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Application of Game Theory in the Sharing Economy

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Abstract:

With the development of the sharing economy, all kinds of sharing services have begun to enter our daily lives, such as shared bikes, shared e-bikes, shared charging banks, and so on. The development of the sharing economy requires the cooperation and restriction of the government, consumers, and providers of shared services. In the process of their cooperation and restriction, the game between them is also evolving. This paper will take shared e-bikes as an example to study how to promote cooperation among the three parties based on maximizing their interests and apply the conclusions drawn from this study to other shared services. This paper's process of research found that the three parties will promote cooperation by guaranteeing basic income, legal consciousness, and a sense of social responsibility. For example, the government needs to maintain normal social benefits so that they have to give more benefits to enterprises in cooperation. Enterprises will comply with relevant laws to distribute a number of shared e-bikes and accept government supervision. Consumers benefit from the sharing economy by consuming and then using and parking e-bikes correctly due to a sense of social responsibility so that the former two can get intuitive benefits and sustain this service power.

Keywords: Sharing economy; shared e-bikes; game theory; Shijiazhuang.

1. Introduction

When the term sharing economy was first proposed, its main feature was a market platform created by a third party and based on information technology. This third party can be a business, an organization or a government. Individuals use these platforms to rent, exchange idle items, share their knowledge, experience, or raise funds from a business or an innovative project. The sharing economy involves three main entities, namely the demand side of goods or services, the supply side and the sharing economy platform. Sharing economy platform as a link between supply and demand, through the establishment of a series of mechanisms, so that the supply and demand side through the sharing economy platform transactions

The essence of the sharing economy is to integrate

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the idle items in people's lives, so that they can provide products or services at a lower price. For suppliers, they give users the right to use shared goods or provide services in order to get a certain monetary return; For the demand side, it does not directly own the ownership of the goods, but uses the goods through sharing such as renting and borrowing.

After investigation and analysis, the application of game theory in the sharing economy can be roughly divided into five aspects: pricing strategy, which helps shared service providers set reasonable prices; risk control, which helps sharing economy companies minimize and avoid unnecessary troubles; platform design and optimization, make the sharing economy service platform more reasonable and intelligent, so that users more convenient to use; fairness, guarantee the legal rights and interests of all parties involved in the sharing economy; cooperation and competition, ensure the sustainable and healthy development of the sharing economy and promote multi-party cooperation. These five aspects reflect the extensive practicability of game theory in the sharing economy and its specific application methods, and these five aspects are different and interrelated, constituting the framework of game theory in the whole sharing economy. The application of game theory in these aspects has been proved feasible by examples and has achieved great results in the sharing economy.

The reason why this paper uses the shared e-bike as an example is that e-bike covers an extremely wide range in current big cities. Furthermore, the cooperation and competition of the shared e-bike companies are also very representative of all kinds of sharing economies. The remainder of this paper analyzes these five areas.

2. Game Theory in the Sharing Economy

2.1 Pricing Strategy

Sharing economy businesses need to develop reasonable pricing strategies to attract regular users of their brands and keep them loyal. Some theories in game theory, such as "Prisoner's dilemma" in game theory, can help enterprises analyze the effect of different pricing strategies and the impact of user behavior on enterprise pricing. Take two shared e-bike brands in Shijiazhuang City as an example. The starting price of shared e-bikes of People's Travel brand is two yuan, but their shared e-bikes are of low quality and prone to problems. By contrast, Didi's shared e-bikes start at a relatively expensive price, 2.50 yuan, but their shared e-bikes are bigger and safer [1]. For the former, their fixed target customers are cyclists who are not afraid of risks and seek cheap rides, so the company often places their e-bikes near low-cost residential areas and office buildings. And the latter often put their e-bikes in some of the city's central business districts [2].

2.2 Risk Control

In the sharing economy, trust between businesses and users is very important. The risk control theory of game theory can help enterprises reduce uncertainty by establishing rules and institutions and encouraging users to trust the platform more. If the user rides a broken e-bike and delays subsequent arrangements as a result, the company should bear the cost of this ride and give the user some compensation, such as coupons or actual compensation. This can also relate to the target users in this passage mentioned earlier. If enterprises want to retain their fixed target customers, they must be able to properly deal with the risks and emergencies during the customer riding process, and properly handling these problems can also increase the user's trust in the enterprise [3]. But rather than remedy a problem, companies should standardize their work system and quality to minimize problems with e-bikes, so that users will be more satisfied with the company.

2.3 Platform Design and Optimization

Game theory can be used to analyze the optimal design of sharing economy platforms, such as how to balance the efficiency of the platform and user satisfaction, and how to deal with information asymmetry in the platform. A faulty e-bike sharing service platform can make users very angry and may incur additional charges. When people choose to ride a shared e-bike to deal with affairs, they need to find the return point after they arrive at the destination, but when the users find the return point in the return point map for a long time but still do not find the return point, they will realize that there is a problem with the return point map, the company may not synchronize their return point to the map. Moreover, while users are in the process of finding the return point, their order cannot be suspended or canceled, which means that the order is being billed continuously. After the users finally find the return point and finish their return, not only their affairs are delayed, but they also need to pay an additional order time fee, but the problem of time out is not caused by the users, which will reduce their trust and satisfaction with the brand, so when they need to ride and choose the brand in the future, it is likely that they will not give priority to the company's shared e-bikes. The staff of the sharing e-bike company do not pay enough attention to their sharing service platform, so such problems are very common now, almost every mini program of the sharing e-bike company has techni-

cal problems. Sharing e-bike companies should design a satisfaction feedback system to help them detect users' dissatisfaction with the sharing service platform and find the problem, and it is also convenient for them to improve and optimize their platform [4].

2.4 Fairness

There are multiple participants involved in the sharing economy, and how to ensure fairness and fairness is an important issue. Some theories of game theory can help businesses develop fair rules and systems to reduce unfair and fraudulent practices. This is related to the user's personal quality and social responsibility. Some user groups will deliberately look for damaged or faulty vehicles, so as to complain to the shared e-bike company after the end of the order and apply for an exemption from the cost of the ride, because there is a clear law that if the shared e-bike ridden by the user fails, the responsibility is the shared e-bike brand, they need to bear the cost of the user's order and recover the e-bike for repair. This part of users took advantage of the vulnerability because the message synchronization was not timely enough that the sharing e-bike company did not know whether the problem was caused by the previous users or the problems caused by the users' riding this time, so they had to choose to give the users free tickets for the sake of user satisfaction, but it was unfair to the users who normally paid for the order. And it is also a gratuitous loss for e-bike sharing companies [5].

However, this phenomenon can still be managed using game theory and the shared services platform mentioned above. Companies can design a system on their shared service platform that both the user and the sharing service platform can get the current vehicle status before the current order starts, and each ride is recorded in the history order. If the user reflects that there is a problem with the vehicle after the end of the ride and asks to waive the riding fee, under the premise that both sides understand the condition of the vehicle in advance, if the vehicle has a problem can only be caused by the improper operation of the user in the ride, so the sharing e-bike company can refuse the unreasonable requirements of the user and immediately send staff to recover the vehicle for maintenance. As for users who have caused damage to their vehicles but are willing to bear the consequences, e-bike sharing companies do not charge extra, but encourage them to give timely feedback and describe the damage in as much detail as possible to reduce the maintenance time of damaged e-bike and bring them back into use as soon as possible to reduce the cost loss [6].

2.5 Cooperation and Competition

In the sharing economy, there may be cooperation and competition between enterprises. Game theory can help businesses analyze the effects of different strategies and how to cooperate with other businesses to achieve win-win results. Yanzhao Evening News of Shijiazhuang City once reported that there has always been moderate cooperation between the sharing e-bike companies, which aims to maximize the interests of both parties [7]. The two brands reported are Hello brand sharing e-bikes and Didi brand sharing e-bikes mentioned above, which are the brands with the largest number of sharing e-bikes in the city. According to a reasonable business competition model, the two brands should be sharing e-bikes in all aspects of the industry can be competitive, but the survey data found that Hello brand e-bikes seem to give up the competition for underage users, this part of the user to Didi brand e-bikes.

After inquiring the investors of the Hello brand e-bike company, the reasons for this phenomenon can be inferred as follows. The Alipay software, which is invested and developed by two very large companies, has a very wide user base and almost all Chinese people are using this software to pay. It can be said that it is a national-level software. Therefore, any commercial project involved in this software must be legal and compliant. Its every move is being watched by the public. When shared e-bikes were first introduced to cities and started to be used, people questioned whether minors should be allowed to ride shared e-bikes, which could be dangerous for them. At that time, there was no age limit for sharing e-bikes, which meant that even teenagers and even several-year-old children could enjoy sharing e-bikes. Later, the country amended the law in this respect and stipulated that children under the age of 16 could not ride the shared e-bike [8].

However, this also led to another problem. After the user scanned the QR code of the shared e-bike using WeChat, the sharing service platform obtained permission to access the user information on WeChat and detect whether the user was over the age of 16. However, the user information system of WeChat was flawed. WeChat will store the information of each user for a long time after the initial collection of the information and will not take the initiative to ask the user to re-check whether it matches the personal information of the account, which means that the user of each account and the personal information recorded by their account are very likely to be different. There are many children under the age of 16 May also have their WeChat, but the input is their parents' personal information, so the sharing service platform, detects the informa-

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tion of the child's parents, and finally, the child under the age of 16 can still ride the shared e-bike.

It is difficult to judge whether this phenomenon is right or wrong, sharing e-bikes is undoubtedly the best means of transportation for children who have no source of income and often need to switch back and forth between several places of classes. But despite this, the law has stipulated that less than 16 can not ride shared e-bikes, so as such a large company, to strictly comply with the regulations, Alipay and Hello brand sharing service platform will face a verification system added to the bullet window after scanning the QR code of shared e-bikes, only instant face verification passed, that is, the real cycling users over 16 years old can ride. This greatly reduces the proportion of minors riding Hello brand shared e-bikes(photo1), and this is part of the cooperation between this company and Didi brand shared e-bikes company, and the first point above in the Didi brand shared e-bikes and people's travel brand shared e-bikes strategy is different, the first two brands are using their advantages and avoid their shortcomings, and the cooperation of the two brands is their own.

As shown in Fig.1, in the financial reports of Didi company, Hello company, and others for the first half of 2024, it can be seen that the number of their users around the age of 16 has changed. This situation is the result of their cooperative strategy mentioned in the previous paragraph.

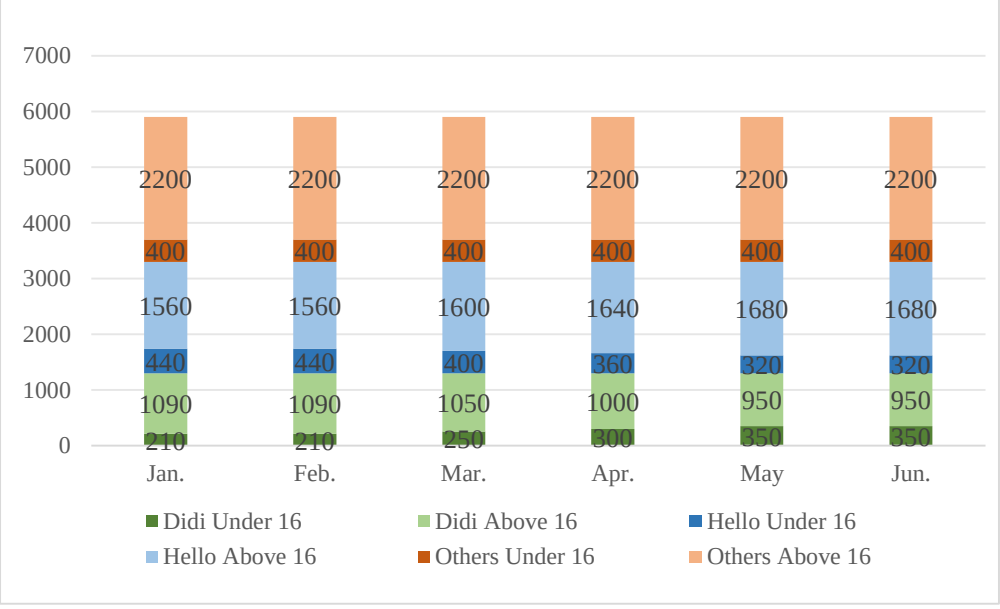

Fig. 1 Number of E-bikes Launched by Three Different Brands in Different Ages in 2024 first half year [4]

At a deeper level, the two competing brands have another reason to cooperate, because they do not want to create a third e-bike sharing company as large as their size, according to game theory, the game between the two is the most stable in any model and event, and they can control the state of equilibrium [9]. Therefore, if the Hello brand shared e-bikes have to give up some users, then as the other side of the game Didi brand shared e-bikes must absorb this part of the users because if this group of users into the third-party brand, the current balance will be broken, the third company is likely to be unfavorable to the two brands. Moreover, after investigation and research, it can be concluded that the entire shared e-bike industry has reached a Nash equilibrium in the incident just described, so this third party will not appear in fact [10].

3. Conclusion

In general, game theory provides a deeper and more comprehensive perspective for multiple participants in the sharing economy, helping them to make smarter and more reasonable decisions to ensure the maximum of their interests, and improving the efficiency and fairness of the sharing economy. As for the future, the application of game theory in the sharing economy will only be more and more, now shared electric vehicles have been put into trial in some cities, and some more new sharing economies are also being invented. After these technologies enter lives in the future, game theory will also play an important role in them. Just like the use of game theory in shared e-bikes, users can choose more suitable brands through game theory; Companies can compete with each other and gain more profits through game theory; The government can restrain enterprises and citizens through game theory and

enhance the legal awareness of the whole society. Above is the general application of the game theory studied in this paper in the sharing economy.

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