

# Study on the Coupling Development of Xi 'an Tourism Economy and Transportation

Xianxue Chen<sup>1,\*</sup>

<sup>1</sup> School of Tourism & Research Institute of Human Geography, Xi'an International Studies University, Xi'an 710128, China

\*Corresponding author: cxianxue@126.com

**Abstract:** Taking Xi 'an City as the research object and taking 2015-2021 as the time dimension, this paper constructs an evaluation system for the development level of tourism economy and transportation. On this basis, the coupled coordination model is used to analyze the spatial and temporal characteristics of the coupled and coordinated development of tourism economy system and transportation system. The results show that both the comprehensive evaluation index and the coupling coordination degree of Xi 'an city increased year by year from 2015 to 2019, and the interaction between them became stronger and stronger. The relative development index in 2020 is less than 0.9, indicating that transport has insufficient support for tourism economic development, and it is less than 0.6 in 2015 and 2016, indicating that transport has not fully played its role in tourism economic development.

**Keywords:** Tourism economy; Transportation; Coupling coordination; Xi 'an City.

## 1. Introduction

Since the reform and open policy, tourism industry of our country has developed rapidly. Before the outbreak of COVID-19, statistics released by the Ministry of Culture and Tourism showed that domestic tourists in 2018 increased by 539 million compared with 2017, an increase of 10.8%; Domestic tourism revenue increased by 1.4 trillion yuan, an increase of 10.5%. Compared with 2018, the number of domestic tourists in 2019 increased by 467 million, an increase of 8.4%. Domestic tourism revenue grew by 0.66 trillion yuan, or 11.1 percent. As a result, tourism has made great contributions to driving domestic economic growth. With the increasing level of national economy, tourism activities have become a part of People's Daily activities.

## 2. Literature Review

The vigorous development of tourism leaves the supporting role provided by transportation[1]. Transportation is an inevitable way for tourists to enter tourist destinations, and the development of tourism can also promote the improvement of transportation infrastructure[2-6]. Zhang Jianchun studied the coupling and coordination relationship between the development of transportation industry and tourism industry and the impact of the construction of Wuhu Yangtze River Bridge on the tourism traffic environment of Anhui province by using correlation analysis method[7]. Yang Zhongyuan et al. studied the spatial changes of traffic pattern characteristics in tourism areas in southern Anhui and drew the conclusion that with the improvement of traffic pattern, the connectivity among scenic spots in southern Anhui gradually increased, and the structure of tourist source market also changed[8]. Mu Chenglin et al., taking the Yangtze River Delta as an example, concluded that the improvement of high-speed rail network has improved the accessibility of tourist traffic in various cities[9]. At present, the research on the integration of transport and tourism is still in the development stage, and the integration of transport and tourism is mainly based on high-speed rail tourism[10-14],

Railway Tourism[15-17], Traffic in Scenic Spots[18-20], "Tourism transportation energy conservation and emission reduction" and other aspects of practice.

Transportation is the "pioneer" of tourism development. As mass tourism and global tourism continue to open up new prospects, driven by the rapid development of transportation, the efficient flow of various factors and the strengthening of regional links and cooperation continue to expand tourism service space, injecting new vitality into the high-quality development of tourism.

### 2.1. Travel fast and travel slowly, and traffic improves tourism accessibility

Yan Huili used GIS spatial method to explore the impact of the opening of "four vertical and four horizontal" high-speed railway on the urban accessibility of stations along the line and the spatial pattern of economic ties, and the results show that the overall accessibility of four vertical and four horizontal high-speed railway regions has been improved[5]. Xu Cairui took the "eight vertical and eight horizontal" transportation network as the main research body to verify the space-time compression effect brought by high-speed rail network[6]. From the completion of the "four vertical and four horizontal" to the acceleration of the construction of "eight vertical and eight horizontal", the high-speed rail network in the eastern region has gradually optimized and improved, the high-speed rail network in the central and western regions has promoted coverage, and the effective supply of high-speed rail in China has continued to strengthen. The high-speed railway has built a convenient tourism transportation network for tourists to achieve "fast travel and slow travel". For example, Jiang Yuan taking Fujian Province as an example, proposed the construction objectives, implementation plans and safeguard measures of the "fast travel slow travel" tourism transportation system.

## 2.2. Spatial optimization, transportation to promote the evolution of tourism industry pattern

With the gradual coverage of accessibility from central areas to less developed areas, transportation breaks the old social and economic pattern, strengthens regional cooperation, and narrows the regional gap. Yang Zhongyuan pointed out that with the gradual improvement of traffic advantages in tourism areas in southern Anhui, the spatial pattern of tourism destinations was gradually optimized, the travel time between scenic spots was gradually shortened, and the structure of tourist source market also changed[7]. Mu Chenglin used a series of indicators to show that the development of tourism economy in the Yangtze River Delta under the high-speed rail network presents an economic pattern of "one main and two pairs of wings"[8]. The gradual formation of urban agglomerations promotes the further improvement of economic and social benefits of tourism activities. Yang Shasha found that high-speed rail greatly improved the accessibility level of tourist traffic in the top ten urban agglomerations in China, and the distribution of traffic flow was balanced, which brought certain positive effects on urban tourism[9]. The division of labor and cooperation of tourism enterprises in urban agglomeration are optimized. By studying the Yangtze River Delta, Wu Fuxiang verified that transportation drives the free flow of factors within urban agglomerations, reducing transportation costs and promoting economic growth[10].

## 2.3. Three-dimensional competition, traffic intensifies the unbalanced development of tourist destinations

While improving the convenience and saving the travel time and cost of tourists, transportation also intensifies the three-dimensional competition among tourist destinations. Liu Junlin pointed out that the quality of high-speed railway auxiliary transportation system directly affects the accessibility, smoothness and experience of destinations, but widens the tourism gap among cities along the route and changes the competition pattern of tourism spatial structure[11]. The unbalanced tourism development between the central region and the outer region of the urban agglomeration is prominent. The research of Zhu Lin shows that while improving the density of transportation infrastructure, the transportation efficiency of transportation infrastructure will be improved, and at the same time, the negative spillover effect will be caused by the unbalanced

development of inter-regional transportation infrastructure construction[12].

To sum up, studies on the relationship between regional transport systems with a high degree of tourism development and tourism economy have been relatively mature. However, due to the different transport development levels and tourism development quality in different regions, there is a high degree of heterogeneity in the coupling and coordinated development of transport systems and tourism economy in different regions. Traffic is an important link that connects regions. Our country has a vast territory and a great gap in the construction of transportation infrastructure between regions. Through the empirical analysis of the relationship between regional transportation system and tourism economic development, we can not only improve the relevant theoretical research, but also point out the direction for the development of regional tourism traffic, and also for other traffic development lag. However, the regions with higher tourism resources grade provide case reference.

## 3. Overview and Data Sources of The Study Area

### 3.1. Overview of the study area

Xi'an is located in Guanzhong Basin in the middle of the Yellow River Basin, with jurisdiction over 11 districts and 2 counties. It has many honorary titles such as "China's Happiest City" and "China's Excellent Tourist City". There are many scenic spots and historic sites in Xi'an, colleges and universities gather together, and the tertiary industry including science and technology, education, tourism and culture is the advantage of Xi'an. In 2022, Xi'an will receive 200 million domestic tourists annually, and the domestic tourism revenue will reach 203 billion yuan, accounting for 33.75% of the total GDP, significantly higher than the national tourism revenue. Tourism has become the pillar industry of Xi'an's social and economic development. It is of great practical and guiding significance to study the distribution of Xi'an's tourism forms.

### 3.2. Index system and data sources

Based on the principles of objectivity and availability of data, the coupling index system of Xi'an's tourism economy and transportation is constructed by referring to existing studies, as shown in Table 1. The main data in this paper are from Xi'an Statistical Yearbook 2022 released by Xi'an Bureau of Statistics.

**Table 1.** Tourism economy and transportation coupling coordination evaluation system

Primary index	Secondary index	Evaluation index	Weight	
Tourism economy	Tourism market scale	Number of tourists received	0.07	
		A-class attractions receive visitors annually	0.08	
	Tourism economic benefit	Gross tourism income	0.07	
		Proportion of total tourism revenue in GDP	0.11	
	Foundation of tourism economy	Number of travel agencies	Number of travel agencies	0.05
			Number of A-level attractions	0.07
		Number of people engaged in the tertiary industry	0.06	
transportation	Traffic scale	Highway mileage	0.15	
		Passenger transport capacity	Passenger turnover	0.04
	Passenger turnover		0.06	
	Transportation foundation	Main year full passenger car	0.06	
		Total number of vehicles in society	0.07	
		Number of urban public transport vehicles in operation	0.11	

## 4. Research Methods

### 4.1. Construction of index system

The evaluation of coupling coordination degree depends on a scientific and reasonable evaluation index system, which should follow the principles of scientificity, representativeness, authenticity, comprehensiveness and data availability. Considering the difficulty of obtaining village-level data, the index data selected in existing literatures should be selected through field investigation of cases. Based on tourism economy and transportation, 13 indicators were selected from six dimensions, namely, tourism market scale, tourism economic benefit, tourism economic foundation, traffic scale, transportation passenger capacity and transportation foundation, to construct an evaluation index system for the coupling and coordinated development of Xi 'an's tourism economy and transportation.

### 4.2. Entropy Weight Method

Entropy originally comes from the thermodynamic concept in physics and mainly reflects the disorder degree of the system. Entropy weight method can eliminate the human interference of the weights of various indicators to the maximum extent, so as to make the evaluation results more objective. When the values of the evaluation objects differ greatly in an indicator, the entropy value is small, indicating that the information provided by the indicator is large, and the weight of the indicator should also be large (Li Shuai et al., 2014). In this paper, this method is used to determine the weight of indicators in the traffic system and each rural tourism system. The calculation steps are as follows: Data standardization—Computational information entropy—Calculate the index entropy.

### 4.3. Coupling coordination degree model

Coupling refers to the phenomenon that two or more systems interact to affect each other, thus forming a coordinated development between systems. When the system or elements promote each other, it is a benign coupling. On the contrary, the coupling is not benign. Coupling degree emphasizes the magnitude of interactions between systems or elements (Meng Deyou et al., 2013; Liu Yaobin et al., 2005) can reflect the previous forces between the transportation system and the rural tourism system, while the coupling coordination degree focuses on the internal coordination of the transportation and tourism integration system, and further measures the coordination consistency between the two in the development process.

## 5. Research Results

### 5.1. 5.1 Research on comprehensive evaluation index of Xi 'an tourism economy and transportation

The comprehensive evaluation index of tourism economy and transportation development of Xi 'an City from 2015 to 2021 is calculated according to the formula .The comprehensive evaluation index of each system based on year comparison found that: From 2015 to 2019, the development of the tourism economy showed a steady rise. In 2020, due to the impact of the epidemic, the comprehensive evaluation index of the tourism economy dropped from 0.41 to 0.19, but

after the recovery of the epidemic, the development of the tourism economy rebounded rapidly, rising from 0.19 to 0.33, although there is still a certain gap compared with 2019. However, it is higher than the average of 0.22 of the comprehensive evaluation index during 2015-2021, so it is positive from the perspective of development trend. Compared with the development of tourism economy, the development of comprehensive evaluation index of transportation system is slow, and it also rose slowly from 2015 to 2018, and also dropped from 0.35 in 2018 to 0.3 due to the impact of the epidemic. The recovery ability and development ability of transportation are also slow. The comprehensive evaluation index from 2020 to 2021 is the same; In 2015 and 2016, the tourism economic system lagged behind the transportation system, and by 2017, the tourism economic system was higher than the transportation system. After 2017, the relationship between the two fluctuated. Tourism was more affected by the epidemic, but the development ability was strong, and the former was higher than the latter by 2021.

**Table 2.** Comprehensive evaluation index

System	Tourism economic system(U1)	Transportation system(U2)
2015	0.01	0.09
2016	0.05	0.09
2017	0.17	0.12
2018	0.35	0.35
2019	0.41	0.30
2020	0.19	0.23
2021	0.33	0.23

### 5.2. Research on the coupling development of Xi 'an tourism economy and transportation

The coupling evaluation index of tourism economy and transportation development of Xi 'an City from 2015 to 2021 was calculated according to the formula. From the perspective of coupling degree value from 2015 to 2021, its value is higher than 0.6, and from 2016 onwards, the coupling degree value is higher than 0.9, indicating that the cooperation between the two systems is getting higher and higher during 2016-2021, and the degree of joint interaction is getting stronger and stronger. From the coupling degree type of 2015-2016, the tourism economic system and the transportation system were in the running-in stage in 2015, and the relationship between the two was in the coupling stage from 2016 to 2021.

**Table 3.** Coupling degree and type of Xi 'an city from 2015 to 2016

Year	Coupling degree (C)	Coupling degree type
2015	0.672174376	Run-in stage
2016	0.95664181	Coupling phase
2017	0.981839358	Coupling phase
2018	0.999977368	Coupling phase
2019	0.988721283	Coupling phase
2020	0.996096558	Coupling phase
2021	0.981362644	Coupling phase

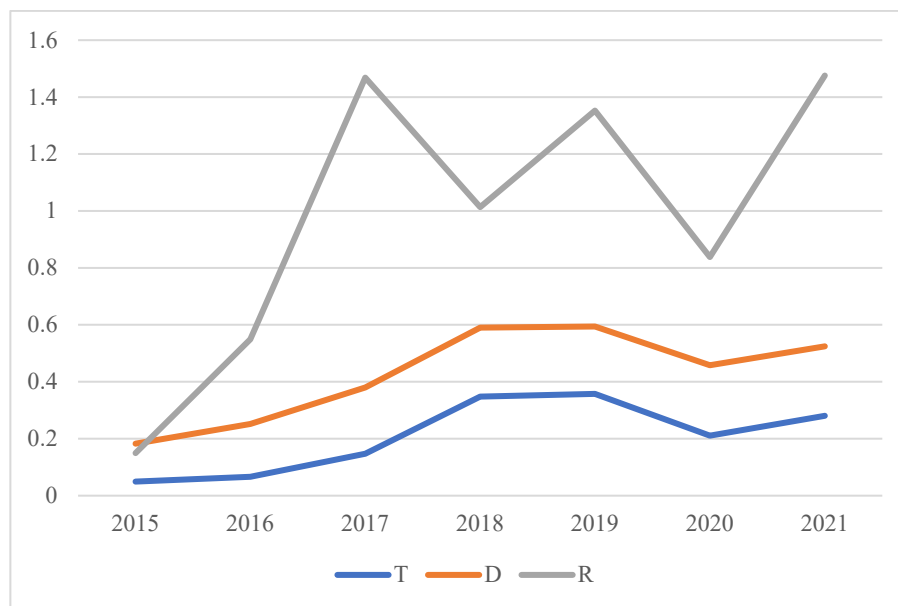
### 5.3. Research on the coordinated development of Xi 'an tourism economy and transportation

The coupling coordination degree between tourism economy and transportation development of Xi 'an City from 2015 to 2021 is calculated according to the formula (Figure 1). From the perspective of the coordination index, the coordination index showed an increasing trend year by year from 2015 to 2019, and was higher than 0.1 since 2017. In 2020, the coordination index dropped from 0.357230827 to 0.210508894 due to the COVID-19 epidemic, and there was a certain rebound in 2021. From 2015 to 2021, the degree of cooperation between the tourism economic system and the transportation system is getting higher and higher, and the synergistic contribution between the two is also getting higher

and higher. From the perspective of coupling coordination degree, the coupling coordination degree increased steadily from 2015 to 2019, decreased from 0.594307767 to 0.457916133 in 2020 due to the impact of the epidemic, and gradually recovered by 2021, but there is still a certain gap compared with 2019. From the perspective of the development type of coupling coordination degree, 2015 and 2016 were in low coupling coordination, 2017 and 2020 were in medium coupling coordination, and 2018, 2019 and 2021 were in high coupling coordination. From the perspective of the relative development index, the relative development index in 2020 is less than 0.9, indicating that transport has insufficient support for tourism economic development, and it is less than 0.6 in 2015 and 2016, indicating that transport has not fully played its role in tourism economic development.

**Table 4.** Coupling coordination degree of Xi 'an City from 2015 to 2021

Year	Coordination index (T)	Coupling coordination degree (D)	Relative Development Index (R)
2015	0.049593539	0.182580136	0.149165818
2016	0.066076446	0.251418954	0.548866382
2017	0.146788481	0.379634967	1.468264877
2018	0.347929171	0.589848538	1.01354673
2019	0.357230827	0.594307767	1.352297022
2020	0.210508894	0.457916133	0.83777871
2021	0.280011601	0.524206949	1.475752879



**Figure 1.** Coupling and coordination development trend

## 6. Conclusion

The coupled coordination model provides an effective method for the study of tourism supply and demand relationship and supply structure, clearly reflects the situation of tourism supply and demand in destinations, and interprets the problems existing in tourism supply structure. The results showed that: ① The comprehensive evaluation index of tourism economy and transportation in Xi 'an showed a steady rise from 2016 to 2019. The epidemic in early 2020 had a great impact on the tourism economy, but the impact on transportation was small, and the synergistic contribution of tourism and transportation was getting higher and higher. ② From 2015 to 2019, the coupling coordination degree of Xi

'an's tourism economic system and transportation system increased year by year, indicating that the degree of interaction between the two is getting higher and higher. ③ The relative development index in 2020 is less than 0.9, indicating that transport has insufficient support for tourism economic development, and it is less than 0.6 in 2015 and 2016, indicating that transport has not fully played its role in tourism economic development.

Based on the above conclusions, the following suggestions are put forward for the development of tourism economy and transportation in Xi 'an City: ① In terms of transportation construction, it is necessary to further improve the regional highway network in the future, focus on promoting the construction of high-speed railways in surrounding areas,

achieve balanced development of expressways and high-speed railways in the province, and provide support for regional tourism.② In terms of tourism development, the future needs to give full play to the leading role of the government, further increase support for the development of tourism, make full use of convenient transportation conditions, enhance the attractiveness of tourism destinations, strengthen regional tourism cooperation, and promote the deep integration and coordinated development of transportation and tourism.

## References

- [1] Zheng Haiyan. A review of high-speed rail tourism research at home and abroad [J]. *Social Science Dynamics*,2019,(7):70-75.
- [2] Zhang Guanghai, ZHAO Jinjin. A spatial econometric study on the impact of transportation infrastructure on regional tourism economic development [J]. *Economic Management*, 2015, 37(7): 116-126.
- [3] Wang Zhaofeng, Yu Han. Spatial-temporal differentiation and mechanism of tourism urbanization response in Western Hunan based on traffic improvement [J.] *Economic Geography*, 2013, 33(1): 187-192.
- [4] Liu Anle, Wang Cheng, Yang Chengyue, et al. Coupling Relationship between transportation and tourism development in border mountain tourism cities: A case study of Lijiang City [J]. *Economic Geography*,2018,38(1):196-203.]
- [5] Chen Xinzhe, Xiong Heigang. Quantitative evaluation and sequential analysis of coordinated development of transportation and tourism in Xinjiang [J]. *Areal Research and Development*, 2009, 28(6):118-121. (in Chinese)
- [6] Lai Fengbo. The impact of transportation on tourism and its development countermeasures [J]. *Railway Transportation and Economy*,2006,(11):85-86.
- [7] Zhang Jianchun, Lu Lin. Wuhu Yangtze River Bridge and the improvement of tourism traffic conditions in Anhui Province. *Human Geography*,2002,(4):75-79.
- [8] Yang Zhongyuan, Lu Song. A study on the impact of traffic development on regional tourism spatial structure: A case study of tourism areas in southern Anhui [J]. *Scientia Geographica Sinica*,2013,33(7):806-814.
- [9] Mu Chenglin, Lu Lin, Huang Jianfeng, et al. Study on pattern and connection of tourism traffic in Yangtze River Delta under high-speed railway network [J]. *Economic Geography*, 2015, 35(12): 193-202. (in Chinese)
- [10] Yin P. High-speed railway and new pattern construction of regional tourism: A case study of Zhengzhou-Xi High-speed Railway.] *Journal of Travel and Tourism*,2012,27(12):47-53.
- [11] Wang Degen. Impact of Beijing-Shanghai High-Speed Railway on Spatial and temporal distribution of tourism flow at major stations [J]. *Tourism Tribune*,2014,29(1):75-82.
- [12] Jiang Haibing, Liu Jianguo, Jiang Jinliang Research on Accessibility of National tourist attractions under the influence of high-speed railway [J]. *Tourism Tribune*,2014,29(7):58-67.
- [13] Wang Degen, Chen Tian, Lu Lin, et al. Effect and mechanism of high-speed railway on spatial structure of regional tourism flow: A case study of Beijing-Shanghai high-speed Railway in China [J]. *Acta Geographica Sinica*,2015,70(2):214-233.
- [14] Wang Degen, Niu Yu, Chen Tian, et al. Optimization of tourism spatial structure in large-scale regional metropolitan area driven by high-speed rail: A case study of Beijing-Shanghai high-speed Rail [J]. *Resources Science*, 2015, 37(3): 581-592.
- [15] Udeng Tsering. Suggestions on development of geological tourism resources in Tibet Section along Qinghai-Tibet Railway [J]. *Journal of Tibet University (Natural Science Edition)*,2008,(2):39-41.
- [16] Xi Jianchao, ZHANG Ruiying, ZHAO Meifeng.Risk Assessment of tourism Safety along Qinghai-Tibet Railway [J]. *Journal of Mountain Science*,2012,30(6):737-746.
- [17] Yan Xuyang. Chinese Tourism Development: Railway Tourism: Strategic new business of railway industry transformation and upgrading [J]. *Tourism Tribune*, 21, 36 (12): 1.
- [18] Li Bohua, LIU Yunpeng, DOU Yindi. Carbon footprint assessment and influencing factors analysis of tourism transportation system in Scenic Area: A case study of Hengshan Mountain in Southern Mountain [J]. *Resources Science*, 2012,34(5):956-963.
- [19] [Li Xiaojing, Wang Zhaofeng.Research on the coupling and Coordinated development of tourism flow and traffic in Zhangjiajie [J]. *Resource Development & Market*, 2013, 29(5): 529-532,552.
- [20] Luo Jinge, Zhang Bo, Liu Siming. The spatial relationship between transportation accessibility and tourism economy in Guangdong-Hong Kong-Macao Greater Bay Area [J]. *Economic Geography*, 2019,40(10):213-220. (in Chinese)
- [21] Li Shuai, WEI Hong, Ni Xilu, GU Yanwen, LI Changxiao. Evaluation of urban human settlement environment quality in Ningxia based on Analytic Hierarchy Process and entropy weight method [J]. *Chinese Journal of Applied Ecology*, 2014, 25(9):2700-2708.
- [22] Qi Wenjing, Hu Weiwei. Evaluation of effective supply of rural quality tourism based on entropy weight TOPSIS: A case study of Zhejiang Province [J]. *Land and Natural Resources Research*,2023(2):84-88. (in Chinese)
- [23] Liu Yaobin, Li Rendong, Song Xuefeng.Analysis of coupling degree between urbanization and ecological environment in China.] *Journal of Natural Resources*,2005,20(1):105-112.
- [24] Lu Sijia, Zhang Xiaolei, Lei Jun. Spatial and temporal differences of urban and industrial harmony along railway lines in Xinjiang [J]. *Acta Geographica Sinica*,2009,64(8):911-923.
- [25] Wang Zhaofeng, Huang Dongchun. Analysis on the coupling coordination of tourism economy-transportation and urbanization and its influencing factors in Chang-Zhu-Xiangtan Urban Agglomeration [J]. *Journal of Natural Science of Hunan Normal University*, 2019,46(1):100-108.
- [26] Zhou Y, Wang Z F. Study on the coupling and coordination relationship between tourism resource development intensity and ecological capacity in the Yangtze River Economic Belt [J]. *Resources and Environment in the Yangtze Basin*, 2019, 30(1):11-22.
- [27] Wang Qun, Yin Ma Hua, Yang Xingzhu et al. Spatial and temporal evolution and influencing mechanism of social-ecosystem vulnerability in tourism areas in Dabie Mountains [J]. *Acta Geographica Sinica*,2019,74(8):1663-1679.
- [28] Hu Jing, JIA Yayan, LI Yajuan, Yu Jie, Wang Rong. Study on the coupling of independent tourism development level and transportation accessibility in Southwest China's ethnic tourism destinations: A case study of Qiandongnan Prefecture [J]. *Journal of Central China Normal University (Natural Science Edition)*,2019,53(1):154-164.