Research on Evaluation of Wuhan City's Tourism Logistics Capability Under the Background of "Internet+" and Big Data

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Abstract. "Internet +" and big data have changed the development direction and thinking mode of the tourism and logistics industries to a certain extent, and studying the new business form of tourism logistics will contribute to exploring new growth points for tourism and logistics at the same time, achieving $1 + 1 > 2$. Therefore, considering that domestic and foreign scholars have not formed a unified evaluation index system for the evaluation of tourism logistics capabilities, a comprehensive evaluation model that reflected the capabilities of urban tourism logistics was constructed in this paper. Moreover, based on this model, the tourism logistics capacity of Wuhan was evaluated. Meanwhile, Chengdu and Hangzhou, the two provincial capitals and new first-tier cities with similar economic development levels, were selected for horizontal comparison, which provides some ideas and directions for Wuhan to improve its tourism logistics capabilities. Besides, this paper proposed countermeasures and suggestions for promoting the sustainable and healthy development of Wuhan's tourism logistics industry.

Keywords: tourism logistics capability · evaluation system · analytic hierarchy process

1 Introduction

The logistics industry is a basic and strategic industry that supports the development of the national economy and society. The National Development and Reform Commission issued implementation opinions on the development of "Internet +" efficient logistics as early as 2017, and the "Outline of Action (2020–2025)" put forward the requirements for the implementation of the "Five Major Actions" for the development of comprehensive transportation big data. Therefore, in the tide of the Internet era, only by accepting the thinking and transformation of "Internet +" can logistics companies adapt to the market faster, improve the scale and quality of logistics services, and enhance their market competitiveness.

On the other hand, in 2019, the tourism industry created nearly 80 million job opportunities for the country, accounting for 10.3% of China's total labor force and 11.3% of China's economy, with an output value of 10.9 trillion yuan. The role of tourism in promoting the growth of the national economy cannot be ignored. Moreover, in recent

years, the tourism industry and enterprises have also continually explored tourism plus new business formats under the Internet + background, which constantly activates new growth points. First of all, from the perspective of national development, the development idea of "Internet + Tourism" fits the "national big data strategy" proposed by China, and the establishment of the "Internet + Tourism" big data collection and sharing mechanism has a greater effect on the collection and sample supplementation to the national big data strategy. Then, at the economic level, the tourism industry has greatly stimulated the development of the national economy [1]. On the other hand, the increase in residents' income has further promoted the development of the tourism industry. Therefore, the field of "Internet + tourism" is quite promising, which has obtained a lot of investment opportunities.

Internet technologies such as big data, Internet of Things, and cloud computing have changed the development direction and thinking mode of the tourism and logistics industries to a certain extent, and intelligent electronic products such as smartphones provide hardware support for the integrated development of tourism and logistics under the background of "Internet +" and big data. What is more, nowadays, both the logistics industry and the tourism industry are constantly seeking to embrace the Internet and big data, as well as the integration and development of other industries. The integrated and innovative development of the two pillar industries of tourism and logistics will undoubtedly bring a lot of room for imagination. Therefore, research on this new business form of tourism logistics will help explore new growth points in tourism and logistics at the same time, achieving $1 + 1 > 2$.

2 Research Summary

In this study, HowNet is used to conduct related literature searches on March 1, 2021. Adopting advanced search mode and checking the English extension, the paper titled "logistics" and contained "tourism" was searched accurately, and 4109 related papers were retrieved. Among them, there were 2495 academic journals and 717 dissertations, including 61 doctoral dissertations and 656 master dissertations. The content of the literature basically meets the research requirements. Moreover, visual analysis of the search results shows that the related literature has increased rapidly since 2000, and the research interest gradually decreased after reaching a peak of 368 papers in 2014. However, the research interest of at least 217 papers per year is still be maintained by 2020. Meanwhile, in terms of disciplines, the current research on tourism logistics is still mainly concentrated in the disciplines that are highly related to it, and the related research is more concentrated in the fields of economic system reform, industrial integration development, and sustainable development.

Early research was more inclined to research on the theory of industrial integration and the initial conceptual induction of tourism logistics, which gradually turned to research on the interactive relationship between tourism and logistics, the logistics practice of tourism enterprises, and the research of tourism logistics service system. Besides, in the middle and late 1980s, domestic and foreign scholars tried to use "flow" to describe and study tourism phenomena [2] In the book "Geographical Analysis of Modern Tourism" written by D. Pearce (1987), the concept of tourism flow was used

[3]; Tang Shuntie and Guo Laixi (1998) believed that tourism flow included not only the flow of tourists, but also the flow of information, material flow and various cost flows borne by tourists and developers between source and destination [4]; Zhang Ling (2010) conducted a survey on the relationship between tourism commodities and logistics industry [5]; Qin Ligong et al. (2011) studied the integrated optimization model of Guilin tourism logistics based on the concept of collaboration; Li Xiaodong (2014) put forward optimization suggestions for the layout of the tourism logistics industry chain in the Yangtze River Economic Belt; Bai Haixia et al. (2014) proposed to reduce the operating cost of tourism logistics by introducing the Internet of Things (IoT) technology to tourism logistics; Xu Shuli (2015) put forward the concept of crowd-sourcing construction of China's tourism logistics network based on the analysis and research of crowd-sourcing tourism logistics network.

In terms of research on the relationship between tourism and logistics, Qing Lidong (2004) proposed that tourism as a comprehensive industry cannot be separated from the strength of the urban economy, and the flow of people, logistics, information, and capital determines the development of regional tourism; Shen Guijuan (2014) used Henan's logistics industry and total tourism revenues from 1994 to 2012 to conduct an empirical test; Chen Jiang (2012) believed that there were similarities and differences between the tourism industry and the logistics industry.

In recent years, related studies have focused on the application of new technologies, the integration of green economy concepts, and the reform of talent training models. For example, Wu Jin (2020) tried to build a tourism service supply chain management model based on big data; Yan Hui (2020) proposed effective strategies for the green development of tourism logistics.

In general, academia has achieved abundant results in tourism logistics research, while the understanding of the concept of tourism logistics and the measurement methods of ability indicators are still inconsistent. What is more, most of the current researches discuss tourism or logistics separately. A few discuss tourism logistics, most of which are mainly based on qualitative analysis. Only a small number of scholars use quantitative methods to study the relationship between tourism and logistics. However, what indicators can be used to observe the tourism logistics capability of a city? How is the quantitative comparative research scientifically carried out to find a breakthrough to improve tourism logistics capabilities on this basis? All these questions require further research and discussion.

Since domestic and foreign scholars have not formed a unified evaluation index system for the evaluation of tourism logistics capabilities, in this paper, taking Wuhan as an example, the construction of tourism logistics capabilities evaluation system is studied, which has certain theoretical and practical significance:

3   Construction of Evaluation Index System of Tourism Logistics Ability

3.1   Selection of Evaluation Indicators

It is argued in this paper that following the basic principles of the selection of evaluation indicators and considering the availability of data, 17 indicators are selected in

Table 1. Evaluation index system of tourism logistics capability

Target layer	Criterion layer		Index layer	
A Tourism logistics capabilities	B1	tourism	C11	Total tourism revenue (100 million yuan)
			C12	Received number of domestic tourists (10,000 person-times)
			C13	Received number of inbound tourists (10,000 person-times)
			C14	Number of beds in star-rated hotels (pieces)
			C15	Passenger turnover (100 million person-kilometers)
			C16	Passenger traffic in the whole society (10,000 people)
	B2	Transportation logistics	C21	Cargo turnover (100 million ton-kilometers)
			C22	Total transportation of goods in the whole society (ten thousand tons)
			C23	Per capita road area (square meters)
			C24	Public transportation vehicles per 10,000 people (standard station)
			C25	Total number of rail transit passengers (10,000 passengers)
	B3	Environmental protection	C31	Harmless waste disposal capacity (tons/day)
			C32	Sewage treatment capacity (ten thousand cubic meters/day)
			C33	Public toilet
	B4	information Technology	C41	Total postal business (100 million yuan)
			C42	Number of mobile phone users (ten thousand)
			C43	Internet users (10,000 households)

this paper from the four aspects of tourism, transportation and logistics, environmental protection, and information technology to establish a three-tier evaluation indicator system for tourism logistics capabilities. Among them, there are 7 tourism indicators, which can evaluate the development level of tourism industry, tourist reception capacity and tourist turnover capacity as a whole; There are 6 indicators in transportation and logistics, which can evaluate the development level of the logistics industry, the ability and potential of cargo transportation and turnover overall; There are three indicators for environmental protection, mainly evaluating the capacity of urban domestic sewage and garbage disposal; There are 3 indicators for information technology to evaluate the postal and telecommunications infrastructure of the city. The specific evaluation index system is shown in Table 1.

3.2 Determination of Evaluation Index Weight

The tourism logistics capability evaluation index system constructed in this paper has three levels, namely the target level A (tourism logistics capability), the criterion level B (tourism, transportation logistics, environmental protection, information technology) and Indicator Level C (a total of 17 indicators such as total tourism revenue). Moreover, on the basis of this hierarchical model, combined with the basic theory of the analytic hierarchy process, the expert scoring method is used to evaluate and score the importance of indicators, constructing a judgment matrix, and obtaining the influence weights of the criterion layer and the indicator layer. The specific steps are as follows:

(1) Construct a judgment matrix. A represent the target, and u_i, $u_j(i,j = 1,2,\cdots,n)$ refers to the factors. U_{ij} indicates the relative importance value of ui to uj. In addition, the A-U judgment matrix P is composed of u_{ij}.

$$P = \begin{bmatrix} u_{11} & u_{12} & \ldots & u_{1n} \\ u_{21} & u_{22} & \ldots & u_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ u_{n1} & u_{n2} & \ldots & u_{nn} \end{bmatrix}$$

(2) Calculate the importance ranking. According to the judgment matrix, find the eigenvector w corresponding to the largest eigenvalue λmax. The equation is as follows:

$$P_w = \lambda_{max} \cdot W$$

The required feature vector w is normalized to rank the importance of each evaluation factor, namely the weight distribution.

(3) Consistency check. Whether the weight distribution obtained above is reasonable, the consistency test of the judgment matrix is needed. The test uses the formula:

$$CR = \frac{CI}{RI}$$

In the formula, CR is the random consistency ratio of the judgment matrix; CI is the consistency index of the judgment matrix, which is given by:

$$CI = \frac{\lambda_{max} - n}{n - 1}$$

RI is the average random consistency index of the judgment matrix, and the RI value of the judgment matrix of order 1–9 is shown in Table 2.

When CR of judgment matrix P is less than 0.1 or $\lambda max = n$, and $CI = 0$, P will be considered to have satisfactory consistency. Otherwise, the elements in P need to be adjusted to make it with satisfactory consistency.

Table 2. Judgement matrix RI value of tourism logistics capability evaluation index system

n	1	2	3	4	5	6	7	8	9
RI	0	0	0.52	0.89	1.12	1.26	1.36	1.41	1.46

Table 3. The weight of tourism logistics capability evaluation index system

Target layer	Criterion layer		Weights	Index layer		Global weight
A Tourism logistics capabilities	B1	tourism	0.3864	C11	Total tourism revenue	0.0279
				C12	Number of domestic tourists received	0.0183
				C13	Number of inbound tourists	0.1313
				C14	Number of Beds in Star Hotel	0.0632
				C15	Passenger turnover	0.0563
				C16	Passenger traffic in the whole society	0.0894
	B2	Transportation logistics	0.3024	C21	Cargo turnover	0.0681
				C22	Total transportation volume of goods in the whole society	0.0325
				C23	Per capita road area	0.1286
				C24	Public transportation vehicles per 10,000 people	0.0227
				C25	Total passenger traffic of rail transit	0.0504
	B3	Environmental protection	0.1746	C31	Harmless waste disposal capacity	0.0543
				C32	Sewage treatment capacity	0.0861
				C33	Public toilet	0.0342
	B4	information Technology	0.1366	C41	Total postal business	0.0267
				C42	Number of mobile phone users	0.0425
				C43	Internet users	0.0674

In this paper, three experts from universities, industry authorities, and companies are invited to construct a pairwise judgment matrix. The group decision matrix is obtained by calculating the geometric average of the judgment matrix analysis results given by each expert. Then, the final group conclusion is calculated on the basis of this group matrix (Table 3).

4 Empirical Analysis

Known as the "Nine Provinces Transportation Hub", Wuhan is a national economic center, a national science and technology innovation center, a national trade and logistics center, an international exchange center, and a regional financial center. Meanwhile, Wuhan is abundant in tourism resources, which has been awarded a number of national honorary titles such as the National Historical and Cultural City and China's Excellent Tourist City, ranking among the top 10 tourist cities for many years in China. Therefore, it is of good representativeness to select Wuhan for tourism logistics capability evaluation.

In this study, a comprehensive evaluation model that reflects the city's tourism logistics capabilities is established, which will be a reference to evaluate Wuhan's tourism logistics capabilities. At the same time, Chengdu and Hangzhou, two provincial capitals and new first-tier cities with similar economic development levels, are selected for horizontal comparison, providing some ideas and directions for Wuhan to improve its tourism logistics capabilities, and proposing countermeasures and suggestions to promote the sustainable and healthy development of Wuhan's tourism logistics industry.

4.1 Original Data Source and Dimensionless Processing

The original data in this paper are all from the annual statistical yearbooks of three cities from 2017 to 2020. Moreover, due to the differences in the statistical calibers of various regions, the statistical data cannot be directly applied to individual indicators. Therefore, considering the attitudes of local residents, tourists, industry experts and other topics, the consultation method is adopted to score on a ten-point scale. Then, the average value is taken as the final score of the indicator. Since some of the indicators are totals and some are averages, the collected data is processed without dimension, and the calculation formula is as follows:

$$M_{ij} = \frac{X_{ij}}{\max\{X_{ij}\}}$$

4.2 Calculation Process and Results

According to the above analysis and calculation, the weight value W_i $(i = 1, 2..., n)$ of each index and the score M_{ij}, $(i = 1, 2..., n; j = 1, 2...., m)$ of each city's tourism logistics capability evaluation index can be obtained. Then, through weighted calculation, the comprehensive competitiveness index of each city can be obtained, namely.

$A = W_i \cdot M_{ij}$

According to the statistical data and the above formula, the criterion-level indicator scores, tourism logistics capability index and ranking of tourism logistics capability evaluation system in Wuhan, Chengdu, and Hangzhou from 2017 to 2019 are calculated, as shown in Table 4.

Table 4. Evaluation scores and rankings of tourism logistics capabilities

year	Criterion layer	Wuhan	Chengdu	Hangzhou
2017	B1 tourism	0.3443	0.3215	0.3770
	B2 transportation and logistics	0.3023	0.2056	0.1438
	B3 environmental protection	0.1746	0.1524	0.1301
	B4 information technology	0.1231	0.1204	0.1328
	A tourism logistics capability index	0.9443	0.7999	0.7836
	ranking	1	2	3
2018	B1 tourism	0.3363	0.3537	0.3103
	B2 transportation and logistics	0.2876	0.2179	0.1480
	B3 environmental protection	0.1722	0.1552	0.1321
	B4 information technology	0.1262	0.1134	0.1328
	A tourism logistics capability index	0.9224	0.8402	0.7232
	ranking	1	2	3
2019	B1 tourism	0.3400	0.3672	0.3069
	B2 transportation and logistics	0.2745	0.2180	0.1404
	B3 environmental protection	0.1746	0.1495	0.1281
	B4 information technology	0.1260	0.1310	0.1302
	A tourism logistics capability index	0.9151	0.8658	0.7057
	ranking	1	2	3
Mean	B1 tourism	0.3402	0.3475	0.3314
	B2 transportation and logistics	0.2881	0.2139	0.1441
	B3 environmental protection	0.1738	0.1524	0.1301
	B4 information technology	0.1251	0.1216	0.1319
	A tourism logistics capability index	0.9273	0.8353	0.7375
	ranking	1	2	3

4.3   Analysis of Calculation Results

At the tourism level, Chengdu 0.3475 > Wuhan 0.3402 > Hangzhou 0.3314. Wuhan's advantage is the number of domestic tourists. For example, in 2019, Wuhan received 315.8627 million domestic tourists, which is significantly higher than that of Chengdu's 276.42 million and Hangzhou's 207 million. However, the total tourism revenue of 357.79 billion yuan is inferior to Chengdu's. 466.4 billion yuan and Hangzhou's 400.45 billion yuan, which reflects that Wuhan is of high tourist popularity and enthusiasm. The potential for tourism development is huge, but the purchasing power of tourists is insufficient. Therefore, efforts need to be made in the development of tourism products to enhance the attractiveness of tourism consumption.

In terms of transportation and logistics, Wuhan 0.2881 > Chengdu 0.2139 > Hangzhou 0.1441. Although Wuhan has a clear advantage, Chengdu is catching up quickly. Moreover, in the past three years, the total volume of goods transportation in Wuhan is equivalent to the sum of Chengdu and Hangzhou, and the annual cargo turnover is equivalent to 4 times that of the sum of Chengdu and Hangzhou, while the per capita road area and total rail transit passenger traffic indicators are both exceeded by Chengdu. In addition, Wuhan owns a fairly good social logistics infrastructure, while Chengdu has invested a lot of resources in the construction of public transportation infrastructure in recent years, and the permanent population is nearly 4 million more than Wuhan, so Chengdu scores higher in terms of passenger flow.

As for environmental protection, Wuhan 0.1738 > Chengdu 0.1524 > Hangzhou 0.1301, which mainly examines the indicators related to waste and reverse logistics such as the harmless treatment of garbage and sewage treatment. In general, Wuhan is slightly stronger than Chengdu and Hangzhou. Additionally, the per capita ownership index of public toilets in Wuhan is significantly higher than that of Chengdu and Hangzhou.

In terms of information processing, Hangzhou 0.1319 > Wuhan 0.1251 > Chengdu 0.1216. Hangzhou's basic conditions are relatively good, and Wuhan is closing the gap.

In general, in terms of the tourism logistics capability index, Wuhan 0.9273 > Chengdu 0.8353 > Hangzhou 0.7375. Wuhan occupies an obvious advantage. However, from the annual data, it can be seen that Chengdu and Hangzhou are continually narrowing the gap, especially Chengdu, which is making rapid progress. Therefore, it is urgent for Wuhan to improve its tourism logistics capabilities.

5   Countermeasures and Suggestions to Improve Tourism Logistics Capabilities

For Wuhan, it can start from the following aspects to continually improve its tourism logistics capabilities:

5.1   Strengthen Tourism Development

The first step is to innovate tourism products and services. Guided by global tourism thinking, existing tourism resources are focused to enhance the attractiveness of tourism products and services with characteristics and quality improvements in scenic spots, catering services, and home-stays. The second one is to broaden cultural exchange channels, so that the city's external influence and the effectiveness of foreign tourism promotion can be improved. The third one is to support the development of cultural and creative industries, enriching the form of tourism products. In addition to continually exploring the tourism and cultural value of tourism business cards such as the Yellow Crane Tower and East Lake, it is also necessary to give full play to the advantages of Wuhan colleges and universities in terms of resources, encouraging college students to innovate and start businesses, and creating new paths in the cultural and creative industries.

5.2 Improve Tourism Logistics Infrastructure

The first step is to promote the digitalization, informatization, and intelligence of infrastructure, advancing the construction of perception facilities for the Internet of Things. Meanwhile, promote digital and intelligent transformation and upgrading of stations, terminals, airports, tourism distribution centers, parking lots, and road guidance and marking systems, and encourage enterprises to build intelligent three-dimensional warehouses. The second one is to strengthen the construction of waste and reverse logistics infrastructure, accelerating the upgrading and transformation of facilities, equipment, and vehicles for waste sorting and treatment, so that the treatment capacity of waste water and solid waste can be continually improved. The third one is to continually and vigorously support the construction of public infrastructure such as transportation and logistics.

5.3 Promote the Informatization Level and Smart Capabilities of Urban Tourism Logistics

The first step is to establish a data sharing platform. Through the comprehensive use of big data, cloud computing and other technologies to broaden tourism public service information collection channels, establish and standardize the integration and sharing mechanism of travel-related big data such as online reservation, time-based tour reservation, flow monitoring and monitoring with relevant data information of public security, transportation, meteorology and other departments, scientifically guiding the distribution and giving full play to the effectiveness of integrated data services and applications. The second one is to promote tourism consumption "on the Internet." Encouraging e-commerce platforms to expand the function of "travel + Internet + modern logistics", online marketing methods such as webcast are adopted to improve the timeliness of tourism consumption, promoting the digitalization and intelligence of tourism consumption. Moreover, monitor regional tourism consumption trends in real time, and guide the dynamic adjustment and docking of transportation and logistics resources. The third one is to do a good job in standardization. For example, enterprises are encouraged to use containerized unitized technologies such as standard-compliant low-carbon and environmentally friendly delivery vehicles and intelligent pallets to improve the standardization and intelligent level of delivery.

6 Conclusion

In this paper, 17 indexes are selected from four aspects of tourism, transportation logistics, environmental protection and information technology to establish a three-tier evaluation index system of tourism logistics capability. Based on this model, the tourism logistics capability of Wuhan is evaluated. At the same time, Chengdu and Hangzhou, two provincial capitals and new first tier cities with similar economic development level, are selected for horizontal comparison. It is found that Wuhan's tourism logistics capability index has obvious advantages, but from the annual data, Chengdu and Hangzhou are continuously narrowing the gap, especially Chengdu, which has made rapid progress

in the past three years, so it is urgent for Wuhan to improve its tourism logistics capability. The author believes that Wuhan can continue to improve its tourism logistics capability by continuously increasing tourism development, improving tourism logistics infrastructure, and improving the informatization level and wisdom ability of urban tourism logistics. The author's energy is limited, and there are still some deficiencies in this study, such as the evaluation index needs to be enriched and improved, the number of cities for comparative evaluation is small, the scope of research objects needs to be expanded, and so on.

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