Hindawi
Journal of Advanced Transportation
Volume 2022, Article ID 6695977, 14 pages
https://doi.org/10.1155/2022/6695977

Research Article

A Choice Behavior Model of Bike-Sharing Based on User Perception, Psychological Expectations, and Loyalty

Xingjian Xue,[1,2] Zixu Wang,[2] Xuejiao Liu,[2] Zhou Zhou,[2] and Rui Song[2]

[1]*Hunan Big Data Engineering Technology Research Center of Natural Protected Areas Landscape Resources, Changsha, Hunan 410004, China*
[2]*College of Logistics and Transportation, Central South University of Forestry and Technology, Changsha, Hunan 410004, China*

Correspondence should be addressed to Xingjian Xue; 7413442@qq.com and Xuejiao Liu; 842540317@qq.com

Received 10 October 2020; Revised 18 October 2021; Accepted 15 March 2022; Published 14 April 2022

Academic Editor: Amanda Stathopoulos

In the midst of sharing concepts, bike sharing has made innovative changes to people's travel modes. Providing high-quality services is essential to promoting the usage of bike sharing and to reducing traffic congestion by shifting people away from private car use. This research explores the factors that influence users' selection of bike sharing as a transportation mode by identifying and describing relationships to user perception, psychological expectations, and loyalty. The effects of value identity, convenience, economy, comfort, perceived safety, travel characteristics (TC), and sociodemographic factors (SD) on the selection and usage of bike-sharing systems in Changsha, China, were analyzed. The mediating effect of user satisfaction (US) on the relationship between perceived quality (PQ) and use loyalty was examined. A total of 700 questionnaires were distributed at 20 bike-sharing locations, to which 569 users effectively responded. The results of the analysis indicate that loyalty to bike sharing was predicted by all of the studied constructs except for gender. The results of this study help us better understand the influencing factors of bike-sharing usage and can aid policymakers in formulating effective guidance strategies for bike-sharing travel demand based on a model structure.

1. Introduction

The bike-sharing system originated in the Netherlands and began to appear in China in March 2016. Compared to traditional public bikes that must be rented and returned at fixed rental stations, bike sharing is an innovative method of bike operation that eliminates the construction of expensive docking stations and provides convenient, flexible, and low-carbon mobility for city travel [1]. When people use bike sharing as well as public transportation (PT), these two modes are complementary. Because bike sharing helps expand the service areas of PT stations, people can use bike sharing to use PT more conveniently. This can help some people located far from a bus stop use PT. When people originally travelling by PT shift to bike sharing, the two modes are competitive; from the emergence of bike sharing, some PT users have shifted to bike sharing. Additionally, bike sharing has other advantages; for example, users can pay fees and borrow a bike using a mobile phone bike-sharing app and find a bike through a global positioning system (GPS). As a result, bike-sharing systems have rapidly gained popularity in China and quickly reached a massive scale. Currently, more than 360 cities in the country have rolled out bike-sharing programs with 300 million registered users. However, despite this rapid rise and development period, academic research on bike sharing has mainly focused on descriptions of economic phenomena, legal supervision, and other macrolevel issues. Few studies exist on the characteristics of bike sharing from a microlevel perspective: Tang et al. [2] explained impacts on bike-sharing travel behavior in terms of services, facilities, users, and operations' management [2]. Xin et al. [3] used partial least squares estimation to calculate the cyclist satisfaction index model, which considers the riding environment, riding safety, government intervention, laws, and staff services [3]. Han et al. [4] investigated the roles of bike-tourism attributes, perceived value, satisfaction, desire, and gender in bikers' loyalty generation [4].

It should be noted that the research object of this study is China's bike-sharing system rather than public bikes. Perhaps, public bikes and bike sharing are not different in other countries, but in China, they represent different bike-sharing systems. Public bikes are used through docked bike-sharing systems developed and operated by the Chinese government or state-owned enterprises and usually involving government subsidies. Bike sharing typically refers to 'dockless bikesharing,' which usually invested in and operated by private companies.

First, this study summarizes users' socioeconomic and travel characteristics (TC) and the effects of user perceptions, risk preferences, and psychological expectations on user choice behavior from the path coefficients of the structural equation model, which can be used to demonstrate the asymmetric responses of bike-share users to multiple dimensions of related indices. Second, we construct and verify hypothesized relationships between model variables and discuss the weights of indices according to the loading coefficients of their corresponding latent variables. The results of the model analysis can be used to predict users' bike-sharing travel behavior. In this study, we examine bike sharing in Changsha, China, in an empirical study to compensate for the limited research in this field on cities in China. The findings of this study can help improve user satisfaction (US) and user loyalty (UL) to bike sharing and identify bike-sharing operation and management strategies that can retain users and attract more users to the system.

2. Literature Review

Because bike sharing is a new travel mode combining Internet technology and bikes, relevant research is limited and focuses more on public bike systems, which are similar to bike-sharing systems. However, past studies of public bikes support a future of bike sharing in China. The existing research on bike-sharing selection and behavior mainly focuses on three factors: user characteristics, TC, and user preferences.

Regarding user characteristics, evidence from different studies shows that important attributes related to choice behavior are gender, age, income, occupation, and education level [5, 6]. For instance, bike-share users are largely educated, affluent, and younger males, and compared to other occupations, students are more likely to use public bikes [7]. In the Netherlands, some researchers have analyzed bike-share user characteristics. The authors show that individuals who are highly educated, have higher incomes, and are aged from 17 to 27 are more likely to use bike sharing [8]. These results are in line with evidence from China showing that high-income, highly educated, and young individuals are more likely to use bike sharing [9–11]. Recently, a study on the travel patterns of bike sharing pointed out that bike-share users are more likely to be younger and more educated [12]. In contrast to the above studies, researchers have also analyzed the characteristics of transit-bike users in the United States from 2001 to 2009 [13] and found that the combined mode is more popular among those with little education or from a low-income household. It may be that high-income groups in the United States mostly live in the suburbs and prefer to travel by car. In addition, individuals who have a personal car are less likely to use the bike-sharing mode in Germany [14].

The TC of bike sharing are of great importance to travel behavior. Currently, scholars mainly focus on travel time, travel distance, travel frequency, and other dimensions [15, 16]. Studies have shown that the acceptable travel distance for public bike transport is between 1 km and 5 km [17]. More than half of the public bikes within 3 km of rental points are used [18], and the critical travel time for cycling is 24 min [19]. A user's travel frequency is higher when the purpose of travelling is to access a bus or subway [20], and the travel purpose is also the main factor that affects whether a passenger will use shared-bike transfers [21]. The travel distance between one's home and transit stations has the most important effect on the use of cycling to access/leave metro stations [9, 22].

Studying the influence of user preferences on bike-sharing usage is useful not only to evaluate bike-sharing systems but also to reduce operation costs and improve user experiences. In other research, such as work on bus services [23], railways [24, 25], and air travel [26], some studies have considered users' subjective preferences and travel behaviors or intentions by constructing model relationships and hypotheses that mainly include users' perceived service quality, perceived value, complaints, satisfaction, loyalty, and other factors [27–30]. Some work has analyzed the relationships between customer satisfaction, service quality, and travel intentions in several service industries and shows that service quality is an antecedent of US, US has a significant effect on travel intentions [31], and there is a strong connection between US and UL [32].

Hence, the study reported in this study is designed to fill gaps in past research by investigating the effects of users' subjective behavior on travel choice behavior. More specifically, the study aimed to achieve the following research objectives: (1) investigate the travel behavior of different user groups, (2) investigate the interactional relations between user perceptions and psychological expectations, and (3) examine the effect of user perceptions and psychological expectations on users' choice behavior. Among travel preference factors of bike sharing, user perceptions are considered to have the greatest effect on bike-sharing use. User perceptions are mainly reflected by a user's subjective perceptions of the service quality of bike sharing [33]. In regard to the perceived of bike-sharing services, perceived risk, economy, convenience, and comfort have been studied frequently [34]. As a new derivative of the sharing economy, bike sharing has great commercial value, users' valuing of bike sharing can greatly improve usage, and previous studies have confirmed that value identity may influence the decision-making processes underlying travel choices [35, 36]. We divide perceived quality (PQ) into five dimensions: perceived safety, value identity, convenience, comfort, and economy. Some studies have pointed out that demographics such as monthly income, age, and occupation and TC play an important role in people's interactions with their surroundings and have significant impacts on users' PQ, affecting their attitudes [37–39]. Therefore, it is necessary to introduce sociodemographic factors (SD) and TC into the research model of influencing factors of bike-sharing travel. In addition, PQ has been shown to have a significant impact on satisfaction and loyalty [40]. Studies suggest that US is a principal antecedent of loyalty [41], has a significant favorable effect on loyalty [42], and mediates the PQ and UL relationship [43]. UL is a postpurchase behavioral intention that refers to the willingness to continue a behavior or recommend it to others after requirements are met, and this concept can be applied to bike-sharing travel choice behavior [4]. Finally, a bike-sharing choice behavior model characterized by loyalty indices is constructed to explore the key factors affecting the choice behavior of bike-share users.

This study makes the following contributions. (1) The research on bike-sharing choice behavior is relatively limited, and although many characteristic variables are involved, a systematic model has not been constructed to explain the correlations among them. Therefore, based on users' subjective perception characteristics, we constructed an SEM of subjective variables to illustrate the impact on user travel choice behavior and explain why we select these variables in detail. (2) Satisfaction and loyalty have widely examined in PT research. This study applies these variables to user behavior research on bike-sharing, serving as a beneficial attempt to clarify the role of bike sharing in urban transportation systems.

Consequently, this work explores positive effects of the studied dimensions with the following hypotheses:

Hypothesis 1. (H1) PQ is positively associated with US with bike sharing.

Hypothesis 2. (H2) US is positively associated with UL to bike sharing.

Hypothesis 3. (H3) PQ is positively associated with UL to bike sharing.

Hypothesis 4. (H4) TC are positively associated with the PQ of bike sharing.

Hypothesis 5. (H5) SD are positively associated with the PQ of bike sharing.

Hypothesis 6. (H6) PQ is positively associated with UL through US with bike sharing.

According to these hypotheses, it is proposed that bike-share users' PQ and US positively influence their UL. It is proposed that bike-share users' TC and SD positively influence PQ. Furthermore, the positive path between perceived value and UL is expected to be partially mediated by US.

The conceptual framework is shown in Figure 1. We use a second-order CFA in this research because the first-order factors are highly correlated, which implies that the model may have a higher-order factor structure, and it may thus be problematic to directly use first-order factors that lack independence to construct the model. It is more suitable to extract a second-order factor with a common feature to represent them. Second, the original model has 5 first-order factors, which makes the model too complicated. Constructing a second-order model simplifies the model and removes degrees of freedom.

3. Research Methodology

3.1. Participants. Table 1 provides a profile of the 569 participants, including their age, education level, occupation, income, and gender information along with their average bike-sharing travel times, weekly frequency of bike-sharing use, and bike-sharing services used. The results indicate that more males than females responded to the survey, with 257 females (45%) and 312 males (55%). The participants were relatively young, mainly in the 18–35 age range (62%), and had an education level primarily concentrated in the undergraduate (61%) range. With respect to occupation, 37% of those surveyed were company employees who work fixed hours and needed to commute during peak hours every workday. This group is followed by university students (29%) without fixed working hours; therefore, their trip schedules were more flexible. The proportion of interviewees with incomes of less than RMB 3000 was the largest (28%). Table 1 presents a summary of the TC. In terms of frequencies of use, most of the users used bike sharing 1–2 times per week on average. Regarding bike-sharing travel times, < 5 min, 5–15 min, and 15–30 min trips accounted for relatively a high proportion at 95%. Travel distances by bike sharing concentrated at 0–5 km with trips of over 5 km being very uncommon.

3.2. Tools. Based on the conceptual model of shared bike selection behavior, a 23-item paper-based questionnaire was designed to assess acceptance of the service. The questionnaire was developed based on other scholars' research, as shown in Table 2. The questionnaire contained three sections focused on the following: (a) demographics: gender, age, occupation, educational level, and monthly income (e.g., questions related to individual information rated according to the classification; for example, gender was measured with a 2-point scale question with 1 denoting "male" and 2 denoting "female"), (b) usage characteristics: average travel time, average travel distance, usage frequency per week, and bike-sharing services used, and (c) respondents' loyalty based on 7 bike-sharing features (value identity, convenience, comfort, economy, PS, US, and UL). Analysis software programs AMOS.21 and SPSS.25 were used to examine the model structure based on previous research results. Based on a review of past literature, we organized a focus group discussion and employed three experts to modify the item design of each variable. To ensure that the questionnaire was reliable and valid, we modified and eliminated some item descriptions according to the pre-survey results, such as items with factor loading coefficients of less than 0.5, which may interfere with the accuracy of the

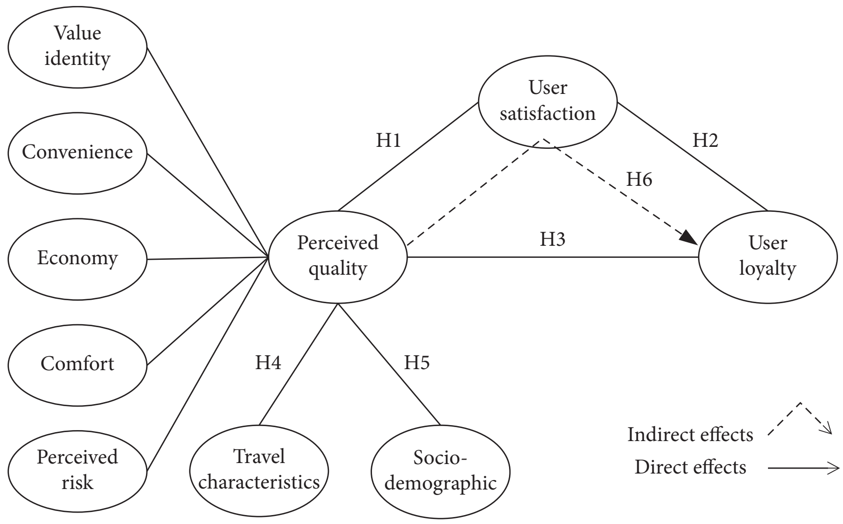

Figure 1: Conceptual model of shared bike selection behavior.

Table 1: Demographic characteristics.

Characteristics	Number	%	Characteristics	Number	%
Gender			*Average travel time*		
Male	312	55	<5 min	115	20
Female	257	45	5–15 min	268	47
Age (in years)			15–30 min	160	28
<18	57	10	30–45 min	20	4
18–25	210	37	>45 min	6	1
25–35	141	25	*Use frequency per week*		
35–50	125	22	<1 time	161	28
>50	36	6	1–2 times	226	40
Education level			3–5 times	154	27
Junior high school and below	17	3	6–10 times	24	4
Senior high school	131	23	>10 times	4	1
Undergraduate degree	318	56	*Average travel distance*		
Master's degree or above	103	18	<1 km	137	24
Occupation			1–2 km	239	42
Civil servant/institution staff	17	3	2–3 km	90	16
Student	165	29	3–5 km	80	14
Company staff	211	37	>5 km	23	4
Self-employed entrepreneur	103	18	*Bike-sharing type*		
Boss or executive	73	13	OFO	125	22
Income per mouth (RMB)			Mobike	193	34
<3000	160	28	Hellobike	148	26
3000–6000	143	25	Greenbike	103	18
6000–10000	147	26			
10000–20000	90	16			
>20000	29	5			

model research results [49]. Table 2 illustrates the items of each construct used in the questionnaire.

All items were measured using a 5-point Likert scale. While 5-point Likert scales are generally treated as ordinal, we apply ours as a continuous measurement because multiple options are used to measure latent variables to perform our analysis, such as averaging, correlation, and regression. We treated the scale as an isometric variable design and informed the participants of this feature. This method is common and considered acceptable in academic research adopting SEM and has been used in numerous prior works on usage behavior intentions [50–53]. The numbers 1, 2, 3, 4, and 5 represent a respondent's agreement or disagreement with the following items: 1, strongly disagree; 2, disagree; 3, neither agree nor disagree; 4, agree; and 5, strongly agree. The survey analysis results showed that the questionnaire design passed the reliability and validity test, meaning that the design items explain the latent variables and accurately reflect the influencing factors of bike-sharing choice behavior.

Table 2: Interpretation of variables included in the questionnaire.

Constructs items	Reference sources
Value identity	
VI1 : improved travel efficiency	[4, 44]
VI2 : improved quality of life	
VI3 : health and environmental protection	
Convenience	
CON1 : short distance travel is more convenient	[7]
CON2 : more convenient to connect to other transportation modes	
CON3 : easy to use and easy to learn	
CON4 : fully equipped facilities	
Economy	
EC1 : reasonable price	[45, 46]
EC2 : more cost-effective than other travel modes	
EC3 : the APP faces very little traffic during use	
Comfort	
COM1 : good bike design and comfortable riding	[47]
COM2 : roads smooth and no illegal road use occurs	
COM3 : no interference occurs from other factors, such as pedestrians, electric vehicles, or motorcycles	
COM4 : bike lanes are flat and continuous	
Perceived safety	
PS1 : cycling across the street is dangerous	[48]
PS2 : bike lanes without isolation	
PS3 : mixed operation of motor vehicles and bikes	
PS4 : vulnerable to weather	
US	
US1 : my expectations are satisfied	[29, 43]
US2 : I am satisfied with the ideal	
US3 : overall, I am satisfied with bike sharing	
UL	
UL1 : I would like to continue to use bike sharing	[4]
UL2 : I would like to recommend bike sharing to my relatives and friends	
TC	
TC1 : average travel distance	[3]
TC2 : average travel time	
TC3 : use frequency per week	
SD	
SD1 : age (in years)	[5]
SD2 : occupation	
SD3 : income per month (RMB)	

3.3. Procedure and Design. First, we conducted an on-site survey of approximately 60 bike-sharing parking locations in Changsha, China, for basic data to select the presurvey location. To ensure the rationality and effectiveness of the questionnaire, a presurvey was carried out, and we selected 30 presurvey sites with high bike-sharing demand as a survey environment including residential and commercial areas, CBD areas, schools, transportation hubs, hospitals, parks, and other property types. From the presurvey, some issues preventing the survey's application were identified (e.g., a property manager who did not allow us to investigate or security issues at the survey site). A total of 50 questionnaires were distributed, and 43 valid questionnaires were collected, resulting in an effective questionnaire recovery rate of 86%.

Finally, we selected 20 sites for our formal survey. Our survey is an intercept survey, which can only be regarded as involving quasi-random sampling, which has certain limitations regarding the representativeness of the participant sample. It is difficult to achieve fully random sampling from surveys, but many studies have shown that interception surveys are a viable alternative to random sampling surveys. We also took many measures to ensure the randomness of the sample and make the sample representative of all bike-share users. For example, we combined user characteristic data released by bike-sharing companies with on-site surveys, conducted stratified sampling for proportions, controlled for conditions such as age and gender, and adopted an isometric survey method. A formal questionnaire survey was conducted from September 7, 2021, to September 14, 2021. Our 20 survey sites included 4 main rail transit stations, 6 commercial and residential areas, 7 greenways, and 3 university towns. For each, 6 trained investigators were evenly distributed to each area and randomly selected survey subjects for intercept surveys. The survey was affected by the location of administration. For example, as there are many students near schools and many office workers near shopping malls, the sample proportion of a given survey location

Table 3: Descriptive statistics for indicators of model constructs.

Question	Median	Mean	SD	Strongly disagree	2	3	4	Strongly agree
VI1	4	3.75	0.604	0	0.4	32.9	58.3	8.4
VI2	4	3.89	0.584	0	0	23.2	64.7	12.1
XQVI3	4	3.73	0.623	0	0	36.7	53.8	9.5
CON1	4	4.11	0.765	0.9	1.9	13.2	53.3	30.8
CON2	4	3.98	0.764	0.2	2.6	21.4	51	24.8
CON3	4	4.05	0.705	0.4	2.1	13.9	59.2	24.4
CON4	4	3.90	0.753	0	2.5	26.5	49.7	21.3
EC1	4	3.77	0.836	1.1	4.9	28.1	48	17.9
EC2	4	3.81	0.795	0.4	4.6	27.2	49.7	18.1
EC3	4	3.73	0.832	0.7	4.2	35.1	41.7	18.3
COM	4	3.59	0.867	0.7	9.3	34.1	41.8	14.1
COM2	3	3.11	0.883	3.2	20.9	41.7	30.6	3.7
COM3	3	3.04	0.907	4	23.4	41.5	27.2	3.9
COM4	4	3.53	0.894	1.6	10	35.3	40.4	12.7
PS1*	4	3.54	0.828	0.9	10	32.5	47.5	9.1
PS2*	4	3.56	0.779	0.5	7.9	35.3	47.8	8.4
PS3*	3	3.28	0.835	2.6	13.5	40.6	39.9	3.3
PS4*	3	3.18	0.817	3	14.1	47.5	32.7	2.8
US1	4	3.67	0.788	0.7	5.1	33.7	47.8	12.7
US2	4	3.61	0.785	0.4	6	38.1	43.8	11.8
US3	4	3.74	0.774	0.9	3.9	29.2	52.2	13.9
UL1	4	3.75	0.793	0.7	4.6	28.8	50.4	15.5
UL2	4	3.89	0.771	0.4	2.8	25.3	50.6	20.9
				Very low				Very high
(km)				<1	1–2	2–3	3–5	>5
TC1	4	3.68	1.107	4	14.1	15.8	42	24.1
(min)				<5	5–15	15–30	30–45	>45
TC2	4	3.82	0.829	1.1	3.5	28.1	47.1	20.2
(times)				<1	1–2	3–5	6–10	>10
TC3	4	3.91	0.882	0.7	4.2	27.1	39.7	28.3
(years)				<18	18–25	25–35	35–50	>50
SD1	3	2.78	1.097	10	36.9	24.8	22	6.4
				Student	Civil servant/ institution staff	Company staff	Self-employed entrepreneur	Boss or executive
SD2	3	2.88	1.425	29	3	37.1	12.8	18.1
(Thousand yuan)				<3	3–6	6–10	10–20	>20
SD3	3	2.45	1.207	28.1	25.1	25.8	15.8	5.1

Note. VI, value identity; CON, convenience; EC, economy; COM, comfort; PS, perceived safety; US, user satisfaction; UL, user loyalty; TC, travel characteristics; SD, sociodemographic factors. ∗ indicates reverse scoring.

may be dominated by a certain population. To ensure the reliability of the samples, nonmonetary gifts were provided to the interviewees to encourage them to complete the questionnaire. A total of 700 questionnaires were distributed, and 634 questionnaires were collected. After questionnaire screening, we eliminated missing and disorderly questionnaires. Finally, a total of 569 valid questionnaires were obtained, meeting our research requirements.

4. Results

In this section, first, a descriptive analysis of the questionnaire items will be presented. Next, the measurement's reliability and validity will be illustrated by reporting Cronbach's alpha (CA), AVE, CR, and KMO results and correlations of the constructs. Subsequently, the hypotheses are tested. As the final result of investigating our conceptual model, the path coefficients and significance between the constructs of the SEM are reported.

4.1. Descriptive Analysis of Questionnaire Items. Table 3 presents the median, mean, standard deviation (SD), and percentage of each response category for each of the items in the questionnaire. There are some important trends in the responses. For example, most of the respondents strongly agree with four statements related to convenience, indicating fairly consistent attitudes toward these elements across the respondents. Similarly, the highest mean scores apply to the items in the convenience construct, while items PS3 and PS4 for perceived safety and items COM2 and COM3 for social influence generated the lowest mean scores compared to the other constructs. The mean scores for TC have average values (3.68, 3.82, and 3.91), and the mean scores for SD have

Table 4: Means and SDs of model variables.

	PQ M(SD)	US M(SD)	UL M(SD)
Total ($N = 569$)	3.64 (0.39)	2.75 (0.51)	3.82 (0.69)
Male ($n = 312$)	3.62 (0.39)	2.76 (0.49)	3.84 (0.70)
Female ($n = 257$)	3.66 (0.38)	2.74 (0.52)	3.80 (0.45)
Age <18 ($n = 57$)	3.68 (0.39)	2.81 (0.56)	3.96 (0.82)
Age 18–25 ($n = 210$)	3.59 (0.38)	2.71 (0.48)	3.80 (0.67)
Age 25–35 ($n = 141$)	3.61 (0.37)	2.67 (0.53)	3.73 (0.66)
Age 35–50 ($n = 125$)	3.71 (0.40)	2.85 (0.46)	3.85 (0.65)
Age >50 ($n = 36$)	3.74 (0.42)	2.89 (0.61)	3.97 (0.76)

average values (2.78, 2.88, and 2.45). Most of the respondents would recommend bike sharing to their relatives and friends.

Table 4 provides the means and SDs for PQ, US, and UL for different genders and ages. The results show insignificant gender differences in PQ ($r^2_{\text{PQ}} = 0.001, p > 0.05$), US ($r^2_{\text{US}} = -0.002, p > 0.05$), and UL ($r^2_{\text{UL}} = -0.001, p > 0.05$). However, men are more satisfied with and loyal to bike-sharing use. Women, as well as first-time users and novice cyclists, have stronger perceptions of quality. Different ages show significant differences in US ($r^2_{\text{US}} = 0.015, p < 0.05$) and PQ ($r^2_{\text{PQ}} = 0.013, p < 0.05$) but not in loyalty ($r^2_{\text{UL}} = 0.004, p > 0.05$). Older people (age >50) are more satisfied with bike sharing. Young people are relatively unsatisfied because they use bike sharing more frequently and ride for longer periods of time, rendering them more attuned to the PQ of riding than elderly people.

In addition, we compared results by gender, age, occupation, and income. We used an ANOVA to determine differences between mean group values and found that, in addition to gender, age, occupation, and income show significant differences in impacts of PQ ($r^2_{\text{Genger-PQ}} = 0.001, P > 0.05$; $r^2_{\text{Age-PQ}} = 0.013, P < 0.05$; $r^2_{\text{occupation-PQ}} = 0.013, P < 0.05$; $r^2_{\text{income-PQ}} = 0.014, P < 0.05$). Therefore, we used age, occupation, and income as observation variables to analyze the impact of SD on PQ. In the same way, the average travel time, average travel distance, and shared bike use frequency are used as observation variables to explore the impact of TC on PQ.

4.2. Reliability Analysis. After performing a principal component analysis of the data, the principal component factors were extracted by maximizing the orthogonal rotation of variance. The load coefficients of the selected variables are greater than 0.5, ensuring the reliability of the variables. Then, the reliability of the study was measured by values of CA and composite reliability (CR), which overcome the shortcomings of split-half methods, such as the Kuder–Richardson formula and split-half reliability, and are the most commonly used reliability analysis methods in social science research [54]. The CA value of the sample was measured as 0.839, which is greater than 0.7, indicating that the scale has good internal consistency. The CR value is greater than 0.7 [49], indicating that the questionnaire data show a good degree of confidence. Moreover, the average variance extracted (AVE) computes discriminant validity and the amount of variance produced by each construct according to its components. The AVE is acceptable if values are higher than 0.5. Above all, the questionnaire data are suitable for the construction of SEM. The detailed analysis results are shown in Table 5, which shows the loading factors, CA coefficients, and CR and AVE values for the constructs.

4.3. Validity Analysis. SPSS 25 was used for factor analysis, and Kaiser–Meyer–Olkin (KMO) and Bartlett tests were carried out. The KMO measure of sampling adequacy reached 0.847 (greater than 0.8), and the correlation was found to be good. From Bartlett's test of sphericity, the approximate Chi-square value was measured as 845.358, and the p value was measured as 0.000, which is less than 0.01. Therefore, the results of this questionnaire are suitable for factor analysis, which is used directly for model construction.

The AVE is applied to compute the discriminant validity of the model [49]. Discriminant validity is based on the premise that the correlations between different constructs should be low. Lower discriminant validity means that a model's constructs are similar. This can be tested by comparing the square root of the AVE to the correlation coefficient. If the square root of the AVE is greater than the correlation coefficient, the degree of discriminant validity is good. In Table 6, the dimensions' square roots of AVEs are greater than the correlation coefficients between the dimensions. Therefore, the discriminant validity of this model is good.

4.4. Model and Hypothesis Testing. The ML method is the most widely used method for estimating fit in SEM. Many studies have found that when the sample size is large, the estimation result of the maximum likelihood method is reliable even if the data do not obey the multivariate normal distribution [55, 56]. However, many scholars believe that when using the Likert scale, it is best to verify that the data follow a multivariate normal distribution when ordinal variables are treated as continuous variables. The assumption of multivariate normality is difficult to test because it is not feasible to test whether the linear combination of infinite variables is normal. The existing detection methods are too sensitive, which may lead to valuable results being discarded. Some studies also provide alternative solutions, assuming that multivariate normality can be partially tested by testing the normality of each variable. Normality can be assessed by statistical or graphical methods [57, 58]. We tested the data and found that the data points of the normal P-P plot of each observed variable in the structural equation model are on the diagonal line representing the normal distribution, and all the data points in the castrated normal P-P plot of each observed variable are randomly located around the 0 scale line. The absolute value of each observed variable kurtosis and skewness is less than 2, which is generally considered to obey a multivariate normal distribution. Therefore, we employ the maximum likelihood (ML) estimate for the SEM. Tables 7 and 8, show that all of the hypotheses of the model

Table 5: Construct loading factors, CA coefficients, CR values, and AVEs.

Constructs	Items	Loading factor	AVE	Cronbach's alpha	CR	Mean	Standard deviation
PQ			0.522	0.815	0.845	3.640	0.387
VI	VI1	0.665	0.506	0.747	0.754	3.789	0.492
	VI2	0.773					
	VI3	0.691					
CON	CON1	0.725	0.504	0.796	0.802	4.009	0.589
	CON2	0.753					
	CON3	0.738					
	CON4	0.616					
EC	EC1	0.718	0.529	0.771	0.771	3.767	0.680
	EC2	0.736					
	EC3	0.727					
COM	COM1	0.622	0.510	0.797	0.801	3.245	0.744
	COM2	0.843					
	COM3	0.813					
	COM4	0.532					
PS	PS1	0.786	0.582	0.847	0.847	3.389	0.675
	PS2	0.805					
	PS3	0.725					
	PS4	0.732					
TC	TC1	0.801	0.627	0.822	0.834	3.858	0.756
	TC2	0.853					
	TC3	0.716					
SD	SD1	0.810	0.708	0.873	0.879	2.749	1.187
	SD2	0.893					
	SD3	0.818					
US	US1	0.842	0.627	0.831	0.834	2.754	0.507
	US2	0.778					
	US3	0.753					
UL	UL1	0.723	0.537	0.700	0.698	3.823	0.686
	UL2	0.742					

Table 6: Correlations of the constructs.

Constructs	A	B	C	D	E	F	G	H	I	J
A.TC	0.792									
B.SD	0.033	0.841								
C.PQ	0.061	.134**	0.722							
D.US	0.071	.108*	.446**	0.792						
E.PS	0.061	0.044	.184**	.231**	0.763					
F.UL	.129**	.108**	.417**	.437**	.319**	0.733				
G.VI	0.018	0.029	0.072	0.068	0.002	0.058	0.711			
H.EC	.087*	0.031	.488**	.463**	.282**	.519**	0.025	0.727		
I.CON	0.008	0.041	.375**	.433**	.166**	.461**	0.068	.626**	0.710	
J.COM	.114**	.136**	.606**	.698**	.597**	.705**	.436**	.559**	.471**	0.714

*Note: $^{*}p < 0.05$; $^{**}p < 0.01$.

Table 7: Results of the structural model.

Hypothetical	Path	Estimate	S.E.	Effect direction	Results
H1	PQ⟶US	2.418	0.374	+	Supported
H2	US⟶UL	0.562	0.093	+	Supported
H3	PQ⟶UL	0.757	0.304	+	Supported
H4	TC⟶PQ	0.042	0.017	+	Supported
H5	SD⟶PQ	0.026	0.011	+	Supported

*Note: $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

Table 8: Test results of model hypotheses (indirect effects).

Latent dependent variable	Latent independent variable	Direct effects	Indirect effects	Total effects	Hypothetical results	Variance explained
UL	PQ	0.265*	0.475* (2.014)	0.740	H3 supported H6 supported	R^2 (UL) = 0.681
	US	0.599***	-	0.599	H1 supported	R^2 (US) = 0.628
US	PQ	0.793***	-	0.793	H2 supported	
PQ	TC	0.133*	-	0.133	H4 supported	R^2 (PQ) = 0.034
	SD	0.126*	-	0.126	H5 supported	

*Note: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

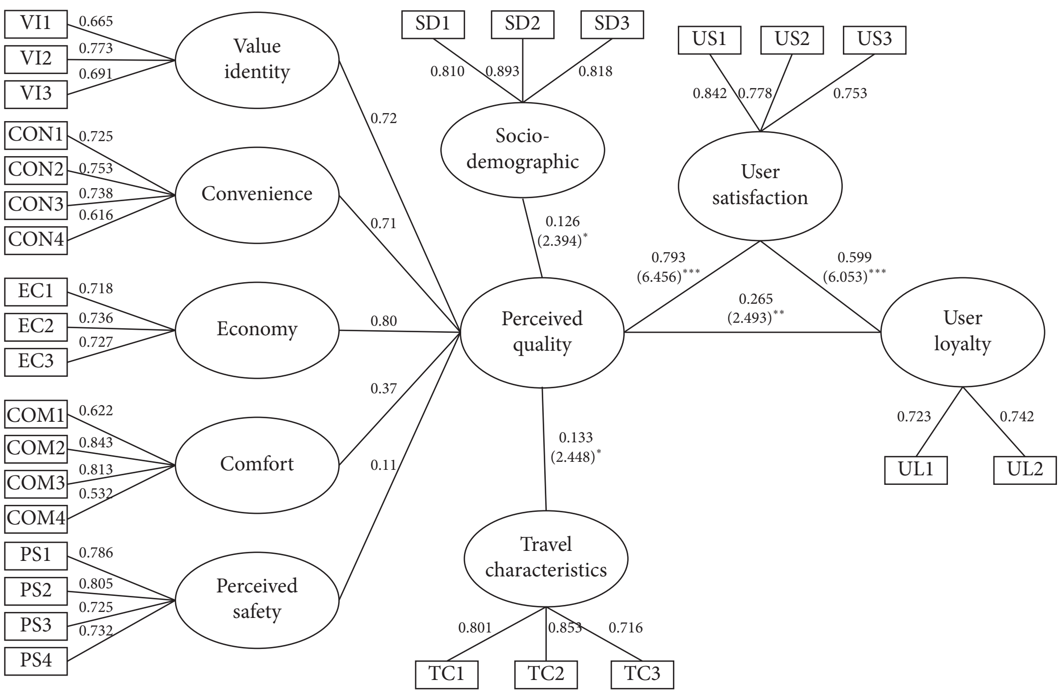

Figure 2: Structural model and standardized weight coefficient. *Note.* The values represent the standardized regression coefficient β and t values.

Table 9: Fit indices of the model.

Fit indices	p	X^2/df	GFI	RMSEA	AGFI	CFI	NFI	NNFI	IFI
Result	0.000	2.30	0.902	0.048	0.884	0.931	0.885	0.924	0.932
Range [59]	<0.05	<3	(0.75, 0.99)	(0.00, 0.13)	(0.63, 0.97)	(0.88, 1.00)	(0.72, 0.99)	(0.73, 1.07)	(0.88, 0.98)

pass the significance test, and the proposed theoretical model better explains differences in UL related to bike sharing ($R^2 = 0.681$). SD are positively associated with the PQ of bike-sharing use ($\beta = 0.133$ and $p < 0.05$). TC are positively associated with PQ ($\beta = 0.126$ and $p < 0.05$).

From the model results, PQ best explains satisfaction ($\beta = 0.793$ and $p < 0.001$) and indirectly affects loyalty through the mediating effect of satisfaction ($\beta_{PQ \longrightarrow US \longrightarrow UL} = 0.475$ and $p < 0.05$). According to the absolute value of the path coefficient, which affects PQ, the hierarchy of importance is as follows: economy > value identity > convenience > comfort > perceived safety. From these dimensions, we can improve service quality, satisfy users' psychological expectations, and enhance UL. We found significant direct ($\beta = 0.599$ and $p < 0.001$) and indirect effects (see Table 9) of US on UL. The final structural composition of the model is shown in Figure 2.

Next, we perform a path analysis of the bike-sharing choice behavior model, and the fit indices are shown in Table 9. As shown in Table 9, the fitness of each fit index of the model passes the test, indicating that the model is highly fitted. Table 7 shows data on the significance and direction of effects between the constructs. As shown in Table 8, after examining the model, all paths are supported. The corresponding T values are greater than 1.96, and the p values are less than 0.05. These results indicate no violation estimate in the model's verification, show that the estimation process is reasonable, and demonstrate that the overall model fit test can be performed.

5. Discussion

In this research, we constructed a model framework to describe the impact of SD, TC, PQ (user perception), and US (psychological expectation) on bike-sharing UL (user choice behavior) and used the SEM method to estimate the path and hypothesis relationships between the variables. The results confirm that SD, TC, PQ, and US play a vital role in loyalty. PQ involves not only the services provided by bike-sharing operators but also the effects of infrastructure conditions, riding environments, socioeconomic conditions, and even social cultures. Perceived safety, convenience, economy, comfort, and value identity have positive and significant impacts on PQ.

We summarized the user characteristics and TC of bike sharing. From our statistical results, users with more education tend to exhibit more acceptance of bike sharing, and most bike-share users were found to be in the low- or middle-income group. The overall use frequency of bike sharing was relatively low. For bike-share users, the suitable range for using shared bikes was 1–3 km, echoing the work of [60], where users were found to be more likely to use a public bike when the travel distance was within 1.5–3.5 km and where the majority of travellers would choose other PT options if the travel distance was more than 3.5 km. This result may be due to limitations of time and effort.

Economic factors are still considered the most important factor affecting PQ. On the one hand, the income structure of users shows that users with monthly incomes of less than RMB 6000 accounted for 74% of all users, and the proportion of travel by private car or taxi is low when no bike-sharing options are present [61]. While the yearly increase in residents' income may reduce the attractiveness of bikes, the costs of car ownership, including environmental protection costs, congestion costs, parking charges, and license plate control, are rising, which will offset the effect of rising resident incomes to a certain extent. What is striking is that we found through face-to-face interviews with users before the formal investigation that almost no users reported caring about the price of bike sharing. This may reflect a "social desirability bias effect." Some users may feel embarrassed about the importance of "economics" in face-to-face interviews because this is easily associated with failure in China.

Value identity is the second most important factor in shaping PQ and includes two aspects. The first is self-identity or whether users strongly recognize the value of bike sharing. Studies have shown that values need to be linked to the self to affect choices made [62]. The second aspect is social identity or whether society recognizes the positive impact of bike sharing, which is often used instead of other travel modes. Value identity is a very important aspect of PQ because of its widespread influence, such as regarding whether government managers are more willing to invest and allocate resources to bike sharing than other modes of transportation. For a long time, motorized transportation thinking, status brought by high-end cars, and negative judgment of bike travel value from government administrators and other travel mode users have suppressed the decision to bike as one's first choice. With growing environmental awareness and increasing traffic congestion and the positive effect of bicycling on health, the personal and social value identity of bike sharing is expected to gradually improve, which should positively affect its promotion. Chen [63] confirmed this conclusion by finding the perceived green value to have a positive effect on loyalty to a public bike system [63].

Although convenience was not found to be as important as expected in other literature [63], it still plays an important role in PQ and an especially significant role in access to subways and buses [7]. The development of intelligent transportation has made the use of bike sharing very convenient, but a lack of parking spaces has lessened its convenience. In addition, the hilly terrain of Changsha reduces the convenience of riding, but some bike-sharing devices are equipped with electric assist devices, which may result in inconsistent evaluation results. With the continuous expansion of urban areas, the likelihood of using bike sharing alone for all travel is relatively low. Thus, the most important aspect of bike sharing to develop is greater access to public transit, and bike sharing must be made more competitive relative to private motor vehicles. From this perspective, bike sharing should be included in urban public transit development systems, such as in the case of "public transit cities", and receive policy support accordingly.

Requirements for comfort are mainly reflected in the riding environment, which is more difficult to control than the comfort of a bike. Concerns about comfort are mainly focused on the uncertainty of the riding environment, which has a more negative impact on the rider's choices, even if only a few difficult locations exist along a riding path. That is, improving the predictability and completeness of riding comfort is more important than improving the quality of riding facilities. Therefore, if funds for large-scale transformation are lacking; the government's focus should not be on the overall improvement of a small number of model roads or small-scale areas. Rather, the government should attempt to achieve the complete transformation of a specific facility, even though its quality is relatively basic. Adopting simple and available measures to ensure certainty in management is appropriate.

Perceived safety affects PQ, and when users face uncertainties such as risk, they will abandon the bike-sharing option. We found that perceived safety is less important among the drivers of PQ likely because many other factors of PQ are associated with perceived safety, which subsequently reduces a user's perception of risk. Policy makers are vigorously promoting green transportation and carbon-free travel, which has led to the gradual improvement of non-motorized facilities. Providing complete safety facilities to reduce users' concerns over risk is also part of creating a good riding environment.

Our findings also indicate that when investigating the process of UL generation, PQ will have an impact on US, and all factors indirectly affect UL through US. Therefore, US needs to be considered from multiple perspectives. Improving satisfaction with bike sharing can play a multilevel role in cultivating UL. Although high satisfaction does not mean that a user will change travel modes or that usage frequency will improve, considering the diversity of travel purposes, its positive influence is still significant. For example, by improving satisfaction, word-of-mouth can be encouraged and nonusers can become users, enhancing recognition of bike sharing and providing a basis of public opinion for the government to formulate incentive policies; such an approach can also encourage people to use bike sharing on holidays or weekends. Therefore, for operators and the government, building a bike-sharing system based on US is the most effective means to increase UL to travel mode options.

5.1. Policy Recommendations. Some policy recommendations for improving US and UL and increasing acceptance of bike sharing include the following:

(1) The findings of this research can facilitate the design of better bike-sharing systems for operating companies, help the government formulate more reasonable incentive and management policies for bike-sharing, and provide guidance for the transformation of bike infrastructure.

(2) Bike sharing is suitable for short-distance travel. Communities that include residential and commercials, offices, and schools are more conducive to increasing the frequency of shared bike use, and the government should consider this when planning cities.

(3) The government's active publicity and policies encouraging the establishment of bike clubs and encouraging certain values rather than treating bike sharing as an inexpensive travel option are important for promoting shared bikes.

(4) By formulating policies on PT [64], congestion, and traffic and card restrictions, the utilization of shared bikes can be effectively improved.

(5) As China is a developing country, economic factors are still the most concerning for users. If the Chinese government wants to reduce the proportion of private car trips and increase the proportion use "low-carbon" transportation, bike sharing should be encouraged and not banned or restricted in certain cities, and the government should formulate policy tools to improve the economy, such as coupons for free cycling during rush hour and offering one yuan off for using shared bikes instead of PT.

(6) China's population is aging, so it is vital for policy makers to take steps to explore means to increase usage among the elderly. Safety-related factors may be the most important to the elderly, and the government must develop safer road facilities and bike design and traffic management systems.

(7) Electric-assisted bike sharing can extend travel distances and is very suitable for cities with complex terrain. The government should encourage this type of bike sharing, but battery safety concerns must be strictly reviewed, especially for the summer months, when batteries can easily burn and explode.

(8) Excessive bike sharing will infringe on pedestrian space along roads, which will generate complaints from some citizens; if the number of bike-sharing facilities is not sufficient, some users will be unable to access such services, which will reduce their loyalty. Determining a reasonable number of bike-sharing facilities and increasing bike parking lots can better enhance satisfaction with and loyalty to shared bikes.

5.2. Limitations and Future Research. Although the present study makes some discoveries, it has several limitations, and further research is needed to fill the following gaps. First, a survey was used to obtain interviewees' subjective perceptions of the investigated items. Subjective data have inherent drawbacks that are difficult to avoid in surveys [65]. Moreover, we used an interception survey. Although we applied a variety of methods to ensure the randomness of the survey, we only achieved quasi-random sampling. In this regard, more objective results such as big data gathered from bike-sharing systems may provide additional insights. Second, our data were gathered in a single time period. Cross-sectional data do not allow for a dynamic assessment of changes in the related behavior of users, which may affect the applicability of our results. Future research should investigate the choice behavior of bike-share users through a combination of cross-sectional and longitudinal research. Third, our survey did not involve nonusers of bike-sharing services and thus cannot be used to develop strategies to cultivate loyalty by encouraging first-time adoption. Future research must discuss ways to encourage nonusers to use such services for the first time and to cultivate the loyalty of bike-share users.

Furthermore, comparative research should be carried out under different conditions. For example, the use of bike sharing should be considered in relation to more topographic-, weather- and climate-related variables, such as by studying hilly and flat areas, activity on rainy and sunny days, and usage in the summer and winter. Differences between weekdays and weekends, large and small cities, and different countries and cultural backgrounds should also be considered. Many countries, including China, Japan, South Korea, and Russia, have aging populations. Making bike sharing suitable for the elderly will be a valuable research direction whether by improving the safety and comfort of bikes or updating infrastructure such as bike lanes, and such improvements should be based on research on the travel choice behavior of the elderly. It is very important to subdivide research fields. A successful bike-sharing system in one city cannot be simply copied in another city; a successful shared bike system may also ignore the needs of some citizens, or other imperfections may remain. Further research is required. The present research only considered the situation in China, and comparing the use of bike sharing in different countries would also be a fruitful research topic in the future.

6. Conclusion

User characteristics, TC, perceptions, and psychological expectations play an important role in bike sharing as a travel behavior. It is important to combine various factors to formulate demand-guidance strategies for bike sharing and bikes using this model, which has the potential to influence travel modes. The model proposed in this study combines PQ with user characteristics, TC, evaluation, and motivation and demonstrates the asymmetric responses of different users to multiple dimensions of related indices. Finally, the model successfully verifies complex relationships to other variables, which can be used to predict a user's travel intentions. Meanwhile, although research on satisfaction and loyalty theory has flourished in recent years, the theory is still developing. Whether there are thresholds for the influence of some factors, such that the corresponding countermeasures must only reach a certain level to show positive effects, is a problem that requires further study. Some new technologies can be used to analyze a user's travel process more accurately. For example, factors such as path complexity and cycling environments have been difficult to evaluate. Combining GIS street view image analysis based on deep learning and user experience surveys may solve this problem. In addition, we propose a new evaluation index and thresholds to measure relevant influencing factors. For example, in the evaluation of bike-sharing services for accessing PT, the transfer tolerance index can be used because such services must not be based on a simple superposition of distance and time, as it is also necessary to consider complex psychological factors. If a certain tolerance threshold is exceeded, users will abandon using bike sharing to access PT. Tolerance is difficult to measure directly, and thus, a percentage index can be constructed to measure how close a traveler's perception is to the corresponding tolerance limit.

Data Availability

The data used to support the findings of this study are available from the first author upon request (the information of first author: Xingjian Xue, 7413442@qq.com).

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

Acknowledgments

This work was supported by the MOE (Ministry of Education in China) Project of Humanities and Social Sciences, under Grant no. 19YJCZH208, the Hunan Social Sciences Federation Think Tank Project, under Grant no. ZK2019025, the Education Bureau Research Foundation Project of Hunan Province, under Grant no. 20A531, the Science and Technology Project of Changsha City, under Grant no. kq2004092, Key Subjects of the State Forestry Bureau in China, under Grant no. [2016]21, and the "Double First-Class" Cultivation Discipline of Hunan Province in China, under Grant no. [2018] 469.

References

[1] S. A. Shaheen, S. Guzman, and H. Zhang, "Bikesharing in europe, the americas, and asia, transportation research record," *Journal of the Transportation Research Board*, vol. 2143, no. 1, pp. 159–167, 2010.

[2] Y. Tang, H. Pan, and Q Shen, "Bike-sharing systems in Beijing, Shanghai, and Hangzhou and their impact on travel behavior," in *Proceedings of the Transportation Research Board 90th Annual Meeting*, vol. 11, no. 3862, p. 2010, Washington, DC, USA, January 2010.

[3] F. Xin, Y. Chen, X. Wang, and X. Chen, "Cyclist satisfaction evaluation model for free-floating bike-sharing system: a case study of shanghai," *Transportation Research Record*, vol. 2672, no. 31, pp. 21–32, 2018.

[4] H. Han, B. Meng, and W. Kim, "Bike-traveling as a growing phenomenon: role of attributes, value, sa tisfaction, desire, and gender in developing loyalty," *Tourism Management*, vol. 59, pp. 91–103, 2017.

[5] A. Biehl, A. Ermagun, and A. Stathopoulos, "Utilizing multi-stage behavior change theory to model the process of bike share adoption," *Transport Policy*, vol. 77, no. 2, pp. 30–45, 2019.

[6] F. Zhang, C. Kuai, H. Lv, and W. Li, "Investigating different types of red-light running behaviors among urban e-bike rider mixed groups," *Journal of Advanced Transportation*, vol. 2021, no. 8, Article ID 1977388, 9 pages, 2021.

[7] A. Fan, X. Chen, and T. Wan, "How have travelers changed mode choices for first/last mile trips after the introduction of bicycle-sharing systems: an empirical study in Beijing, China," *Journal of Advanced Transportation*, vol. 2019, no. 5, Article ID 1977388, 16 pages, 2019.

[8] S. Shelat, R. Huisman, and O. N. Van, "Analysing the trip and user characteristics of the combined bicycle and transit mode," *Research in Transportation Economics*, vol. 69, pp. 68–76, 2018.

[9] P. Zhao and S. Li, "Bicycle-metro integration in a growing city: the determinants of cycling as a transfer mode in metro station areas in Beijing," *Transportation Research Part A: Policy and Practice*, vol. 99, pp. 46–60, 2017.

[10] Y. Ji, Y. Fan, A. Ermagun, X. Cao, W. Wang, and K. Das, "Public bicycle as a feeder mode to rail transit in China: the role of gender, age, income, trip purpose, and bicycle theft experience," *International Journal of Sustainable Transportation*, vol. 11, no. 4, pp. 308–317, 2017.

[11] Y. H. Cheng and K. C. Liu, "Evaluating bicycle-transit users' perceptions of intermodal inconvenience," *Transportation Research Part A: Policy and Practice*, vol. 46, no. 10, pp. 1690–1706, 2012.

[12] M. Du and L. Cheng, "Better understanding the characteristics and influential factors of different travel patterns in free-floating bike sharing: evidence from Nanjing, China," *Sustainability*, vol. 10, no. 4, p. 1244, 2018.

[13] R. Wang and C. Liu, "Bicycle-transit integration in the United States, 2001-2009," *Journal of Public Transportation*, vol. 16, no. 3, 2013.

[14] T. Kuhnimhof, B. Chlond, and P. C. Huang, "Multimodal travel choices of bicyclists: multiday data analysis of bicycle

use in Germany," *Transportation Research Record*, vol. 2190, no. 1, pp. 19–27, 2010.

[15] Y. Zhang and Y. Zhang, "Associations between public transit usage and bikesharing behaviors in the United States," *Sustainability*, vol. 10, no. 6, p. 1868, 2018.

[16] W. Li, W. Feng, and H. Yuan, "Multimode traffic travel behavior characteristics analysis and congestion governance research," *Journal of Advanced Transportation*, vol. 2020, no. 11, Article ID 6678158, 8 pages, 2020.

[17] T. M. Rahul and A. Verma, "A study of acceptable trip distances using walking and cycling in Bangalore," *Journal of Transport Geography*, vol. 38, pp. 106–113, 2014.

[18] B. Liu, J. J. Cao, and Y. J. Zhou, "Study on the spatiotemporal characteristics of urban public bicycle use: a case study of Hangzhou," *Urban Planning Forum*, vol. 3, pp. 77–84, 2016.

[19] V. T. Arasan, V. R. Rengaraju, and K. V. Rao, "Characteristics of trips by foot and bicycle modes in Indian City," *Journal of Transportation Engineering-asce*, vol. 120, no. 2, pp. 283–294, 1994.

[20] R. L. Wang, "Analysis of user characteristics of bike sharing in Shanghai and its relationship with public transport development," *Public Utilities*, vol. 4, no. 6, pp. 46–52+80, 2017.

[21] L. Chen, A. J. Pel, X. Chen, D. Sparing, and I. A. Hansen, "Determinants of bicycle transfer demand at metro stations: analysis of stations in Nanjing, China," *Transportation Research Record*, vol. 2276, no. 1, pp. 131–137, 2012.

[22] S. F. de, L. L. P. Puello, M. Brussel, R. D. Orrico, and M. F. A. M. Maarseveen, "Modelling the potential for cycling in access trips to bus, train and metro in Rio de Janeiro," *Transportation Research Part D: Transport and Environment*, vol. 56, pp. 55–67, 2017.

[23] D. Wan, K. Camille, H. Wei, A. Sugiura, and E. B. Beaton, "Customer satisfaction with bus rapid transit: a study of New York City select bus service applying structural equation modelling," *Public Transportation*, vol. 8, pp. 497–520, 2016.

[24] R. Agarwal, "Public transportation and customer satisfaction the case of Indian railways," *Global Business Review*, vol. 9, no. 2, pp. 257–272, 2014.

[25] R. De Ona, J. S. Machado, and J. De Ona, "Perceived service quality, customer satisfaction, and behavioral intentions: a Structural Equation Model for the Metro of Seville, Spain," *Transportation Research Record Journal of the Transportation Research Board*, vol. 25, no. 38, pp. 76–85, 2015.

[26] C. Chen, "Investigating structural relationships between service quality, perceived value, satisfaction, and behavioral intentions for air passengers: evidence from Taiwan," *Transportation Research Part A: Policy and Practice*, vol. 42, no. 4, pp. 709–717, 2008.

[27] L. Li, F. Liu, and C. Li, "Customer satisfaction evaluation method for customized product development using Entropy weight and Analytic Hierarchy Process," *Computers & Industrial Engineering*, vol. 77, pp. 80–87, 2014.

[28] S. W. Perng, C. C. Chow, and W. C. Liao, "Analysis of shopping preference and satisfaction with airport retailing products," *Journal of Air Transport Management*, vol. 16, no. 5, pp. 279–283, 2010.

[29] D. Yin, "Research on fuzzy comprehensive evaluation of passenger satisfaction in urban public transport," *Modern Economy*, vol. 09, no. 3, pp. 528–535, 2018.

[30] A. Aktepe and S. Ersöz, "Customer satisfaction and loyalty analysis with classification algorithms and Structural Equation Modeling," *Computers & Industrial Engineering*, vol. 86, pp. 95–106, 2015.

[31] J. J. Cronin and S. A. Taylor, "Measuring service quality: a reexamination and extension," *Journal of Marketing*, vol. 56, pp. 55–68, 1992.

[32] W. Boulding, A. Kalra, R. Staelin, and V. A. Zeithaml, "A dynamic process model of service quality: from expectations to behavioral intentions," *Journal of Marketing Research*, vol. 30, no. 3, pp. 7–27, 1993.

[33] R. Alvarezvaldes, J. M. Belenguer, E. Benavent et al., "Optimizing the level of service quality of a bike-sharing system," *Omega-international Journal of Management Science*, vol. 62, no. 62, pp. 163–175, 2016.

[34] L. Caggiani, R. Camporeale, M. Marinelli, and M. Ottomanelli, "User Satisfaction Based Model for Resource Allocation in Bike-Sharing Systems," *Transport Policy*, vol. 80, pp. 117–126, 2019.

[35] M. M. Li and L. A. Cai, "The effects of personal values on travel motivation and behavioral intention," *Journal of Travel Research*, vol. 51, no. 4, pp. 473–487, 2012.

[36] S. Y. Chen, "Green helpfulness or fun? Influences of green perceived value on the green loyalty of users and non-users of public bikes," *Transport Policy*, vol. 47, no. 4, pp. 149–159, 2016.

[37] J. DeFrancisco, R. Harb, and E. Radwan, "Evaluation of a carpooling program in a university setting using a stated preference survey," in *Proceedings of the Ninety Third Annual Meeting of the Transportation Research Board, no. 14-0730*, Washington, DC, USA, January 2014.

[38] K. Deutsch, S. Y. Yoon, and K. Goulias, "Modeling travel behavior and sense of place using a structural equation model," *Journal of Transport Geography*, vol. 28, no. 3, pp. 155–163, 2013.

[39] D. Jahanshahi, Z. Tabibi, and W. B. Van, "Factors influencing the acceptance and use of a bicycle sharing system: applying an extended Unified Theory of Acceptance and Use of Technology (UTAUT)," *Case studies on transport policy*, vol. 8, no. 4, pp. 1212–1223, 2020.

[40] T. B. Joewono and H. Kubota, "User satisfaction with paratransit in competition with motorization in Indonesia: anticipation of future implications," *Transportation*, vol. 34, no. 3, pp. 337–354, 2007.

[41] I. Santouridis and P. Trivellas, "Investigating the impact of service quality and customer satisfaction on customer loyalty in mobile telephony in Greece," *The Tqm Journal*, vol. 22, no. 3, pp. 330–343, 2010.

[42] Y. Yi and S. La, "What influences the relationship between customer satisfaction and repurchase intention? Investigating the effects of adjusted expectations and customer loyalty," *Psychology and Marketing*, vol. 21, no. 5, pp. 351–373, 2004.

[43] N. U. Hadi, N. Abdullah, and I. Sentosa, "Making sense of mediating analysis: a marketing perspective," *Review of Integrative Business and Economics Research*, vol. 5, no. 2, pp. 62–76, 2016.

[44] A. Bhattacherjee, "Understanding information systems continuance: an expectation-confirmation model," *MIS Quarterly*, vol. 25, no. 3, pp. 351–370, 2001.

[45] E. Woo, "Experience value: antecedents and consequences," *Current Issues in Tourism*, vol. 17, no. 10, pp. 910–928, 2014.

[46] E. Molin and K. Maat, "Bicycle parking demand at railway stations: capturing price-walking trade offs," *Research in Transportation Economics*, vol. 53, pp. 3–12, 2015.

[47] P. N. Nguyen, P. P. Koh, and Y. D. Wong, "Impacts of bicycle infrastructure: a case study in Singapore," *Municipal Engineer*, vol. 168, no. 3, pp. 186–198, 2015.

[48] P. Gabriele, F. Federico, and D. A. Marco, "Gender differences in cycling patterns and attitudes towards cycling in a sample of European regular cyclists," *Journal of Transport Geography*, vol. 78, pp. 1–7, 2019.

[49] J. F. Hair, R. E. Anderson, R. L. Tatham, B. J. Babin, and W. C. Black, *Multivariate Data Analysis*, All Publications, Prentice Hall, Upper Saddle River, NJ, USA, 5th edition, 1998.

[50] L. Mo, Z. Wen, and C. Chen, *Research Methods in Psychological*, Guangdong Higher Education Press, Guangzhou, China, 2007.

[51] C. D. Chen, Y. W. Fan, and C. K. Farn, "Predicting electronic toll collection service adoption: an integration of the technology acceptance model and the theory of planned behavior," *Transportation Research Part C: Emerging Technologies*, vol. 15, no. 5, pp. 300–311, 2007.

[52] C. F. Chen and W. H. Chao, "Habitual or reasoned? Using the theory of planned behavior, technology acceptance model, and habit to examine switching intentions toward public transit," *Transportation Research Part F: Traffic Psychology and Behaviour*, vol. 14, no. 2, pp. 128–137, 2011.

[53] S. Y. Chen and C. C. Lu, "A model of green acceptance and intentions to use bike-sharing: YouBike users in Taiwan," *Networks and Spatial Economics*, vol. 16, no. 4, pp. 1103–1124, 2016.

[54] L. J. Cronbach, "Coefficient alpha and the internal structure of tests," *Psychometrika*, vol. 16, no. 3, pp. 297–334, 1951.

[55] T. F. Golob and M. G. McNally, "A model of activity participation and travel interactions between household heads," *Transportation Research Part B: Methodological*, vol. 31, no. 3, pp. 177–194, 1997.

[56] A. Boomsma, *The Robustness of Maximum Likelihood Estimation in Structural Equation Models*, Cambridge university press, Cambridge, UK, 1987.

[57] R. B. Kline, *Principles and Practice of Structural Equation Modeling*, Guilford publications, New York, NY, USA, 2015.

[58] B. G. Tabachnick, L. S. Fidell, and J. B. Ullman, *Using Multivariate Statistics*, Pearson, Boston, MA, USA, 2007.

[59] R. Shah and S. M. Goldstein, "Use of structural equation modeling in operations management research: looking back and forward," *Journal of Operations Management*, vol. 24, pp. 148–169, 2006.

[60] M. J. Keijer and P. Rietveld, "How do people get to the railway station? The Dutch experience," *Transportation Planning and Technology*, vol. 23, no. 3, pp. 215–235, 2000.

[61] L. Zhang, J. Zhang, Z. Duan, and D. Bryde, "Sustainable bike-sharing systems: characteristics and commonalities across cases in urban China," *Journal of Cleaner Production*, vol. 97, pp. 124–133, 2015.

[62] E. V. Der Werff, L. Steg, and K. Keizer, "The value of environmental self-identity: the relationship between biospheric values, environmental self-identity and environmental preferences, intentions and behaviour," *Journal of Environmental Psychology*, vol. 34, pp. 55–63, 2013.

[63] S. Chen, "Using the sustainable modified TAM and TPB to analyze the effects of perceived green value on loyalty to a public bike system," *Transportation Research Part A-policy and Practice*, vol. 88, no. 88, pp. 58–72, 2016.

[64] C. Zhu, Y. Chen, and C. Ma, "The Theory of Dynamic Public Transit Priority with Dynamic Stochastic Park and Ride," *Mathematical Problems in Engineering*, vol. 2014, Article ID 525460, 7 pages, 2014.

[65] E. Lee and H. K. Kang, "Narcissism and perspective taking: the mediating effect of need for control," *Social Behavior and Personality: International Journal*, vol. 48, no. 7, Article ID e9333, 2020.