worthen et al., 2014), and project collinearity diagnosis (Shrestha et al., 2020), based on existing literature metrics analysis and interview records. The second part includes the discriminant validity analysis, reliability analysis, and exploratory factor analysis (EFA) (Kyriazos, 2018) of the item pool and pre-test to initialize the scale. The third section involves the utilization of confirmatory factor analysis (CFA) (Marsh et al., 2020) on formal survey data to evaluate the scale's validity. The interrelation between research methodology, objectives, sample, and expected outcomes can be referenced in Table 2.

Table 2: Method and Sample in This Study

Id	Methodology	Objectives	Sample	Expected
1	①Qualitative analysis ②Interview ③Item-objective congruence	Exploring TQM Impact on STD	66 respondents 10 experts	Dimensions of TQM impact on STD
2	①Questionnaire Survey ②Discriminant analysis ③Reliability analysis ④Factor analysis ⑤Questionnaire Survey ⑥ Exploratory factor analysis	Improving items	180 respondents 700 respondents	Initial item pools Generating scales
3	①Confirmatory factor analysis	Scale evaluation	700 respondents	Obtaining scale validity

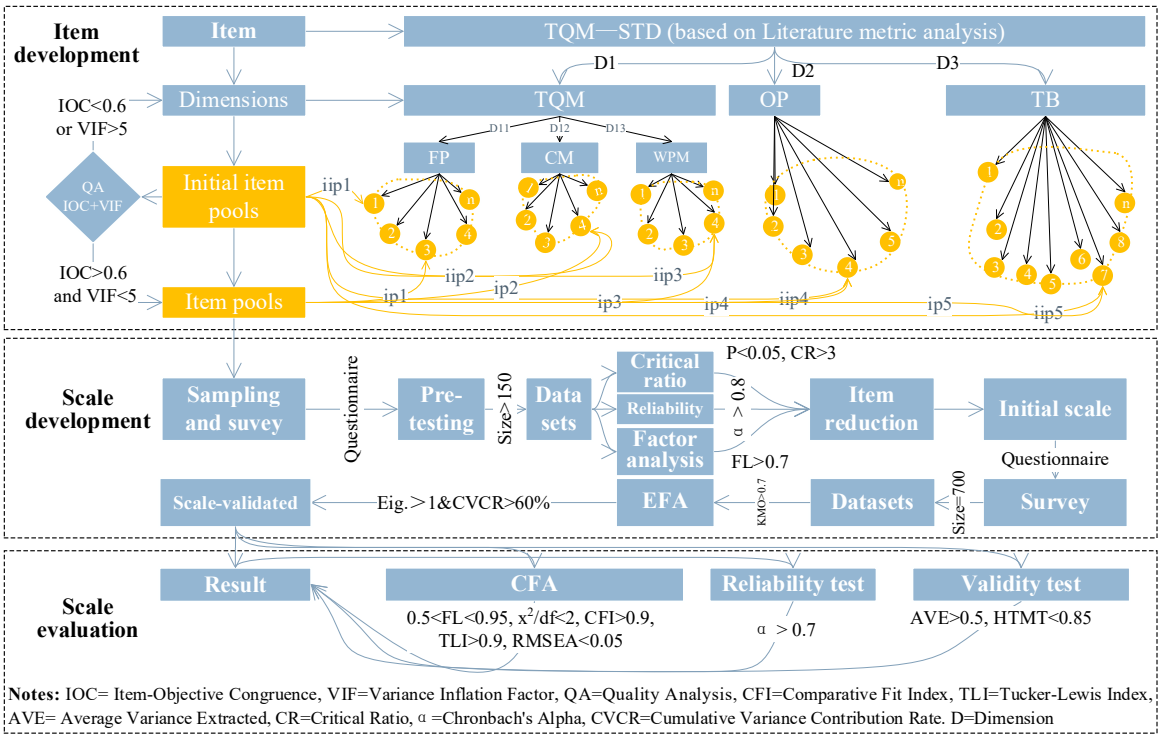

Figure 3: General Research Framework

Analysis and Findings

Item development

The influence of TQM on STD and the extent of its impact are uncertain. To accurately establish the hypothetical relationship between multiple dimensions of TQM and STD, as well as to define the conceptual constructs of each dimension, we conducted interviews at two randomly selected scenic spots in the study area. The interviews focused on the relationship between TQM and STD and involved scenic spot visitors, employees, and local officials. We collected a total of 66 interview records, including 32 visitors, 18 scenic spot employees, and 16 local officials. Using Nvivo12 software, we conducted statistical analysis on the interview records. The results showed that the interviewees mainly believed that participation and process management play a facilitating role in STD. They also believed that full participation and process management have positive effects on tourism revenue and tourism experiences. Based on the interview results and existing reference literature, we constructed five dimensions of TQM for STD and initially defined the constructs of the five dimensions as follows: full participation (FP), whole process management (WPM), comprehensive management (CM), overall perception (OP), and tourism benefits (TB). For the concepts of each dimension, please consult Table 3.

Table 3: Definitions and Explanations of the Constructs (Dimensions)

Constructs	Definition and Explanation
Full participation (FP)	The employees of the tourist attraction should be actively involved in quality management, extending beyond individual or departmental confines, with the expectation that each individual shares the responsibility for quality management.
Whole process management (WPM)	WPM extends quality management across all aspects of the tourist attraction, from planning to operation. Planning and design integrate quality criteria for standards compliance and ongoing improvement during operations.
Comprehensive management (CM)	CM integrates internal and external factors for effective tourist attraction quality management, assessing internal quality factors and incorporating external considerations like cost-effectiveness and visitor services.
Overall perception (OP)	OP refers to tourists' overall experience and impression of a tourist destination, including their perceptions of the scenic environment, service quality, cultural experiences, and attractions' appeal.
Tourism benefits (TB)	TB includes promoting cultural exchange, enhancing social cohesion, creating employment opportunities, fostering local economic development, preserving natural resources, and promoting sustainable development across three dimensions.

Based on the interview results and literature knowledge, we established five dimensions, 14 hypotheses, and 50 items for the impact of TQM) on STD. To ensure consistency between each item and the research objectives, we invited 10 experts to conduct an Item-Objective Congruence (IOC) test (Table 4). After eliminating items with IOC values less than 0.7, we retained 38 items. The IOC test results indicated that each dimension (variable) was adequately represented by its corresponding items. However, the presence of collinearity between items (Shrestha, 2020) was uncertain. Therefore, we used SPSS software

to diagnose collinearity among items within the same variable. The results revealed that there was 1 item each under the FP and STD variables with collinearity issues (VIF > 5). Consequently, these items were removed, leaving us with 36 effective items, distributed across five item pools: OP, FP, WPM, CM, and TB.

Table 4: IOC Test

Dimension	Item	Measurement Scale Adopted	IOC Value
Overall Perception	6	5-point scale ranging from "strongly disagree" to "strongly agree"	0.86
Full Participation	7		0.92
Whole Process Management	5		0.86
Comprehensive Management	9		0.86
Tourism Benefit	9		0.71

Scale development

Item analysis

Item development has undergone construction and screening of items through IOC and collinearity diagnosis. To ensure the scientific rationality of item composition and quantity, we need to conduct item analysis using questionnaires based on the item pool and survey data. This allows us to reassess whether any items need to be removed. With the assistance of the tourism management departments of the surveyed scenic areas, both online and on-site questionnaire surveys and pretests were conducted. The survey questionnaires were collected and preprocessed, resulting in a total distribution of 180 questionnaires. After removing 15 invalid questionnaires, there were 165 valid questionnaires, yielding an effective questionnaire rate of 91.7%. The data from these 165 pretest questionnaires were then subjected to discriminant analysis, reliability analysis, and factor analysis.

The 165 questionnaires were sorted based on the total average score for each variable, with the top 27% of scores categorized as the high-score group and the bottom 27% as the low-score group. The average scores for each variable in the high and low-score groups were calculated separately, and the difference between the two averages represented the discriminant coefficient for each variable (Table 5). A larger absolute value of the difference indicates higher discriminant power for the item. Through independent sample t-tests, it was found that the t-values for WPM3, OP3, and OP9 were all less than 3 and not significant ($p>0.05$), indicating poor discriminant power for these items. Therefore, they were removed, resulting in a final item pool of 33 items.

Based on the discriminant analysis of items, a reliability analysis was also conducted. As shown in Table 6, deleting three items (FP1, WPM5, and OP6) would increase Cronbach's α coefficients for FP, WPM, and OP to 0.881, 0.875, and 0.892, respectively, all exceeding 0.80. This represents a significant improvement from the original Cronbach's α coefficients of 0.813, 0.778, and 0.773, respectively. However, deleting these three items would result in a significant decrease in Cronbach's α coefficients for the corresponding scales compared to when all 30 items are retained. Therefore, removing FP1, WPM5, and OP6 items was deemed necessary to further optimize each scale. After deletion, the Cronbach's α coefficients for each scale exceeded 0.8, indicating excellent internal consistency of the scales. The results suggest strong associations among the factors in this study, with high internal consistency. Thus, the items within each dimension of the scale are deemed reliable.

Table 5: Analysis Results of the Discriminant Coefficient and Critical Ratio

Item code	Mean		discriminant coefficient	t-value	p
	low-score	high-score			
FP1	2.66	3.38	0.72	3.512	0.010
FP2	2.47	4.38	1.91	11.058	0.000
FP3	3.09	4.55	1.46	8.271	0.000
FP4	2.88	4.59	1.71	11.313	0.000
FP5	2.72	4.62	1.9	14.569	0.000
FP6	2.94	4.62	1.68	10.584	0.000
WPM1	3.19	4.75	1.56	10.056	0.000
WPM2	2.71	4.43	1.72	10.799	0.000
WPM3△	2.61	2.82	0.21	1.805△	0.076△
WPM4	3.39	4.82	1.43	12.418	0.000
WPM5	1.97	3.04	1.07	3.752	0.000
WPM6	2.84	4.50	1.66	11.602	0.000
WPM7	2.97	4.71	1.74	13.2	0.000
CM1	3.04	4.64	1.60	10.065	0.000
CM2	2.64	4.36	1.72	10.951	0.000
CM3	2.93	4.85	1.92	15.285	0.000
CM4	2.82	4.48	1.66	10.519	0.000
CM5	2.79	4.67	1.88	14.037	0.000
TB1	2.72	4.55	1.83	13.673	0.000
TB2	2.9	4.52	1.62	9.659	0.000
TB3	2.52	4.52	2.00	12.291	0.000
TB4	2.93	4.55	1.62	9.434	0.000
TB5	2.9	4.58	1.68	10.084	0.000
TB6	2.55	4.32	1.77	12.323	0.000
TB7	2.86	4.48	1.62	8.849	0.000
TB8	2.62	4.55	1.93	13.988	0.000
TB9	2.79	4.71	1.92	12.912	0.000
OP1	3.29	4.71	1.42	8.399	0.000
OP2	3.14	4.52	1.38	6.905	0.000
OP3△	2.75	3.26	0.51	2.884△	0.070△
OP4	2.79	4.58	1.79	10.143	0.000
OP5	3.11	4.74	1.63	10.178	0.000
OP6	2.36	4.03	1.67	3.891	0.000
OP7	2.61	4.23	1.62	9.175	0.000
OP8	2.89	4.35	1.46	9.073	0.000
OP9△	2.64	2.55	0.09	-0.468△	0.640△

Table 6: Cronbach's Coefficient Reliability Analysis

Dimension	Item code	After removal, Cronbach's α for the variable	Cronbach's α
FP	FP1△	0.881△	0.813
	FP2	0.755	
	FP3	0.775	
	FP4	0.763	
	FP5	0.739	
	FP6	0.757	
WPM	WPM1	0.720	0.778
	WPM2	0.714	
	WPM4	0.720	
	WPM5△	0.875△	
	WPM6	0.707	
	WPM7	0.710	
CM	CM1	0.854	0.877
	CM2	0.864	
	CM3	0.834	
	CM4	0.849	
	CM5	0.850	
TB	TB1	0.916	0.927
	TB2	0.920	
	TB3	0.921	
	TB4	0.923	
	TB5	0.919	
	TB6	0.918	
	TB7	0.924	
	TB8	0.913	
	TB9	0.913	
OP	OP1	0.674	0.733
	OP2	0.674	
	OP4	0.655	
	OP5	0.661	
	OP6△	0.892△	
	OP7	0.667	
	OP8	0.663	

The KMO statistic is one of the measures used to assess the suitability of a factor analysis model. After conducting statistical analysis on the 165-pre-test data, the results revealed a KMO value of 0.852, with a chi-square value of 2836.158 for Bartlett's test ($p<0.001$) and 741 degrees of freedom. This indicates that there is a significant correlation among the variables, suggesting the presence of underlying common factors, making the data

highly suitable for factor analysis. Upon examining the communalities (Table 7), it was found that all values exceeded 0.2, and the factor loadings were all above 0.45, indicating that all items could be retained. Through independent sample tests, reliability analysis, commonalities analysis, and item reduction, an initial scale was formed, with the FP, WPM, CM, TB, and OP scales containing 5, 5, 5, 9, and 6 items respectively (Table 7).

Table 7: Communalities and Factor Loadings for Each Variable

Item Code	Communalities	Factor Loading
FP2	0.713	0.845
FP3	0.603	0.776
FP4	0.677	0.823
FP5	0.727	0.853
FP6	0.674	0.821
WPM1	0.607	0.779
WPM2	0.663	0.814
WPM4	0.645	0.803
WPM6	0.710	0.843
WPM7	0.720	0.849
CM1	0.654	0.809
CM2	0.597	0.772
CM3	0.750	0.866
CM4	0.681	0.825
CM5	0.671	0.819
TB1	0.686	0.829
TB2	0.605	0.778
TB3	0.585	0.765
TB4	0.543	0.737
TB5	0.617	0.786
TB6	0.659	0.812
TB7	0.515	0.718
TB8	0.745	0.863
TB9	0.751	0.867
OP1	0.547	0.740
OP2	0.638	0.799
OP4	0.678	0.823
OP5	0.645	0.803
OP7	0.678	0.824
OP8	0.727	0.853

Exploratory factor analysis

After conducting item analysis and validation, an initial scale was obtained. With the assistance of tourism management departments from the sampled scenic areas, an official questionnaire survey was conducted both online and on-site. A total of 700 questionnaires were distributed, out of which 643 were returned. After removing 11 questionnaires with excessively short completion times or identical responses, 632 valid questionnaires remained, resulting in an effective response rate of 90.2%.

Table 8: EFA Results (n=632)

Dimension	Item code		FL	Eigenvalue	CVCR
Item code	FP	FP3	0.793	9.942	33.081%
		FP4	0.782		
		FP5	0.794		
		FP6	0.813		
	WPM	WPM1	0.791	2.987	43.039%
		WPM2	0.757		
		WPM4	0.803		
		WPM6	0.788		
		WPM7	0.803		
	CM	CM1	0.799	2.841	52.509%
		CM2	0.791		
		CM3	0.795		
		CM4	0.782		
		CM5	0.824		
	OP	OP1	0.731	2.683	61.451%
		OP2	0.736		
		OP4	0.753		
		OP5	0.761		
		OP7	0.805		
		OP8	0.773		
	TB	TB1	0.706	1.655	66.968%
		TB2	0.735		
		TB3	0.745		
		TB4	0.731		
		TB5	0.714		
		TB6	0.713		
		TB7	0.745		
		TB8	0.825		
		TB9	0.828		

Notes: FL is Factor Loading, CVCR is Cumulative Variance Contribution Rate

The validity of items was examined and the factor structure of observed variables was explored using Exploratory Factor Analysis (EFA) to explore the dimensionality of STD (Table 8). Initially, the valid questionnaires (N = 632) were imported into SPSS 26.0 for analysis, resulting in a Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy of 0.941, and a significant Bartlett's Test of Sphericity chi-square value of 11166.271 ($p < 0.001$), with 435 degrees of freedom. These results suggest the presence of correlations among items and indicate the suitability of the data for factor analysis. Principal Component Analysis (PCA) and Varimax rotation were then employed to extract and orthogonalize factors. Factors with eigenvalues greater than 1 were retained, resulting in the extraction of 5 common factors. The cumulative variance contribution reached 66.96%, exceeding the 60% extraction criterion. The scree plot test also indicated the suitability of retaining 5 factors. Based on the relationships among items, the structure of the 5 factors reflected the theoretical framework well, confirming the extraction of the 5 factors.

The PCA analysis revealed that FP2, FP3, FP4, FP5, and FP6 had higher loadings on the 4th factor, which was named "full participation (FP)"; WPM1, WPM2, WPM4, WPM6, and WPM7 had higher loadings on the 5th factor, named "whole process management (WPM)"; CM1, CM2, CM3, CM4, and CM5 had higher loadings on the 3rd factor, named "comprehensive management (CM)"; TB1, TB2, TB3, TB4, TB5, TB6, TB7, TB8, and TB9 had higher loadings on the 1st factor, named "tourism benefits (TB)"; OP1, OP2, OP4, OP5, OP7, and OP8 had higher loadings on the 2nd factor, named "overall perception (OP)". This dimensional division is consistent with the expected dimensions, demonstrating good validity, and leading to the formation of the final version of the scale.

Scale evaluation

Confirmatory factor analysis (CFA) can be used to validate the structural stability of the scale. In this study, AMOS 24.0 was employed to perform CFA on the data. As shown in Figure 4, the goodness-of-fit indices for the overall dimension measurement model were examined. It was found that X2/df=1.377, CFI=0.986, GFI=0.948, AGFI=0.928, IFI=0.986, TLI=0.985, RMSEA=0.024. All of these indices met the standard criteria for goodness-of-fit, indicating that the measurement model passed the goodness-of-fit test.

Convergence analysis results (Table 9) indicate that the factor loading values of the 30 items range from 0.72 to 0.84, demonstrating the high construct validity of the scale. The convergent validity of the scale was tested by combining the composite reliability (CR) and average variance extracted (AVE). The CR values for each dimension ranged from 0.885 to 0.926, all exceeding the standard of 0.700. Additionally, the AVE values for each dimension were all greater than the standard value of 0.500, indicating good convergent validity of the scale. The discriminant validity of the scale was assessed by determining whether the square root of the average variance extracted (AVE) for each dimension was greater than the correlation coefficients between other dimensions. The data (Table 9) show that the square root values of AVE for all five dimensions are higher than the correlation coefficients between other related dimensions. The correlation coefficients between dimensions (Table 10) are all below the standard of 0.750 (Kline, 2015), demonstrating ideal discriminant validity among the dimensions.

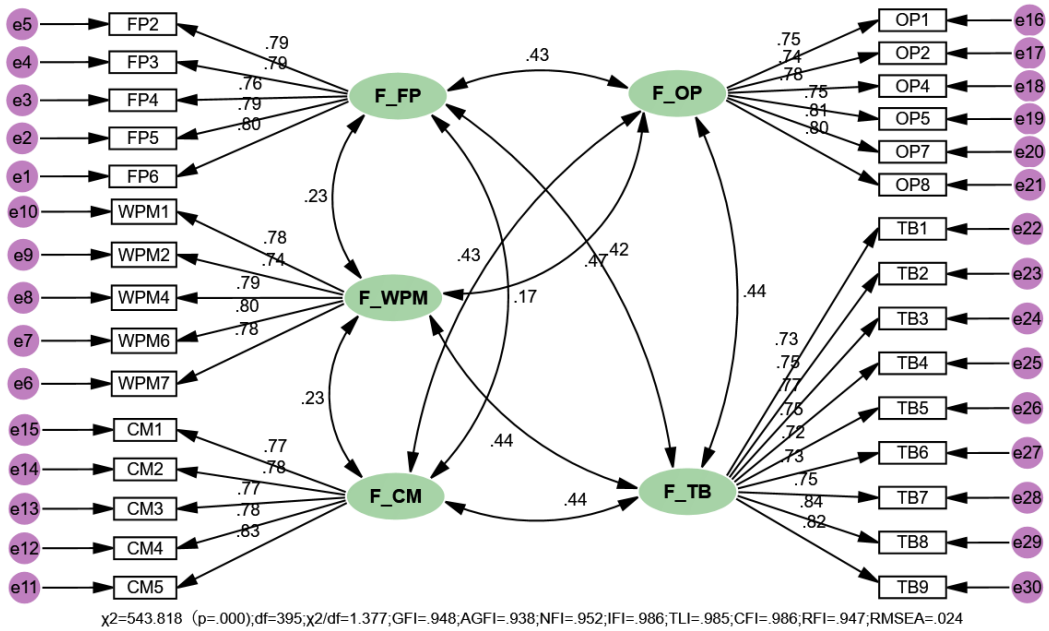

Figure 4: Fit Test of CFA Model

Table 9: Convergence evaluation of The Formal Scale

Dimensions	Item (Abbreviation)	Item code	Significance Un-std	Significance S.E.	Significance P	Factor Loading Std.	Reliability CR	Validity AVE
FP	Full participation enhances sustainable	FP2	1.057	0.050	***	0.79	0.890	0.618
	Tourism involvement in management	FP3	1.017	0.048	***	0.79		
	All-staff involvement enhance management	FP4	0.982	0.048	***	0.76		
	Employee opinions improve service quality	FP5	1.037	0.049	***	0.79		
	Employee participation in decision-making	FP6	1.000		***	0.80		
WPM	Planning and management	WPM1	1.018	0.051	***	0.78	0.885	0.606
	Training management	WPM2	0.968	0.051	***	0.74		
	Operation management	WPM4	1.000	0.049	***	0.79		
	Supervision management	WPM6	1.059	0.051	***	0.80		
	Resource allocation management	WPM7	1.000		***	0.78		
CM	Innovation management	CM1	0.898	0.042	***	0.77	0.890	0.617
	Product feature management	CM2	0.898	0.041	***	0.78		
	Integrity management	CM3	0.891	0.042	***	0.77		
	Hardware management	CM4	0.932	0.043	***	0.78		
	Application of new technologies	CM5	1.000		***	0.83		
TB	Tourism benefits increase resident's income	TB1	1.000		***	0.73	0.926	0.583
	STD attracts more investment	TB2	1.016	0.054	***	0.75		
	STD enhances scale of tourism products	TB3	1.108	0.057	***	0.77		
	STD promotes employment	TB4	1.023	0.054	***	0.75		
	STD improves transportation	TB5	0.935	0.052	***	0.72		
	STD promotes cultural preservation	TB6	1.016	0.056	***	0.73		
	STD improves surrounding ecology	TB7	1.023	0.054	***	0.75		
	STD enhances environment awareness	TB8	1.168	0.055	***	0.84		
	STD promotes harmonious tourism relations	TB9	1.116	0.054	***	0.82		
OP	Transportation and facility experience	OP1	1.000		***	0.75	0.899	0.597
	Evaluation of the impact of tourism	OP2	0.956	0.051	***	0.74		
	Feedback on experience promotes	OP4	1.100	0.055	***	0.78		
	Environment influences experience	OP5	0.952	0.050	***	0.75		
	Cost-effectiveness of tourism experience	OP7	1.118	0.054	***	0.81		
	Cost and commuting impact experience	OP8	1.106	0.055	***	0.80		

Table 10: Two-dimensional Correlation Matrix and HTMT for The TQM-STD Scale

N	FP	WPM	CM	TB	OP
FP	fp 2 3 4 5 6 2 1 3 0.59 1 4 0.59 0.62 1 5 0.64 0.61 0.59 1 6 0.65 0.63 0.59 0.61 1	0.226	0.173	0.420	0.435
WPM	0.201**	wp 1 2 4 6 7 1 1 2 0.54 1 4 0.63 0.60 1 6 0.62 0.61 0.61 1 7 0.62 0.56 0.61 0.62 1	0.233	0.449	0.468
CM	0.153**	0.207**	cm 1 2 3 4 5 1 1 2 0.57 1 3 0.60 0.60 1 4 0.61 0.61 0.59 1 5 0.65 0.65 0.63 0.62 1	0.444	0.428
TB	0.381**	0.407**	0.403**	tb 1 2 3 4 5 6 7 8 9 1 1 2 0.53 1 3 0.58 0.54 1 4 0.56 0.54 0.56 1 5 0.51 0.54 0.55 0.50 1 6 0.52 0.55 0.54 0.54 0.52 1 7 0.54 0.54 0.56 0.59 0.55 0.54 1 8 0.62 0.60 0.66 0.65 0.60 0.62 0.65 1 9 0.60 0.64 0.66 0.63 0.62 0.62 0.62 0.64 1	0.448
OP	0.389**	0.417**	0.383**	0.408**	op 1 2 4 5 7 8 1 1 2 0.52 1 4 0.59 0.55 1 5 0.57 0.55 0.55 1 7 0.62 0.62 0.64 0.62 1 8 0.58 0.61 0.64 0.61 0.60 1

Discussion

Based on bibliometric analysis and expert knowledge, the relationship between three dimensions of TQM and STD was established, successfully developing a TQM-STD scale system consisting of five dimensions: FP, WPM, CM, TB, and OP, comprising 30 items. The construction process of the scale system for the five dimensions passed a series of rigorous tests including IOC, collinearity, reliability, and validity. The TQM-STD scale can be presented from the perspectives of FP, WPM, CM, TB, and OP, and the correlation coefficients between dimensions (Table 10) are all below the standard of 0.750 (Kline, 2015), indicating no model collinearity or overlap issues. This suggests that the first-order model (Figure 4) is appropriate for this study, with no second-order constructs present.

In the TQM-STD scale system, the FP scale items mainly revolve around tourists, local residents, and scenic area staff, covering stakeholders in tourism (Roxas et al., 2020) and reflecting the concept of full participation. The items in the scale are objectively accurate. The WPM scale items involve tourism planning, operation, and supervisory management, which align with the PDCA cycle (Carvalho et al., 2023) and are a significant manifestation of the tourist attraction lifecycle management (Witt & Muhlemann,1994). The construct of CM consists of five items, encompassing aspects such as hardware and software, tourism features, innovative concepts, etc., which align with the comprehensive management's promotion of sustainable tourism development (Ahmad et al., 2022； Li et al., 2024).TB and OP are two intermediate variables influencing TQM-STD. The TB scale includes 9 items involving residents' income, investment, product sales, and environmental awareness, aligning with the three dimensions of economic, social, and ecological benefits of STD (Czernek-Marszalek, 2020; Khan et al., 2020; León et al., 2021). Timothy and Said (2023) proposed that residents' perception of tourism includes positive and negative aspects, with positive perception showing

high consistency with the overall perception scale items in this study. Additionally, research indicates that in special tourism scenarios, tourists are willing to exchange time costs for better travel experiences (Yin et al., 2024), and tourism attractions often focus on enhancing tourists' travel experiences for better marketing (Dong & Qu, 2023). This underscores the importance of tourism perception for sustainable tourism, which is highly relevant to the content included in the OP scale items of this study.

In addition, this study has certain limitations. Firstly, the data were derived from questionnaire responses. Although respondents were encouraged to answer truthfully, they may have been influenced by social expectations and inclined to provide responses that aligned with these expectations, leading to inflated item scores. This is a common issue in questionnaire surveys (Fowler et al., 2014). Secondly, the sample comprised national 5A-level scenic areas, which employ relatively advanced management methods. However, there may be differences in management concepts and methods among scenic areas of different levels (Wang et al., 2024). In the future, it is necessary to conduct uniform sampling across A-5A-level scenic areas to validate the applicability of the scale. While the scale has passed various tests of reliability and validity, further optimization of the scale items for each dimension may be required to adapt to specific survey subjects as the application scenarios change.

Conclusion

This study integrates literature analysis and expert opinions to construct an innovative model of the impact of TQM on STD. Utilizing data from 632 questionnaires collected from two UNESCO World Heritage sites, the study conducts the development and validation of a TQM-STD scale system. Each of the three critical stages of scale development has undergone rigorous testing. The development process and outcomes hold two significant values.

Theoretical Contributions

The literature analysis provides a more scientifically accurate analysis of existing research findings on TQM and STD. This analysis helps to better understand the spatial dimensions and scientific connotations of TQM and STD, leading to the construction of a reasonable multi-dimensional relationship between TQM and STD. Supported by two intermediate variables, the study successfully constructs the FP, WPM, CM, TB, and OP dimensions, comprising a TQM-STD scale system with 30 items. This scale system demonstrates high reliability and validity, serving as an accurate and effective measurement tool that provides theoretical reference and technical support for subsequent research. More importantly, this research involves an interdisciplinary study between project management and tourism management, applying the principles of project management to the management of tourist attractions. This enriches the content of tourist attraction management and has the potential to drive theoretical innovation and development in tourism management.

Managerial Implications

This study also holds significant practical implications. By conducting interviews in 5A-level tourist attractions and both online and on-site surveys, the research sample deeply analyzes the connotations and dimensions of STD. By scientifically integrating TQM principles into STD management, the study effectively guides innovation in methods during STD processes, thereby enhancing the quality and standards of tourist attraction management. Furthermore, the study thoroughly analyzes the dimensions of TQM and STD, as well as the

influence of different TQM dimensions on STD, and incorporates them into the scale items. This helps managers in tourist attractions effectively identify the influencing factors of STD and explore reasonable paths for STD based on this knowledge, ultimately enhancing the tourist experience and promoting sustainable development in tourist attractions. Furthermore, the findings of this study provide support for advancing sustainable tourism development and offer corresponding measurement tools. They promote the application of Total Quality Management (TQM) principles in the field of the tourism and culture.

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