

Research on the Synergistic Effect of Digital Economy in Wuxi's Tourism Industry

Suni Sunny Rui

Dipont School of Arts and Science, Wuxi, Jiangsu, 214124, China

Keywords: Digital economy; entropy increase method; in-depth interview; tourism industry innovation

Abstract: As an emerging economic form, the digital economy, based on technologies such as big data, artificial intelligence, and digital systems, is integrating with the traditional tourism industry. This integration not only promotes the innovative development of the tourism industry, but also improves the experience and benefits of consumers and practitioners, and enhances the quality of life and tourism. This study uses the entropy increase method to quantitatively analyze the relationship between the digital economy and the coordinated development of Wuxi's tourism industry, aiming to reveal the promoting effect of the digital economy on the development of Wuxi's tourism industry. At the same time, the study adopts the in-depth interview method to collect empirical data by interviewing tourism practitioners, consumers and related experts in the Wuxi area, and explores the current application and effect of the digital economy in Wuxi's tourism industry. By analyzing the empirical data, the study examines the specific manifestations and influencing factors of the synergistic effect of the digital economy in the tourism industry, providing theoretical and practical guidance for further promoting the integrated development of the digital economy and the tourism industry.

1. Introduction

1.1 Digital economy

Nowadays, the vigorous development of the digital economy has affected a variety of industries around the world. Under the background of the digital economy, people's lifestyles, life rhythms, and production methods are widely and profoundly affected. [1] As a result, the tourism industry is being imperceptibly influenced and adapting to the changes brought about by the big data era. The tourism industry has experienced an unprecedented boom, and the digital economy has pushed the innovative and coordinated development of the tourism industry into a new era and laid a solid foundation for it.

Wuxi, a prefecture-level city in Jiangsu Province, has become a model for the development of the tourism industry driven by the digital economy, thanks to its economic strength that has been leading the national GDP ranking for many years. Wuxi is located in the eastern part of China, bordering the Yangtze River in the north, Taihu Lake in the south, Suzhou, Changzhou, Zhejiang Province and Anhui Province, with the Beijing-Hangzhou Grand Canal running through its territory and a total area of 4,627.46 square kilometers. Its unique geographical advantages have not only nurtured rich natural

and tourism resources, but also promoted the prosperous development of the local economy and tourism industry. In this context, it becomes particularly important to explore the impact of the digital economy on the tourism industry.

The digital economy, also known as the information economy, is a very broad concept. It not only includes driving the efficient use of resources and economic development through data, but also involves multiple fields such as e-commerce, Internet economy, artificial intelligence, digital entertainment and cultural industries, financial technology, etc. The rapid development and deep integration of these fields have made the digital economy an integral part of contemporary socio-economic development, not only greatly promoting the progress of the tourism industry, but also fundamentally changing the economic structure and social development pattern.

1.2 The importance of the tourism industry to the national economy

The importance of the tourism industry in the national economy is increasingly prominent. As an important industry that drives economic growth, increases employment, and promotes balanced regional development, the development of the tourism industry plays a key role in the healthy and stable development of the national economy. The tourism industry can not only directly create a large number of job opportunities, but also indirectly promote the development of related industries such as transportation, catering, accommodation, and retail, forming an industrial chain and realizing the diversified development of the economy. In addition, the tourism industry can also drive the protection and inheritance of regional culture and enhance the country's soft power, which has an important role in promoting the national economy.

1.2.1 The main bottlenecks in the current development of the tourism industry

Although the tourism industry has developed rapidly, it also faces some development bottlenecks. First, the development of tourism resources has problems of over-development and imbalance. Some popular tourist destinations are over-developed, while some areas with potential are neglected. Second, the service quality and level of the tourism industry need to be improved. Some tourist destinations have imperfect service facilities and poor service attitudes, which affect tourists' travel experience. Finally, the development of the tourism industry also faces the challenge of environmental protection. How to develop the tourism industry while protecting the environment is a major problem in the current development of the tourism industry.

1.2.2 The main innovation paths for the current development of the tourism industry

Faced with the bottlenecks in the development of the tourism industry, innovation has become a key path to promote the development of the tourism industry. First, digital innovation has become an important driving force for the development of the tourism industry. Through technologies such as big data and artificial intelligence, the tourism industry can provide more personalized and convenient services and improve tourists' travel experience. Second, green and environmentally friendly tourism models have also received widespread attention and promotion. By developing eco-tourism, rural tourism and other methods, the environment can be protected while meeting the needs of tourists for high-quality tourism. Finally, cultural innovation is also an important path for the development of the tourism industry. By exploring and inheriting local culture, the tourism industry can provide richer and more in-depth tourism experiences and increase the added value of tourism.

1.3 Research on the relationship between digital economy and tourism industry

The relationship between the digital economy and the tourism industry is becoming an important

research area. In the past few years, many researchers have begun to explore this topic and have put forward some insightful observations and findings.

1.3.1 Data-driven decision making

First, the digital economy enables the tourism industry to use big data and artificial intelligence technology to make more precise decisions. For example, by analyzing a large amount of user behavior data, tourism companies can better understand consumer needs and preferences, and provide more personalized services. At the same time, through predictive analysis, companies can also predict trends in the tourism market in advance, and thus make more reasonable strategic decisions.

1.3.2 Enhancing customer experience

Second, the digital economy also helps the tourism industry improve customer experience. Through mobile applications, virtual reality and other digital technologies, tourism companies can provide more convenient and richer travel experiences. For example, travelers can book hotels and purchase attraction tickets through mobile apps, and even preview tourist attractions through virtual reality technology before traveling, greatly improving the convenience and fun of travel.

1.3.3 Innovative marketing strategies

Finally, the digital economy also brings innovative marketing strategies to the tourism industry. Through social media, content marketing, big data analysis and other tools, tourism companies can more effectively promote their products and services and attract more consumers. For example, through social media marketing, tourism companies can establish closer relationships with consumers and increase brand awareness and reputation.

In general, the digital economy has profoundly affected the operation mode and development trend of the tourism industry, which also provides new opportunities and challenges for the future development of the tourism industry.

1.4 Summary

The importance of the digital economy goes without saying, especially in the tourism industry, a key area of the national economy, where its innovative development can significantly benefit from the promotion of the digital economy. However, the entropy increase method commonly used in many studies has some limitations, such as strong data dependence, difficulty in interpretation, and insufficient handling of timeliness, cultural and background differences. Especially in the field of social sciences, the same data may produce different interpretations in different cultures and backgrounds, which makes the analysis of entropy may not fully reflect these differences.

In order to solve these problems, this study takes the tourism industry in Wuxi area as the research object, uses the Wuxi Statistical Yearbook as the main data source, and constructs a set of indicator analysis system. In addition, we also conducted in-depth interviews with seven boutique folk practitioners in Yixing area as a supplementary verification of the indicator analysis. We try to establish an effective evaluation index system of Wuxi regional tourism industry through this method, and verify it through in-depth interviews with two practitioners to understand the meaning behind the data more deeply.

2. Construction and Research Methods of the Evaluation Index System

2.1 Entropy Weight Method

The entropy weight method is an objective weighting method. It establishes a judgment matrix of evaluation indexes for each year, normalizes the judgment matrix to obtain a normalized judgment matrix. According to the definition of information entropy, the entropy value (i.e., the dispersion degree) of an index can be determined. The smaller the information entropy value, the greater the dispersion degree of the index, and the greater the impact (i.e., weight) of the index on the comprehensive evaluation. If the values of an index are all equal, then the index does not play a role in the comprehensive evaluation.

2.2 Construction of the Evaluation Index System

By distinguishing the nature of the indexes, we can divide them into two categories: positive and negative. From Table 1, positive indexes, such as passenger traffic and expenditure on science and technology, promote the development of tourism; negative indexes, such as the unemployment rate, may weaken the driving force of tourism development if they increase. Using this classification method, we will construct a systematic evaluation index system to deepen the understanding of the development of Wuxi's tourism industry.

This paper mainly selects five first-level indexes: population, science and technology, communication, convenience, and economy. Under the first-level indexes, the indexes that have a greater impact on the tourism industry are selected as second-level indexes. The specific evaluation indexes of the innovative development of the tourism industry are shown in Table 1. The assessment framework is established based on the foundation of "Research on the Innovative Development of Liaoning Tourism Industry under the Background of Digital Economy."

Table 1: Tourism Development Evaluation Indicators

First-level Index	Second-level Index	Unit	Index Nature
Population	Passenger Traffic (x1)	10,000 persons	Positive
	Unemployment Rate (x2)	%	Negative
Science and Technology	Expenditure on Science and Technology (x3)	100 million yuan	Positive
	Expenditure on Culture, Sports and Media (x4)	100 million yuan	Positive
Communication	Internet Users (x5)	10,000 households	Positive
	Average Number of Mobile Phones Owned per 100 Households (x6)	Sets	Positive
Convenience	Private Car Ownership (x7)	10,000 vehicles	Positive
	Catering Enterprises Above Designated Size (x8)	Units	Positive
	Accommodation Enterprises Above Designated Size (x9)	Units	Positive
Economy	Tertiary Industry Proportion (x10)	%	Positive
	Per Capita Disposable Income (x11)	Yuan	Negative
	Consumer Price Index for Residents (x12)	%	Positive

2.2.1 Normalization of Evaluation Indicators

Since the units of measurement for each index are not uniform, the indexes are normalized before calculating the comprehensive index.

$$x'_{ij} = \frac{x_{ij} - \min(x_j)}{\max(x_j) - \min(x_j)} \quad (1)$$

In formula (1): x'_{ij} is the normalized value of the j th option of the i th influencing factor; x_{ij} is the number of selections of the j th option of the i th influencing factor; $\min(x_j)$ and $\max(x_j)$ are the minimum and maximum values of the number of the j th option, respectively.

The proportion of the j th option of the i th factor, y_{ij} , is

$$y_{ij} = \frac{x'_{ij}}{\sum_{i=1}^m x'_{ij}} \quad (2)$$

In formula (2): m is the number of influencing factors considered.

The information entropy of the j th option is

2.2.2 Calculation of the Entropy Value for the k -th Indicator

$$e_j = -K \sum_{i=1}^m y_{ij} \ln y_{ij} \quad (3)$$

$$K = 1 / \ln m \quad (4)$$

In formulas (3) and (4): " $K = 1 / \ln m$ (4)", K is a constant.

2.2.3 Determination of Weights

The weight of the j th option is

$$w_j = \frac{1 - e_j}{\sum_{k=1}^n (1 - e_k)} \quad (5)$$

The weighted calculation is performed for each factor to obtain the score S_i of the i th influencing factor

2.2.4 Computation of the Comprehensive Score

$$S_i = \sum_{j=1}^n y_{ij} w_j \quad (6)$$

According to the scores of each influencing factor, the importance ranking of all factors can be obtained.

2.3 Interview Method

The interview method, also known as the conversation method, is a basic research method in psychology that understands the psychology and behavior of the interviewee through face-to-face conversations between the interviewer and the interviewee. Due to the different nature, purpose, or object of the research question, the interview method has different forms. According to the degree of standardization of the interview process, it can be divided into structured interviews and unstructured interviews.^[2] In the preparation of this paper, the author used a semi-structured interview, which is an informal interview conducted according to a rough outline. This method has only a rough basic requirement for the conditions of the interviewee and the questions to be asked. The interviewer can flexibly make necessary adjustments according to the actual situation during the interview. This paper interviewed a total of 10 tourism and hotel practitioners in Wuxi, two of whom accepted in-depth interviews. The following is an introduction to the in-depth interviewees.

Ms. J is responsible for the local marketing of her hotel, mainly dealing with individual customers, companies, and conference groups. The hotel she works for is a resort hotel with good mountain and

cliff views. The room prices range from 1,580 yuan for a single room to 11,880 yuan for a five-bedroom villa.

Ms. W is the director of sales and marketing at her hotel and has worked in the hotel industry for over ten years. Her hotel is divided into three areas: 1. Resort hotel; 2. Villa hotel; 3. Hot spring resort hotel. In addition, this hotel covers an area of 3,000 acres and has a complete conference system. Prices range from 888 yuan for a single room to the hot spring resort hotel that has not yet started operating.

3. Analysis of Evaluation Index Weights

3.1 Analysis Steps

First, analyze the weights of each index according to the weight calculation results. Obtain the weight analysis matrix through the weight calculation results. Finally, summarize the analysis.

3.2 Analysis of Evaluation Index Weights

Table 2: Weight Calculation Results

Entropy Weight Method			
Item Information	Entropy Value e	Information Utility Value d	Weight (%)
x1	0.869	0.131	7.35
x2	0.904	0.096	5.365
x3	0.695	0.305	17.052
x4	0.761	0.239	13.354
x5	0.81	0.19	10.612
x6	0.892	0.108	6.064
x7	0.897	0.103	5.783
x8	0.722	0.278	15.561
x9	0.924	0.076	4.27
x10	0.911	0.089	4.952
x11	0.892	0.108	6.04
x12	0.936	0.064	3.596

From the table 2, it can be seen that x3, x8, and x4 are the main indexes, which are expenditure on science and technology, catering enterprises above designated size, and expenditure on culture, sports and media, respectively. Expenditure on science and technology is the largest in the whole country, indicating that to develop Wuxi's tourism industry, it is necessary to increase investment in science and technology to achieve greater improvement in the tourism industry. From the figure 1, practitioners can help development by learning to use technology, recruiting technology-related personnel, and introducing the latest technologies. Next are catering enterprises above designated size and expenditure on culture, sports and media. The catering industry has played a significant role in the development of Wuxi's tourism industry, and tourists in Wuxi attach great importance to catering. Expenditure on culture, sports and media can be reflected in publicity strategies such as live streaming with goods and influencer promotion.

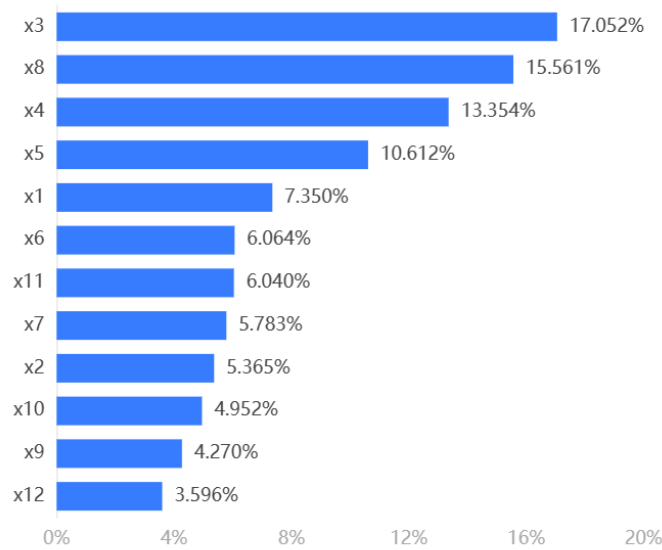


Figure 1: Histogram of Index Importance

3.3 Comprehensive Score Analysis

Table 3: Comprehensive Score Table

Row Index	Comprehensive Evaluation	Ranking
2011	0.153078093700479	11
2012	0.233804929454950	9
2013	0.242300094318161	7
2014	0.188491430579197	10
2015	0.235728006882661	8
2016	0.278291688491003	f
2017	0.492433731958319	5
2018	0.555752200448658	4
2019	0.6576582424541648	3
2020	0.767932519736932	1
2021	0.7439518885046181	2

From the table 3, the top 3 rankings are 2020, 2021, and 2019 respectively. From Figure n, it can be seen that since 2017, Wuxi has continuously maintained stable increases in science and technology expenditures and catering industry expenditures, while cultural, sports and media expenditures reached a ten-year peak in 2020. Therefore, the year-on-year increase of these three indicators effectively promoted the development of science, technology and tourism.

4. Interview Results

4.1 Many practitioners stated that the digital economy helps improve hotel booking efficiency

"OTAs account for over 60% of total bookings"

OTA, which stands for Online Travel Agency, is a professional term in the tourism e-commerce industry. It refers to "travel consumers booking travel products or services with travel service providers through the Internet, and paying online or offline. That is, various tourism entities can conduct product marketing or sales through the Internet."

All homestays and hotels that participated in the questionnaire survey registered on Internet platforms and used them for publicity and booking. Among them, 7 practitioners said they registered on "Ctrip", over three-quarters of hotels registered on "Dianping", followed by "Xiaohongshu" and "Meituan". These four social and booking platforms effectively narrowed the distance between customers and hotels, allowing customers to contact, communicate and make reservations with their favorite hotels anytime, anywhere. In addition to placing advertisements on the registered basic platforms to attract customers, some hotel owners said that Internet platforms also have livestreaming and convenient payment functions. For example, over half of the hotels have registered on the "Douyin" platform. Some hotels have also developed their own booking mobile apps/links/mini programs/official accounts and private domain communities to facilitate faster and more convenient contact and attraction of new and old customers to convey information to consumers. All hotel managers unanimously agreed that booking rooms online is more convenient than booking offline, and it is also more efficient and time-saving for managers. Many managers believe that online Internet platforms are not only convenient and fast, but also have higher occupancy rates than offline bookings.

Ms. J said that her hotel uses digital systems for brand promotion and has achieved good returns. Every year, each Internet booking platform brings in at least 900,000 yuan in additional revenue for her hotel. Both Ms. J and Ms. W said that inviting Internet influencers, i.e. Internet celebrities with a certain fan base, to promote can effectively build the hotel's image and attract many tourists to come for vacations every year.

4.2 The digital economy helps improve customer satisfaction

In the interviews, 6 practitioners said that the digital economy effectively helps improve customer satisfaction.

In interviews with two interviewees, it was learned that their hotels are equipped with "Xiao Du" intelligent robots, which completely free up customers' hands and allow them to adjust lighting, curtains, play music, call waiters and other convenient services. Moreover, installing a one-button butler call bell in villa hotels allows customers to quickly get help from hotel staff in the originally dispersed hotel, and also greatly improves the effectiveness of security work. Furthermore, hotel robot food delivery service is also very popular with customers. This robot not only reduces customers' waiting time, but also saves labor costs for the hotel.

4.3 Most practitioners actively invest in the digital economy

With the development of big data, all respondents said that hotel marketing strategies should be improved with big data at the center. Among them, four hotels are using online livestreaming to promote their hotels, sell hotel affiliated products, and establish the hotel's positioning and image in the minds of customers. Ms. J said, "Online traffic is the main source of customer acquisition for this hotel today."

In addition, Ms. J believes that the digital economy has greatly improved the efficiency of hotel management personnel. This improvement is mainly reflected in artificial intelligence improving the efficiency of graphic design, bilingual Chinese-English systems facilitating the adaptation of staff and customers from different countries to the hotel environment, and systematically establishing customer files, income reports, average quotes, etc.

Ms. W also said, "Digitalization empowers employee training." Due to the different cultural experiences of each employee, the digital system can effectively help managers develop personalized training plans, help reasonably allocate eight-hour workdays, and can achieve training effect assessment and overall planning. Moreover, video training and online training are also training methods used by Ms. W's company. Managers play livestream courses to allow hotel service

providers to learn and serve more efficiently.

4.4 Rapid upgrades will become the main factor limiting the digital economy's support for the tourism industry

When asked about the negative effects of the digital economy on the tourism industry, all participants agreed with the view that "the Internet is upgrading too quickly." The rapid development of the Internet has left many hotels unable to respond or lacking coping methods, resulting in a lack of competitiveness in the digital economy environment. Compared with first-tier cities such as Shanghai and Beijing, Wuxi has a lower technology penetration rate, but it has already put considerable pressure on the hotel industry. Ms. J said, "I hope that in the future, this hotel can develop an online 3D tour program to allow more customers who have not yet come for tourism to experience the hotel's scenery."

5. Conclusion

5.1 A mutually promoting relationship

Through the results of in-depth interviews and the entropy increase method, we can clearly see that there is a mutually promoting relationship between the digital economy and tourism innovation. The digital economy provides new development momentum and space for the tourism industry. Through the application of information technology, the tourism industry can achieve better customer experiences, more effective marketing and promotion, and more efficient operations management, thereby driving innovation and development of the entire industry. At the same time, the innovation and development of the tourism industry will in turn promote the development of the digital economy, because the demand of the tourism industry will drive the innovation and improvement of related digital technologies and services. In this process, scientific and technological innovation has become a key factor in promoting the digital transformation of the tourism industry. Whether it is emerging technologies such as big data, artificial intelligence, cloud computing or the Internet of Things, they are all providing possibilities for the digital transformation of the tourism industry.

5.2 Interview results further reveal the importance of digital technology for the hotel industry

Through interviews, we can see the importance of digital technology to the hotel industry. First, digital technology can increase the online booking rate. Through the online booking system, customers can make reservations anytime, anywhere, which greatly improves the convenience of booking and also brings more customers to the hotel. Second, digital technology can save hotel managers' time and labor costs. Through digital management systems, real-time monitoring and efficient management of hotel operations can be realized, thereby improving operational efficiency and saving costs. Furthermore, digital technology can achieve effective promotion of hotels. Through social media, search engines and other digital platforms, hotels can conduct precise marketing, increase brand awareness, and attract more customers. Finally, digital technology can also efficiently train employees. Through online training systems, employees can learn anytime, anywhere to improve their skills and qualities.

5.3 Challenges faced

Although the digital economy has brought great development opportunities for the tourism industry, it also faces some challenges in the actual development process. First, the digital divide is a

problem that cannot be ignored. Due to differences in social infrastructure, education level, income level, etc., there is an inequality in information access, and some groups may not be able to enjoy the convenience brought by the digital economy, forming the so-called "digital divide".^[3] This situation will reduce the effect of digitization and informatization, and affect the sustainable development of the digital economy. Second, the transformation of traditional enterprises is also a challenge. With the development of the digital economy, many traditional jobs may be replaced by machines or artificial intelligence, which may lead to technological and structural unemployment. For those companies that still adhere to the traditional business model, how to transform and how to use digital technology to improve their own competitiveness is a problem that needs to be solved. Finally, data security is an issue that needs to be focused on. With a large amount of personal information existing on the Internet, how to protect the security of personal data and prevent data leakage is an important challenge that needs to be faced when developing the digital economy.

6. Prospects

6.1 Innovative Paths for Digital Economy to Empower Tourism Development

In the context of the digital age, internet technology has greatly empowered consumers with broader choices and has prompted the tourism service industry to recognize the importance of providing differentiated services. The collaborative development of the digital economy has brought unprecedented renewal and innovation opportunities for the tourism industry, heralding a diversified and prosperous industry future. It is necessary to both carefully create IP tourism routes that align with global standards and deeply explore local culture to create unique tourism products and services to meet increasingly personalized and diverse consumer needs. Through such innovative paths, we can not only enhance the tourist experience but also improve the international competitiveness of the tourism industry.

6.2 Avoiding Wastage of Holistic Ecological Resources Caused by "Fast" Consumer Culture

The current consumer culture is entering an era of "fast consumption" dominated by popular trends and fashion. In this context, consumers often disregard the practical value of goods and instead pursue their symbolic value. This behavior is equally evident in the tourism field. Tourists' pursuit of the latest trendy travel experiences leads the tourism industry to constantly update and renovate to meet the rapidly changing trends. This model results in a great deal of resource waste, especially those tourism resources and cultural heritage that could have been utilized for a long time. Therefore, we call for establishing a more sustainable and responsible consumption model while encouraging the tourism industry to adopt circular economy and green development strategies to avoid depleting precious natural and cultural capital.

6.3 Accelerating High-level Talent Cultivation

The expansion of the digital economy is inseparable from the support of high-quality talent. Although the digital economy field has attracted many talents to join, market demand remains pressing. Therefore, the tourism industry needs to formulate customized talent training programs for young people and provide professional technical training for senior tourism practitioners to ensure they can keep pace with digital transformation. Through online education platforms such as live classrooms, practitioners' learning processes can be more efficient and convenient while promoting their continuous development and career growth. Furthermore, this talent enrichment and improvement will directly impact the overall competitiveness of the tourism market and the

professional level of the workforce.

6.4 Building a One-stop Service Platform

Diversified booking platforms have already provided impetus for the development of the tourism industry, but building a one-stop service platform will further simplify the interaction process between customers and operators. This comprehensive platform can integrate necessary information and data analysis functions, make prices more transparent, and greatly improve the efficiency of booking and managing tourism products. At the same time, to address potential monopoly risks, appropriate government regulation is crucial for the fair operation of the platform. Only by ensuring benign market competition can such an integrated service platform maximize its utility while driving the innovation and sustainable development of the entire tourism industry.

References

- [1] Wang, L., & Zeng, T. (2023). *Research on the Innovative Development of Liaoning's Tourism Industry in the Context of Digital Economy*. *Western Tourism* (4), 5-7.
- [2] Feng, X. (2009). *Modern Social Survey Methods*. Huazhong University of Science and Technology Press.
- [3] Huang, R., & Li, X. *The Mechanism and Path of Digital Technology to Improve the Efficiency of China's Tourism Industry*. *Contemporary Economic Research*, 2021(2):75-84.