

# Analysis on the Spatial Distribution Characteristics of Industrial Tourism in Zhejiang Province

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## Abstract

**The paper studies the spatial distribution of Zhejiang industrial tourism demonstration bases used the geostationary methods and GIS spatial analysis tools, which mainly shows the following characteristics: Zhejiang industrial tourism demonstration bases present a cohesive distribution, which is concentrated in Ningbo, Hangzhou, Huzhou and Jinhua; the distribution in the five geographical regions is uneven, and the distribution varies greatly; the main distribution is in the vicinity of Hangzhou, Jiaxing, Ningbo and Jinhua. According to these distribution characteristics, some suggestions for the effective development of industrial tourism in Zhejiang Province are put forward.**

## Keywords

**Industrial tourism; Industrial tourism demonstration base; spatial distribution.**

## 1. INTRODUCTION

Industrial tourism refers to activities such as visits, excursions, experiences, and shopping in factories, enterprises, and projects in operation. The Industrial Tourism Demonstration Base is an enterprise or enterprise gathering area suitable for industrial tourism activities, providing necessary tourism facilities and services, and having a certain demonstration and leading role in the development of industrial tourism.

Foreign industrial tourism research is earlier than domestic, and the research content includes tourism effect, development motivation, related public policy, planning and management, industrial heritage protection and development [1], but still lacks normative research results[2]; Heinz believes that more professional industrial tourism planning will become more and more important as industrial tourism matures [3], and more attention should be paid to location research in industrial tourism planning [4]. However, there is still a lack of research on the issue of industrial tourism space abroad. There are also few domestic explorations in the field of industrial tourism spatial distribution. Xiaoguang Gu studied the regional distribution of national industrial tourism demonstration sites [5]; Yang Wu and Yufang Shen proposed two models for the development of industrial tourism space in China [6]; Jie Zhang takes the geographical concentration index of industrial tourist attractions as a reference, and divides the country into three levels: hot development provinces, general development provinces, and cold spot development provinces [7]; Zhen Yang launched a study on the spatial concentration of industrial tourism enterprises in China through the share concentration index [8]; Yang Wu used geostatistical methods and geographic information systems to measure the spatial distribution and linkage characteristics of Shanghai's industrial tourism resources [9].

In summary, China's industrial tourism research started late, and the research on the spatial distribution of industrial tourism areas is still weak, especially the regional industrial tourism

spatial structure, which is generally universal and lacks pertinence. In the "National Industrial Tourism Innovation and Development Three-Year Action Plan (2018-2020)" also pointed out the problem of insufficient development of industrial tourism in China, which includes uneven spatial distribution. Zhejiang Province is one of the more developed provinces in China. With its advantageous geographical location, abundant tourism resources and huge tourist market, the tourism economy is highly developed, and industrial tourism has also developed rapidly. Therefore, based on the relevant research, this paper uses geostationary methods and GIS spatial analysis techniques to study the spatial distribution of industrial tourism areas in Zhejiang Province, summarizes its laws, and provides the scientific basis for the development of industrial tourism in Zhejiang Province. Because the Zhejiang Province Industrial Tourism Demonstration Base has undergone strict screening and evaluation, the number of people receiving the reception, the income from tourism, the number of indirect labor employment, the increase in tax paid by industrial enterprises due to the establishment of tourism, and the points of visits that have been formed in industrial tourism units. The quantity has strict requirements and is the representative of the well-developed industrial tourism area. Therefore, it is more instructive to study the distribution law of the industrial tourism demonstration base. In this paper, spatial distribution law of Zhejiang Industrial Tourism Demonstration Base is used to reflect the spatial distribution of industrial tourism in Zhejiang Province.

## 2. RESEARCH AREA OVERVIEW

Zhejiang Province is located in the south of the Yangtze River Delta on the southeast coast of China, east of the East China Sea, south of Fujian, west of Jiangxi and Anhui, and north of Shanghai and Jiangsu. Zhejiang Province has a longitude of 118°E - 123°E and a latitude of 27°12'N—31°31'N. The province has a land area of 10.43 million square kilometers [10], and it has jurisdiction over 11 prefecture-level cities. Zhejiang Province is one of the most developed and mature provinces in the country, and its industrial development has a long history. In order to further promote the development of industrial tourism, since 2012, Zhejiang Province has selected a number of outstanding industrial tourism demonstration bases every year. As of March 2019, the Zhejiang Provincial Department of Culture and Tourism and the Zhejiang Provincial Department of Economics and Information Technology have selected 119 industrial tourism demonstration bases. Strong industrial enterprises have brought strong driving force for the development of industrial tourism in Zhejiang Province.

## 3. DATA SOURCES AND RESEARCH METHODS

According to the publicity list of the Zhejiang Provincial Department of Culture and Tourism and the official website of the Zhejiang Provincial Department of Economics and Information Technology, as of June 2019, there were 119 Zhejiang Industrial Tourism Demonstration Bases. With Google Earth, 119 industrial tourism demonstration bases in Zhejiang Province were accurately positioned, and then imported into ArcGIS to generate distribution maps (Fig.1). Taking 119 industrial tourism demonstration bases as research objects, combined with ArcGIS spatial analysis technology, quantitative research on the spatial distribution of industrial tourism in Zhejiang Province was carried out, and the spatial distribution characteristics of industrial tourism demonstration bases in Zhejiang Province were analyzed. The specific research methods are shown in Tab.1.

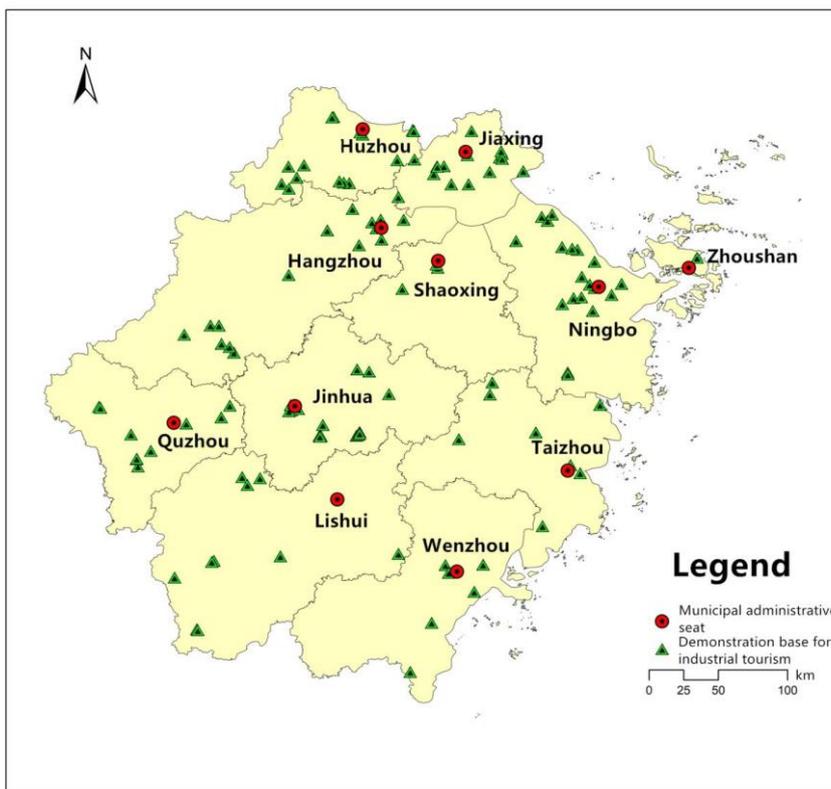


Fig 1. Zhejiang industrial tourism demonstration base distribution map

Tab 1. Research method of spatial distribution

research method	model	research content
Nearest neighbor index (R)	$R = \frac{\bar{r}_1}{r_E} = 2\sqrt{D\bar{r}_1}$ $\bar{r}_1 = \frac{1}{2\sqrt{n/A}} = \frac{1}{2\sqrt{D}}$	Spatial distribution structure type
Geographic concentration index (G)	$G = 100 * \sqrt{\sum_{i=1}^n \left(\frac{x_i}{T}\right)^2}$	Distribution concentration
Unbalanced index (S)	$S = \frac{\sum_{i=1}^n Y_i - 50(n+1)}{100n - 50(n+1)}$	Distribution equilibrium
Gini Coefficient (Gini)	$Gini = \frac{-\sum_{i=1}^n p_i \ln p_i}{\ln N} \quad C = 1 - Gini$	Regional distribution difference
Spatial distribution density	$f_n(x) = \frac{1}{nh} \sum_{i=1}^n k\left(\frac{x - X_i}{h}\right)$	Spatial distribution density

#### 4. SPATIAL DISTRIBUTION CHARACTERISTICS OF INDUSTRIAL TOURISM AREAS IN ZHEJIANG PROVINCE

The spatial distribution characteristics of Zhejiang Industrial Tourism Demonstration Base can be analyzed from the aspects of spatial distribution type, spatial distribution balance and spatial distribution density.

#### 4.1. The spatial distribution type of industrial tourism in Zhejiang Province

In the study of this paper, the industrial tourism demonstration base is regarded as a point-like element distributed discretely in the Zhejiang Province. There are three types of distribution in space, random, uniform and cohesive. In general, we can visually observe the distribution of a certain feature on the distribution map, but often the three distributions will appear in the distribution map at the same time. Therefore, the nearest neighbor index can be calculated to determine the exact distribution type. The ArcGIS software was used to calculate the distance between the 119 industrial tourism demonstration bases and their nearest neighbors, and the nearest neighbor index was calculated. According to the calculation results, the actual nearest neighbor distance is 9.29 kilometers, and the theoretical closest distance is 14.89 kilometers, which gives  $R=0.62 < 1$ . Therefore, the spatial distribution type of Zhejiang Industrial Tourism Demonstration Base is a cohesive type.

#### 4.2. The spatial distribution of industrial tourism in Zhejiang Province

Due to the comprehensive influence of various factors such as natural geography, social culture and economic development level, Zhejiang Province's industrial tourism demonstration base has obvious spatial distribution imbalance, and the number of bases owned by each region is also very different.

##### 4.2.1. Distribution concentration

This paper reflects the concentration of industrial tourism demonstration bases in Zhejiang Province through the geographical concentration index. In this paper, the total number of industrial tourism demonstration bases is  $T=119$ , and the number of prefecture-level cities in Zhejiang Province is  $n=11$ . According to the formula, the geographical concentration index of Zhejiang Industrial Tourism Demonstration Base is calculated as  $G=33.9791$ . Assuming that 119 industrial tourism demonstration bases are evenly distributed in 11 prefecture-level cities, the average number of industrial tourism demonstration bases in each prefecture-level city is about 11, representing a geographical concentration index of  $G=11$ . The actual situation  $G=33.9791$  is far greater than 11, which means that at the level of prefecture-level cities, the industrial tourism demonstration bases in Zhejiang Province are more concentrated. According to Tab.2, Zhejiang Industrial Tourism Demonstration Base is mainly distributed in Ningbo, Hangzhou and Huzhou.

**Tab 2.** Distribution statistics of Zhejiang industrial tourism demonstration base

city	amount	proportion / %	Cumulative weight / %
Ningbo	19	15.97	15.97
Hangzhou	17	14.29	30.25
Huzhou	16	13.45	43.70
Jinhua	15	12.61	56.30
Jiaxing	14	11.76	68.07
Quzhou	10	8.40	76.47
Lishui	10	8.40	84.87
Wenzhou	7	5.88	90.76
Taizhou	7	5.88	96.64
Shaoxing	3	2.52	99.16
Zhoushan	1	0.84	100.00
Total	119	100.00	

#### 4.2.2. Distribution equilibrium

According to the geographical location, natural environment, economic development and historical reasons of Zhejiang Province, Zhejiang Province is divided into five geographical regions. The northern part of Zhejiang is Hangzhou, Jiaxing and Huzhou, the eastern part of Zhejiang is Ningbo, Shaoxing and Zhoushan, the south of Zhejiang is Wenzhou, Taizhou and Lishui, the west of Zhejiang is Quzhou, and the central of Zhejiang is Jinhua. According to statistics, the distribution of industrial tourism demonstration bases in Zhejiang Province shows obvious regional differences, that is, the distribution of the northern regions is concentrated, and the southeast is also distributed more, and the central and western regions are less distributed. The distribution of Zhejiang Industrial Tourism Demonstration Base in five regions is shown in Tab.3.

**Tab 3.** Distribution statistics of industrial tourism demonstration bases in various regions of Zhejiang province

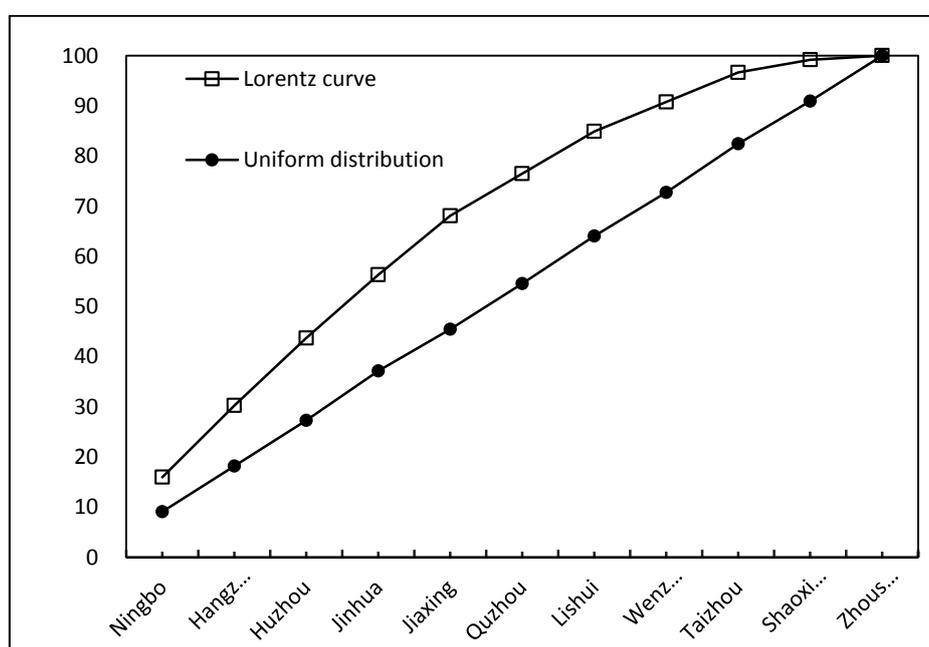
region	amount	proportion / %	Cumulative weight / %
Northern Zhejiang	47	39.50	39.50
Southern Zhejiang	24	20.17	59.67
Eastern Zhejiang	23	19.33	78.99
Central Zhejiang	15	12.61	87.40
Western Zhejiang	10	8.40	100.00

Calculate the Gini coefficient of the number of industrial tourism demonstration bases distributed in five major regions, and then analyze the distribution uniformity of Zhejiang Industrial Tourism Demonstration Base in various regions. In this paper,  $N=5$ , according to the calculation formula of Gini coefficient,  $Gini=0.9175$ ,  $C=0.0825$ , that is, Zhejiang Industrial Tourism Demonstration Base is concentrated in the five geographical regions and the spatial distribution uniformity is very low.

Using the imbalance index to analyze the equilibrium of Zhejiang Industrial Tourism Demonstration Base distribution in various prefecture-level cities, calculate the imbalance index  $S=0.324$  according to the formula, indicating that the distribution of Zhejiang Industrial Tourism Demonstration Base is uneven in 11 prefecture-level cities. Combined with the Lorentz curve of the industrial tourism demonstration base distributed in various cities and towns (Fig.2), it can be found that the demonstration bases are mainly distributed in Ningbo, Hangzhou, Huzhou and Jinhua, and the distribution of these four prefecture-level cities is 56.3%. More than half of the province's total.

As shown in Tab.3, the regional distribution of Zhejiang Industrial Tourism Demonstration Base shows the following characteristics: Most of it is concentrated in the northern part of Zhejiang, up to 39.50%. The first reason is that the provincial capital Hangzhou is located in the north of Zhejiang Province, with strong economic strength and advanced enterprise management. The industrial development in Huzhou and Jiaxing is full of power, and industrial development is in the forefront of the province. The second reason is that the northern part of Zhejiang belongs to the alluvial plain of Hangjiahu, and the terrain is flat and open. The transportation network extends in all directions and has high accessibility. The third reason is that the tourist source of industrial tourism mainly comes from students, local residents and tourists[11], while the proportion of foreign tourists has been relatively small. The resident population of northern Zhejiang has the largest number of residents. It has a good source of tourists. Finally, Hangzhou is also a famous scenic tourist city. Jiaxing and Huzhou also have rich tourism resources, which makes the tourism industry in the north of Zhejiang developed,

attracting a large number of tourists every year. The second largest concentrated area is the southern part of Zhejiang, accounting for 20.17%. The manufacturing industry in the southern region is developed, the industrial system is perfect, and there are management experience; the Taizhou area has a flat and accessible accessibility, while the Wenzhou and Lishui areas belong to the hilly and mountainous terrain, and the accessibility is low; the eastern part of Zhejiang has a total 19.33%. Ningbo and Shaoxing in the east are two other economic centers in Zhejiang Province except Hangzhou. They are developed in industry and rich in human resources. They have a good foundation for the development of industrial tourism. The eastern part belongs to the Ningshao Plain. The terrain is flat and open, with high accessibility. great accessibility. Central Zhejiang and western Zhejiang have the least distribution, accounting for 12.61% and 8.40% respectively. The major factors affecting the development of industrial tourism include the constraints of terrain, its low accessibility, and lack of economic power.



**Fig 2.** Spatial distribution of Industrial tourism demonstration base of Lorentz Curve in Zhejiang Province

#### 4.3. Analysis of Spatial Distribution Density of Industrial Tourism Areas in Zhejiang Province

This paper uses the ArcGIS software to analyze the nuclear density of 119 industrial tourism demonstration bases in Zhejiang Province, as shown in Fig.3. The areas with the highest density of industrial tourism demonstration bases in Zhejiang Province are near Hangzhou, Jiaying and Ningbo: these regions have high economic development level and industrial strength ranks among the best in the province, especially the radiation effects of Hangzhou and Ningbo, which has led to the rapid development of Jiaying and the formation of industry. The gathering of tourism demonstration bases. The second clearly concentrated area is in Jinhua City: Yiwu International Commodity Market is located in Jinhua. Most of the products it supplies are completed in the surrounding areas, which makes its industrial enterprises densely distributed, resulting in agglomeration effects. Good production levels and corporate management advantages are also spawning. A batch of industrial tourism demonstration bases were produced.

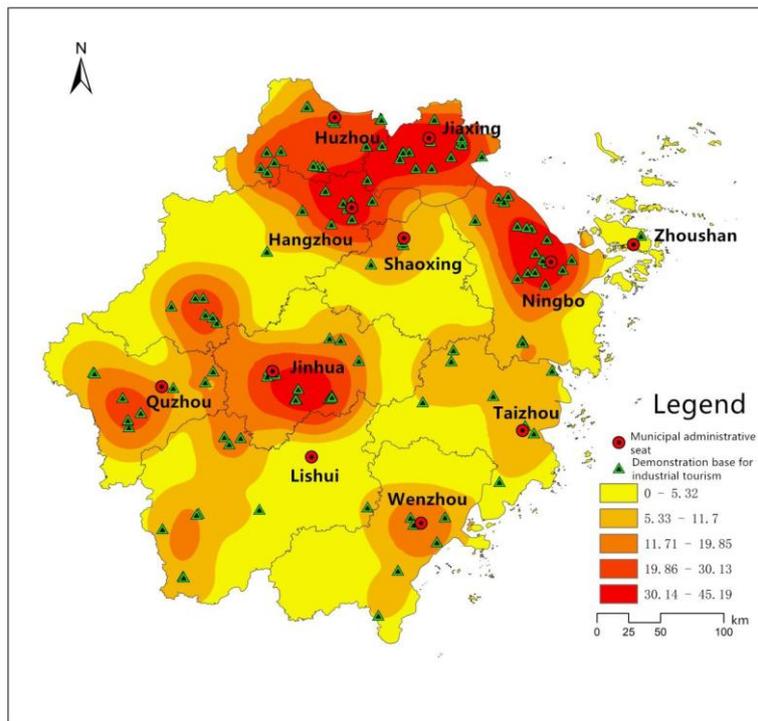


Fig 3. Distribution density map of Zhejiang Industrial tourism demonstration base

### 5. RESULTS AND DISCUSSION

After conducting research on 119 industrial tourism demonstration bases in Zhejiang Province through geostatistical analysis and GIS spatial analysis, the following conclusions can be drawn:

The distribution of industrial tourism demonstration bases in Zhejiang Province shows a cohesive distribution, the nearest neighbor index  $R=0.62$ ; the geographical concentration index  $G=33.9791$ , the imbalance index  $S=0.324$ , the distribution is relatively concentrated, and the difference in the number of distribution between prefecture-level cities Larger, Ningbo, Hangzhou, Huzhou, Jinhua, Jiaxing are concentrated distribution; concentrated distribution in five geographical regions, spatial distribution uniformity is very low, Gini = 0.9175,  $C = 0.0825$ ; formed in Hangzhou, Ningbo, Jiaxing High density distribution, another high density area in Jinhua.

The distribution density of industrial tourism demonstration bases in Zhejiang Province is characterized by spatial imbalance. The reason is the difference between industrial tourism resources distribution and economic strength.

Therefore, the following suggestions are made:

Regional joint development. The spatial distribution of industrial tourism in Zhejiang Province is relatively uneven, showing a clear agglomeration trend. The concentrated distribution area of Zhejiang Industrial Tourism Demonstration Base has obvious advantages in terms of location, transportation, talents and resources, and has good conditions for developing industrial tourism. Joint development is conducive to the industrial clusters to play a cluster effect, which will greatly promote the development of regional industries and drive the development of surrounding areas.

Point-line-to-face planning. The industrial tourism demonstration base has formed a part of high-density distribution in Hangzhou, Jiaxing, Ningbo and Jinhua. The industrial tourism demonstration bases in the rest of Zhejiang Province are scattered and sparse. The industrial

tourism resources should be further explored to further promote the development and promotion of industrial tourism bases. Its accessibility and market appeal. The point integration line will be integrated with the line and the surface to plan industrial tourism routes and industrial tourism areas, and accelerate the integrated development of industrial tourism in Zhejiang Province.

Give full play to the radiation-driven effect of the Zhejiang Industrial Tourism Demonstration Base. The tourism development of Hangzhou-Jiaxing-Huzhou region in the north of Zhejiang Province has been in the forefront of the province, and the development of industrial tourism is also growing rapidly. In the southern part of Zhejiang and western Zhejiang, industrial tourism has developed slowly due to economic, location and transportation. Therefore, we should give full play to the role of the industrial tourism demonstration base in northern Zhejiang, and radiate the development and development of the surrounding areas in the advantageous areas, so that the industrial tourism in Zhejiang Province can be balanced.

Continuously improve the management system of industrial tourism areas. Encourage and support areas where industrial tourism demonstration bases are less distributed, fully tap industrial tourism resources, and carry out industrial tourism activities. Continuously improve industrial tourism in densely populated areas of industrial tourism demonstration bases and improve the quality of industrial tourism. The selection criteria for industrial tourism demonstration bases should also be rationally adjusted and improved so that they can reflect the quality of industrial tourism zones and reflect market demand, so that regional industrial tourism can be balanced from agglomeration to development.

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