

The Policies of Government Intervention as Third-Party for Conflict in Bike-Sharing War in Nanjing

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ABSTRACT

This research accesses to the unbalance phenomenon between the rapid development of Sharing bicycle industry and the good public order. Taking into account the inconsistent goals of bicycle companies and users, the local government is employed as a third party to mediate the conflict. We establish the conflict model including three decision makers - Enterprises, Citizens and Government - based on GMCR (Graph Model for Conflict Resolution) theory, and then find out the equilibrium by means of the decision support system GMCR II. The results show that the sustainable development of the Sharing bicycle market requires the cooperation and efforts of all the three parties, the government plays a necessary role to guide the enterprises and the users. We also propose some management insights on how to provide suggestions for the sharing bicycle companies to improve their dispatching services, and how to establish and improve relevant laws and regulations to guide citizens to use shared bicycles in order to achieve mutual benefits.

KEYWORDS: Bike-Sharing (BS), Market Conflict, Graph Model, Government Strategy.

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I. INTRODUCTION

The initial generation of bicycle sharing projects started on July 28, 1965 in Amsterdam with the Witte Fietsen, or White Bikes. Standard bicycles painted white, were accommodated for public use. One could discover a bicycle, ride it to his or her last stop, and abandon it for the next user [2]. Things did not go as arranged, as bicycles were thrown into the canals or appropriated for private utilize. In 1991, a second era of bicycle sharing projects was conceived in Farso and Grena, Denmark, and 1993 in Nakskov, Denmark. These projects were small; Nakskov had 26 bicycles at four stations. It was not until 1995 that the first huge-scale second generation was introduced in Copenhagen as Bicycle, or City Bikes, with many improvements over the past generation. The first of this new type of third generation bicycles was Bike about in 1996 at Portsmouth University in England where students could utilize a magnetic stripe card to rent a bicycle [1]. Bike share systems may provide to lessen pollution and automobile usage. Regarding benefits to users, the travel times of commuting trips can be possibly reduced by 10%. Furthermore, a bike-sharing system liberates individuals from the need to secure their bicycles; bicycle theft is normal issue in urban regions. With regard to health, the bicycle sharing has likewise positive on male and older users [3].

Ofo and Mobike, as the duopoly of the shared bicycle industry in Nanjing, play an absolute dominant role in the conflict of the shared bicycle market. The duopoly pattern will be maintained for a period of time and will not be easily broken by competitors such as Hello bike and Youon. According to the data of Analysis Qianfan, the market coverage of Ofo and Mobike in February 2018 was 50.89% and 49.14%, respectively. Based on the official website these two enterprises, the delivery quantity of Ofo is 10 million whilst delivery quantity of Mobike is 7 million. Ofo has market value 13.8 billion CYN and Mobike has 10.5 billion CYN. Although the both companies have got 200 million registered users; Ofo's daily orders is 32 million whilst Mobike's 30 million. As a result, the two companies fell into the dilemma of market competition. On the one hand, the increase in the number of shared bicycles facilitates the short-distance travel of residents. On the other hand, vicious competition between companies and inappropriate use of users have caused many negative effects to the public. For instance, the two companies adopted some inappropriate means for vicious competition addition to benign competition, such as deliberately destroying the other's vehicle, occupying public space, thus disturbing the public order. The two companies rushed to increase the amount of bicycles, which not only seriously damaged the interests of both parties, but also disrupted public order and caused traffic jams. Therefore, it's urgent to set down the conflict between ofo and Mobike.

However, since companies are aiming at maximizing their own interests and citizens care about travel convenience, it is difficult to reach a concerted action plan. Without a fair and just coordinator, the conflict between the two sides can't achieve a balance and even worse. Thus, we have to introduce the third party to mediate, and the government who is able to constraint the market should take on this responsibility. This paper considers the conflict among the Sharing-bike enterprises, the citizens and the government. Firstly, we analyze the pros and cons of the three parties in detail, and think about their respective strategies. Secondly, we establish the conflict model based on GMCR (Graph Model for Conflict Resolution) theory, discuss preferences of three decision-makers, and find out the equilibrium via the decision support system GMCR II. Then, We focus on analyzing and explaining the practical significance of the equilibrium states, and draw useful conclusions. At last, some management insights are provided both for companies and for government according to the analysis and conclusions.

GMCR [4] theory, originated from the classic game theory, is a method for making decisions through mathematical modeling and solution analysis. It conducts conflict analysis in a combination of qualitative and quantitative methods to make up for the shortcomings of traditional game theory. GMCR provides with a flexible conflict resolution methodology in resolving political, economic, social and environmental convicts as it is based on solid and realistic mathematical foundations [5]. GMCR II is the first decision support system proposed by professor Fang [6], allowing the users to create their own model to analyze complex conflicts in GMCR.

II. BACKGROUND ABOUT BIKE-SHARING COMPANIES AND GMCR

Background about Sharing-bicycle Companies: In China bicycle sharing has turned out to be well known in numerous cities like Nanjing. Bicycle sharing is a service giving bikes to be shared (rental) use around subway stations, bus stations, residential areas, commercial districts, campus and other public places. Users do not need to park the bikes at assigned locations. Bicycle sharing previously showed up in 2014 in China and became very popular in 2015 and blasted in 2016 [7]. In China, most of bicycle sharing companies focus at cities across the country, yet some also focus on a specific region. With an expanding number of bicycles sharing companies, market competition became more extreme. Mobike and Ofo are two of the biggest players in the market. The market has been flourishing since July 2017, however demonstrates a plateau as early as May 2017, around 70 million Monthly active users.



Figure 1 Numbers of shared bikes monthly active users.

Besides, Mobike and Ofo are particularly in a tie when it comes to users, with around 35 million monthly active users each with about 27% of overlap between the two companies.

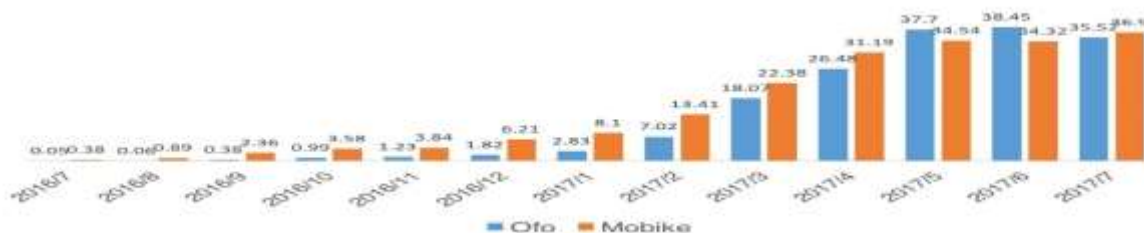


Figure 2 Numbers of monthly active users (million).

Moreover, in the initial stage, users were trying different types of bikes and enjoying a lot of free rides and coupons yet then now users are beginning to coverage to utilizing one type of bikes because of the market consolidation, thus bike-sharing trips are getting shorter and shorter. Therefore, the goal of this paper is to amplify a more realistic and solid methodology to model and analyze municipal government intervention in conflicts. The objective is to solve a conflict in bike-sharing by the means of contribution from government.

Graph Model for Conflict Resolution: The GMCR, expressed as a 4-tuple: $\{N, S, G, P\}$, is used to analyze a strategic conflict means to investigate the interaction of two or more decision makers (DMs) to identify possible outcomes [9~10]. We use vertices of the graph represent states, arcs of the graph represent transitions that's listed as following

- N , the set of decision-makers (DMs), where $2 \leq |N| < \infty$. We write $N = \{1, 2, \dots, n\}$.
- S , the set of (distinguishable) states, satisfying $2 \leq |S| < \infty$. One particular state, s_0 , is designated as the status quo state.
- For each $i \in N$, DM i 's directed graph $G_i = (S, A_i)$. The arc set $A_i \subseteq S \times S$ has the property that if $(s, t) \in A_i$ then $s \neq t$; in other words, G_i contains no loops. The entries of A_i are the state transitions controlled by DM i .
- For each $i \in N$, a complete binary relation i on S that specifies DM i 's preference over.

The modeling phase mainly extracts the following elements from the actual conflict events: the negotiator, the negotiator's strategy, the feasible state and state transition diagram generated by the strategy, the policy statement, the preference order formed by the policy statement, and the integrated element information description conflict . The analysis phase specifically refers to the calculation of individual stable solutions and overall equilibrium solutions to provide negotiators with decision information.

For a broader view of related approaches and results, see the Encyclopedia section introduced by Hipel [5]. The specific focus of this paper is the Graph Model for Conflict Resolution, which we believe is more flexible, broader in scope and easier to use than the alternatives. The original formulation of the GMCR appeared in Kilgour et al.[8]; the first complete presentation is the text of Fang et al. [6]. It has been applied across a wide range of application areas; examples include environmental management at the local level. To apply the graph model conveniently and expeditiously to an actual conflict, we can employ the decision support system GMCR II.

GMCR II Software: Although the graph model for conflict resolution has many advantages, it is difficult to apply in real problems without computational assistance, even to small models. With this purpose, the basic decision support system GMCR I was developed by Kilgour et al. [8]. However, GMCR I only includes a basic analysis engine so that a model must be converted to the GMCR I data format first. It is a difficult conversion process. A decision support system GMCR II including modeling and analyzing procedures of the graph model later replaced GMCR I. GMCR II written in Visual C++, a computer implementation of the graph model for conflict resolution, is described by Fang et al.[6]. It offers model management and stability analysis and includes some basic coalition analysis and status quo analysis procedures.

Conflict Model among Enterprise, Citizen and Nanjing Municipal Government: Conflicts are inevitable due to the inconsistent goals of shared bicycle enterprises, their users and the government. As is known, the enterprises pursue users as many as possible, occupying the largest market share, thus gaining the most profits. Therefore, the enterprises are likely either to increase their quantity of delivery, or to improve the users' satisfaction by all means. The citizens, as users, care about the convenience of short-distance travel, and concern the public order in the meantime. That is, citizens may boycott Sharing bicycles for better public order, or support the enterprises to put in more for travel convenience. The government was introduced as a coordinator because of its power to control market. Generally speaking, the government is neutral, he does not want enterprises to suffer serious losses, but also has the responsibility to maintain social order and protect the legitimate rights of citizens. As a consequence, what the government should do is introducing some rules to constraint both the enterprises and the citizens, urging the enterprises to operations and appealing the citizens to use the bicycles in a civilized way.

Decision Makers and Their Options: Table 1 represents the original list of decision makers and options for the third-party conflict in the bike sharing war in Nanjing. In the original thesis we analyzed the bicycle companies without the municipal government then with the citizens but in this paper only covers the enterprises, Nanjing government and the Citizens

Table 1. Decision Makers and Options

Decision makers	Strategies
Enterprises (DM1)	1. Increase the quantity of delivery, retain bicycles to the greatest extent and minimize the reduction of bicycles when required by the government 2. Improve operation and maintenance, optimize bicycle scheduling, and maintain bicycle condition in time.
Nanjing Government (DM2)	3. Control shared bicycle enterprises, including interviewing and asking enterprises to improve operation and maintenance and reduce the current bicycle delivery quantity when citizens complain about the enterprises.
Citizen (DM3)	4. Boycott shared bicycles, are unwilling to use them to travel, make uncivilized use of them and even intentionally or unintentionally destroy the normal operation of them.

There are 24 theoretical states. After eliminating the infeasible state, there are 16 feasible states (referred to as ‘s1, s2, s3,... ,s16’) are presented in Figures 3 and 4:

There are in total 16 feasible states.

DMs	Options	1	2	3	4	5	6	7	8	9	10	11
Enterprises	1. Increase	N	Y	N	Y	N	Y	N	Y	N	Y	N
Enterprises	2. Improve	N	Y	Y	Y	N	Y	Y	N	N	N	Y
Nanjing Govern	3. Control	N	Y	N	N	Y	Y	Y	N	N	N	N
Citizens	4. boycott	N	N	N	N	N	Y	N	N	Y	Y	Y

Figure 3. Feasible States (1)

There are in total 16 feasible states.

DMs	Options	12	13	14	15	16
Enterprises	1. Increase	Y	N	Y	N	Y
Enterprises	2. Improve	Y	N	N	Y	N
Nanjing Govern	3. Control	N	Y	Y	Y	Y
Citizens	4. boycott	Y	Y	Y	Y	N

Figure 4. Feasible states (2)

Preference Statement based on Options: The preference statement using strategic priority process of each are essential to analyze the conflict from different perspectives. The presences of each decision maker were evaluated using as evidence found in articles, as well as inferences from the options that have been recently taken from these decision makers. The priorities of preference statements and preference ranking for each decision maker are presented in Table 2.

Table 2. Preference Statement based on Options

Decision makers	Statement	Interpretation
Enterprises	-3	Enterprises must obey government control if they want to operate legally, so they worry most about being controlled by the government.
DM1	-4	Enterprises do not want to be boycotted by citizens, so as not to lose the benefits brought by the market
	1	Enterprises want to increase their quantity of delivery to expand their market share
	-2	Enterprises do not want to spend money on improving operation and maintenance.
The preference of Enterprises		$s8 > s4 > s1 > s3 > s10 > s12 > s9 > s11 > s16 > s2 > s5 > s7 > s14 > s6 > s13 > s15$
Nanjing Government	3if4	The government represents the interests of the people. Once a citizen complaint, the government must exercise control.
DM2	2	The government hopes that enterprises will take the initiative to improve operation and maintenance and maintain a good market atmosphere.
	-4	The government does not want citizens to boycott enterprises, causing the market to shrink.
	-1	The government does not want enterprises to blindly deliver bicycles and disrupt the order.
The preference of Government		$S3 > s7 > s4 > s2 > s15 > s6 > s5 > s1 > s16 > s8 > s13 > s14 > s11 > s12 > s9 > s10$
Citizens	2	Citizens want to see bicycle companies improving operation and maintenance.
DM3	4IF2	If enterprises do not improve operation and maintenance, citizens will inevitably complain after travel inconvenience.
	1	Citizens hope that shared bicycle enterprises will increase the quantity of delivery to facilitate the use of bicycles.
	3	Citizens hope that the government will take the initiative to control and maintain order.
The preference of Citizens		$S6 > s12 > s15 > s11 > s2 > s4 > s7 > s3 > s16 > s8 > s5 > s1 > s14 > s10 > s13 > s9$

Equilibrium State: Find Equilibrium State with GMCRII System, and the result is shown as follow:

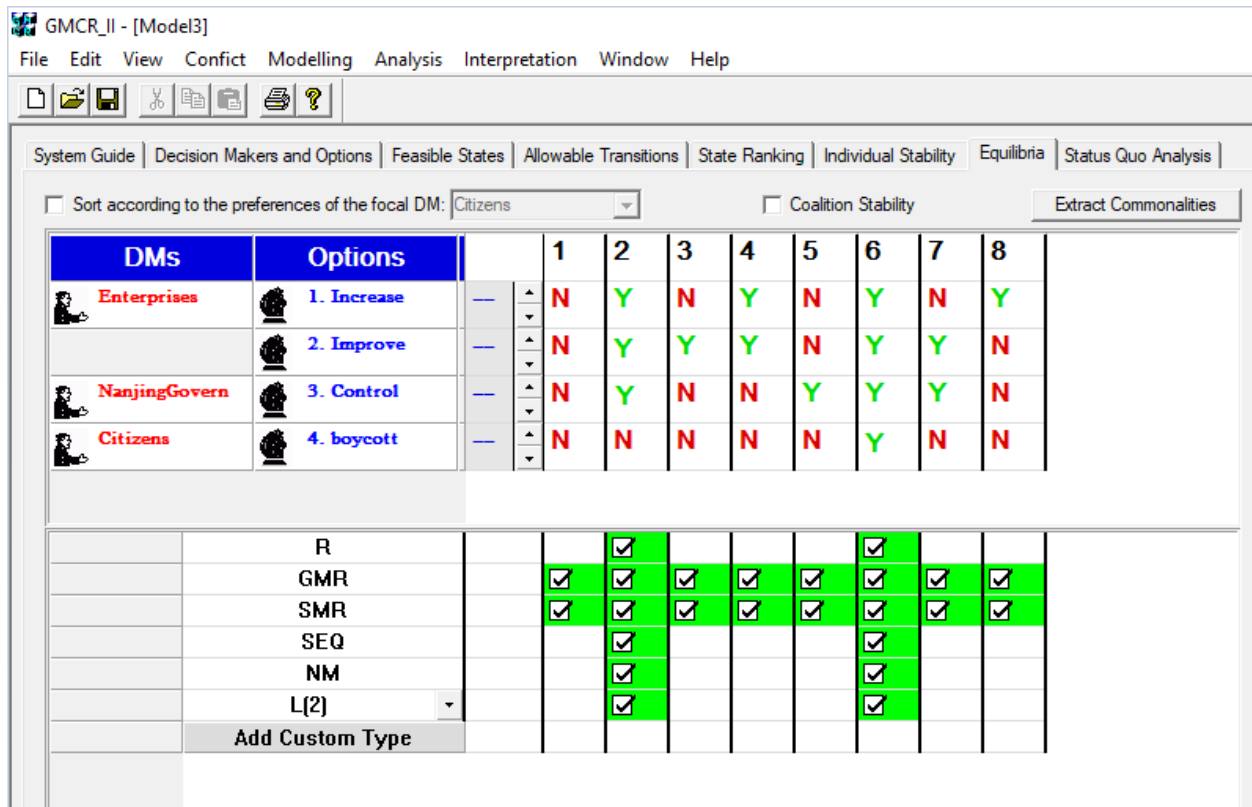


Figure 5. Equilibrium State

From the Figure 5, the best states are s2 and s6: enterprises increase the quantity of delivery while improving operation and maintenance; the municipal government strengthens control to avoid unlimited growth in the number of bicycles; and the attitude of citizens makes no sense to the conflict. The two states not only satisfy the need of shared bicycle enterprises to occupy and gain profits from the market but also take into account the travel needs of citizens; the municipal government needs to strengthen the control of shared bicycle enterprises, requiring enterprises to pay attention to improving operation and maintenance before allowing to increase the quantity of delivery or to maintain existing quantity.

Combined with reality, it is easy to find out the reason for this balance. Firstly, the "enterprise" in this conflict model is not the whole shared bicycle "industry," but a decision maker who merges Ofo and Mobike as a duopoly into a decision maker due to the high consistency of their strategic preferences and attitudes and the homogeneity of the impact of market conflicts. Therefore, it is impossible to ask them to reduce their market possession, which is not in line with market rules, but a blow to the initiative of leading enterprises and even the whole industry. Nobody wants to see themselves doing for others with no benefit and being forced to sell their market share to the losers in the competition while growing.

User satisfaction of Ofo and Mobike is not low, but it has a great impact on market conflict due to the size. Therefore, it is reasonable to allow the expansion under the premise of improving operation and maintenance as well as services. The difference between S15 and S16 is the attitude of citizens. One should know that the attitudes of citizens are also different. Some citizens have no demand or little demand to use shared bicycles, so they think that shared bicycles affect travel, and hold a resistance attitude; while others often use shared bicycles to facilitate travel, so it is easy for them to ignore the need for better market management; naturally, some citizens are wavering in terms of attitude. The municipal government not only represents the will of the people but also affects citizens' opinion to a certain extent. This article is aimed at the government putting forward strategic proposals, so the strategy analysis of citizens is integrated into the guidance role of the government.

Proposals for Government Strategy : To maintain the healthy development of the industry and maintain public order, it is suggested that the municipal government set up a special group to implement the evaluation mechanism of the shared bicycle enterprises, to conduct regular evaluation of the existing shared bicycle enterprises. The main evaluation indexes cover almost all the contents of the enterprise and give the evaluation results on operation service, enterprise management, order management, information reporting, compliance to territorial management and so on. At present, the main means of the government's supervision over the shared bicycle industry is to ban on delivering bicycles, i.e., "Delivery Ban." However, although this approach may eventually make the number of bicycles in cities more reasonable, it also makes the market basically monopolized by the shared bicycle giants. The sluggish operation caused by monopoly will make the shared bicycle market again get into trouble. The way to supervise the problem of excessive shared bicycles is to simply control the quantity, but to build a comprehensive evaluation system fairly and impartially, to encourage companies with high-quality services to enter, and force the stock market to improve efficiency, even to achieve market clearance for inefficient enterprises, so that the evaluation results can truly be linked with entry and exit, bicycle delivery, replacement, and renewal share allocation to keep the initiative of shared bicycle enterprises while insisting on improving operation and optimizing service, and to promote the healthy development of the whole industry. At the same time, the government should also pay attention to the guidance of citizens. We should speed up the improvement of citizens' quality, guide the civilized use of shared bicycles, standardize the use order of shared bicycles and make sharing a national awareness. Suggestions to the government:

1. The media should be used to widely publicize civilized use. The shared bicycle is an effective means of travel shared by the public, and civilized use of a shared bicycle is the responsibility of every citizen. It is suggested that the government should make use of media resources such as news media and Wechat public platform to publicize the civilized use of shared bicycles to let the public keep civilized sharing in the heart.
2. Go deep into community schools for publicity. Community and school are the most concentrated areas for shared bicycle users. It is suggested that the government asks community cadres and school teachers to organize propaganda of civilized use of shared bicycles so that they can clarify the importance and necessity of civilized use of bicycles in the community and classroom.
3. Play the street warning role of urban inspectors and traffic police. It is suggested that the government gives full play to the role of urban inspectors and traffic police, and deal decisively with and give warning education to those who use, destroy and privately occupy shared bicycles to effectively control the occurrence of uncivilized use.

4. Introduce integrity mechanism to change the uncivilized behaviors. Temper justice with mercy makes successful management. It is suggested that the government should record those who are not civilized in using shared bicycles or intentionally destroying them and have not been corrected by education in their personal integrity documents, as well as vigorously publicize the role of honesty mechanism, to raise the "cost of integrity" of uncivilized use.

Conclusion and Recommendation: The shared bicycle enterprises mediate competition conflicts, and enterprises and citizens coordinate the unbalance between the development and convenience for people, which will eventually tend to a vicious growth situation of crazy investment due to the capital-follow-profitability essence and the humanity of citizens in pursuing convenient and cheap travel. Such a situation is obviously not expected by everyone, so the government must be introduced as a third-party mediation strategy to play a regulatory role. From the reality analysis, the problem caused by shared bicycles is not only the competition conflict within the industry, but also the contradiction between the market and society. It is a tripartite game among enterprises, governments, and citizens. Through the conflict analysis, the best solution is obtained that the shared bicycle enterprises led by Ofo and Mobike should improve operation and maintenance while increasing the quantity of delivery. The government plays a regulatory role in restricting excessive bicycle delivery, supervising the operation and maintenance management of shared bicycle enterprises, and the citizens have tolerance for shared bicycles and make civilized use of shared bicycles.

In fact, the shared bicycle industry is worth maintaining, just like an adolescent "wild kid," with a bright future, but lack of discipline. It needs the correct education and guidance of the government, which is like "father" and the tolerant attitude of the citizens, which are like "mother" to lead the healthy development and growth of the shared bicycle industry. Shared bicycles are the representative of the sharing economy; the market situation of shared bicycles is actually a process of rapid change. When preparing the opening report of this paper, Youon was the "First Stock of Shared Bicycles" with a market value of nearly 10 billion Yuan; when the paper is completed, the rise of Hello bike is a future that everyone can see, although it is still not comparable to Ofo and Mobike, under the current trend, Hellobike, Ofo and Youon will stand up as an equal in the future; while Mobike has been sold to Meituan. The founder HU Wei has monetized and left; the founder of Ofo refuses the funding of Alibaba and tries to develop independently. The internal conflict of shared bicycles discussed in this paper is only effective in the market part and must be eclipsed by new changes in the shared bicycle market.

The rise of the shared bicycle industry represents the progress of China's innovative industrial power, facilitates people's short-distance travel and also conforms to the green concept of green travel. Promoting the healthy development of the shared bicycle industry and benefiting the country and the people are an important part of China's public transportation. However, a series of social problems such as the vicious competition in the shared bicycle industry and the public disorder and traffic congestion caused by shared bicycles must not be tolerated. The future of the shared bicycle industry must be a trade-off between "Convenience" and "Order". Shared bicycle companies have the responsibility and obligation to maintain scientific and efficient operation; the citizens have a tendency of civilized use with active care; the government has reasonable control and active guidance. All of them ensure that the shared bicycle industry is on the right track. The government needs correct supervision, which not only restricts the voluntary delivery by bicycle companies, but also allows enterprises to moderately deliver shared bicycles to promote their enthusiasm under the premise of good operation and order; it needs to guide the citizens to develop the habit of civilized travel, and to constrain destroy, lock, and misplacing behaviors. Only in this way the government can lead the healthy development of the industry. Therefore, the analysis of the conflicts in the shared bicycle market is a problem that is necessary to continue the research in combination with the actual situation.

In this paper, due to restrictions in time and learning, more research and data analysis on the shared bicycle market are made to analyze the current situation of market conflict in the shared bicycle industry; many researches on conflict subjects are made in this paper; however, the three-party conflict modeling of enterprises, governments and citizens is relatively simple with only macro-strategic suggestions. For example, the equilibrium solution obtained in above is just a possible plan of the equilibrium state to satisfy the government, citizens, and enterprises; Allowing enterprises to increase the quantity of delivery is for the development of the enterprise, and is necessary for promoting the healthy growth of the industry. But the quantity is very critical. In this study, there is no specific increase in the quantity of delivery and will be the key in follow-up study. Starting from the planning and management and combining with optimized modeling are the direction of future research.

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