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Analysis of the Choice Behaviour towards Docked and Dockless Shared Bicycles based on User Experience

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Abstract: The major cities of China have experienced massive growth in the number and usage of dockless shared bicycle systems, such as Mobike and Ofo, which have replaced the traditional docked bicycle systems that are heavily regulated by local governments. However, docked bicycle systems are still in operation, especially in small and medium-sized cities that have docked shared bicycle systems run by the local government. This study aims to reveal the user choice behaviours for these two shared bicycle systems from the perspective of user experience and to find win-win strategies for the two systems, based on a case study of the Shunde district in Foshan city. The structural equation model and binary logit model are employed to identify the impact factors of the choice behaviours. It is found that user experience plays a key role in the use intention for two kinds of bicycles, including factors such as convenience, riding experience, and level of service. Age is the most important indicator distinguishing the user groups, as older people prefer docked bicycles while younger people prefer dockless ones. Docked and dockless shared bicycle systems operate together harmoniously in Shunde as they satisfy the demands of different user groups with little overlap. It is suggested that a new shared bicycle system, which combines the advantages of both docked and dockless shared bicycles, would be a better solution for small and mid-size cities.

1. INTRODUCTION

There are two types of public shared bicycle systems developing in China, dockless shared bicycle systems (free-floating bicycle-sharing systems) and traditional docked shared bicycle systems.

Traditional docked shared bicycle systems, supported by the state and local governments, have experienced rapid growth since the first launch in Beijing in 2007 (Zhang et al., 2015). By the end of 2015, there were 52,399 docked shared bicycles and 1,971 docking stations in China (Y. Wang et al., 2018). Traditional docked shared bicycle systems are usually run by firms that are heavily subsided by local governments, but inefficiency caused by the dock causes a poor user experience. With the emergence of new technologies, such as the smart locker, mobile payments, and smartphones, dockless shared bicycles have gained the dominant market share in major cities in China since they were first introduced in March 2016. Unlike traditional docked bicycles, dockless bicycles, such as Mobike and Ofo, are operated by private companies. Without docking stations, they can be found and parked at any available place as they have inbuilt global positioning system (GPS) devices to prevent theft (Du & Cheng, 2018). According to the 2017 white paper on dockless shared bicycles and the Urban Development of Beijing Planning Design Research Institute (2017), the total distance covered by dockless bicycles has exceeded 2.5 billion kilometers, and by the end of February 2017, the share of trips by bicycle was more than double the period before dockless shared bicycles emerged.

Public shared bicycles, especially the dockless shared bicycles, have significantly changed the way people travel, since they provide great convenience for users who no longer need to return bicycles to their original locations. However, the rapid expansion of the dockless shared bicycles have caused several issues for both operators and cities, such as disorderly parking, inadequate guarantee of users' deposits, breakdowns, illegal possession, and oversupply. Moreover, there is fierce competition among companies to gain market share. Financing difficulties, capital chain rupture and other issues have led to increasing numbers of companies going bankrupt. Meanwhile, although the government-subsidized docked bicycle systems are in relatively good condition, they have been criticized for inefficiency and high cost of operation and maintenance.

The major cities of China have experienced massive growth in the number and use of dockless shared bicycles, which have replaced traditional docked bicycle systems. For example, according to news reports, in Xiamen city, the number of docked shared bicycle card holders has reduced by 30,000, an average of fifty cards refunded by citizens every day across various agencies of docked shared bicycles since dockless shared bicycles were introduced. The situations are different for the small and medium-sized cities with docked shared bicycle systems, since very few dockless bicycle systems are introduced in those cities due to profit and regulation concerns. It is necessary to study the development strategies of two types of public shared bicycle systems.

This study aims to reveal the user choice behaviours for docked and dockless bicycles based on analysis of the user experience in cities where both kinds of docked and dockless shared bicycles operate, and to find strategies to improve docked shared bicycle systems. Shunde district in Foshan city was chosen for a case study. Data collection for the study involved a questionnaire concerning the user experience about the two systems, and the structural equation model (SEM) and binary logit model (BL) were employed to identify the impact factors for the user choice between docked or dockless bicycles. A discussion on the impact factors is presented in detail, and the possible strategies to develop a better docked system are proposed.

The remainder of the paper is organised as follows. In Section 2, a literature review of docked shared bicycles and dockless shared bicycles is provided. The method is described in Section 3. Section 4 describes the profile of the respondents for Shunde district, Foshan city and the results of the models. Section 5 carries out a case study, followed by the conclusion in Section 6.

2. LITERATURE REVIEW

Public shared bicycle systems have now been in development for four generations. The first generation of docked shared bicycles, painted white, were launched in the Netherlands in 1965. The following generation of shared bicycles adopted coin deposit systems in Copenhagen in 1995, however, theft and vandalism of bicycles continued as problems without a real-name system. A third generation, IT-based docking stations' system, was established and used improved technology, such as electronically-locking racks and smartcards (DeMaio, 2009). The fourth generation introduced dockless bicycles, with further improved technology, such as global positioning system (GPS) tracking, and electric bicycles (Shaheen, Martin, & Cohen, 2013). Generally, different bicycle-sharing systems provided users with different services and experiences.

To cater to users and expand their market share, dockless shared bicycle companies increased their tolerance of some violations in China. To reduce violations, the companies were able to formulate self-disciplined norms and enforce them strictly (Tan, 2017). Governments' financial subsidies lead to improved user satisfaction and financial pressure from the government and lower profits (Ma & Yang, 2018). Governments could also contribute to accelerated construction of the necessary infrastructure and the integration of the two bicycle-sharing systems into city development (Shao & Xue, 2017).

There are many factors affecting cycling (Zahran et al., 2008). For example, it was found that precipitation and cold temperatures clearly reduced the frequency of utilitarian cycling in Canadian cities (Winters et al., 2007). Pollution can have a negative effect on cycling commuters (Zahran et al., 2008). Fine weather (sunny, few clouds, and appropriate temperature) and lower amounts of ground snow increase cycling frequency and, moreover, thermal perception was also an influencing factor (Brandenburg, Matzarakis, & Arnberger, 2007; El-Assi, Mahmoud, & Habib, 2017). Urban road infrastructure influences the choice over docked shared bicycles (Y. Wang et al., 2018). A survey showed that the absence of bicycle lanes or trails negatively affected cycling frequency (Dill & Voros, 2007). Docked shared bicycles in stations near universities or transit stations were more likely to be used (El-Assi, Mahmoud, & Habib, 2017). Socio-economic characteristics affecting the use of bicycles also varied from country to country. Lower incomes correlated with lower bicycle commuting numbers, men and younger adults cycled more in England and Wales (Parkin, Wardman, & Page, 2008). Most docked bicycle users in Xi'an city, China were highly educated with middle to low income (Y. Wang et al., 2018). In contrast, Fishman et al. (2015) found docked shared bicycle users had higher incomes than other groups in central Melbourne and Brisbane. The influencing factors of docked shared bicycles varied by city density (Martin & Shaheen, 2014), but user experience was the most important attribute, especially in China. It was found that improving the service of docked shared bicycles, such as access time saving and travel cost saving, was more effective than improving air quality for users (W. Li & Kamargianni, 2018).

The discrete choice model is usually used to simulate the relationship between choice behaviour and influencing factors. Z. Wang, Wang, & Liu, (2014) analyzed the related factors influencing private car travel behaviour against dynamic traffic information using the binary logit model. Ran & Li, (2017) developed a binary logit model to explore the factors influencing people using dockless shared bicycles. In recent years, the structural equation model has been used to study travel behaviour, such as travel demand, attitudes, and stated behaviour intentions (Golob, 2003). Kuppam & Pendyala, (2001) confirmed the relationships among users' characteristics, activity engagement information and travel behaviour through the SEM. Yan (2017) studied factors which influenced the intention to use dockless shared bicycle systems according to the Theory of Planned Behaviour and an SEM whose latent variables were the users' attitudes, subjective norms, and behaviour intentions. The latent variables in the model were potential factors that cannot be directly measured and must be inferred from their measured indicators. Measured indicators were collected using measuring tools such as questionnaires.

Therefore, it is necessary to explore the choice behaviour for dockless and docked shared bicycles from the perspective of user experience. The SEM and binary choice model were employed to identify the impact factors in this study.

3. QUESTIONNAIRE AND DATA COLLECTIONS

3.1 Questionnaire Design

There were five sections to the survey:

Part 1) Individual characteristics, including gender, age, occupation and monthly income.

Part 2) Basic information about cycling, including the main patterns in cycling, purposes, use duration and frequency.

Part 3) Preferences of travel plans. In total, the five items, including the connection between start points and the subway or bus stations (CSP), arbitrary path options (APO), reasonable deposit cost (RDC), deposit return guarantee (DRG), and cheap rental price (CRP), measured using a three-point Likert scale ranging from not sure (1), relatively agree (2), to strongly agree (3). For example, "I care about whether I can select a path arbitrarily when I make a choice between the two systems".

Part 4) Cycling experience constructed using the SEM, whereby the endogenous latent variable D (the use intention) is measured from three aspects: d_1 (the degree of satisfaction), d_2 (the evaluation of meeting users' demand), and d_3 (the recommendation rating).

The first exogenous latent variable is Y_1 (the convenience of the operating system), which is measured by three indicative variables (measured indicators):

I_1 The operating system is simple;

I_2 The loan system rarely has problems;

I_3 A quick response code can always be easily identified.

The exogenous latent variable Y_2 (the convenience of borrowing-returning), is measured by five indicative variables:

I_4 The bicycle scheduling system is perfect, and the speed of scheduling is guaranteed;

I_5 A bicycle can be rented in a crowded area or during peak times;

I_6 A bicycle can often be found near a subway or bus station;

I_7 The index system is perfect and can accurately determine whether there is a bicycle nearby;

I_8 It is convenient to return the bicycles.

The exogenous latent variable Y_3 (the riding experience), is measured by five indicative variables:

I_9 Hidden danger of bicycles is negligible;
I_{10} Bicycle design is beautiful;
I_{11} Quality of bicycles is good;
I_{12} Riding is comfortable;
I_{13} It is easy to use the first time.

The exogenous latent variable Y_4 (the service level), is measured by three indicative variables:

I_{14} A bicycle service hotline is available;
I_{15} Repair and maintenance of the bicycles occurs regularly;
I_{16} Managers sufficiently promote safe riding.

In total, 19 items were measured using a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5). The sample question of one indicative variable I_6 of the exogenous variable Y_2 was "I can often find a docked/dockless shared bicycle near a subway or bus station". The sample question of one indicative variable d_3 of the endogenous latent variable D was "I would like to recommend docked/dockless shared bicycles to my friends", measured from strongly disagree (1) to strongly agree (5).

Part 5) Attitude towards the integration of dockless and docked shared bicycles, and comparison of the user experience for the two bicycle-sharing systems.

3.2 Methodology

This paper develops a discrete selection model and structural equation model (SEM). The discrete selection model is developed using a binary logit model (BL). Individual characteristics of the travelers and preferences are assumed to affect the utility function of users' choice (choice utility) in the BL model. Travelers' characteristics include gender, age, occupation and income, and preferences include the cost of use and path selection. An SEM was established when latent variables were added. The latent variables of the SEM are as follows: the convenience of the operating system, borrowing-returning, riding experience, service level and the intention to use either dockless or docked shared bicycles.

3.2.1 Binary Logit Model

The binary logit model is based on random utility theory, assuming the random component of the utility function follows the Gumbel distribution:

$$V_2 - V_1 = \sum_{a=1}^{k} \theta_a Z_a + \theta_0 \qquad \textbf{(1)}$$

where

V_i is the fixed term of the utility function,
$i = 1$ represents docked shared bicycles,
$i = 2$ represents dockless shared bicycles,

Z_a are attributes measured or observed associated with each alternative (Orozco-Fontalvo et al., 2018), and
θ_a and θ_0 are the parameters that need to be estimated.

3.2.2 Structural Equation Model

The structural equation model is used to analyze the data, as shown in *Figure 1*. It consists of a structural model of latent variables, and a measurement model.

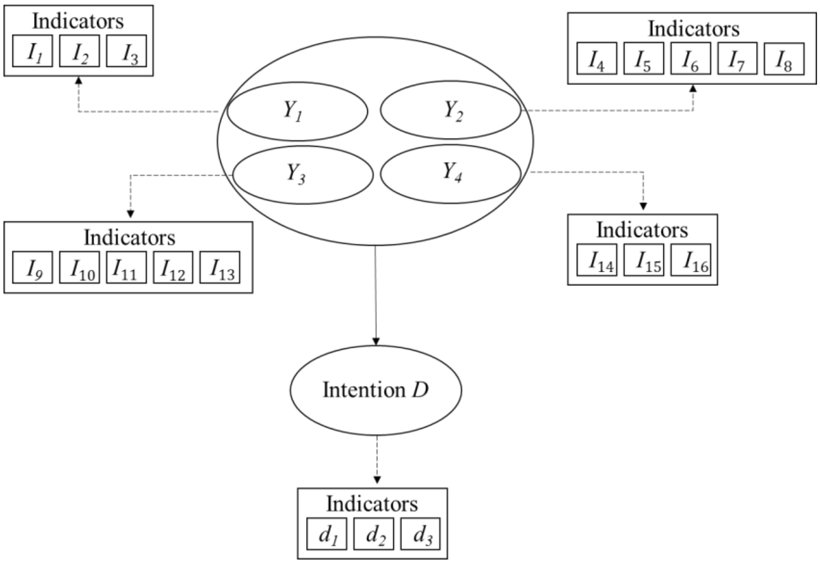

Figure 1. Framework of the Structural Equation Model (SEM)

The regression equations of the measurement model of the latent variable are given as:

$$I = \Lambda_I Y + \delta \quad \textbf{(2)}$$

$$d = \Lambda_d D + \eta \quad \textbf{(3)}$$

The structural model is formulated as follows:

$$D = \Gamma Y + \zeta \quad \textbf{(4)}$$

where,

Y is an exogenous latent variable,
D is an endogenous latent variable,
Λ_d, Λ_{I_i} are factor loadings of latent variables,
δ, η are measurement error terms,
Γ is regression coefficient matrix,
ζ is residual,
d, I are the indicative variables of latent variables.

3.3 Data collection

Web-based questionnaires and paper-based questionnaires were delivered in Shunde district. A total number of 392 questionnaires were distributed and collected, and 361 were valid among them. The individual characteristics are shown in *Table 1*.

Table 1. Profile of Respondents

Characteristics		Number	Proportion %
Gender	Male (0)	151	41.8
	Female (1)	210	58.2
Age	12-25 (0)	62	17.2
	26-35 (1)	203	56.2
	Over 35 (2)	96	26.6
Occupation	Student or teacher (0)	74	20.5
	Company Personnel (1)	169	46.8
	Self-employed person (2)	92	25.5
	Other (3)	26	7.2
Income per month (yuan)	Below 3000 (0)	17	4.7
	3000-5000 (1)	103	28.5
	5000-8000 (2)	144	39.9
	Over 8000 (3)	97	26.9

The summary data regarding cycling is as follows:

As for the main cycling patterns, 45.8% of people transferred between public transport and bicycles, 29.3% of people rode bicycles for short trips and did not transfer. The reason 24.9% of people rode bicycles was to transfer to private cars. According to the above findings, the bicycles helped the residents solve the "last mile problem". Docked shared bicycles and dockless shared bicycles are important convergence tools for other travel modes.

In terms of purpose, 53.2% of the people used docked shared bicycles or dockless shared bicycles to commute, about 27.1% of people used the service to go shopping, and bodybuilding/fitness and holiday travel accounted for about 10.8% and 8.9%, respectively. In addition, a study showed that people whose purpose was leisure were included as potential users of docked shared bicycles (Pai & Pai, 2015).

Concerning use duration, 59.2% of users rode bicycles for less than 30 minutes, between 30-60 minutes accounted for 38.8%, and for more than an hour accounted for about 2%. Previous studies show that when the destination is within 4.6 kilometres, even if conventional public transportation is available, bicycles still have an advantage over the former, because bicycles achieve point to point service (Q. Li & Tang, 2003). In this distance range, the use time was generally not more than 30 minutes, which can therefore explain why most users rode below 30 minutes one way.

For use frequency, the number of users who rode bicycles over five times a week was the largest, reaching 43.5%, the second was 1-4 times, accounting for 42.7%. Meanwhile, users who rode once or less a week accounted for 13.8%.

4. RESULTS AND DISCUSSION

4.1 Model Results

The collected data was edited and a binary logit model (BL) was established using SPSS software through the maximum likelihood method and analyzed through structural equation modeling (SEM) using AMOS software. There are several parameter estimation methods for SEM, which include the instrumental variable method (IV), generalised least squares (GLS), and maximum likelihood (ML) (Kelloway, 1998). In this paper, the maximum likelihood method is used to estimate the model.

In practice, Cronbach's α coefficient is usually used to test the credibility of a questionnaire and is defined as follows:

$$\alpha = \frac{K}{K-1}\left(1 - \frac{\sum_{m=1}^{K} S_m^2}{S^2}\right) \quad (5)$$

where,

S_m is the variance in question m,

K is the total number of question items, and

S is the variance of the observed total test scores.

The alpha coefficient is an intrinsic coherence coefficient. This method is usually used to analyse the reliability of the scale. The Cronbach's α coefficient and degree of reliability are shown in *Table 2* below. The Cronbach's α reliability of the questionnaire is 0.766, which shows that the questionnaire is reasonable and the overall credibility is acceptable.

Table 2. Cronbach's α Coefficient reference range

Reliability level	Range of Cronbach's α	Reliability degree
1	$0 < \alpha \leqslant 0.5$	Unacceptable
2	$0.5 < \alpha \leqslant 0.6$	Poor
3	$0.6 < \alpha \leqslant 0.7$	Questionable
4	$0.7 < \alpha \leqslant 0.8$	Acceptable
5	$0.8 < \alpha \leqslant 0.9$	Good
6	$0.9 < \alpha$	Completely credible

The evaluation of the structural equation model is mainly reflected by the chi square value (χ^2), relative chi-square (χ^2/df), Tacker-Lewis index (TLI), comparative fit index (CFI), Akaike information standard (AIC), Bayesian information standard (BIC), goodness-of-fit index (GFI), Root Mean Square Error of Approximation (RMSEA) and other indexes (Browne & Cudeck, 1993)

Table 3. Model fitting index

Evaluating indicator	Standard value	SEM 1	SEM 2
χ^2		196.159	280.462
df		142	142
χ^2/df	<3	1.381	1.975
TLI	>0.9	0.979	0.928
CFI	>0.9	0.982	0.941
AIC		292.159	376.462
BIC		478.826	563.8128
GFI	>0.90	0.946	0.925
RMSEA	<0.08	0.033	0.052

Table 3 shows that the two SEMs in this study have high credibility and certain prediction ability.

The estimation results of the BL model - from which nonsignificant variables (gender and income) were removed - and SEM are shown in *Table 4*, *Figure 2* and *Figure 3* respectively.

Table 4. Estimation results of Binary Logit model

Variable	B
Constant	1.238
Characteristics of the travellers	
Age (0)	0***
Age (1)	1.433**
Age (2)	-.987**
Occupation (0)	0***
Occupation (1)	-1.865**
Occupation (2)	.245
Occupation (3)	-.1041
Preferences	
CSP	.706***
APO	.716***
RDC	.337*
DRG	-.745***
CRP	-1.056***
R^2(Cox & Snell)	.303
R^2(Nagelkerke)	.414
Model χ^2	129.98

*(Note: *, ** and * * * indicate significance confidence levels of 90%, 95% and 99% respectively)*

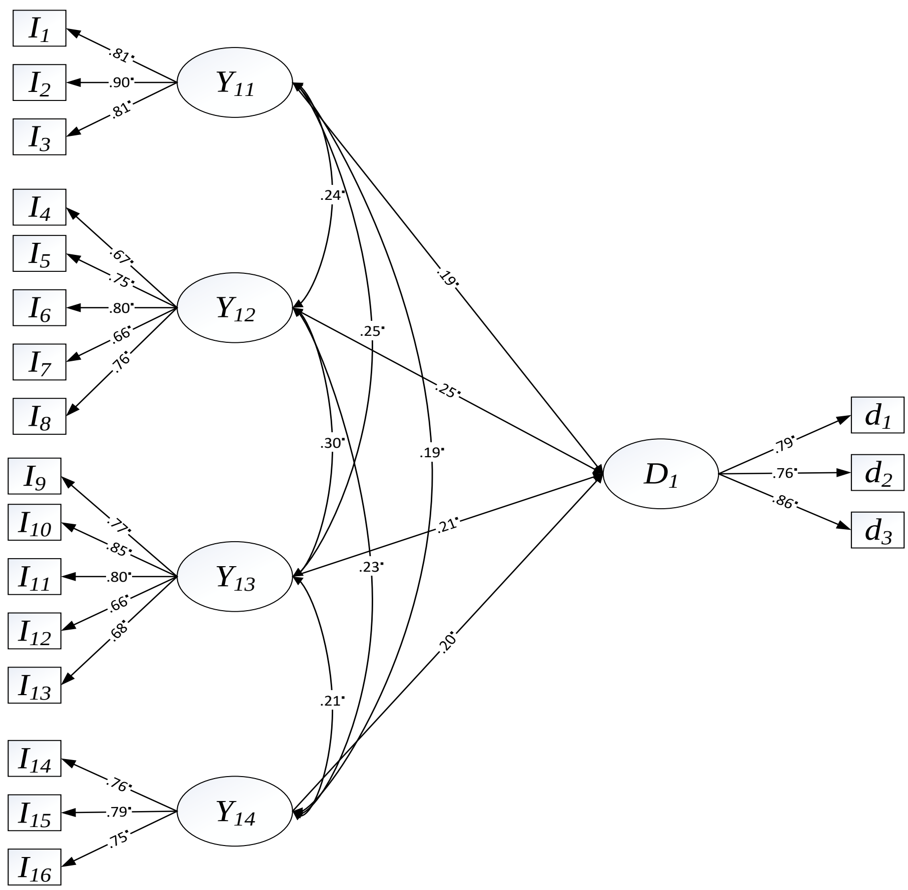

Figure 2. Standardised estimates of Structural Equation Model 1.

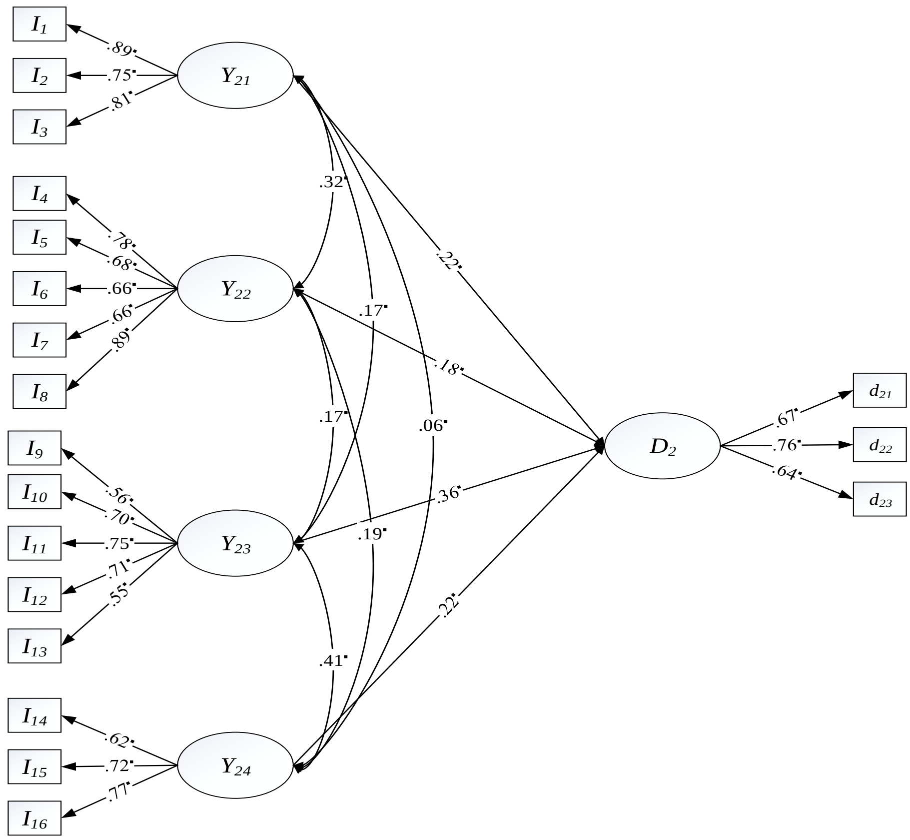

Figure 3. Standardised estimates of Structural Equation Model 2.
(Note: • indicates significance confidence levels of 99%)

4.2 Discussion

In terms of characteristics of the travelers, the correlation coefficient between choice and age and choice and occupation were noteworthy, whereas there was no significant correlation between gender versus choice and income versus choice. Choice behaviour was influenced by whether the user was a student, teacher or company personnel. As the age increased, people were more inclined to choose docked shared bicycles (over 35 years old).

As for preferences, arbitrary path options and the connection between start points and the subway or bus stations were positively related to the choice utility. When users wanted to select a path arbitrarily or valued the connection between start points and the subway or bus stations, they were more likely to choose dockless shared bicycles compared to docked shared bicycles. There was a weak significant correlation between the deposit cost and users' choice behaviour. However, the deposit return guarantee and rent price were important factors affecting the users' choice behaviour. When users valued low prices, and the deposit guarantee was effective, the possibility of choosing docked shared bicycles would be higher compared to dockless shared bicycles.

Regarding the user experience, the convenience of the operating system, borrowing-returning, riding experience, and level of service, whose indicative variables had good explanatory power, all had a significantly positive impact on users' intention to use dockless and docked shared bicycles.

4.3 Application in Shunde district

Shunde district is one of the municipal districts of Foshan city, Guangdong Province where private transport dominates. The share of trips by bus is only 13% across Shunde district and less than 22% in the central area. Docked shared bicycles have been developed since 2011 and this transport mode has been normalised within the traffic community; as the project operator in Shunde, Space Carden is responsible for the construction and operation of docked shared bicycles, subsidised by the Shunde local government. At present, there are about 6,200 docked shared bicycles, 390 docking stations, 8,577 berths, and on average 18,600 daily rentals. Single uses of docked shared bicycles grew steadily from one million to five million and the share of trips by docked shared bicycles increased from 0.6% to 3.2% between 2014 to 2016. Since March 2017, some dockless shared bicycles such as U-bicycle, Mobike and Getb have been developed in different areas. There were 2,000 U-bicycles in the Daliang area, 4,000 Mobikes in the Ronggui area, and 1,000 Getbs in the Daliang area. Both dockless and docked shared bicycle systems work well and numbers of system users are roughly equal, which indicates that the two systems co-exist in Shunde.

Age was the most important indicator distinguishing user groups since older people prefer docked bicycles while younger people prefer dockless.

The deposit of docked shared bicycles is 200 Yuan if users apply for admission via agencies, or 299 Yuan through the mobile phone app. The deposit for Mobike is 299 Yuan, and for U-bicycle and Getb it is 299 and 99 Yuan respectively. There was little difference in the deposits between most dockless and docked shared bicycles. All dockless shared bicycles cost 0.5 Yuan per half hour, but docked shared bicycles were free for use under one hour, which was one of the important ways that docked shared bicycles were able to establish a stable group of users.

Although the function of scanning the quick-response (QR) code to borrow docked shared bicycles has been in use since 2017 in Shunde district, so that citizens did not need to take smartcards with them, more than 62% of users believed that the system of dockless shared bicycles had an obvious advantage over docked shared bicycles, and more than 40% believed that the operation of dockless shared bicycles was simpler than that of docked shared bicycles. Therefore, the convenience of the system could be improved to increase the utilization ratio of docked shared bicycles and provide better service to users.

In terms of the borrowing-returning convenience, the coefficient had a significantly positive impact on users' intention. But more than 53.7% of the users thought the scheduling of docked shared bicycles was not sufficiently available, and distribution of bicycle parking areas was not sufficient; 63.7% of the users thought it was more convenient to borrow or return a dockless shared bicycle. Meanwhile, it is shown that about 53.2% of the users cycled to commute, in other words, they had strict time requirements, and using dockless shared bicycles avoided the drawback of the traditional docking system if they were forced to dock the bicycle a perceptibly significant distance from the destination. However, being without docks led to disorderly parking of dockless shared bicycles, which was one of the reasons that some local governments opposed the development of dockless shared bicycles in their cities. In addition, there was a big gap in usage frequency between different areas, where an average of 3,200 persons rode shared bicycles per day in the Leliu area, which had the highest usage frequency, and the lowest usage frequency was 23 persons per day in the Lecong area. Therefore, this study suggests that the docks of the docked shared bicycles could be distributed according to the needs of most users (over 35 years old), and the bicycles would be scheduled to meet most groups' demands for different times.

The survey indicates that users were very satisfied with the quality and riding comfort of the docked shared bicycles. Some docked shared bicycles were even equipped with children's seats. However, 21.6% of users thought there was an insufficient level of promotion for docked shared bicycles. Therefore, the government could intensify their promotion, emphasizing the high quality and riding comfort of docked shared bicycles to attract more potential users.

As for service level, an example for reference was that, in the first half of 2017, about 30 bicycle repair stations were developed by the Hangzhou city docked shared bicycles company to help people repair docked shared bicycles and even their private bicycles in Hangzhou. In this way, the service level of public shared bicycles' infrastructure can be improved, but would require word-of-mouth promotion to attract more people.

In summary, although dockless bicycles are more convenient than docked shared bicycles for borrowing-returning, the current number and scale of dockless bicycles are still limited and they cannot fully meet the needs of citizens. Furthermore, docked shared bicycles have relatively stable users, high evaluation of the riding experience and an almost free service. This survey indicates that 70.1% of interviewees thought the existence of docked shared bicycles was necessary, 85.3% of the interviewees stood by the integrated development of docked and dockless shared bicycles to provide a better service for the population. Therefore, a new-shared bicycle system that combines the advantages of both docked and dockless shared bicycles would be a possible solution for small and medium-sized cities.

5. CONCLUSION

Bicycles are popular among people for being environmentally friendly and providing people with convenience. In recent years, docked and dockless shared bicycles have emerged and been radically developed, while encountering many bottlenecks in China. Dockless shared bicycle systems have replaced traditional docked ones and saturated the market in many big cities. The situation is completely different in small and medium-sized cities where docked shared bicycles are operated by the local government. It is found that the two systems co-exist in small and medium-sized cities. This study reveals the user choice behaviours favouring the docked and dockless bicycles based on user experience, and illustrates the win-win strategies for docked shared bicycle systems.

This case study carried out in Shunde district of Foshan city shows that age, occupation and preferences have significant influence on users' choice behaviour towards docked and dockless shared bicycles. The convenience of riding, borrowing-returning, riding experience and service level all influence the use intention as well. In other words, the local governments and companies could provide better service for bicycle-sharing systems to enhance user experience from those aspects. Docked and dockless shared bicycle systems work well together in Shunde since they satisfy mostly independent user groups. The government and companies should actively promote their respective advantages and mitigate their disadvantages. The relationship between docked shared bicycles and dockless shared bicycles could be shifted to a complimentary, rather than competitive, relationship and a new, shared bicycle system that combines their advantages would be a better solution for small and medium-sized cities.

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