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Discussion on Smart Tourism from the Perspective of Big Data Analysis

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Abstract:

Both tourism and big data are hot spots at present. Various types of complex data in tourism show explosive growth in everyday, that is tourism big data. With the rapid development of information and communication technology (ICT) such as Cloud computing, Internet of things, 5G network, Blockchain and Mobile intelligent terminal, and meeting the needs of better service management, smart tourism has become the main direction of global tourism information construction and theoretical discussion, so there are many problems to be solved urgently. As a service industry, only by fully mining and analyzing the potential information in tourism data can tourism better carry out decision-making management and provide tourists with more comprehensive and high-quality services. Based on this, combined with the research on big data, this paper believes that big data analysis is the core of smart tourism. we summarized the concept and development of smart tourism, and combined with big data analysis, this paper defines the smart tourism and analyzes the current construction of smart tourism, we talked about the problems and challenges faced by big data analysis in smart tourism, and discussed and the research direction and development opportunities created by the big data analysis for smart tourism.

Keywords*: Smart tourism; Big data; Data analysis; ICT*

I. INTRODUCTION

Since the 21st century, due to the rapid development of society and economy, tourism has increasingly become an important part of people's life, resulting in tourism becoming one of the largest and fastest-growing service industries in the world. Even under the serious influence of COVID-19, according to the statistics of World Tourism Cities Federation, the total number of tourist trips reached 6 billion 600 million people in 2021, and the total global tourism revenue reached US $3 trillion and 300 billion, which returned to 53.7% and 55.9% respectively in 2019. The proportion of global tourism revenue equivalent to GDP rose to 3.8%. In China, tourism industry started late, but its development speed is fast. The total number of domestic and overseas inbound tourists in China was 2.237 billion in 2010, and the number which was also affected by COVID-19 and just returned to 54% in 2019 was 3.246 billion in 2021. We believe that after COVID-19, China and the world's tourism industry will have a rapid development.

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The global tourism boom has promoted the rapid development of tourism informatization. Since the 1980s, information and communication technology has completely changed the business model and structure of tourism [1]. Especially in the past 10 years, the rapid development of information technologies such as cloud computing, Internet of things, Internet and mobile intelligent terminals has further upgraded tourism informatization. At the same time, it has also brought subversive changes to the traditional tourism management mode, marketing mode, tourist demand and consumption mode. ICT has completely changed the efficiency of tourism organization, the driving mode of tourism market and the interaction mode between tourists and tourism organization [2,3]. Providing high-quality decision-making service management, meeting the diversified and real-time personalized needs of tourists, improving the consumption efficiency of tourism, and improving the effective allocation and sustainable utilization of tourism resources and social resources have become the most serious challenges in the current tourism industry.

At the same time, the rapid development of the new ICT has also led to an explosive growth in the amount of data in various industries around the world. According to the digital universe research report of International Data Corporation (IDC), the total amount of data created and copied in the world in 2011 exceeded 1.8ZB [4], but it has reached an amazing number which was 60ZB in 2020. The data form is not only reflected in the huge quantity, but also its complexity, it has various forms (text, number, picture, audio, video, etc.) and complex structure (structured, unstructured and semi-structured), the information value density in the data is low, but the total value is large (the data contains a lot of irrelevant and inaccurate information, but the total value is large and has a significant impact on society and economy), the real-time processing ability of data is required to be stronger - this is big data. “Nature” magazine launched a special issue of "big data" in September 2008, marking the official arrival of the era of big data. The advent of the era of big data has brought opportunities and challenges to the manufacturing industry, service industry and various disciplines. In February 2011, “Science” magazine and other journals launched a special issue "dealing with data" from the perspective of data processing, The compression of data from various fields, such as astronomy and medicine, brings many challenges .

As a hot service industry at present, its data certainly has all the characteristics of big data and is one of the important sources of big data. However, at present, the application of big data in tourism lags far behind other industries, such as biomedicine, aerospace technology, e-commerce and so on. In our opinion, there are many reasons. For example, the tourism industry started late, the application of emerging information technologies related to the tourism industry is not as extensive as other industries, the tourism industry has a low impact on people's life and social development compared with other industries, and the national government pays less attention to big data of the tourism industry and relevant economic and technological investment. The arrival of the era of smart tourism not only promotes the development of ICT in tourism, but also caters to the development of big data in tourism. But so far, few scholars have discussed the application of big data in tourism. That's why smart tourism needs to solve many new research problems with big data. The most fundamental problem is that the definition of smart tourism needs to integrate big data, the relevant architecture of smart tourism needs to integrate big data, and the core of smart tourism is big data analysis.

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II DEFINITION OF SMART TOURISM

Smart tourism is an extension of the two concepts of smart earth and smart city. Smart earth, also known as intelligent earth, was first proposed by IBM in 2008 [5]. In early 2009, US President Barack Obama publicly affirmed the smart earth strategy. In August 2009, IBM released the plan of "smart earth wins in China". Through the development in recent years, IBM's smart earth strategy has been recognized by the world. According to the definition of IBM, smart earth is a smarter way to change the way governments, companies and people interact with each other by using a new generation of information technology, so as to improve the clarity, efficiency, flexibility and response speed of interaction. It has three characteristics: more thorough perception, wider interconnection and deeper intelligence. Smart city is the specific practical application of smart earth, and it is composed of many parts. It connects with each other through diversified networks and provides real-time information data of people's activities and objects, so as to make effective real-time decisions for relevant activities of the city [6].

As an extension of smart earth and smart city, smart tourism related information technology has been widely used [7-10]. However, at present, there is few unified and scientific academic term on "smart tourism" in tourism research at home and abroad. For example, some scholars think that smart tourism is to use emerging information technology and equipment to actively perceive the information of tourism resources, tourism economy and tourism activities, so as to release it in time, understand the arrangement and adjust the work and plan in time, so as to realize the intelligent perception and utilization of all kinds of tourism information. And other scholars pointed out that smart tourism is based on the new generation of information and communication technology to specify personalized needs for tourists, improve tourism management level, realize the sharing and effective utilization of tourism resources. It is gratifying that China's smart tourism cities have achieved initial results, and a number of smart cities and smart tourism experimental platforms such as Beijing and Shanghai have been established. However, the above definitions of smart tourism are mainly based on the level of information technology, which is biased towards intelligent tourism, and the construction of smart tourism also focuses on information construction.

We believe that the essence of smart tourism is the upgrading of traditional tourism, which is still a service. All the informatization of tourism management, the informatization of tourism resources and the optimal operation of tourism economy ultimately serve tourism consumers and various interest groups, in order to customize better personalized services for tourists, improve the interests of various profit-making groups and improve the level of management decision-making. The arrival of the era of big data also marks the arrival of the era of big service [11], and so does smart tourism. The process of smart tourism service is the process of big data collection, storage, management and analysis, and the key in this process is big data analysis. Other aspects are for data analysis. Only through in-depth analysis of the information of various types of tourism and all source data, can we better carry out the cooperative management of various interest groups, the development and effective utilization of tourism resources, the scheduling and coordination of personnel, materials and transportation, understand the behavior of tourists, provide better services, and promote the sustainable and healthy development of tourism service industry.

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Combined with the above description, this paper defines smart tourism as, smart tourism is to fully collect and manage all types and sources of tourism data through the new generation of information technology, and in-depth analysis of the potential important value information of these data, the information provides services for tourism management decision-makers to make effective management decisions, to improve the interests and cooperation ability of profit-making groups, and to fully meet the personalized needs of tourists and better tourism experience. Figure 1 shows the conceptual structure of smart tourism. It can be seen that the early collection and management of information technology and its data is the basis of smart tourism, the analysis of tourism big data is the core, and the three types of services provided are the purpose. Certainly, smart tourism is also a part of smart earth, but from the perspective of urban tourism, a small part of smart tourism belongs to smart city, because in addition to urban tourism, tourism also includes natural sightseeing tourism, religious and cultural tourism, etc.

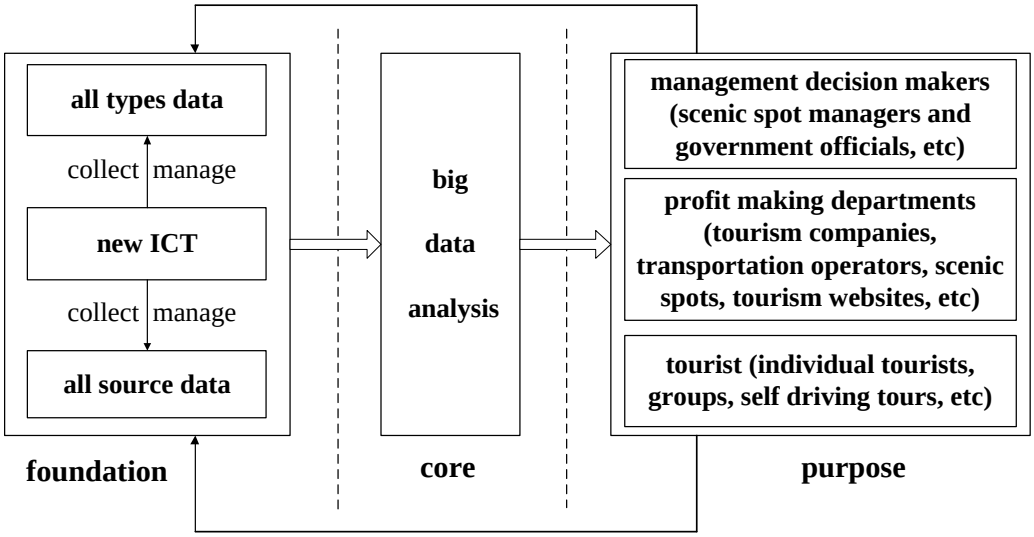

Figure 1: The conceptual framework of smart tourism

III PROBLEMS AND CHALLENGES

Big data and traditional data have the characteristics of the Pareto Principle (or the 80-20 rule) in the proportion of data volume. With the explosive growth of data, this proportion may be greater. On the contrary, the value generated by big data is "20-80 rule " compared with traditional data, which may be smaller. One of the reasons is that there are not so many tools and methods similar to traditional data analysis to deeply mine and analyze big data in order to find more important value. How to conduct big data analysis is the biggest problem and challenge faced by making full use of big data. In addition, big data is still facing problems such as collection, management and security, but compared with big data mining and analysis, these problems tend to be simple. As smart tourism is still in its infancy, as the core of smart tourism, tourism big data analysis certainly has many problems and challenges that need to be

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studied and solved in the future. At the same time, the current construction and development of smart tourism also faces many problems.

3.1 Tourism big data analysis

Since big data became a hot spot, scholars first tried to analyze and mine big data with traditional data analysis methods, but almost none of them succeeded. From the current research, big data analysis subverts the traditional data analysis method, and changes from traditional causality analysis to correlation analysis [12]. In the era of big data, we no longer pursue the causes of results, but only focus on the value of results. Successful cases, such as Google's successful prediction of H1N1 influenza outbreak time and Walmart supermarket bundle sales through relevant analysis of search records. The problems and challenges of tourism big data mining are not only limited by the experimental platform and data security, but also by the lack of effective mining methods.

3.1.1 Experimental platform

The experimental platform is the basis of data analysis, especially big data analysis. The data structure of traditional data analysis is simple and easy to collect and manage. The analysis tools have low requirements for the processing ability of computers. Experiments can be carried out on personal computers or small computer clusters. The massive, complex structure and huge space occupied by big data make the performance requirements of big data on the experimental platform much higher, which is impossible to be carried out on the traditional experimental platform. At present, the effective method is to collect, manage, mine and analyze big data on cloud platform or large-scale computer integration [13], which is also the reason for the rapid development of big data analysis in big Internet companies such as Google , Amazon, Alibaba and Tencent, etc, many scholars also study big data through cooperation with these companies.

At present, for smart tourism, the bad thing is that the construction of big data experimental platform in scenic spots or tourism departments is slower than that in other industries. In China, only a few large scenic spots such as Huangshan and Jiuzhai Valley have basically realized the digital construction of tourism, but there is still a certain distance from the intelligent construction, and the construction of cloud platform and big data experimental platform has hardly started. We know that the big data experimental platform is a data sharing platform. In addition to increasing investment in the necessary hardware facilities of the experimental platform, the construction of tourism big data experimental platform involves more departments than other industries. As shown in Figure 2, the scenic spot needs to build a data center of the big data experimental platform. In order to complete the data, this data center must be associated with the government affairs, weather and geography, transportation, e-commerce, government management departments, tourism agencies, tourism companies, tourism forum websites and other departments of the scenic spot. This is a huge project, and coordinating the interests of all parties is the difficulty and focus. It can be seen that it is very difficult to establish a complete big data experimental platform. The reasons for the difficulties are, on the one hand, the development of the tourism industry

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started late, and its value advantages and benefit advantages for countries and regions are not obvious. However, with the improvement of living standards, people's tourism is becoming more and more intense, and the development of tourism is unstoppable. On the other hand, the government has not invested enough in the construction of tourism, and has only preliminarily built the government affairs platform of scenic spots and tourism departments. However, with the tourism boom and the increase of tourist demand, the government will certainly increase the investment in the construction of smart tourism.

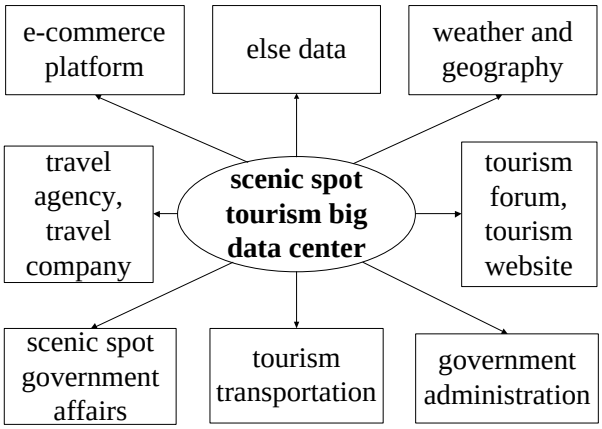

Figure 2: The distribution of big data sources in scenic spots

3.1.2 Data analysis methods

Everyone's point of view is limited to their own cognitive area. The exploration of big data is like a blind man touching an elephant [14]. With the explosive expansion of data sets, the difficulty increases. The biggest difficulty of data analysis lies in the need for scientific and effective data analysis methods. Big data subverts the traditional data analysis methods and has to explore new methods. At present, scholars have achieved some results, most research related to social network media, which coincides with smart tourism. Tourism is also a social means. Many data also come from various social network platforms, such as foreign Facebook, Twitter, Wechat, microblog and various tourism website forums.

There are complex relationship networks in big data. To fully mine its value information, it is necessary to associate multiple data sources, which is the main method of big data analysis - correlation analysis. However, using correlation analysis to mine the value information of tourism data is more difficult than other fields, because there are more sources of tourism data, resulting in more redundant data and more complex data forms. Providing satisfactory services to tourists requires fully mining tourism data. Traditional data analysis can analyze the relationship between tourism risk intuition and tourism hesitation [15] and the impact of tourism quality and satisfaction on Tourism loyalty [16]. However, if you want to analyze a tourist's travel plan behavior, you may need to pay attention to his search for weather, transportation, scenic spots and other aspects. A picture he pays attention to and his social media interaction with friends will affect his travel plan. You need to thoroughly analyze these data. On the other hand, the real-time analysis of big data is more important in the field of tourism. The characteristics of

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tourists' real-time demand make the mining of tourism data must also be real-time For example, through big data, we can collect rich and real feedback information about their travel experience actively released by users. Compared with interviews and questionnaires that need to be designed in advance, the text information containing their true feelings actively released by these tourists is usually considered unbiased and fair. Combined with big data analysis, it can help tourism researchers study the influencing factors of tourism experience more accurately [17]. Through the big data text mining technology, we can automatically process a large number of texts and deeply mine the hidden tourism information, so as to find the tourism behavior of tourists [18]. The big data dimensionality reduction technology is used to eliminate the ambiguity of terms with multiple meanings, and the unsupervised algorithm is used to obtain the final theme. The hidden dimension is revealed, which can analyze the tourists' satisfaction with scenic hotels [19]. However, these are only a small part of the tourism big data analysis methods, and many problems need to be solved.

It is undeniable that there will be more scientific big data analysis methods in the future to explore more value of big data. However, at present, in addition to correlation analysis and mining, we can only cross the river by feeling the stone. Fortunately, at this stage, it is our real purpose to create more social value through mining. Because of its industry particularity, tourism big data may be different from big data analysis in other industries, in addition to exploring different methods from traditional data analysis.

3.1.3 Data security

Big data advocates data sharing. The lower the degree of data sharing, the greater the difficulty of big data analysis, but the higher the degree of data sharing, the greater the data security risk. Data sharing requires the association of multiple data sources, which is easy to cause the disclosure of personal privacy of individual users and business secrets of companies and enterprises. Starting from data collection and storage, our geographic information, mobile communication, e-mail, online chat and even electronic medical treatment will leave traces in the associated data center [20], and these traces will allow hackers to take advantage of the opportunity. Big data mining analysis will also involve a large amount of sensitive information about customers and employees, as well as intellectual property rights, trade secrets and financial information [21]. There are inevitable data security risks in tourism data. For example, when tourists travel, their food, housing, transportation, shopping and electronic transactions will be stored in the database. If these data are fully shared, if tourists are placed under a microscope and become transparent, they have no privacy at all. If they do not manage the data safely, the personal and property safety of tourists will be affected, which will eventually lead to a decline in satisfaction. The security of tourism data has always existed from collection and storage to later data analysis. To carry out big data analysis, the security management of big data is the primary premise.

At present, big data takes the cloud platform as the storage management center, most of the research on big data security focuses on the background of cloud environment, and considers the security of data in the storage and management stage. There is little research on the security of data in the analysis and use stage, which is a big threat to the security of tourism data. Smart tourism focuses on the real-time analysis of

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tourism data. Tourism data security involves many groups. In order to make full use of the potential value of tourism data, in addition to technical support, tourism data security must formulate a set of perfect data sharing mechanism, data access mode and data security protocol.

3.2 Smart tourism construction

There are two main problems in tourism construction. On the one hand, the construction of a new generation of tourism information and communication technology is imminent. On the other hand, the relevant management and operation mode of tourism needs to be innovated. The development of ICT can make tourism management and operation more intelligent, and the innovation of management and operation will inevitably promote the development of ICT in tourism.

3.2.1 Strengthen the construction of tourism informatization

In terms of tourism informatization, smart tourism is the highest mode of tourism informatization development. At present, the tourism informatization construction in developed countries has reached the digital stage, but only a few scenic spots and management departments have reached this stage, which delays the development of smart tourism. The informatization construction of tourism needs to further build mobile communication network, Internet of things and tourism cloud platform on the basis of improving the original digitization.

Mobile Internet is a bridge between tourist mobile intelligent terminal and data centers such as tourism cloud platform. It is the infrastructure supporting the Internet of things. Tourists can enjoy real-time diversified services about tourism information, real-time transmission of tourists' demand information and interactive transmission of various tourism data information, which are inseparable from high-quality mobile communication networks. The Internet of things realizes the real-time interaction between things and people and between people. It can collect, transmit, store, manage, perceive and use the information of objects and people without the limitation of time and region, and realize the function of "all-in-one card". For example, based on the construction of the Internet of things, the scenic spot establishes the natural landscape, cultural relics and other tourism resource information database and explanation system by using RFID, QR code, 5G network and other technologies. Finally, tourists can view and listen in real time by using mobile terminal equipment, and the management department can monitor, manage and protect the tourism resources in real time. Tourism cloud platform is not only the experimental platform of tourism big data mining, but also the tourism information service platform. It is the application center of various functions such as tourism information collection, storage, processing and query. It is the integration of the original independent tourism information service system and data center. The establishment of tourism cloud platform can make tourism related management more unified, data information more complete, effectively improve tourism information service level, and make full use of tourism resource information.

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3.2.2 Innovative management and operation mode

The development of smart tourism will inevitably lead to the transformation of tourism management and operation from traditional mode to modern mode, and its management mode and operation mode are more intelligent. Smart tourism management and operation need to make full use of the new generation of information and communication technology, which is based on the analysis and mining of tourism big data.

The management innovation of tourism requires the management department to carry out intelligent management on the basis of the original digital management. The integration of information management system based on the new generation of information and communication technology can carry out remote management and cooperation on various management and cooperation objectives, cultivate more professional staff and service personnel, establish a new evaluation system and coordinate the interests of all parties, Guide tourists and cooperative companies to move towards intelligent tourism. For example, the intelligent management of scenic spots mainly includes:

(1) Providing intelligent services for tourists, designing satisfactory personalized tourism products, establishing a fast and real-time tourism related information query system, and monitoring the location and flow of tourists in real time.

(2) The real-time management of tourism resources and environment is to integrate tourism resources information, establish an intelligent supervision system, and analyze the state of tourism resources and environment in real time for scientific development and utilization.

(3) The emergency management and handling of emergencies reflect the intelligent management level of the scenic spot, and an increasingly intelligent emergency system needs to be established.

(4) The cooperation and coordination of cooperative units are more intelligent, which can reduce manual intervention, save costs and improve efficiency.

The new generation of information technology and big data have spawned new business models in various industries, as well as tourism. Smart tourism also needs to develop innovative business models. Traditional tourists choose tourism destinations and find tourism related information in a relatively fixed way. They all rely on travel agencies or tourism companies to arrange their relevant tourism activities. However, in the era of smart tourism, tourists' tourism behavior is more diversified, autonomous and personalized, and pay more attention to the real experience of tourism products. This is because the new generation of information technology has affected the tourism behavior mode of tourists. Tourists' behavior may change all the time, and its life cycle becomes shorter and shorter. Therefore, smart tourism needs to strengthen its insight into tourists and the market. At the same time, in the big data environment, the strategy and design of tourism operation pay more attention to real-time, so as to enrich and perfect the experience of tourists. Traditional data mining is mainly aimed at historical data, while big data pays attention to real-time mining and analysis to understand tourists' interests and preferences [22], and then combined with theoretical knowledge such as psychology and marketing, we can design and provide tourism products and services with more personalized needs to meet the real-time needs of tourists.

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IV RESEARCH DIRECTION AND DEVELOPMENT OPPORTUNITIES

As the core of smart tourism, big data not only brings problems and challenges, but also produces many new research directions and development opportunities. Data serves us, and tourism data is no exception. How to find value information from massive tourism data for our use is a new topic facing smart tourism. Big data analysis will bring the following research directions and development opportunities in the field of smart tourism.

4.1 Explore tourism business value information

Through big data mining and analysis, we can fully understand tourists' consumption behavior, interests and preferences. Then design personalized tourism products for tourists, recommend tourism destinations, optimize tourism routes, tap potential tourism customers and so on. For example, through the browsing records, it is found that while viewing the relevant tourism information of the scenic spot, a tourist also browses the information of other scenic spots around the scenic spot, it indicated that the tourist is likely to visit the surrounding scenic spots after sightseeing the scenic spot. Combined with other gender, age, occupation and other information, we can recommend appropriate travel plans for him. At the same time, there are more than one such tourists and they are a group. Therefore, it is necessary for the scenic spot to improve the traffic conditions with other scenic spots and add links to the information of other scenic spots on its official website.

4.2 Development and protection of tourism resources

Tourism resources are the carrier of tourism. Fully and reasonably developing and protecting tourism resources is also one of the purposes of smart tourism. It can improve tourists' tourism experience and benefit multiple interests. The premise of tourism resources development and protection is the sustainable development of tourism. In order to develop and protect tourism resources in the smart tourism environment, we must make full use of the new generation of information technology and with the help of big data mining analysis. We must grasp the status of natural landscape, cultural relics and other tourism resources in real time, analyze the carrying capacity of scenic spots, analyze various factors affecting tourism resources, and analyze the maximization of development, these are inseparable from big data analysis.

4.3 Generate new management and operation theory

As mentioned above, smart tourism is bound to face the challenge of management and operation innovation, but on the other hand, smart tourism is bound to generate new management and operation theory. For example, through tourism big data, it is easy to find that the tourism supply chain in the smart tourism environment is no longer the traditional supply chain model. The traditional supply chain is a simple upstream and downstream relationship, but in the big data environment, the tourism supply chain is a complex network structure with multiple levels, and each level contains multiple groups. These groups

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compete or cooperate. It is obviously inseparable from big data analysis to study the contractual relationship and coordination relationship between them and their superiors and subordinates, it will not only produce different from the traditional supply chain model theory, but also produce a new management and operation theory.

4.4 Development of big data analysis

The boom of tourism will inevitably promote the development of theories and methods related to big data analysis together with other industries, and the industrial characteristics of smart tourism may produce big data mining methods different from other industries. An hour of audio may be valuable for a few seconds. What tools and methods are designed to find these value information from the massive tourism data? Big data analysis must be carried out in combination with the characteristics of the tourism industry.

V. CONCLUSION

The era of smart tourism and big data has come. We can understand the world and experience tourism through our fingers and using smart phones and related devices. Smart tourism is quietly changing the tourism behavior of tourists. However, smart tourism is still in its infancy, and the application of big data mining is hardly involved in the tourism industry. However, the huge value contained in big data will set off a management revolution. Similarly, big data will have an unstoppable impact on smart tourism. The hot of tourism makes the competition in the tourism market more and more intense. Through the construction of smart tourism and big data mining, obtaining more potential value information will greatly improve the competitiveness of the tourism market. At present, although there are many obstacles to the development of big data in smart tourism, big data deserves our attention. The tourism industry's attitude towards big data should be changed from planning ahead to fully mining and application.

Smart tourism will further upgrade the whole tourism industry. Fueled by the new generation of information technology, tourists' dependence on tourism information will gradually increase, tourists' behavioral needs will be more personalized and diversified, the structure of the tourism market will become more and more complex, and the sustainable development and utilization of tourism resources will highlight the importance. This will urge the tourism industry to integrate and share various data information, innovate management mode and change operation thinking, which are inseparable from tourism big data mining. With the deepening of mining, the application of tourism big data in the tourism industry is becoming more and more extensive, and the potential value information contained will continue to be used by us. Tourism big data will inevitably input fresh blood for the development of smart tourism. The development prospect of smart tourism is full of vitality and will be more colorful than traditional tourism.

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