

Research on Development Models and Paths of Shared Bicycles in China*

Hang Gao

Business School

Shandong University of Political Science and Law

Ji'nan, China

Abstract—The development of shared bicycles is a new hot spot in China's sharing economy. It uses idle social resources to solve the "last kilometer" demand of residents' travel through the network platform, and rises rapidly in various cities. This paper analyzes the unique business model and profit model of shared bicycles, and points out several major problems in their development. Finally, the path to promote the development of shared bicycles is proposed from the perspectives of government, industry association, enterprises and individuals.

Keywords—shared bicycle; sharing economy; business model; profit model

I. INTRODUCTION

At present, the wave of sharing economy has swept across China, and an economic model characterized by openness and sharing has gradually replaced the traditional model. The shared bicycle is a shared service model of time-sharing lease non-motor vehicle. It is a kind of service that users can check the bike that can be rented nearby after they register with the mobile phone software and pay the predetermined deposit. They can use the bike by scanning the QR code on the bike and unlocking it. After using the bike, they can return it anytime and anywhere.

It is a product of the sharing economy and human's huge travel needs, an efficient flow of resources in the market field under the construction of the Internet, and an innovation to fill the vacancy of subway, bus and other public transport tools. After the initial operation, shared bicycles have developed a broad market in China, and brought problems such as disorderly parking, illegal possession, malicious destruction, secret fraud and deposit keeping risks. This paper has studied the characteristics and mode of the development of shared bicycle, analyzed the current situation of its industry market, systematically sorted out its advantages and disadvantages, and then put forward the optimal development path.

The development of shared bicycles has gone through three stages. The first stage was from 2007 to 2010, and most of which were piling bicycles. The government introduced bicycles from abroad and was responsible for the management and maintenance of them. The second stage

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was from 2010 to 2014, and there were still pile-bike companies, but the difference was the emergence of enterprises specializing in shared bicycles. The third stage is from 2014 to now, and piling-free shared bicycles gradually have been gradually promoted, characterized by the Internet and time-sharing rental.

II. FEATURES OF SHARED BICYCLES

A. Convenience and Speediness

The process of searching, borrowing, locking and paying for Shared bikes is all completed on the mobile phone. After downloading and installing the shared bicycle APP on the mobile phone, users can register with their real names, to facilitate the "last mile" short trip. For many shared bicycle users, the distance from home to work is too close to drive and too far to walk, so the ride time is just right. However, for those who go to work by subway or bus, the subway station and bus station are crowded with shared bicycles, which can greatly reduce the chance of being late for work.

B. Low Carbon and Environmental Protection

The emergence of Shared bikes has reduced the use of cars, not only getting through the "last mile" of travel, but also making our life greener and environmentally friendly. Shared bicycle has greatly reduced people's dependence on cars and played a positive role in alleviating air pollution. Many people who used to like driving have changed their ways of getting around, preferring shared bicycles when the journey is shorter or the traffic is heavy. The reduction of motor vehicles has led to a decline in exhaust emissions, which in turn has reduced air pollution.

C. Easing Traffic Congestion

Traffic jam has become a common phenomenon in big cities, especially in busy roads. The popularity of shared bicycles has reduced the use frequency of cars, freed up road space and eased traffic congestion in cities, especially big cities. By analyzing regional user activity and bicycle demand, shared bicycle enterprises can constantly optimize the delivery and scheduling. By analyzing users' travel habits during peak hours, shared bicycle enterprises can reduce people's dependence on a single form of transportation, thus reducing the number of vehicles on the road.

D. Low Rental Costs

At present, there are two kinds of charges for shared bicycles in the Chinese market, one is the rental fee of 1 Yuan per hour, and the other is 0.5 Yuan per hour. These two kinds of charges are acceptable to ordinary people. For those who occasionally need to ride, spending hundreds of Yuan on a bike is likely to be a waste of both money and resources. If they choose to ride shared bicycles, they can do so for only 1 Yuan, saving a lot of money on the cost of buying a bicycle.

E. Business Features

Compared with public bicycles, shared bicycles have stronger commercial properties. Under the market orientation, shared bicycle enterprises can make use of recharge, advertising revenue and third-party investment to promote their continuous operation. While actively expanding the market scale, shared bicycle enterprises can not only improve the coverage of bicycle, but also have enough funds to support the smooth operation. Its operation mode pays more attention to the business value of user experience, and can timely adjust the existing problems in operation according to the user feedback information. In addition, enterprises can effectively analyze and predict users' habits and distribution trends, and formulate scientific investment strategies to maximize benefits.

III. BUSINESS MODELS OF SHARED BICYCLES

The industrial chain of shared bicycle industry consists of three links: upstream industry, middle industry and downstream industry. Among them, the upstream industry is represented by bicycle manufacturers and communication operators, the middle industry is represented by internet platform operators, and the downstream industry is dominated by derivative service providers. At present, the industry chain of shared bicycle is gradually mature, and a new development trend has emerged. These new trends include upstream bicycle suppliers extending to mid-stream platform operators, and mid-stream platform operators expanding downstream to find more suitable profit models.

A. Independent Research and Production

The representative of this kind of model is Mobike. Mobike has its own bicycle manufacturing plant and independently designs bicycles. Mobike is a typical "heavy asset" operation mode, integrating production, delivery, operation and maintenance. By the end of 2017, Mobike has successfully entered more than 60 cities at home and abroad, with monthly active users covering tens of millions of users.

B. Supporting Entrepreneurial Teams to Build Bicycle Platforms

Based on the existing manufacturing capacity, bicycle enterprises support the entrepreneurial team to build a business model of bicycle platform. Most of them are bicycle manufacturers with strong bicycle manufacturing capacity and years of sales experience. However, due to the impact of the platform economy, they have to move from offline to

online. For example, sports bike maker CRONUS invested in Xiaoming bike and then promoted more fitness friendly Shared bicycles in Shanghai, Guangzhou and Shenzhen. Flying Pigeon Cycle chose to cooperate with Joybike to launch the smart bike, and made Beijing the first pilot city.

C. Connecting Multiple Participants Through Platform Flow

Ofo, China's pioneering shared bicycle company, is a representative of this model. Ofo defines itself as a "connector", and most bikes on the platform are purchased, with a small proportion coming from second-hand bikes shared by users. Ofo does not set up its own bicycle manufacturing plant, but only focuses on operating platforms. It increases user flow in a flat and networked way, linking multiple resources. At the beginning of 2017, ofo launched the "big city sharing" plan, which has entered Hefei, Wuhan, Changsha, Nanjing and other big cities in China. At present, it has covered more than 25 cities and more than 200 universities nationwide.

D. Garrison Based on Original Resources

Before the emergence of shared bicycles, public bicycles always dominated the bicycle market of time-sharing lease. However, the fixed pile reduces the convenience of pickup and return of public bicycles. As a result, they have been squeezed by the market for shared bicycles. However, public bikes have been in operation for a long time, and they have great advantages in capital, experience and government resources. Therefore, it is not difficult for public bicycle enterprises to take advantage of their good foundation to enter the shared bicycle market and quickly establish a foothold. The representative brand is Yongan. Yongan hang was the first bicycle operator to enter the public bicycle system. So far, Yongan hang has more than 800,000 public bikes with 15 million members in more than 200 cities across the country. Relying on its large number of members, Yongan has started to implement the mode of combining piling with non-piling, and has entered Chengdu, Shanghai, Beijing and other major first-tier and second-tier cities.

IV. PROFIT MODELS OF SHARED BICYCLES

A. Deposit and Pre-charge

Deposit and pre-charge are the two main sources of revenue for shared bicycle enterprises. Before using shared bicycles, users must pay a deposit, and then top up their account. When using shared bicycles, the required riding cost will be automatically deducted from the user's recharge amount. For the use of shared bicycles, the time is not too long and the frequency is high, so the users will not get back the deposit every time. They generally choose to store the deposit in the platform for a long time to facilitate their next use. As a result, a large amount of money is temporarily transferred to the account of the platform, and the bicycle enterprise can also reasonably use the money for business activities.

B. Advertising Revenue

First, the huge monthly active users of shared bicycles have attracted the attention of numerous advertisers. The application client is a necessary way for customers to use shared bicycles. When users click on the application, the advertisement will inevitably appear. Secondly, the bike body is also a good vehicle for advertising. The large number of bicycles that pass through the city every day makes it easy for people to notice their existence.

C. Big Data Revenue

To register to ride a shared bicycle, users must submit their id number, real name, mobile phone number, etc. In addition, shared bicycle enterprises will record users' cycling habits and summarize useful big data information through integration and classification. In the era of big data, if an enterprise wants to make a reasonable strategic layout, it is inevitable to use big data analysis. Shared bicycles can precisely obtain coveted data through its unique business model, and can also bring considerable benefits through the output of data.

D. Government Subsidies

Shared bicycles have a low-carbon, environment-friendly and crowd-alleviating innovative development model, which conforms to the five new development concepts of the country and has been favored by the government in recent years. The government-run public bike system has been losing money for years, so the government is keen to find solutions. The government provides subsidies for shared bicycles, which can reduce operating costs of shared bicycle enterprises. In this way, sharing bicycle enterprises will be more motivated to invest limited funds in product research and develop in a positive direction.

V. RUNNING DILEMMA OF SHARED BICYCLES

The emergence of shared bicycles is both an opportunity and a challenge to social development. In the process of operation, the difficulties encountered by bike sharing can be summarized as five aspects of chaos, such as unordered parking, private possession, malicious damage, and encryption fraud and deposit custody risk.

A. Unordered Parking

With the rapid development of shared bicycles, the problem of parking occupation is emerging one after another. Some Shared bicycles were parked directly on the sidewalk, and some in the entrance and exit of the underground passage. Some Shared bicycles were jammed onto green belts, locked to railings or crowded into blind alleys. Both sides of the bus stop are often occupied by parked shared bicycles. In front of supermarkets and malls, shared bicycles also take up parking Spaces. In some places, many shared bicycles directly occupy the motorway, directly increasing the traffic pressure.

B. Private Possession

Shared bicycles have the convenience of scanning codes to open locks, which attracts many citizens to use them. However, there are many examples of people hiding their shared bicycles, locking them, keeping them for their own use. Some shared bicycles were not only locked but also put in underground garages. Some users park their shared bicycles under their office buildings or in the corridors of residential communities to facilitate their next ride. Even, in order to facilitate their return journey, some users bring their own locks, parking bicycles after private locking. What's more, some users privately modify shared bikes and sell them as personal property.

C. Malicious Damage

Shared bicycles cannot detect the damaged parts and the degree of damage by itself, which leads to the escape of uncivilized behaviors of users. If malicious damage to shared bicycles is not punished, it will lead to trouble for other users when they use the seemingly intact bicycles. Phenomena such as failure to open the lock, gear falling off and two-dimensional code painted occurs from time to time, resulting in shared bicycles can not be used normally. Punctured tires, dismantled seats, deformed wheels and other problems, result in the majority of bad cars, good car difficult to find the situation. Punctured tires, dismantled seats and deformed wheels make it difficult to find a good bike.

D. Encryption Fraud

In the course of operation, fraud incidents which shared bicycles were pasted with fake QR codes occurred in many places across the country. Some people use high-tech methods to attack the background system of shared bicycles, breaking the password lock in batches. Some people destroy the original two-dimensional code, some people put Wechat or Alipay transfer two-dimensional code on the regular two-dimensional code. Once the users did not carefully identify, it is easy to scan the fake two-dimensional code. These fake QR codes directly require you to transfer money, or use Trojans to cause users' information and property losses." Scan code trap" also caused many users to suffer from fraud.

E. Deposit Custody Risk

Users' deposits are given financial attributes in the economy. The user's account deposit is temporarily held by the shared bicycle enterprises. Once the shared bicycle enterprises face the situation of bankruptcy, the user's deposit is at great risk. At present, the poorly run shared bicycle enterprises such as Ofo, Kuqi and Xiaoming have encountered the problem of deposit refund. Enterprises have encountered difficulties in returning deposits because they have used them for other purposes. For example, some enterprises use the deposit for expansion and reproduction, and some enterprises use the deposit for company operation and daily expenses. The centralized deposit refund will further aggravate the operating difficulties of shared bicycle enterprises, and eventually lead to their bankruptcy.

VI. PATHS TO PROMOTING THE BENIGN DEVELOPMENT OF SHARED BICYCLES

Shared bicycles have developed rapidly and become the third major city transportation mode after bus and subway in a short time. They are changing the city's ecological and cultural environment, and the market prospects are generally optimistic. The emergence of shared bicycles benefits from the support of innovative ideas and technologies. The growth of shared bicycles depends on the relaxed institutional environment. On the one hand, the government and society should actively encourage, guide and support the development of shared bicycle industry with an inclusive and fault-tolerant attitude. The government should not lose heart just because they have a few teething problems. On the other hand, it is needed to face up to the problems and shortcomings in the development of shared bicycles. It is needed need to respond prudently, adopt comprehensive policies and conduct joint governance in various ways, so as to remove obstacles and help the industry and market achieve the goal of standardization, stability and sustainability.

A. The Government Strengthens Supervision

The government needs to clearly define the scientific positioning of shared bicycles, introduce policies to encourage its development, and formulate measures for joint governance of multiple parties. The government should promote a shared bicycle delivery mechanism based on a good relationship between supply and demand, improve the construction of urban non-motorized lane network system, and guide the setting of special parking areas for bicycles. The government should plan and set up the quasi-parking area and no-parking area for shared bicycles respectively in the way of positive list and negative list. The government also needs to clean up and dispose of the existing bicycle dump in time. The government should strengthen financial monitoring of shared bicycle platforms to ensure the safety and legitimate interests of investors and consumers. The government will crack down on illegal activities such as illegally appropriating, destroying bicycles, disclosing user information and swindling funds.

To be specific, government departments should establish and improve relevant legal systems in a timely manner from the perspective of top-level system design. First, the government stipulates the market access mechanism and the obligations to be performed by shared bicycle enterprises through legislation, so as to fundamentally avoid the disorderly release of bicycles. Second, the government legislates to protect the legitimate rights and interests of shared bicycle enterprises and severely punish users who steal or damage bicycles. Thirdly, the government should clearly stipulate its power to deal with the offending enterprises and users. Fourthly, the government should formulate supportive policies and measures to encourage the development of shared bicycle industry. Fifth, for the deposit of shared bicycles, the government should formulate management measures for all shared bicycles enterprises.

Meanwhile, the government should establish supervision and control mechanism for the operation of shared bicycles. First, the daily management mechanism needs to be established. The government should set up special daily management personnel to monitor the operation of shared bicycles and ensure their normal operation. Secondly, user integrity needs to be cultivated. The government should establish a personal credit management system, and promote the sharing of information on major shared bicycle platforms. In social personal information records, users' violation information needs to be directly included in order to strengthen the constraints on individuals from the perspective of integrity. Thirdly, the platform should establish a reasonable management and operation mechanism to avoid vicious competition according to market rules. Finally, the local government can issue some local laws and regulations according to the regional characteristics to restrict the shared bicycle market.

B. The Industry Association Improves Supervision

The shared bicycle industry association should establish and improve the industry self-discipline mechanism to safeguard the legitimate rights and interests of its members. At the same time, industry associations need to assist government departments to strengthen industry supervision. The association shall assist government departments in formulating industrial standards on product quality, operation and maintenance, after-sales service and bicycle elimination. The association should help set up minimum competition barriers, raise the entry threshold of the industry, and prevent and control the competitive risks of small and weak enterprises. The association should promote the active disclosure of enterprise product and service standards and release supervision reports to the society in due course. The association should grasp the market trend, and regularly analyze the industry situation and performance, to provide service reference for the orderly development of shared bicycle enterprises.

The association should set up a deposit supervision mechanism for shared bicycle enterprises. Whether the deposit of shared bicycles can be returned in time, concerns the interests of users and the healthy development of market economy. Therefore, the industry association should attach great importance to the common problems in the management of shared bicycle deposit. The association should establish a supervision mechanism for the deposit of shared bicycles, and put the supervision and governance of the deposit into practice. First, the association should urge shared bicycle enterprises to establish a perfect deposit return mechanism and simple return process. Second, the association shall guide the establishment of a unified third-party deposit supervision institution to conduct unified management and refund of the deposit, so as to completely separate the deposit from the enterprise operating funds. Thirdly, the association should promote the construction of social credit system and pay attention to the education and publicity work of improving citizens' moral quality. The association should actively advocate the use of credit guarantee in place of deposit for bike rental. Fourth, the

association should promote the establishment of a strict market withdrawal mechanism. Only after all the deposit returned to the user, the shared bicycle enterprises can be allowed to withdraw from the market.

C. Shared Bicycle Enterprises Optimize Product Operation

Shared bicycle enterprises should gradually promote the upgrade of hardware and software. Shared bicycle enterprises should further improve the design and manufacture of bicycles, so that they have durability, safety, intelligence and economy, and promote the iteration of the old version. Enterprises should apply more sophisticated positioning technology to facilitate the platform and users' positioning needs and refined management of bicycles. Enterprises should strengthen research and development, improve the positioning navigation and audio-visual functions of bicycles, and enhance the riding quality of users. Enterprises should strengthen the construction of online and offline services, match the offline service team, and efficiently schedule bicycle operation and manage bicycle parking. Enterprises should strengthen the security technology of shared bicycle platforms, and earnestly protect the security of user information and funds.

The quality of shared bicycles determines the maintenance cost in the later stage. Only by constantly optimizing the bike design and improving the comfort level, can the enterprises provide users with a more superior experience. Shared bicycle enterprises should promptly investigate the user feedback information, determine the cause of failure, and arrange professional personnel to deal with the relevant causes. In the future cycle manufacturing, enterprises should avoid disadvantages and reduce cycle failure rate. In addition, bike quality improvement can also improve user loyalty and reputation.

Shared bicycle enterprises can use big data algorithm to accurately analyze the location and user data of shared bicycles. Big data analysis can provide users with more accurate bicycle positioning, reduce users' confusion, and bring greater convenience to travel. In addition, enterprises can automatically push well-intentioned tips to users with bad behaviors through big data analysis, so as to reduce the behaviors of randomly parking bicycles.

D. Close Participation of Populace

Public opinion should increase the publicity of green travel and low-carbon life. The users should enhance the recognition of shared bicycles, enhance the moral and legal accomplishment, and achieve civilized use.

Users have the best say on the performance quality, riding experience, safety guarantee, charging price and service level of shared bicycles. Users can exercise the right to know, evaluate and supervise, and give feedback to shared bicycle enterprises in various forms to push them to comply with the demand, optimize products and improve services. Users should pay attention to the negative effects such as random parking, road blocking and urban obstruction while enjoying the "hidden benefits" of environmental protection brought by shared bicycles. Users should push public

opinion to form close concerns and take joint measures to solve problems.

College student volunteer group is an important cooperative object of shared bicycle enterprises. In the university campus and its surrounding areas, shared bicycle enterprises can cooperate with campus communities and teams of campus volunteers. College student volunteers can help manage shared bicycles and supervise users' riding behavior. When cooperating with college student associations, the government and the shared bicycle enterprises can provide material incentives to college student volunteers according to the situation.

Community workers and business people can also work with shared bicycle enterprises. In the business district and living area with large flow of people and large demand of bicycles, shared bicycle enterprises can cooperate with the staff of the commercial center and community volunteers. The shared bicycle enterprises pay them monthly, which not only strengthen the standardized management of shared bicycles, but also save the labor cost.

NGOs are also good partners for shared bicycle enterprises. In places where government and capital are hard to come by, enterprises can work actively with social NGOs. Enterprises and NGOs can share information timely, so as to make full use of their characteristics of wide distribution and abundant resources, realizing real-time sharing management.

E. Strengthening Market Service Guarantee

Enterprises should attach importance to user experience, promote shared bicycles to become a healthy, casual and fashionable lifestyle, and strive for and stabilize high-frequency user groups. Enterprises should implement the real-name registration and use system for users, and prohibit the provision of bicycle services to children under the age of 12. Enterprises should assume the main responsibility, and assist government departments to maintain the parking order, recycling and disposal of abandoned bicycles. Enterprises should sign service agreements, disclose service quality commitments, improve complaint handling mechanisms and accept social supervision.

Enterprises should explore the establishment of deposit custody system. Specifically, the deposit custody system with commercial banks as the custodian subject should be established, and then the government regulatory departments should supervise and manage the deposit accounts under custody. To eliminate the moral hazard that may arise from information asymmetry, fully independent and capable third parties should be introduced. The third-party organization takes custody of the deposit, thus avoiding the direct possession of the deposit by shared bicycle enterprises. In view of the fact that commercial banks meet the requirements of third-party independent institutions and have the ability of custody, shared bicycle enterprises can choose commercial banks for deposit custody. After the completion of the trusteeship, it shall be filed with the financial regulatory department at the district level.

F. Active Development of Overseas Markets

Chinese shared bicycle enterprises have first-mover advantages in terms of concept technology, scale capacity and operation experience in the international market, so it is inevitable for them to expand overseas. In the process of developing overseas markets, Chinese enterprises should grasp four key points.

First, Chinese enterprises should do a good job in overseas market research. By analyzing the market potential and risk coefficient, enterprises can avoid blind investment, excessive investment and poor management in the domestic market. This will avoid resistance from local governments and citizens. Second, Chinese enterprises should seek cooperation with governments of destination countries. According to the national conditions, geography, population, climate, culture and legal factors of the destination country, enterprises should develop marketing strategies. Chinese enterprises should scientifically estimate the number of bicycles, plan the parking area, and strive to form a mature market format. Third, Chinese enterprises should merge and cooperate with overseas brands. Enterprises should seek partners to share market and customer resources, accelerate market expansion efficiency, and build Chinese brands. Fourth, Chinese enterprises should pay attention to the protection of intellectual property rights. On the basis of being familiar with the market rules, Chinese enterprises should apply for the protection of international patents and registered trademarks of their own products and technologies. This makes it easier to compete with local competitors and avoids the risk of legal disputes.

VII. CONCLUSION

Shared bicycle has been booming in China recently. So far, shared bicycle enterprises have formed the following business models such as independent research and production, supporting entrepreneurial teams to build bicycle platforms, connecting multiple participants through platform flow, and garrison based on original resources. However, there are also some problems in the development of shared bicycles. These problems include unordered parking, private possession, malicious damage, encryption fraud, and deposit custody risk, etc. This paper puts forward the paths to improve the operation of shared bicycles from many angles. The governance of shared bicycles is not only the responsibility of enterprises themselves, but also the participation of the governments, the industry association and users. The government should actively provide policy support and institutional supervision for the development of shared bicycles. Shared bicycle enterprises should improve the operation management system and improve service efficiency from many aspects. The industry association should also play an active role in urging shared bicycle enterprises to strengthen self-discipline. Users also need to enhance their own literacy to civilized cycling.

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