Analysis of Factors Influencing the Deployment of Internet Rental Bike Capacity: A Case Study of Foshan

Sen Ye*, Hualing Lin, Lianbin Luo, Huayuan Zeng, Guizhu Ni

School of Transportation and Civil Architecture, Foshan University, Foshan, Guangdong, China
* Corresponding author: Sen Ye

Abstract: In modern society, transportation is an indispensable part of people's lives. However, with the intensification of global climate change and the increasing severity of environmental issues, as well as the country's demand for supply side structural reform, the implementation of green transportation policies has become particularly important. Internet rental bicycles (IRB) are an important part of urban green transportation systems, and their capacity allocation is crucial for operational service quality and urban traffic management. This article takes the central urban area of Chancheng District, Foshan, China as an example to analyze the factors affecting IRB capacity allocation in detail. The analysis is supported by empirical data, including infrastructure, enterprise maintenance investment, vehicle utilization, vehicle performance, government regulation, and other aspects. Finally, this article takes the representative product of the sharing economy - shared bicycles as an example, and based on the theory of collaborative governance, explores the problems and reasons that exist in the current development process of China's sharing economy. Reasonable countermeasures and suggestions are proposed to promote rational capacity allocation.

Keywords: internet rental bicycles (IRB); infrastructure; capacity scale; management platform; collaborative governance

1. Introduction

As an important component of urban green transportation systems [1-5], IRB effectively meets the commuting needs of "last mile" and "door-to-door" travel, providing a valuable supplement to urban public transportation. After undergoing a rapid development stage, the industry is gradually transitioning towards standardized and stable growth, showing a more optimized travel structure, higher safety performance, more organized management, and stronger sustainability.

However, due to the lack of relevant constraints, the problem of excessive deployment of shared bicycles has not been effectively curbed, and the problem of enterprises illegally deploying excessive bicycles continues to persist. At the same time, the problems of chaotic parking and uncivilized riding caused by excessive vehicle deployment have become increasingly serious [6-11]. Taking Chancheng District in Foshan City as an example, in order to regulate the market order of shared bicycles and guide the healthy development of the shared bicycle market, the management department started to formulate relevant management measures and regulations at the end of 2019, and has achieved certain results.

If the capacity is deployed excessively, it will bring a series of problems such as chaotic parking and difficult management [12-16]. Therefore, it is necessary to comprehensively consider the influencing factors of the deployment to provide a basis for establishing a quantitative calculation model.

2. Analysis of Factors Affecting Capacity Deployment

2.1. Inadequate Basic Supporting Infrastructure

Taking Chancheng District in Foshan City as an example, in order to promote the healthy development of urban transportation and establish a comprehensive commuting network, Chancheng District started to construct the "Three Verticals and Three Horizontals" slow travel corridors in the central urban area in 2017, improving the quality of slow travel. As of March 2020, the slow travel corridors in Chancheng District have been improved to "Seven Verticals and Seven Horizontals". The construction of slow travel corridors and the improvement of commuting networks provide strong guidance for the development of shared bicycles, making them more convenient to use and more standardized. However, there are still various problems with bicycle lanes, such as discontinuity, occupation, narrowness, and mixed traffic (pedestrian walkways and non-motorized vehicle lanes), which indeed affect the user experience and even pose some safety hazards.

In addition, around the slow travel corridors, Chancheng District has also started to establish bicycle parking facilities since 2017. As of May 2020, Chancheng District has established 893 shared bicycle parking spots, which is the highest number among all districts in Foshan City. However, compared to the 126,000 shared bicycles deployed in Chancheng District, the current number of parking spots is far from meeting the demand. Chancheng District plans to reconfigure the shared bicycle parking spots in the district, adding additional spots based on

actual needs, which should effectively alleviate the problem of vehicle parking.

2.2. Insufficient Operational and Maintenance Capacity of Enterprises

Firstly, the decision-making power at the grassroots level of enterprise is not enough. Taking Chancheng District in Foshan City as an example, the registered offices of shared bicycle operators in Chancheng District are not located in the district. The operation mode mainly relies on setting up maintenance departments, and they do not have decision-making power. All management requirements put forward by the local government or significant problems discovered by the companies themselves need to be reported to the headquarters for research and decision-making before implementation, which leads to delayed problem-solving.

Secondly, there is insufficient space and personnel for operation and maintenance. Taking Chancheng District in Foshan City as an example, among the three main operators, there are only 1.7 to 2.4 maintenance personnel per 1000 bicycles. Compared with the standard of 5 maintenance personnel per 1000 bicycles in surrounding cities, the number of maintenance personnel in Chancheng District is severely inadequate. Additionally, according to the data provided by Qingju, its own maintenance sites can only accommodate 1800 bicycles (based on the standard of 3 square meters for parking two bicycles), which accounts for only 4.5% of the total deployment of 40,000 bicycles. The existing sites cannot meet the requirements of operation and maintenance. Although other companies cannot provide precise data, the actual situation is similar to Qingju. It can be seen that the lack of operation and maintenance sites and personnel is a common problem. To ensure the normal use of every deployed bicycle, it relies on effective operation and maintenance. If the operation and maintenance sites and personnel cannot keep up, it will ultimately affect the development of shared bicycles.

Thirdly, insufficient operation and maintenance exacerbates other problems. On one hand, it leads to frequent occurrences of delayed repair and replacement of damaged bicycles and difficulty in maintaining the order of bicycle parking. On the other hand, it is unable to completely dispatch the deployed bicycles in real-time, resulting in a large accumulation of bicycles in areas with high passenger flow and a lack of available bicycles in other areas, leading to a supply-demand imbalance. The existence of these problems by the operating companies undoubtedly exacerbates issues like improper parking of bicycles.

2.3. Low Vehicle Utilization

Taking Chancheng District of Foshan City as an example, since the introduction of shared bicycles in 2016, shared bicycle operators have continuously increased the number of vehicles to seize market share. By the end of 2017, Chancheng District had deployed 55,000 bicycles, and by January 2020, the number had increased to 126,000. At the same time, in order to improve vehicle utilization, the operators prioritize deploying vehicles to densely populated commercial areas. However, when the vehicle saturation point is reached in these areas, competing companies are unwilling to take their own vehicles away. This results in regular oversupply of vehicles in densely populated areas.

The increase in the number of vehicles deployed is much greater than the increase in user demand. This contradiction between saturated user demand and the continuous rapid growth of vehicle deployment directly leads to a decrease in the daily average turnover rate from 5.6 rides per vehicle per day at the end of 2017 to 2.9 rides per vehicle per day, halving the turnover rate. The decline in the daily average turnover rate not only reduces company profits and hinders the recovery of initial investment costs but also increases the number of idle vehicles and operational costs. If the fundamental economic benefits of the companies are not guaranteed, it will inevitably affect the development of the entire shared bicycle industry. Therefore, deploying an appropriate number of vehicles and implementing effective maintenance is the cornerstone of the economic benefits for companies.

2.4. Room for Improvement in Vehicle Performance

Currently, the vehicles operated by the companies, especially bicycles, have not achieved precise positioning, and daily maintenance can only rely on a combination of technical management and manual intervention. The maintenance management is not efficient enough and requires a large amount of human and material resources. However, due to cost considerations, the actual investment in human and material resources is limited, which leads to various problems. Therefore, companies urgently need to increase their efforts in technological research and development to further improve vehicle performance. This includes investing in GPS tracking systems to ensure precise positioning of vehicles at all times. By accurately tracking the location of their vehicles, companies can improve efficiency in fleet management and maintenance. Moreover, enhanced technological advancements such as real-time performance monitoring and remote diagnostics can help identify any mechanical issues promptly, reducing the need for manual intervention and improving the overall maintenance process. By investing in these technological advancements, companies can greatly improve the performance, efficiency, and reliability of their vehicles.

2.5. Lack of a Unified Supervision Platform

Currently, each shared bicycle company has its own operational data platform. Although the government is preparing to establish a standardized and unified supervision platform, it has not been fully implemented. This lack of a unified platform creates challenges in monitoring the number of vehicles deployed and the operational management of each company in real-time. Without accurate and timely information on the number of bicycles and their locations, it becomes difficult for authorities to effectively regulate and manage shared bicycles throughout the district. However, it is expected

that with the official implementation of the supervision platform in the later stage, regulatory issues can be effectively resolved. This unified platform will enable authorities to monitor and manage shared bicycles more efficiently, ensuring better control over fleet size, distribution, and maintenance. It will also facilitate data sharing between companies, leading to improved coordination and overall management of shared bicycle services. With the implementation of a standardized and unified supervision platform, both companies and authorities can work together to address operational challenges, minimize operational inefficiencies, and enhance the overall experience of shared bicycle users.

3. Ride-sharing Capacity Deployment Strategy

3.1. Total Quantity Control Strategy

When determining the number of ride-sharing vehicles to deploy, factors such as road width, usage of traffic lanes, population density, and surrounding attractions need to be considered to ensure an appropriate quantity. Real-time monitoring should be conducted for each deployment area to ensure the reasonable use and quantity of ride-sharing bicycles. If the number of deployed vehicles is excessive or insufficient in a certain area, adjustments should be made promptly. Additionally, regular inspections and surveys of the deployment areas should be conducted to monitor the usage and appropriateness of the deployment quantity.

In order to implement the Total Quantity Control Strategy, it is essential to gather accurate and up-to-date information about the areas where the ride-sharing bicycles will be deployed. This includes analyzing the width of the roads to determine how many bicycles can fit comfortably and safely, as well as the usage of traffic lanes to ensure that the bicycles do not disrupt the flow of traffic.

Population density is another important factor to consider. It is necessary to identify areas with high population density and higher demand for ride-sharing bicycles. By deploying a larger number of bicycles in these areas, it ensures that there are enough bicycles available for users to meet their transportation needs.

Surrounding attractions should also be taken into consideration. Ride-sharing bicycles can be particularly useful near tourist attractions, shopping centers, and sports stadiums where people may prefer to use bicycles instead of other modes of transportation. By analyzing the surrounding attractions, it helps determine the appropriate quantity of ride-sharing bicycles in these areas.

Real-time monitoring is crucial to evaluate the effectiveness of the deployment strategy. By monitoring the usage and availability of ride-sharing bicycles in each area, adjustments can be made promptly if the number of deployed vehicles is found to be excessive or insufficient. This ensures that there is a balance between supply and demand, making the ride-sharing bicycles more accessible and convenient for users.

Furthermore, regular inspections and surveys should be conducted to assess the usage and appropriateness of the deployment quantity. This involves gathering feedback from users, conducting surveys to understand their needs and preferences, and addressing any issues or concerns that may arise.

Implementing the Total Quantity Control Strategy requires continuous evaluation and adjustment to ensure that the quantity of ride-sharing bicycles deployed in each area is appropriate and meets the needs of the users.

3.2. Reasonable Establishment of Bike Parking Spots

Bike parking spot placement should be carried out in areas such as both sides of main roads, areas with high passenger flow, and bus stops. In areas with high passenger flow: Bike parking spots can be established near iconic commercial buildings, public service venues, tourist attractions, sports stadiums, schools, hospitals, etc., to meet people's travel needs. In areas with convenient parking facilities, such as near bus stops, subway stations, public parking lots, and dedicated bike lanes, bike parking spots can be established to facilitate the use of ride-sharing bicycles during transportation transfers. In densely populated areas, such as urban business districts, residential communities, and residential areas, bike parking spots can also be established to facilitate residents' travel. Road and traffic planning should consider the need for ride-sharing bicycles. Bike parking spots should be reserved near transportation hubs, public facilities, and residential areas to ensure the convenience and safety of ride-sharing bicycle parking.

To ensure the convenience and accessibility of ride-sharing bicycles, it is important to establish bike parking spots in strategic locations. These locations should be selected based on the traffic flow and demand for bicycles.

In areas with high passenger flow, bike parking spots can be established near iconic commercial buildings, public service venues, tourist attractions, sports stadiums, schools, hospitals, and other places where people tend to gather. This placement allows users to easily find and park the ride-sharing bicycles, meeting their travel needs efficiently.

Areas with convenient parking facilities, such as bus stops, subway stations, public parking lots, and dedicated bike lanes, are also suitable for establishing bike parking spots. This helps users easily transition from one mode of transportation to another, allowing for smoother transportation transfers while ensuring the availability of bicycles.

Densely populated areas, including urban business districts, residential communities, and residential areas, should also have bike parking spots to cater to the travel needs of residents. By strategically placing these parking spots, it promotes the use of ride-sharing bicycles as a convenient and sustainable mode of transportation.

Road and traffic planning should take into consideration the need for ride-sharing bicycles. When designing roads and traffic flow, bike lanes and bike parking facilities should be included. This ensures that there are designated areas for bicycles, enhancing safety and convenience for users.

Bike parking spots should be reserved near transportation hubs, public facilities, and residential areas. This guarantees the accessibility and safety of parking for

ride-sharing bicycles, encouraging more people to use this mode of transportation. Additionally, regular maintenance and monitoring of the parking spots should be carried out to ensure that they are in good condition and meet the needs of users.

By establishing bike parking spots in appropriate locations, it promotes the use of ride-sharing bicycles as a viable transportation option while ensuring convenience and safety for users.

4. Conclusions

This article reviews existing literature and systematically summarizes the development of shared bicycles, as well as the research on various aspects of shared bicycles by domestic experts and scholars. It also provides prospects for future research directions, in order to provide reference and reference for further research on shared bicycles. The deployment of Internet Rented Bicycles (IRBs) after reasonable planning helps to improve the operational level of leased bicycles and connect them to various urban road systems such as public transportation systems, subway stations, and high-speed railways, improve vehicle utilization, solve land resource problems, improve the service quality of shared bicycles, facilitate residents' travel, form a more comprehensive urban road system, and alleviate urban traffic pressure and save scheduling costs, It has constructive significance for environmental protection.

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