Countermeasures of Developing Smart Tourism in Transportation Hub City Based on Big Data
—The Case of Wuhan City in Hubei Province

Xin Zhao¹, Zhenzhen Xu², Yifeng Yu*¹

Abstract Wuhan, an important transportation hub city in the middle of China, has always been known as "thoroughfare to nine provinces". It has outstanding advantages in obtaining large passenger flow data and the development of smart tourism. This paper probes into the position of Wuhan's unique transportation hub, analyzes the problems existing in its development of smart tourism, and puts forward three countermeasures for the development of Wuhan smart tourism based on big data. Firstly, Wuhan should take advantage of traffic big data to improve the public service facilities. Secondly, strengthen the smart vehicle management to create humanized service environment. Lastly, broaden the intelligent network coverage to provide personalized service experience for tourists.

Keywords big data; smart tourism; transportation hub; Wuhan

1 Introduction

With the progress and promotion of Internet technology, smart tourism based on the background of big data has emerged gradually, China put forward the concept of "smart tourism" formally in 2010. The National Tourism Bureau regards smart tourism as the direction of China's tourism development in 2011, and then calls the year of 2014 as “the theme year of smart tourism”, which witnesses the smart tourism is recognized by more and more people and becoming the future trend of tourism gradually. Wuhan, one of the first batch of 18 smart travel pilot city, has a long history and rich cultural tourism resources: three 5A-class tourist attractions, 15 4A-class tourist attractions and 339 places of historic interest and scenic beauty in total, including 5A-level scenic spots Yellow Crane Tower, the Wuhan Yangtze River Bridge known as the "the first bridge on Yangtze River", East Lake Eco-tourism Scenic Area, Qingchuan Pavilion, Guiyuan Temple, and Wuhan University with the profound humanism atmosphere. In 2016 Hubei Provincial Tourism Development Committee released data that the number of tourist reception in Wuhan reached 233 million person-times, accounting for 40% of the total number of received people in the province, and the total income was 250.57 billion yuan, accounting for 49.8% of the total revenue of the province. In 2012, National Tourism Administration has

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E-mail: cindy_vin@163.com

¹ Xin Zhao: postgraduate student, Business School, Hubei University, Wuhan 430062, China
² Zhenzhen Xu: postgraduate student, School of Resources and Environment, Hubei University, Wuhan 430062, China
Corresponding Author: ¹*Yifeng Yu: professor, Business School, Hubei University, Wuhan 430062, China
identified 18 smart tourism pilot cities including Wuhan. In 2015, the National Tourism Administration issued *Guidance on the Promotion of the Development of Smart Tourism*, indicating that the smart tourism should adhere to the government guidance and market combination. In terms of transportation, WuHan is the important transportation hub known as "throughfare to nine provinces". The transport volume of aviation, railway, subway, bus is increasing year by year, and the popularity of sharing bicycles also makes it easier than before for people to travel in the city. The State Council issued the *Development Plan of Modern Integrated Transportation System during 13th Five-Year Plan Period* in 2017, and proposed the construction of "ten vertical and ten horizontal" integrated transport corridor, of which three lines will pass Wuhan.

In the payment and purchase means, the prevalence of Alipay opens a cashless payment era in some of cities in our country. According to statistics, the current resident population of Wuhan has more than 11 million, of which the population using Alipay is nearly 9 million. This convenient payment mode allows visitors who go to Wuhan for travel to have not the trouble to carry huge amounts of cash, and to avoid the loss of cash. Wuhan bus opened a mobile phone swiping card mode in August this year. By mobile phone scan payment, the discount is equivalent to that by bus card to bring a lot of convenience to the people's travel. The convenience of Alipay is not only reflected in the trip, but also in the scenic ticket and tourist goods. In 2013, Wuhan issued the annual card of the scenic spots, and in 2015, launched Wuhan travel joint card. The combination of tourism e-card and scenic spots achieve double convenience of trop and tourism. But these are still not enough to guarantee the development of smart Tourism. How to use the convenient transportation to construct the Smart Tourism System is an urgent problem in Wuhan.

### 2 Big Data and Smart Tourism

#### 2.1 Big Data

People gain deep insights into the desired product or service based on analysis of massive data, which is named big data (Viktor 2013). McKinsey reckons that big data is beyond the conventional database acquisition, storage, management and analysis of the data set, and is a combination of structured and unstructured data. It has four distinct features: Volume, Velocity, Variety and Value (Weng K 2015). The emergence of big data can give a city knowledge and wisdom, which is the important tool for the development of smart city and make managers propose better decisions about this city (Steenbruggen 2015). In recent years, big data has been widely used in all walks of life, big data in tourism is mainly from Internet Co, mobile operators and networking sensors (Dai XL 2017). Compared to the traditional tourism industry, the operation of big data can break the barrier of asymmetry in tourist information, so that tourists can collect the travel destination information quickly and efficiently. Moreover, it can learn about the evaluation of the destination from other tourists and bring convenience for tourists to travel and tourism decision-making. For tourism enterprises, big data
operation makes them pay more attention to the subdivision of tourist, understanding tourism needs of different tourists and make personalized tourism products. Tourism enterprises can analysis tourists’ motivation through data to create corresponding tourism advantages. In 2017, mafengwo release the report pointed out that 67% of tourists regard food as an important factor in choosing tourist destination, accordingly, relevant tourist destination managers can take local food as unique tourist attraction for tourists to experience.

2.2 Smart Tourism

Smart tourism is a new tourist-oriented tourism operation mode, with intelligent technology as method, computers, mobile devices and intelligent terminals as tools, expressed in the form of intelligent service, intelligent commerce, intelligent management and intelligent government affairs, so as to satisfy the basic service required by the tourists, such as food, accommodation, travelling, shopping and entertainment, and to create values for other relevant stakeholders (Yao GZ, 2012). Zhang LY et al (2012), based on the concepts of smart earth and smart city, propose the connotations of smart tourism and believe that smart tourism refers to the systematic and intensified management reform of sharing and effective utilization of tourism and social resources that is realized to provide high-quality and highly-satisfying service aiming at satisfying tourists’ personalized requirement based on information communication technology. Jin WD (2012) argues that smart tourism is an integrated application platform that provides public service for tourists, tourism enterprises and tourism management departments with high techniques like IOT and cloud calculation as methods through service terminals like computers and smart phones. Li YP et al (2016) research smart tourism from the perspective of tourism information service and believe it is the generalized tourism information service of tourists in tourism activities.

2.3 Big Data Boosts the Development of Smart Tourism

The influence of big data on smart tourism is demonstrated by tourists, tourism institutions (Lian TH, 2016) and tourism experience (Zhao L, 2014). Through accurate analysis of big data, tourism institutions have clear knowledge about tourist groups so as to produce tourism products that are more appropriate for tourists with better tourism experience. It can be indicated from Analytic Report of China Inbound Tourism Consumption in 2017 released by Tuniu that over 80% tourists prefer “mobile consulting and booking”, most of which are the post-80s and the post-90s. Furthermore, among the top ten tourism scenic zones favored by tourists, Mount Huang and The Imperial Palace apply intelligent devices to promote consumers to conduct smart tourism, leading to the apparent increase of tourists. With increase of economic income and transformation of vacation requirement, customized tourism is gradually becoming a trend of future tourism. As displayed by the monitoring data of Tuniu, the number of the youth in groups of domestic customized tourism dominates, occupying 68% of the total population. In the group structure, the groups of family
and couples dominate. According to the data released by Tuniu, the tendency of future tourism development can be indicated. The tourists dominated by the post-80s and the post-90s are becoming more and more inclined to formulate customized tourism routines through Internet. The influence of big data on smart tourism is also presented in the prediction of future tourism trends. APPs, such as Elong, Lvmama and Mafengwo, have recently released the tourist prediction in the National Day and the Mid-autumn Festival, most of which believe that the National Day together with the Mid-autumn Festival will promote the increase of tourists. Congestion situations can occur to some scenic zones, thus tourists and each tourism scenic zone are suggested to accomplish relevant preparation work.

3 The Profile of Wuhan as a Transportation Hub

Wuhan is the capital city of Hubei Province, located in the eastern part of the Jianghan Plain. It is divided into three districts by the Yangtze River and Han River, i.e. Wuchang, Hanyang and Hankou. It is the largest sea, land and air transportation hub in China and also the geographical center connecting east-west and south-north. Wuhan City has always been known as the land of “thoroughfare of nine provinces”, which generally refers to the convenient transportation of Wuhan city to the provinces and cities, and really refers to the connection to the Sichuan, Shaanxi, Henan, Guizhou, Jiangxi, Anhui, Jiangsu, Hunan and Guangxi and so on. Passenger traffic is the number of passengers transported by the transport department within a certain period of time, reflecting the satisfaction situation on the passenger demands for the industrial and agricultural production, people's lives and international exchanges provided by transport sector. Figures 1 and Figures 2 reflect the volume of passenger traffic and turnover of Wuhan in the past ten years, according to the annual report on 2016 annual report on traffic development in Wuhan. In 2016, the total volume of passenger transport in the whole society was 286 million 394 thousand, an increase of 3.7% over the previous year. Passenger turnover was 115 billion 140 million person kilometers, an increase of 4.5%. The annual passenger throughput of the airport was 20 million 772 thousand, an increase of 9.7% compared with those of last year.

![Figure 1. Passenger transport volume in Wuhan in recent ten years (ten thousand people)](image)
3.1 The Railway Transport

With respect to the railway transport, Wuhan is the main hub of China's high-speed rail passenger dedicated line, the fourth major railway hub and sixth railway passenger center in China, and is the intersection of Beijing-Guangzhou high-speed railway and Shanghai--Wuhan-Chengdu high-speed railway, two state-level high-speed railways. The passenger traffic of Wuhan railway in 2013 exceeded that of Beijing and Guangzhou for the first time, reaching 120 million person-times and ranking first in Greater China. According to the statistical communique on national economic and social development of Wuhan in 2016, Wuhan received 233 million 210 thousand domestic and overseas tourists in 2016, ranking first in the national sub provincial cities. Among them, the railway passengers were transported 158 million 550 thousand people. In addition, as can be seen from Figure 2, the turnover of railway passenger transport not only increases year by year, but also obviously higher than other modes of transportation. According to statistics, only during the National Day Golden Week in 2016, Wuhan Railway Bureau sent a total of 6.4 million passengers, of which Wuhan, Hankou and Wuhan Railway Station sent a total of 2.64 million persons. From these data it can be seen that Wuhan passenger traffic is increased year by year with the continuous improvement of the traffic network layout.

In 2016, China's early planned "four vertical and four horizontal" high-speed railway network was basically formed, and wuhan was at the center of it. Nowadays, with wuhan as the center and the rapid passenger transport circle of radiation nationwide, the wuhan railway station has become a veritable high-speed railway hub in China. From the WuHan Railway Station, tourists can spend one hour to reach the main city of Hubei province, 2 hours to reach Zhengzhou, Hefei, Changsha and other central city, 4 to 7 hours to reach Beijing, Shanghai, Guangzhou, Chongqing and other major domestic big city. Tourists can travel from Wuhan to 25 provinces and cities by rail. Wuhan has formed a "half-day living circle" with 20 municipalities and
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provincial capitals (see figure 3). On the other hand, the inter-city railways from Wuhan to the surrounding urban areas such as Xianning, Huangshi, Huanggang, Xiaogan and so on have been completed and started operation, which means that the convenient degree of tourism from the surrounding cities to Wuhan has been improved. Wuhan has become the largest transit station of railway transport in China.

![Figure 3. Half-day living circle of Wuhan](image)

3.2 The Subway and Bus Transport

Subway and bus traffic can not be underestimated. According to Hubei Daily statistics, in 2015, Wuhan subway daily passenger capacity was 1.87 million passengers, rail passenger capacity was 570 million passengers, and the average daily traffic volume was 1.565 million person-times. Compared to the previous year, it increased by 58%, accounting for 24% of public transit trips. With the opening of the 3rd line, the average daily passenger traffic rose to 1.87 million person-times in the first half of 2016. According to the statistics of 2016 Wuhan City Traffic Development Annual Report, by the end of 2015, Wuhan has a total of 2.132 million motor vehicles, of which private passenger cars that people commonly known as private cars were 1.6518 million units. There were 8301 conventional bus transport vehicles and 467 bus lines. The line length was 1750 km. Bus lanes reached 39, and the total mileage is 155 km. It made a great contribution for the Wuhan City traffic travel.

3.3 Air Transport

As to air traffic, Wuhan became the city which has the most international and regional routes in the central region in 2014, a total of 25 routes, including 17 international routes and 8 regional routes. In 2015, the international routes to Bali Island, Saipan, Maldives, Osaka and Moscow opened. Tianhe Airport's international regional routes have reached 30 routes. Among them, the international routes from Wuhan to Paris, Moscow and San Francisco and so on are the unique route in central China, which is conducive to enhance Wuhan Airport's radiation capacity in the central China to further lay the status of Wuhan integrated transport hub.
4 Countermeasures of Wuhan Smart Tourism Development Based on Big Data

4.1 Problems in the Development of Smart Tourism in Wuhan

At present, the problem of tourism in Wuhan is mainly that convenient traffic does not match with scenic spots. As a transport hub city, the tourism industry of Wuhan City still lags behind Guangzhou and Shanghai. The main reasons are that the public service facilities are insufficient, tourism service facilities are not suited to the development trend of smart tourism, and the function of Wuhan's integrated intelligent monitoring platform such as early warning, public opinion monitoring, traffic management and so on needs yet to be improved. In addition, with the development of smart tourism in Wuhan, the phenomenon of crowded vehicles and parking problems in scenic spots are prominent. Especially in holidays and other tourist season, with the increasing number of self driving tourists, traditional parking spots in scenic spots have been unable to meet the demand of tourists, resulting in a decline in tourist experience.

Now the development of smart tourism in Wuhan is still at the preliminary stage, intellectual support remains to be improved, and the flow area wireless coverage is not comprehensive, data sharing and openness is not enough, the construction of smart travel system under the big data is not perfect, the problem in homogenization of commodity model and tourism products is serious. The tourism resources information update speed needs to be improved and tourism enterprises fail to tap their own characteristics, the products and services provided can not meet the tourists' personalized tourism experience.

Therefore, in order to further develop the smart tourism in Wuhan City, and promote the development of smart tourism, we should make full use of local convenient traffic conditions, and improve the public service facilities by science and technology, strengthen the smart vehicle management to create humanized service environment, broaden the intelligent network coverage to provide personalized service experience, in order to make Wuhan transform from the transit point to a destination of smart tourism.

4.2 Countermeasures for the Development of Smart Tourism in Wuhan

4.2.1 Take Advantage of Traffic Big Data to Improve Public Service Facilities

The traffic data is an important indicator of the characteristics of urban traffic. The local government should attach importance to the important position of Wuhan transportation hub, integrate the data of various departments in the transportation industry, fully explore its data value and make use of the traffic convenience of Wuhan and the outside to realize the conversion from the transfer station to the tourism destination so as to retain tourists, improve the public service facilities in Wuhan, and lay the foundation for the smart tourism.

According to the traffic information issued by the Wuhan traffic sector, it can be seen that when the traffic advantage in Wuhan is applied to the smart tourism, the propaganda, navigation, tour guides, shopping guide and other public service facilities
could be developed. As the capacity of railway and aircraft in Wuhan gradually increases, the number of potential tourists is also gradually increased. How to change the potential tourists into the actual tourists is the focus of the problem. As for the specific measures, in addition to the propaganda of tourist attractions of Wuhan by the railway and aircraft broadcast, Wuhan tourism culture can be spread also through the visual and experience, for instance, the screen wall of Wuhan Chu culture characteristics can be set after each seat so that passengers can see Wuhan existing tourist attractions, and the panoramic view of the attractions can be displayed through the touch screen. Besides, from the screen, people can also get the relevant tourist information, the travel strategies plan, appropriate tourist routes, or get the price, scenic type and distance by searching to find favorite travel scenic spots and hotels, or by entering personal preferences, automatically the screen outputs a personalized travel program.

The number of metro, bus and sharing bike in the urban area of Wuhan is also increasing, but the improvement of traffic information system is not enough. The subsystems of the real-time traffic monitoring system, traffic congestion evaluation system, traffic information integrated display system, traffic planning and decision support system and so on need to be further strengthened. The improvement of traffic information system can make tourists have a complete grasp for Wuhan local traffic lines and road conditions to design the shortest route to reach the tourist attractions to save the time on the road, leaving more time in the tourist attractions. In the traffic combination, learn from Hainan Province, create a barrier-free tourist transport network, and achieve the scenic "last mile" arriving project to promote the smooth connection between Wuhan city and village and between the source and the scenic area.

4.2.2 Strengthen the Intelligent Management of Vehicles to Create a Humanized Service Environment

In view of the gradual increase in private cars and foreign vehicles in Wuhan, the management of vehicles should also be considered seriously. In order to prevent traffic congestion and solve the parking problem, the local government and the transport sector should establish the relevant database, monitoring vehicle and scenic traffic data, and establish intelligent traffic, intelligent scenic spots and so on. By strengthening the management of the vehicle, make an important contribution for visitors to travel smoothly and reduce the tour time. Through the monitoring and forecasting of vehicles, scenic spots can design intelligent parking places, issue a warning reminder to the coming vehicles in case of saturation conditions in the tourist season, and guide the self-driving tourists to the nearby tourist attractions so as to solve the problem of parking areas. In addition, the emergence of shared bike has also met the "slow travel" desire of people in the past two years. According to incomplete statistics, since December last year, 600,000 shared bicycles have been put in Wuhan. The emergence of shared bikes make tourist's trip more convenient. The tourists can visit the landscape around the surrounding area by bike, enjoying the fun on the road. However, the gradual increase in the shared bikes brings convenience to the tourists, and at the same time, also increases the management problem of the tourist areas. The
lack of fixed parking place will lead to the disorderly parking of shared bikes so as to impact scenic environment. In order to solve this problem, scenic area managers can build an electronic parking lot near the scenic area to standardize the environment in the scenic spots.

4.2.3 Broaden the Intelligent Network Coverage to Provide Personalized Service Experience

The development of smart tourism is inseparable from the promotion of network information. Wuhan should learn from the experience of Anhui, Mount Huangshan and other scenic spots to create smart scenic spots, establish a large data monitoring system for tourism, implement wireless networks and traffic coverage for tourist attractions, hotels and many other places, so that tourists enjoy the intelligent tour guide services within the scenic area, or learn about local attractions and cate in other services through mobile clients.

In addition to creating smart scenic spots, the government should also create smart communities, smart blocks and so on, using technology to provide intelligent parking lot, intelligent access control and other management services for the residents of Wuhan City, using cloud computing to monitor road congestion and cleanliness, so that Wuhan can provide the material guarantee for the tourist's convenient and comfortable life style. On the other hand, according to the analysis of tourism consumer behavior under the big data, tourism enterprises should, based on the tourist's preferences, create personalized tourism products and provide personalized travel services to meet the different needs of tourists.

References


