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Research Progress and Current Situation on Tourism Carbon Emissions

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Abstract: The global climate problem is becoming more and more serious, and the contribution of carbon emissions caused by rapid tourism development to global warming cannot be ignored. It is of great significance to study the measurement of tourism carbon emission and its influencing factors, clarify the level of tourism carbon emission, and deepen the understanding of tourism's role in energy conservation and emission reduction for promoting the low-carbon transformation of tourism, improving tourism environment, and constructing tourism ecological civilization. Based on the Web of Science and CNKI database, this paper makes statistics and analyses of domestic and foreign journals in the field of tourism carbon emissions from 2010 to 2023. By combing the domestic and foreign literature, this paper further discusses the research status on the measurement range, quantitative method, influencing factors, and reduction countermeasures of tourism carbon emissions, points out the shortcomings of existing research, and puts forward the prospect of future research.

1. Introduction

With the rapid development of world economy, fossil energy is widely used in various fields of human production and life. The increasing convenience of residents' lives has also produced a large amount of greenhouse gases. The greenhouse effect caused by the increase of greenhouse gas content plays a leading role in the rapid global warming in the 20th century. Global warming is a serious threat to ecological, economic, and social sustainable development. Energy conservation and emission reduction has become a hot topic in the international community. As the world's largest developing country, China bears an important responsibility in the process of global low-carbon development. To further address global climate issues, China put forward the goal of "carbon peak, carbon neutrality" in September 2020. It means China needs to reach the peak of carbon emissions by 2030, and achieve the development vision of carbon neutrality by 2060. It can be said that "carbon reduction" has become the key direction and main content of China's high-quality economic development and ecological civilization construction in the new era[1].

The tourism industry has become one of the most important paths for many countries and regions to achieve economic growth, improve the ecological environment, and balance regional disparities. It is considered to be a green industry with "low energy consumption and light pollution". In fact, the tourism is not a "smokeless industry" as traditionally recognized, and it has become one of the important contributors to global warming. China's tourism industry started with the reform and opening up and has made great progress since the 21st century, the Chinese government promoted the tourism industry to the height of national strategic pillar industry. As shown in Figure 1, in 2019, the number of domestic tourists in China reached 60.06 billion, and the total tourism income was as high as 6.56 trillion yuan, an increase of 7.07 times and 13.52 times respectively compared with 2000. Such a large-scale population migration' and economic activities will inevitably generate a large amount of energy consumption and carbon emissions.

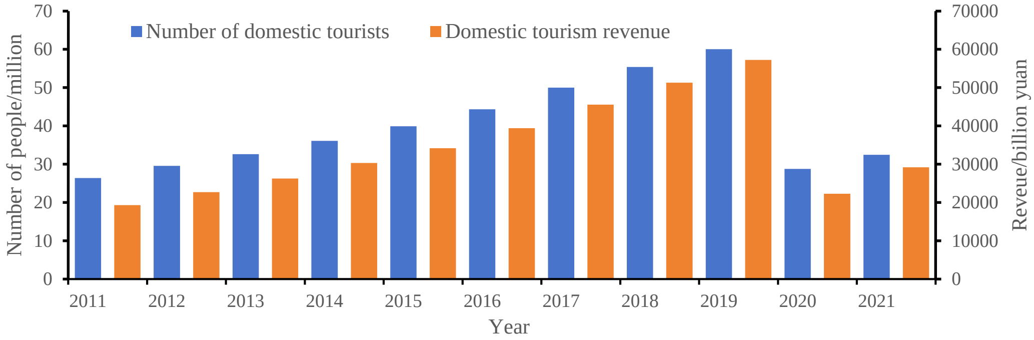

Figure 1: The number of domestic tourists and domestic tourism income in China

In response to the significant surge in carbon emissions resulting from tourism, the Chinese government has implemented numerous policies, introduced specific requirements for energy conservation and emission reduction within the tourism sector, and implemented a range of complementary measures. However, these efforts have not effectively alleviated the pressure posed by carbon emissions stemming from China's tourism development. Therefore, promoting the energy conservation and emission reduction of the tourism industry and promoting the transformation of the tourism industry from the traditional rough development model to the sustainable low-carbon development model are not only the requirements for the tourism industry to achieve its sustainable development [2], but also a positive response to China's series of emission reduction commitments. This paper systematically sorts out the relevant literature on tourism carbon emissions and analyzes the research status in this field, aiming to provide ideas for improving the measurement of tourism, the decomposition of influencing factors, and the path of emission reduction.

2. Literature statistics

Based on the Web of Science core collection database, the research period is set to 2010-2023, the theme is 'tourism carbon emission' or 'tourism energy consumption', and the literature type is 'article'. A total of 536 articles were searched. 248 journal articles were retrieved based on CNKI in the same way. The literature changes year by year are shown in Figure 2. From the practice of publishing papers, the literature on carbon emissions in the Web of Science has been increasing steadily since 2010. Among them, 2022 was the most, with 122 articles, an increase of 24.5% compared with 2021. Although the number of articles in CNKI was more than that in Web of Science from 2011 to 2017, it was lower than that in Web of Science after 2018, and the gap gradually widened. In addition, the linear tendency rate of Web of Science on the rising trend of carbon emissions is significantly larger than that of CNKI.

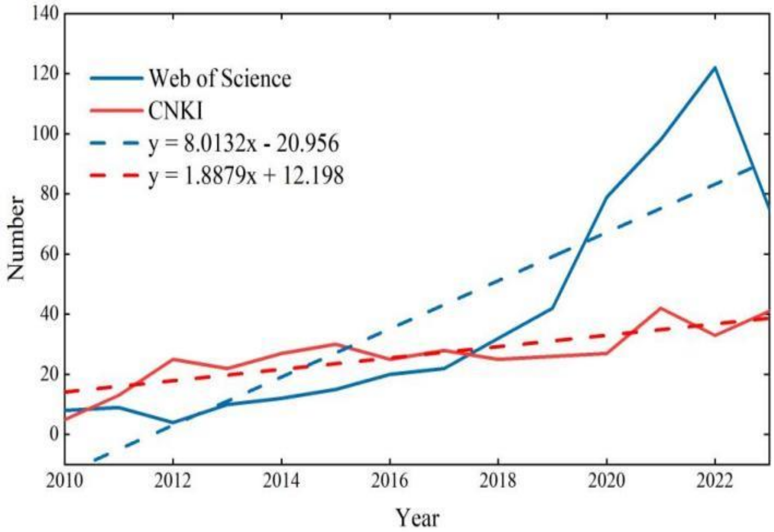

Figure 2: The literature distribution curve of tourism carbon emissions

3. Research status of tourism carbon emission measurement

The quantitative measurement of tourism carbon emissions is the basic link to promote the low-carbon construction of tourism. The study of tourism carbon emissions measurement began in the early 21st century. Gössling[3] first proposed a systematic quantitative measurement of tourism carbon emissions. Since then, scholars have gradually enriched the quantitative measurement of tourism carbon emissions. At present, some progress has been made in the definition of the scope of tourism carbon emission accounting, as well as the measurement of carbon emissions in the three sectors of tourism transportation, tourism accommodation, and tourism activities, and the measurement of carbon emissions in the whole tourism industry. Some scholars have set the boundary of tourism carbon emission accounting as the total amount of carbon emissions generated by a series of activities such as the mode of transportation chosen by tourists to leave their habitual place and the accommodation and sightseeing activities to the destination. The research idea of characterizing the overall carbon emissions of the tourism industry with these three links is recognized by many scholars.

3.1 The measurement range of tourism carbon emissions

3.1.1 Tourism traffic carbon emissions

Tourism transportation refers to the transportation facilities and services provided for tourists to and from the source and destination of tourists and activities in tourist destinations. It is the carrier for tourists to directly experience tourism activities and the main source of carbon emissions from tourism. According to the existing research, the carbon emissions of tourism transportation are higher than the carbon emissions of tourism accommodation and recreation activities in the total carbon emissions of the tourism industry. Only the carbon emissions contributed by ground transportation account for 32% of the total carbon emissions of the tourism industry.

Scholars at home and abroad mainly use the "bottom-up" method to measure the carbon emissions of tourism transportation, that is, from the perspective of consumption, according to the number and distance of passengers taking various modes of transportation and the carbon emission coefficient of each mode of transportation, to measure the carbon emissions of tourism transportation. On the research scale, it involves not only the macro scale of Antarctica and the country, but also the medium and micro scale of provinces, cities, and scenic spots. Specifically, on the intercontinental and national macro scales, the carbon emissions generated by international cruises carrying each passenger when traveling to and from New Zealand in 2007 were about 390g/km, which was about 4 times that of international airlines. Some scholars have studied the carbon emissions generated by tourists traveling to Antarctica, and found that the contribution of maritime navigation and air transportation to traffic carbon emissions is about 70% and 30%, respectively, indicating that in some specific areas, air transportation has lost its dominant position in the contribution of tourism traffic carbon emissions.

On the meso scale of provinces and cities, the total carbon emissions in East China are characterized by high in the north and low in the south, and Jiangsu Province is the largest carbon emission area of tourism transportation. Some scholars found that the total carbon emissions of tourism transportation in Sichuan Province showed a trend of increasing first and then decreasing, and then increasing and then decreasing, and the carbon emissions of different modes of transportation were quite different. In the study of tourism traffic carbon emissions at the micro level of scenic spots, some studies have taken Fuzhou National Forest Park, Taimu Mountain and Wuyi Mountain, three scenic spots with different passenger attraction radius, as the research objects. The calculation results show that the increase of passenger attraction radius is the main reason for the increase of per capita tourism traffic carbon emissions. Some studies have also measured the carbon emissions of tourism transportation in Wulingyuan Scenic Area, and found that the carbon emissions in different months are quite different, and the carbon emissions of tourism transportation in October are 4 times that in January.

3.1.2 Tourism accommodation carbon emissions

The accommodation industry is an important part of the tourism industry. The traditional concept is that the pressure on the environment caused by the accommodation industry is not great, but in fact, the average energy consumption of the accommodation industry can reach 250-350 kilowatt hours/square meters. The average energy consumption of higher-grade hotels is as high as 450-700 kilowatt hours/square meters, which is much higher than the average energy consumption of commercial buildings of 30-152 kilowatt hours/square meters. Relevant research shows that the carbon emission of the accommodation industry accounts for between 6% and 30% of the total carbon emission of the tourism industry, which is the second largest carbon emission sector of the tourism industry after the tourism transportation sector. Scholars have paid more and more attention to the measurement of carbon emissions in the accommodation industry, and have achieved certain results. The measurement ideas are divided into two categories: " top-down" approach and "bottom-up" approach. From the perspective of carbon regulation, Lai [4] believes that the global audit results on carbon emissions in the hotel industry are still not mature enough. The daily audit result of each room in Hong Kong hotels is 31.07 $kgCO_2$-e, slightly higher than that in the United States. In the carbon emission structure of Zhenjiang' Sanshan' scenic spot, the carbon emission of the accommodation industry accounts for 25.87% of the total carbon emission of the scenic spot. Although the proportion of carbon emissions in China's overall tourism wholesale and retail and accommodation and catering industry is smaller than that in the transportation industry, the average annual growth rate has increased and the growth space is large.

3.1.3 Carbon emissions from tourism activities

The carbon emissions of tourism activities account for a relatively small proportion of the total carbon emissions of tourism. Therefore, there is no special study on the quantitative measurement of carbon emissions of tourism activities. The research results are all from the comprehensive measurement of carbon emissions of tourism by scholars. Most scholars divide the tourism industry into three sectors: tourism transportation, tourism accommodation and tourism activities, and use the "bottom-up" method to calculate the energy consumption and CO_2 emissions of the tourism industry.

3.2 Measurement method of carbon emissions in tourism industry

3.2.1 "Bottom-up" method

The "bottom-up" measurement method is based on the consumption terminal of tourism products or services. Through the detailed list of carbon emissions, tourism consumption is classified according to the food, housing, transportation, tourism, shopping, entertainment, and other sectors. The carbon emissions are calculated by factors and sectors, and the total carbon emissions of the tourism industry are summed up. The calculation structure of this method is clear and the data is easy to obtain. However, since this method starts from the perspective of terminal consumption, it cannot measure the indirect carbon emissions generated by intermediate products, and it is easy to underestimate the carbon emissions of tourism. This classification method is equivalent to artificially cutting off the continuous industrial chain, which will also cause certain measurement errors. Since most countries have not established a special tourism energy consumption statistical account, the "bottom-up" tourism carbon emission measurement method has been widely used, from the global scale to a certain scenic spot, and has achieved certain results.

From the perspective of global and national macro-scale, Gössling [5] first constructed a tourism carbon emission accounting system including three sub-sectors of tourism transportation, tourism accommodation, and other tourism activities, and quantitatively measured the global tourism carbon emissions. The results show that tourism carbon emissions account for 5.3% of the total global carbon emissions, and the contribution to global warming can reach 5% -14%. It is one of the eight major carbon emission sectors in the world. The measurement results of Peeters [6] also show that in 2005, on a global scale, the contribution of tourism carbon emissions to total emissions was 4.95%, and it is increasing at an average annual growth rate of 3%. Some studies have also used this method to estimate the CO_2 emissions of China's tourism industry. The quantitative measurement results show that the CO_2 emissions of China's tourism industry in 2008 were about 51.34 Mt, accounting for 0.86% of the total carbon emissions in the country. Based on previous studies, some scholars have lengthened the measurement year and analyzed the time series evolution of carbon emissions in China's tourism industry. The measurement results of the proportion of tourism carbon emissions in total carbon emissions at the national level are different from the global corresponding measurement results. On the one hand, this is due to the different development levels and development stages of tourism in different countries. On the other hand, it is also because scholars in different countries have different standards and scopes when subdividing the tourism part, so the measurement results between countries are not horizontally comparable.

On the provincial and municipal scale, some studies have measured the carbon emissions of tourism in 30 provinces and cities in China. The results show that the carbon emissions of tourism in all provinces and cities in China are on the rise, and the carbon emissions of tourism traffic are the main source of tourism carbon emissions, accounting for more than 80%. Li[7] calculated the carbon emissions of tourism in Hainan Province from 2000 to 2020 and found that the carbon emissions of tourism in Hainan Province have obvious stage characteristics, and the total carbon emissions are the same as the growth trend of carbon emissions of domestic tourism and inbound tourism. The research on the micro-scale of scenic spots has also achieved certain results. For example, some scholars have quantitatively measured the carbon emissions of 42 leisure forests in the East China Sea Economic Zone of Malaysia. Other scholars have also measured the carbon emissions of Baiyangdian scenic spots from seven aspects: catering, accommodation, transportation, sightseeing, entertainment, shopping, and waste.

3.2.2 "Top-down" method

The "top-down" calculation idea refers to directly estimating the carbon emissions of the tourism industry as a whole according to the energy consumption of the tourism industry at the national or regional level and the carbon emission coefficient of various energy sources. Because this method generally needs to use the input-output table to calculate the energy consumption and energy consumption intensity of various sectors of the tourism industry, it is also called the input-output method. The system boundary of the "top-down" measurement idea is more complete, and the input-output data can be used to measure the indirect carbon emissions of the tourism industry. Therefore, the measurement results are more accurate than the "bottom-up" method. However, due to the lack of tourism energy statistics accounts in most countries and the lack of details caused by the "integrity" of the method, it is not used to measure carbon emissions at the micro level such as scenic spots. The results of tourism carbon emissions measurement using this method are relatively few.

Based on the life cycle theory and input-output model, combined with the national economic accounting system tourism satellite account, and other measurement techniques, most scholars have compiled a "top-down" tourism carbon emission measurement system. On this basis, Meng [8] estimated the carbon emissions of China's tourism industry in 2002, 2005, 2007 and 2010. Since then, some scholars used the modified input-output model to analyze the carbon emissions of China's tourism industry in 2002, 2007, and 2012. There are also studies that used the environment-extended input-output method to estimate the total carbon emissions generated by inbound and domestic tourism in the Welsh region of the UK.

3.2.3 The combination of "bottom-up" method and 'top-down' method

Some scholars have used the "bottom-up" method and the "top-down" method to measure the carbon emissions of tourism in the same area to compare the results. Perch-Nielsen [9] used the "bottom-up" method and the "top-down" method to calculate Switzerland's tourism carbon emissions in 1998. The results were 2.29 million tons and 2.62 million tons, respectively. In addition, some scholars have measured the carbon emissions of tourism by combining the passenger consumption structure data in the "bottom-up" method and the input-output data in the "top-down" method. For example, some scholars have used the "tourism consumption stripping coefficient" to measure the carbon emissions of tourism throughout China, pointing out that the carbon emissions of tourism transportation, warehousing, and postal services dominate the carbon emissions of tourism. There are also studies that use the proportion of total tourism revenue to the added value of the tertiary industry to separate the energy consumption of the tourism industry from the energy consumption of the tertiary industry, and then measure the tourism carbon emissions of 25 cities in the Yangtze River Delta region.

The advantages and limitations of the tourism industry carbon emissions measurement method are shown in Table 1.

Table 1: The advantages and limitations of the measurement method of carbon emissions in tourism industry

Method	Advantages	Limitation	Representative literature
"bottom-up" method	From the perspective of consumers, the scope of accounting and data collection are defined. The data collection is convenient and the logical thinking is simple and clear, which is suitable for the calculation of tourism carbon emissions in areas and tourist attractions without tourism energy satellite statistical accounts. In addition, it can also classify the carbon emissions of the tourism sub-sectors.	It has not yet formed a unified accounting scope division method, and can only account for the carbon emissions generated by the tourism terminal sector, and the indirect tourism carbon emissions generated by the intermediate sector are insufficiently accounted for.	Gössling et al. 2002; Peeters and Dubois 2010
"top-down" method	The estimation is directly carried out at the national /regional level, which can consider indirect carbon emissions. The accounting is more comprehensive and comparable, and it is suitable for the estimation of tourism carbon emissions at the macro level.	It is required to establish a relatively complete statistical account of energy consumption and carbon emissions in the tourism industry, and the data are difficult to obtain.	Meng et al. 2016
The combination of "bottom-up" method and " top-down" method	To a certain extent, it makes up for the lack of consideration of indirect tourism carbon emissions by the ' bottom-up ' method and the high data requirements of the ' top-down ' method. It is an alternative method before the establishment of a tourism energy satellite statistical account.	It is necessary to use some way to separate tourism energy consumption and carbon emissions data from related industries, and the accuracy needs to be verified.	Perch-Nielsen et al. 2010

4. Research on the influencing factors of tourism and the countermeasures of carbon emission reduction

4.1 Study on the influencing factors of carbon emissions in tourism industry

In recent years, from the perspective of technology and systems, it has become the focus of some researchers to analyze the impact of tourism energy structure, energy intensity, consumption level, passenger flow scale, and other factors on tourism carbon emissions, and to analyze the corresponding carbon emission reduction countermeasures.

From a technical perspective, some studies mainly analyze the impact of energy structure and energy intensity on tourism carbon emissions from a technical perspective[10]. Although some enterprises have a positive attitude towards the use of renewable energy to optimize the energy structure and improve energy efficiency, the actual support is not enough[11]. Because energy efficiency measures seem to be difficult to make up for the growth of carbon emissions, the current tourism development model is unsustainable, and the way and quantity of tourism transportation must be changed. Based on the dual perspectives of fairness and efficiency, some scholars have evaluated the carbon emission reduction potential of tourism in 30 provinces (cities and districts) of China from 2000 to 2018. The results show that the carbon emission reduction potential of the national tourism industry is declining. Some studies have also explored the spatial and temporal evolution characteristics of energy intensity, industrial structure, and emission factors driving the change of carbon emission intensity in the Beijing-Tianjin-Hebei region from 2000 to 2020, and traced and quantified the phased contribution of terminal sub-sectors in each driving factor. Other studies have analyzed the spatial and temporal evolution characteristics of China's carbon emission performance and the impact of technological innovation on carbon emission performance.

From the perspective of the system, some achievements focus on the analysis of the impact of tourism management, consumption level, tourist scale, and other factors on carbon emissions from the perspective of the system. Tourism carbon emissions are closely related to the tourism economy and the total number of tourists. Coles [12] reveals the cognitive gap between small and medium-sized tourism enterprise dealers in terms of energy consumption and management, which will lead to the growth of tourism carbon emissions. There are also studies found that regional economic development, urban environmental governance, and other factors have a certain impact on tourism carbon emissions by constructing a forest carbon sink threshold model based on the impact of tourism activities.

4.2 Tourism carbon emission reduction countermeasures research

From a technical perspective, renewable energy has the characteristics of rich variety, large storage capacity, and clean and environmental protection, which provides the possibility of technical application for carbon emission reduction in tourism. Some scholars believe that Singapore's different star hotels should formulate more balanced emission reduction measures based on their energy intensity. Taking Xixi Wetland as an example, Cheng [13] put forward the view that tourism should pay attention to the utilization of new energy in order to create a low-carbon tourism environment. Some scholars have also found that renewable energy consumption and R & D can help reduce carbon dioxide emissions from tourism. By analyzing the relationship between carbon emissions and influencing factors, Han [14] has constructed a carbon emission system dynamics model to simulate and predict its impact on the carbon peak time, peak value, and emission reduction potential of Beijing, Tianjin, and Hebei. Some studies also take China's transportation industry as the research object and believe that the adjustment and optimization of transportation structure, the scale of electric trucks, and the optimization of energy structure can effectively reduce the carbon emissions of China's transportation industry.

Under the background of the international community's continuous game on global climate change, institutional strategy research has received increasing attention. In order to improve the energy conservation and emission reduction of tourism, tourism enterprises should be encouraged to form low-carbon alliances, exchange and promote low-carbon technologies, and implement low-carbon tourism methods and low-carbon tourism routes to create a good low-carbon tourism atmosphere. Based on the background of national economic development and carbon emission reduction, Zhao [15] proposed the optimization strategy and path of carbon emission transfer. In addition, some scholars have taken the low-carbon city and innovative city policy as the research object and found that the carbon emissions of the dual pilot cities are significantly lower than those of the non-dual pilot cities. Based on the practice of national eco-industrial demonstration parks, some studies have empirically tested the impact of green location-oriented policies on carbon emissions and their mechanism by using the difference-in-difference method. The research conclusions show that the green location-oriented policy with Chinese characteristics is an effective measure to actively respond to climate change and promote the realization of the "double carbon" goal.

5. Deficiency and outlook

Overall, the research on measuring tourism carbon emissions at home and abroad has made positive progress. From the perspective of the measurement of tourism carbon emissions, the measurement objects of tourism carbon emissions tend to evolve from macro and micro to macro on a spatial scale, but the research at the regional level is relatively weak. In the department, it goes from plane to depth, but the tourism transportation modes such as self-driving tours, the forms of tourism accommodation such as social hotels, and the types of tourism tours such as visiting relatives and friends need to be further studied. In the industry, there is a trend from a few departments to all elements. However, there is still not enough attention to other departments such as catering, shopping, entertainment, etc., and the six elements of travel, travel, housing, food, shopping, and entertainment within the city are rarely involved. The measurement method of carbon emissions in tourism is becoming more and more perfect and mature, but there is still room for improvement. First, the measurement method of carbon footprint is mainly based on field research, the measurement scale is relatively small, and the dependence on data is high, which cannot fully show the environmental impact of China's tourism industry from a macro perspective. Second, the "top-down" measurement method is limited by the input-output table, and there is a certain time lag in the measurement of carbon emissions in the tourism industry. Third, the "bottom-up" measurement method is more flexible than the first two methods to reflect the changes in tourism pollution in a timely manner. However, in terms of measurement structure, it is still necessary to explore carbon emissions measurement methods related to tourism, such as catering, entertainment, and shopping.

In terms of the influencing factors of tourism carbon emissions, the research methods have shifted from qualitative to quantitative. The analysis time has changed from short to long, and the cycle has changed from less to more. However, the research is still relatively scattered, the system is not strong, and the deep-seated reasons behind it are not enough. The application of quantitative methods, including LMDI, is still in the trial stage. In terms of the influence of single factors, important achievements and progress have been made in energy structure and other aspects, from theoretical deduction to empirical application, but empirical cases to evaluate the effect of carbon emission reduction regulated by various factors are rare. In terms of tourism carbon emission reduction countermeasures, scholars have conducted a more in-depth analysis of low-carbon tourism consumption patterns. Future research should pay more attention to the overall promotion and focus, and pay more attention to the measurement of carbon emissions and factor decomposition as a platform. However, the existing research is slightly insufficient in this regard, resulting in some countermeasures with a certain degree of subjectivity or generality.

References

[1] Zhang Y, Sun Q, Xue J J, et al. Synergistic effects of pollution control and carbon reduction and their pathways. China population, resources and environment, vol. 35, no. 5, pp. 1-13, 2022.

[2] Zhu, H., Wang, L. Spatial association and identification of carbon neutrality in Chinese tourism, based on social

network analysis. All Earth, vol. 35, no. 1, pp. 65-81, 2023.
[3] Gössling S. "Sustainable tourism development in developing countries: Some aspects of energy use". Journal of sustainable tourism, vol. 8, no. 5, pp. 410-425, 2000.
[4] Lai, J. H., Yik, F. W., Man, C. S. "Carbon audit: a literature review and an empirical study on a hotel". Facilities, vol. 30, no. 9-10, pp. 417-431, 2012.
[5] Gössling, S., Hansson, C. B., Hörstmeier, O., et al. "Ecological footprint analysis as a tool to assess tourism sustainability". Ecological economics, vol. 43, no. 2-3, pp. 199-211, 2002.
[6] Peeters, P., Dubois, G. "Tourism travel under climate change mitigation constraints". Journal of Transport Geography, vol. 18, no. 3, pp. 447-457, 2010.
[7] Li S X, Tong J, He B. "Prediction of Tourism Carbon Peak and Carbon Neutrality Based on Multiple Scenarios: A Case Study of Hainan Province". Economic Geography, vol. 43, no. 6, pp. 230-240, 2010.
[8] Meng, W., Xu, L., Hu, B., et al. "Quantifying direct and indirect carbon dioxide emissions of the Chinese tourism industry". Journal of Cleaner Production, vol. 126, no. 10, pp. 586-594, 2016.
[9] Perch-Nielsen S, Sesartic A, Stucki M. "The greenhouse gas intensity of the tourism sector: The case of Switzerland". Environmental Science & Policy, vol. 12, no. 2, pp. 131-140, 2010.
[10] Anser, M. K., Ahmad, M., Khan, M. A., et al. "The role of information and communication technologies in mitigating carbon emissions: evidence from panel quantile regression". Environmental Science and Pollution Research, no. 28, pp. 21065-21084, 2021.
[11] Gössling, S., Broderick, J., Upham, P., et al. "Voluntary carbon offsetting schemes for aviation: Efficiency, credibility and sustainable tourism". Journal of Sustainable tourism, vol. 15, no. 3, pp. 223-248, 2007.
[12] Coles, T., Dinan, C., Warren, N. "Energy practices among small-and medium-sized tourism enterprises: a case of misdirected effort?". Journal of Cleaner Production, vol. 111, no. PartB, pp. 399-408, 2016.
[13] Cheng Q, Su B R, Tan J. "Developing an evaluation index system for low-carbon tourist attractions in China – A case study examining the Xixi wetland". Tourism Management. vol. 36, no. 6, pp. 314-320, 2013
[14] Han N, Luo X Y. "Carbon emission peak prediction and reduction potential in Beijing-Tianjin-Hebei region from the perspective of multiple scenarios". Journal of Natural Resources, vol. 37, no. 5, pp. 1277-1288, 2022
[15] Zhao, B., Sun, L., Qin, L. "Optimization of China's provincial carbon emission transfer structure under the dual constraints of economic development and emission reduction goals". Environmental Science and Pollution Research, vol. 29, no. 33, pp. 50335-50351, 2022.