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China's Bike Sharing Walk on a Tightrope

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Abstract

In recent years, the development of Bike-sharing in China has experienced an outbreak and then returned to normal. Based on the development of the Bike-sharing business model in China, this paper puts forward a diversified business model of Bike-sharing utilization to diversify the revenue structure. Secondly, taking Mobike and ofo shared bikes as cases, this paper discusses the social problems in the development of Bike-sharing in China and overseas and puts forward optimization. Finally, this paper outlines the future development direction of Bike-sharing.

Keywords

Bike-sharing; Business Model; Sharing Economy.

1. Introduction

With the development of the social economy, Bike-sharing, as a way to travel, brings convenience to people's life and conforms to the concept of sustainable development. Bike-sharing bears the short-distance movement of a single person in the city, which can solve and remedy the urban traffic problems dominated by private cars and buses [1]. After rapid growth in the early stage of development (as shown in Figure1), the Bike-sharing industry is now facing high internal operating costs, limited liquidity in the platform, disordered urban environmental governance, increasingly strict social and government supervision, and other problems. This paper analyzes the business model, current development, and issues of Bike-sharing, as well as puts forward some suggestions to promote the healthy development of Bike-sharing and describes the future of it.

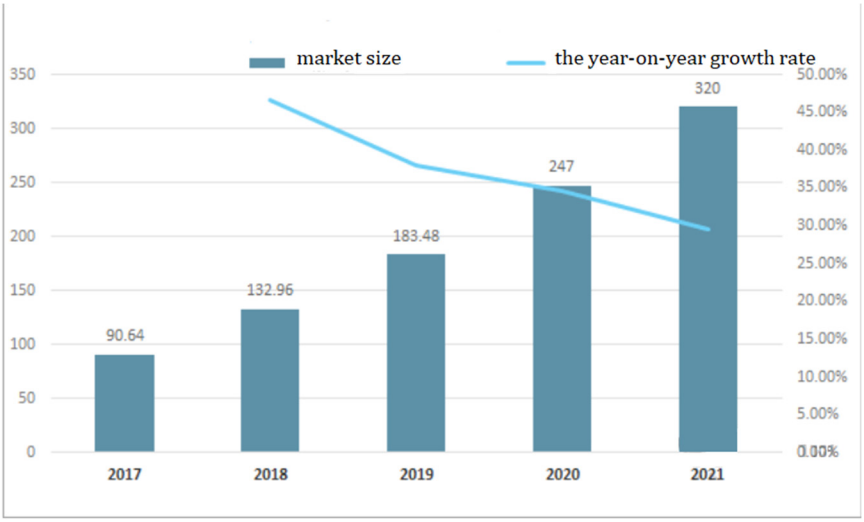

Fig 1. 2017-2021 China's Bike-sharing market size statistics

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2. Suggestions on the Development and Optimization of the Bike-sharing Business Model

2.1. Development of a Bike-sharing Business Model

The development of the Bike-sharing market in China has gone through three stages[2]. The first stage is the introduction of public bicycle mode in China from 2007 to 2010. The public bicycle mode is led by the government and managed by cities in a unified manner, most of which are docked bikes. The second stage is the emergence of enterprises specializing in the bicycle market from 2010 to 2014, for example, Youon Technology. Management of Bike-sharing has also shifted from government-led to enterprise-led, but most of the bikes are docked. The third stage is from 2014 to 2018. Under the background of sharing economy, the Bike-sharing market is developing more and more enthusiastically. Ofo shared bikes, Mobike and other Internet sharing platforms are replacing locked bikes. In 2014, Dai Wei, a graduate from Peking University, co-founded ofo shared bike with four partners, aiming to solve the traffic problems on college campuses [3]. In June 2015, ofo shared bike program was launched and successfully acquired 2,000 Bike-sharing at Peking University. At that time, China was already in the popular period of Alipay, WeChat Pay and mobile QR code settlement system. The formation of the M2O consumption culture became the foundation of the rapid growth of Bike-sharing. Bike-sharing is a combination of bike, station, sharing platform and maintenance center, and a social service products with tourists as the main body, and local governments as the auxiliary operation[4]. In 2016, the public has increased awareness of Bike-sharing, and the Bike-sharing economy had become an industry with low barriers to entry at that time. People will choose products with good service quality and high configuration. There is also a surge of investment in the public bicycle industry[5] (as shown in Figure 2). In 2016, the newly established Mobike Bike-sharing enterprise officially entered the market; Mobike focuses on the launch of new bikes, and is committed to the aggressive competition of layout, with 23 million bikes occupied the city. In 2018, the operating profit of the Bike-sharing industry in the first half of the year decreased by 80% year-on-year [6], and its related industries were hit to varying degrees. As the loss of the profit, users' understanding of Bike-sharing became negative, and their trust in the enterprise began to decline, so they required to refund the deposit of Bike-sharing. The loss of customers led to the loss of other services (as shown in Figure 3).

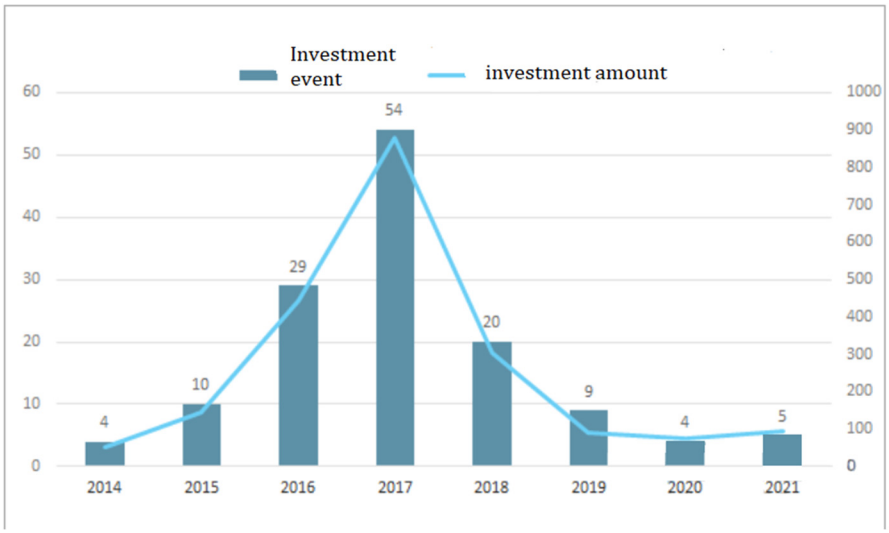

Fig 2. Investment practice and investment amount statistics in China's Bike-sharing sector from 2014 to 2021

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The business model of Bike-sharing is to create additional profit by optimizing the allocation of resources. Being tangible resources, Bike-sharing creates higher returns by selling the use value of shared bikes, and optimizing the allocation of idle resources of them. As for the value innovation model, Bike-sharing is designed to solve short-distance travel. In terms of the profit model, the profit of Bike-sharing comes from deposit, rent and advertising. Take the ofo shared bike as an example; before June 2017, the deposit of the ofo shared bike was 99 yuan, and that was 199 yuan from June 2017 to March 2018. According to the "2017 China Bike-sharing Market Research Report" published by Ariadne Consulting, ofo shared bike's monthly active users reached 62.72 million in May 2017. At the same time, ofo shared bike proposed to waive the deposits of 2.5 million people every month from March 2017 to March 2018. Therefore, as of May 2017, ofo shared bikes had at least 5.96 billion yuan of user deposits. However, as the use of credit or identification replaced deposits in 2018, ofo shared bikes, and Sesame Credit entered into a partnership to apply deposit-free services in 25 cities across the country one after another in March 2018. Rents arises when users scanning the code to unlock the bike, which will automatically deduct money at the end of the ride[7]. Ofo's rent is 0. 5 yuan/hour for school students and 1 yuan/hour for social workers. Although less profitable, rent is the most stable profit for Bike-sharing. Advertising benefit from Bike-sharing is generated by implanting advertisements within the Bike-sharing software or covering the bike body with advertisements, or by using big data to channel user travel data to businesses as they make decisions about advertising. Analyzing data at scale can help advertisers find a more accurate group audience to make purposeful ad placements, helping advertisers improve the conversion rate of target users and save advertising costs, while Bike-sharing gains profit from this. From the perspective of key resources, the use of bicycles in the early phase, Bike-sharing takes advantage of the idle use value of bicycles. In the middle and late stages of Bike-sharing development, a large number of technological innovations such as the positioning of target groups, the investigation of needs, the positioning and monitoring of the cycling process, and the remote security control of bicycles have also become critical resources for Bike-sharing. The advantage of Bike-sharing is that it is convenient, as it provides a short distance connection between public transport and a fixed location and access to Bike-sharing anytime and anywhere. The target group for Bike-sharing is mainly the young, commuters, tourists and students (Figure 4, Figure 5). The product positioning and target group targeting affect the product design of Bike-sharing. The design of Bike-sharing needs to consider the life span of the vehicle, the complexity of the environment, and the safety of the vehicle. Currently, Bike-sharing meets the needs of the target group through the use of GPS positioning, centralized drop-off, and more ergonomic design. The target groups of Bike-sharing are the young and fashionable; as a result, in the process of marketing, the characteristics of the target group also need to be fully considered, and a more targeted marketing strategy needs to be selected.

Fig 3. Ofo shared bike and Mobike share bike customer loss map
The source: The economist (2019.01.26) Lessons from the fall of China's Bike-sharing pioneer

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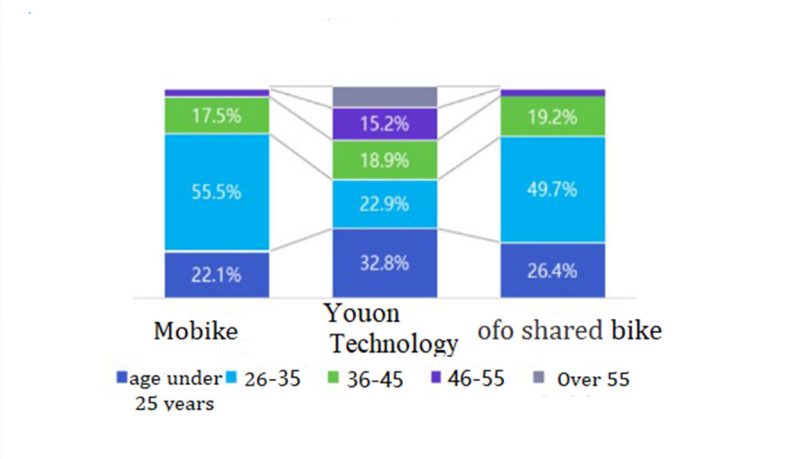

Fig 4. Age distribution map of Bike-sharing users

Fig 5. Usage scenario of China's Bike-sharing users in 2021

2.2. Diversified Business Models of Bike-sharing

Since the start of 2019, the focus of competition in the Bike-sharing market is not fund raising, but improving platform operation and creating new services through intelligent technology. Therefore, for Bike-sharing enterprises, the key is to establish user trust and enhance operation capacity by analyzing user behaviors. Although the unilateral transaction mode can enable the normal operation of the enterprise, the core competitiveness of the enterprise is to improve the utilization rate of products and diversify the income structure.

2.2.1. Increase the Number of Users by Improving Service Quality, Reorganizing and Merging Enterprises, Increasing Points or Discounts, Etc.

When users ask for the exemption of deposit, Bike-sharing platforms can link with large platforms to use credit rating to replace deposit, so as to improve customer stickiness and service quality. Bike-sharing platforms can mark the degree of carbon emission reduction and calorie consumption according to the time and distance of users; on the one hand, to improve user experience, on the other hand, carbon emission reduction can be converted into points. Bike-sharing platforms can convert monthly ticket discounts and Bike-sharing usage into points, or increase payment amounts in individual or community rankings (riding team, etc.) into points or discounts and other marketing strategies to further expand users' using time. In cycling communities, users can exchange points of Bike-sharing for money so that users can use them in supermarkets, convenience stores, restaurants, beauty shops, cultural sites and other places, and connect them with coupons or promotions, so as to carry out marketing activities on the premise that users do not feel excluded. Bike-sharing platforms can be marketed through

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partnerships with other companies (such as only offering mobike users coupons for loans on JD's platform). In addition, Bike-sharing achieves stable revenue sources through mergers and acquisitions. Although all platforms cannot solve structural problems in this way, by eliminating financial burdens, Bike-sharing can embrace a turning point of consolidating operation management system, service expansion and cooperation framework and exploring solid development.

2.2.2. Add Big Data and Artificial Intelligence Applications

The Bike-sharing APP provides more customized services such as riding information, distance, low carbon emission reduction, calorie consumption and speed, and adds functions that can search fitness details separately, expand functions about health, cycling equipment, low carbon and more. It is expected to generate additional revenue from related products such as wearable devices and linkage.

2.2.3. Forming Strategy of Environmental Awareness

The sense of responsibility to the environment, the contribution to environmental protection and the improvement of personal quality of life of perceptual value are more explanatory than the satisfaction of subjective norms. Therefore, in addition to creating a more convenient consumption life service environment for users and improving users' experience in improving the environment, sharing platforms should promote environment-related communication activities with enterprises to guide users to participate in, which is conducive to improving the image of enterprises. For example, the recycling of waste tires and other low-carbon environmental protection activities can improve the corporate image. In the process of using Bike-sharing, social value and the elements of environmental protection consciousness are as important as the economic value (practical value) of services. Therefore, participating in the policies for circulating resources of using Bike-sharing or recycling sharing bikes can manifest the social values of raising environmental sustainability so as to form the users' satisfaction and engagement, as well as master consciousness.

3. Taking Mobike and Ofo Shared Bikes as Examples to Discuss the Operation of Bike-sharing

Mobike Balance Sheet (Dec 2017)

RMB in million	201712
Total current assets	**4,497**
Cash	3,752
Accounts receivable	147
Prepayment	105
Inventory	493
Total non-current assets	**8,503**
Total Current liabilities	**10,367**
Short-term borrowings	511
Account payables	1,001
Deferred revenue (User prepaid)	623
Other liabilities (User deposits)	9,829
Payroll payable	40
Taxes payable	(1,637)
Total long-term liabilities	**799**
Total shareholders' (deficit)/equity	**1,834**
Total Net Cash (Cash - STB - AP - OL - LTB)	**(8,388)**

Fig 6. Mobike's balance sheet as of December 2017

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As of December 2017, Mobike held 3.752 billion yuan in cash (as shown in Figure 6) and owed suppliers 1 billion yuan. According to its account of 9.829 billion yuan of user deposits, there is still 6 billion yuan missing. The total debt exceeds $1 billion, indicating that Mobike's financial situation is not optimistic due to frequent financing. This paper analyzes the problems in the operation of bicycles as Fig 6.

3.1. High Operating Costs of the Bike-sharing Industry [8]

Since its inception, Mobike has taken the high-cost, asset-heavy route of making its bikes. According to its 2017 financial statement, the depreciation cost in December and the 3-year service life of each bike, the cost of each bike is 1000 yuan. The more important data is that according to the monthly impairment loss of 80 million yuan in the table, an average of 80,000 bikes can no longer be put into use normally every month, which clearly makes it difficult for Mobike to break even. In addition to the cost of building bikes, there is also the rate of bike damage, bike maintenance, personnel scheduling costs and various influencing factors that are difficult to reduce. In the Shanghai area, mobike has had a 10% damage rate in just four months of operation. Later figures show well over 10% [9]. Ofo shared bike is using the strategy of ordering bikes. Shanghai Phoenix Bicycle signed a strategic cooperation agreement with ofo shared bike. According to the agreement, Dongxia Datong (a wholly-owned subsidiary of ofo shared bike) or its affiliates shall provide Phoenix Bicycle with a purchase plan of no less than 5 million units within 12 months from the date of signing the agreement. Phoenix said, "If the company's performance in 2016 is consistent, the 5 million units in the agreement will bring about 40 million yuan of income to Phoenix Bikes." However, according to the announcement of Phoenix in May 2018, Phoenix only provided 1.8616 million bicycles to Dongxia Datong, the operator of ofo shared bike, and its affiliated companies, realizing sales revenue of 637 million yuan, and ofo shared bike owed 68.1511 million yuan in payment to Shanghai Phoenix Bicycle [10]. It can be seen that the high labor cost of bike management, maintenance and operation is an important reason for the difficulty of Bike-sharing.

3.2. It is Difficult to Make Profits from Bike-sharing

According to Mobike's financial statement, expenses, including operating and administrative costs, reached 429 million yuan in December 2017. It can be estimated that Mobike needs to generate 450 million yuan per month and 15 million yuan per day on average if it wants to make profits (as shown in Figure7). According to the monthly income statement in December 2017 (as shown in Figure8), Mobike's revenue was 110 million yuan, while its cost was 560 million yuan, and its net profit loss was 681 million yuan. In addition, the daily volume of Mobike in January 2018 was less than 10 million. Based on the volume of 9 million mobikes, the average turnover of each bike was only once a day. The number of rides fluctuated because of the weather. In December 2017, the average number of rides of per bike fell from nearly three times to once per day, with Mobike making about 10 million trips a day and about 300 million rides a month. Based on 110 million yuan in revenue, Mobike receives an average of 30 yuan per ride. Positive monetization is hard to come by, even at the stage where users ride most frequently.

Bike-sharing companies use users' deposits for financial investment and earn profits from user fees and advertisements posted on bikes, which are subject to the review and restrictions of local government. The core of the market share of Bike-sharing is to make it easier for users to get close to the products. The service model is "use first, pay later." Therefore, shared bike companies use all the profits and capital for price competition and allocation competition. Price competition is to attract users. In order to attract users, some enterprises exempt using fees and provide free use services in the form of retaining deposits. This price competition strategy makes Bike-sharing enterprises dependent on deposits and financing [11].

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Fig 7. Order quantity and daily order data of Mobike

Mobike P/L (Dec 2017)	
RMB in million	201712
Revenue	**110**
Cost of Sales	**(565)**
Depreciation	(282)
Operation	(283)
Gross Profits	**(455)**
SG&A	**(146)**
Comp & Benefits	(60)
Marketing Expense	(39)
Advisory Expenses	(38)
Other Expenses	**(9)**
Impairment loss	(80)
EBIT	**(681)**
Net Profits	**(681)**

Fig 8. Income statement of Mobike

Mobike has also tried to ease its struggling profitability in various ways. In March 2017, Mobike launched a monthly top-up card, but it failed to attract users. In March 2018, Mobike switched to a charging model of 20 yuan per month.

3.3. Lack of Clear Business Model and Excessive Reliance on Capital

In November 2017, AI Finance reported that under the pressure of high operating costs and marketing costs, both Mobike and ofo shared bike began to optimize their staff in November 2017 due to financial constraints. Part-time outsourcing workers in several cities were the first to be fired, and some cities were shut down. Facing with the long-term loss of Bike-sharing, investors can only promote capital mergers and enterprise mergers. Mobike was sold to Meituan. Capital plays the role of the terminator. Chen Liteng, an analyst at the e-commerce Research Center, said that most sharing platforms are still in the development stage of burning money, their business models are unclear, and their operations depend on financing, which is a major painpoint for the sharing economy industry. Whether it can be independent of the capital's "blood transfusion" becomes the key to the development of sharing platform.

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3.4. Blind Expansion Abroad of Bike-sharing Enterprises

Both in China and overseas, the launch of Bike-sharing has caused a series of social and operational problems. Ofo shared bike has expanded its overseas business in Australia, the United States and other countries. However, due to the travel mode and transportation organization mode of overseas users, users do not fully accept this sharing mode, resulting in a low utilization rate of Bike-sharing. The average number of riding of users in Sidney is only 0.3 times per day. Users in other countries ride 2-6 times a day. On July 11, 2018, ofo shared bike announced that it would gradually shut down its Australian operations within 60 days [12]. For some cities with sophisticated management, such as Washington, D.C., mobike has only been given a six-month "trial period" because of concerns about parking and environmental problems. It can be seen that European and American cities are still worried about the emergence of the bicycle siege. How to solve the problem of indiscriminate parking of Bike-sharing and make them fully integrate into the delicate city management is a problem that Bike-sharing encounters.

4. Social Problems Caused by the Development of Bike-sharing and Optimization Suggestions

4.1. Bike Scheduling and Processing of Tidal Effect

The essence of users' illegal occupancy of bikes is to solve the problem of not having a bike when they want to ride, and they hope to have a bike around at any time. From the perspective of product, we should increase intelligent traffic scheduling, combine with big data analysis to schedule bikes, so as to avoid the situation of "no bike when you want", solve users' painpoints and reduce the encroachment of bikes. The tidal effect is particularly severe during rush hours, a large number of bikes flood public areas of bus and subway stations, seriously affecting public transportation and causing some users to find a ride. In view of this situation, intelligent scheduling can be combined with big data to intervene in tidal effect [13].

4.2. Frequent Accidents of Bike-sharing

With the growing number of Bike-sharing users, accidents frequently happen in many places. According to incomplete media statistics, there were 18 accidents caused by Bike-sharing in Zhengzhou in 2017, among which 6 accidents were caused by children under the age of 12. In order to reduce this kind of accident, the Bike-sharing company on the one hand, opened real-name authentication that only a person who is at least 12 years old can pass the authentication. On the other hand, Bike-sharing platform can find an insurance company to launch a bicycle at a relatively low cost to provide insurance for users to use a bicycle, and the Bike-sharing platform has an obligation to the maintenance of Bike-sharing on a regular basis. Derivatives of Bike-sharing, such as Shared electric vehicles, should require users to be 18 years old before they can use them.

4.3. Reduce Non-standard Behaviors by Improving the Credit System and Management System

There are many non-standard behaviors of users when using a bike, such as private lock, unauthorized encroachment, destruction and more. Bike-sharing platforms should introduce a credit system and an Internet credit investigation system. For users with low credit scores, deposits can be charged. For old users, credit scores can be deducted if the user is tracked to damage or occupying the bike and other non-standard behaviors. Civilized use of Bike-sharing can improve credit rating. In the case of Mobike, users get 100 credit points when they register for the first time. They can get credit points for normal use or for reporting irregularities, and credit points will be deducted for irregular use, forgotten locks, private locks and occupancy.

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When the credit score is lower than the standard, the use fee of Bike-sharing will be increased, thus playing a role in regulating user's behavior. At the same time, Bike-sharing companies can encourage users to supervise each other by rewarding them for reporting violations. When users see a bike being occupied or damaged, they can take photos to locate and report it. When the bike or the saboteur are found, it will be regarded as a successful report. Successful tip-offs will be rewarded with cash, red envelopes, discounts or extra credit points. The illegal users who are tracked down shall be punished by the deduction of credit scores. When the bikes are occupied or vandalized, and users cannot effectively report, the intelligent management mode of bikes should be opened. Under Internet management, Bike-sharing should have the functions of active and passive alarm. Active alarm means that the cycling frequency of the bikes at a certain time is estimated according to big data. If a bike is not used for a long time or the frequency is lower than the due frequency, the bike will report to the management center. Passive bicycle alarm means that if a bicycle has not sent alarm or information to the center for a long time, then the management center should locate and searches for the bike.

5. The Future of Bike-sharing

Bike-sharing can reach places where public transport is inconvenient. Flexible, convenient and fast Bike-sharing has refined the city's transportation network. It not only increases people's travel choices but also eases urban traffic pressure. According to the data released by the Ministry of Transport, by the end of October 2020, China had launched 19.45 million Internet bicycle rental units, covering 363 cities across the country, with 287 million users [14]. In August 2019, The State Council issued the Guiding Opinions on Promoting the Standardized and Healthy Development of platform Economy, putting forward higher requirements for the economic management of platforms such as Internet bike rental. In the future, the number of Bike-sharing users will continue to increase, and the long-term transaction volume will continue to rise. Bike-sharing will have great development space in China in the future. But in third - and fourth-tier cities, an electric car seems to solve most of the travelling problems. Due to the technical application of the Internet of Things, artificial intelligence and big data, shared electric bikes emerge at the historic moment, aiming at the painpoints of 3-10km short and medium trips. Shared electric vehicles are occupying the market in tier 3 and 4 cities. This paper argues that Bike-sharing can meet relatively limited travelling demand, and the demand for shared electric vehicles will show an increasing trend. According to the user scenario data of Bike-sharing in China in 2020, 46.5% of users choose to use Bike-sharing when roads/people are crowded. Transportation tools, emergencies such as being in a hurry, shopping and leisure are also among the scenarios where users choose e-bikes, accounting for 46.1%, 37.8% and 30.4%, respectively. The economic scale of Bike-sharing will show steady growth.

At present, the market pattern of Bike-sharing has been basically established, and the development has entered a mature period. Since 2019, the Bike-sharing industry has developed at a relatively stable pace and tends to be normal, gradually forming a development pattern of "three pillars": Hello Travel, Meituan and Didi [15]. Meituan and Didi both have mature LBS technology. On the one hand, the purpose of Bike-sharing is to improve the closed-loop of travel and achieve a higher market share. On the other hand, Bike-sharing are also used as the entrance to offline traffic. Take Hallo Bike as an example; relying on rich and mature experience; the refined business operation has entered the 2.0 stage -- intelligent operation. With the help of big data and artificial intelligence technology, and based on the intelligent command center of Hallo Brain, intelligent prediction of supply and demand, intelligent planning, intelligent scheduling, intelligent ordering and other intelligent full-link operation of bikes are realized. The adaptive Bluetooth spike independently developed by Hallo can guide users to park orderly in a standardized area and solve the problem of disorderly parking of bikes [16]. As Bike-

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sharing enter the stage of rational development, government departments at all levels will carry out more scientific and classified management according to the service level of Bike-sharing enterprises in the future, and total control and other policies are expected to be launched. In view of the problem of disorderly parking of non-motor vehicles, the government and enterprises need to cooperate with each other in the future to promote electronic fence management in the terminal area. And in the non-key areas, management can be appropriately relaxed to increase the convenience of the bike. In the process of fine development, enterprises will gradually become standardized and institutionalized and will also force technological innovation of enterprises to promote intelligent and convenient development of Bike-sharing. In the future, enterprises should increase investment in Bike-sharing operation management, order maintenance and research and development of intelligent equipment so as to realize the upgrading and intelligent development of the whole industry.

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