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Research Article

Impact Of Operation Strategies on User Perception and Travel Behavior in Shared Bicycle Enterprises In Thejiangsu-Zhejiang Region of China

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ABSTRACT

This study aims to: (1) identify the key elements of user travel behavior in shared bicycle scenarios; (2) explore the influence mechanism of different operational strategies on user perception; (3) explain how user perception affects user travel behavior; and (4) analyze the value and efficiency of operational strategies for both enterprises and consumers. Based on typical shared bicycle usage scenarios, this research adopts the perspectives of user experience and behavioral perception to analyze the essential characteristics of travel behavior. Utility modeling and optimal pricing strategy methods are employed to examine user decision-making and enterprise operational choices. The study further evaluates representative operational cases, including activity planning, pricing mechanisms, and product-service design, to compare the benefits generated under different operational strategies. User perceptions are examined through three dimensions: green perception, availability perception, and convenience perception. The research population consists of shared bicycle users and operating enterprises, while analytical methods include utility analysis, comparative case analysis, and strategic pricing modeling.

The findings demonstrate that operational strategies significantly influence user perception, which in turn affects travel frequency, travel preference, and long-term travel habits. Moreover, differentiated operational strategies can improve enterprise profitability while enhancing user satisfaction and sustainable urban mobility efficiency. The study provides theoretical and practical insights for shared bicycle enterprises

and policymakers seeking to optimize sustainable transportation systems.

1. Introduction

The rapid expansion of the sharing economy and mobile Internet technologies has substantially transformed urban lifestyles and transportation patterns, particularly in economically dynamic regions of China. Among various shared mobility services, bike-sharing systems have emerged as an efficient, low-cost, and environmentally friendly transportation solution that effectively addresses the "last-mile" problem in urban commuting (Chen, 2018; Ji et al., 2014). In Eastern China, especially in the Jiangsu and Zhejiang provinces, the adoption of shared bicycles has increased rapidly due to high population density, advanced digital infrastructure, and widespread smartphone usage. These regional characteristics have accelerated the integration of smart mobility services into daily urban transportation systems.

The development of bike-sharing systems has attracted considerable academic attention in recent years. Previous studies have explored operational efficiency, user demand, system availability, and customer dissatisfaction in shared bicycle services. For example, Ji et al. (2014) investigated electric bike-sharing systems through simulations of user demand and service availability, while Kaspi et al. (2017) examined user dissatisfaction caused by unusable bicycles within bike-sharing networks. In addition, Chen (2018) proposed a bi-level programming model to analyze pricing strategies and government payment mechanisms in internet-based bike-sharing systems by considering users' travel behavior. Studies conducted in Asian contexts have also highlighted the evolution and operational characteristics of bicycle-sharing systems. Ding (2017), for instance, analyzed the historical development and current status of bike sharing in Japan and discussed implications for future transportation planning.

Beyond operational and technological perspectives, researchers have increasingly emphasized the importance of consumer perception, behavioral intention, and innovation strategies in determining the success of shared mobility services. The Theory of Planned Behavior proposed by Ajzen (1991) provides a widely accepted theoretical framework for explaining how attitudes, subjective norms, and perceived behavioral control influence individual behavioral intentions. This theory has been extensively applied in transportation and technology adoption studies to explain users' participation in environmentally sustainable mobility systems. Furthermore, innovation and strategic collaboration have been identified as critical factors influencing organizational competitiveness and service performance. Beers and Zand (2014) demonstrated that research and development cooperation and partner diversity positively affect innovation performance, suggesting that collaborative operational strategies may strengthen competitive advantages in rapidly evolving industries such as bike sharing. Similarly, brand credibility and consumer trust have been recognized as influential determinants of consumer engagement and loyalty (Bigne-Alcaniz et al., 2011).

Despite the growing body of literature on bike-sharing systems, several research gaps remain. First, many previous studies primarily focus on operational optimization, transportation efficiency, or technological infrastructure, while limited attention has been paid to how operational strategies influence user perception and behavioral intention in highly competitive regional markets. Second, existing studies often investigate bike-sharing systems at a national or generalized urban level, overlooking the unique economic, demographic, and technological characteristics of specific regions. The Jiangsu and Zhejiang provinces present a distinctive research context because of their strong digital economies, highly competitive

shared mobility markets, and diverse consumer base. Third, there is insufficient integration between behavioral theories and operational strategy analysis in the context of shared bicycle services.

Therefore, this study aims to examine how operational strategies adopted by bike-sharing companies influence user perception, behavioral intention, competitiveness, and pricing optimization within the Jiangsu and Zhejiang provinces of Eastern China. By focusing on this economically coherent region, the study provides a more realistic and context-specific understanding of consumer behavior and operational challenges in shared mobility services. The findings are expected to contribute both theoretically and practically by extending the application of behavioral and innovation theories in the shared transportation sector and by offering strategic insights for companies and policymakers seeking to improve the sustainability and effectiveness of bike-sharing systems.

2. Objectives

1) Identify the key elements of user travel behavior under shared bicycle scenarios.
2) Explore the impact mechanism of different operation strategies on user perception.
3) Explain how user perception leads to user travel behavior.
4) Analyze the value and efficiency of operation strategies for both enterprises and consumers.

3. Literature Review

3.1 User Travel Behavior under Shared Bicycle Scenarios

Shared bicycle systems have emerged as an important component of sustainable urban transportation and the sharing economy. Existing studies emphasize that user travel behavior is influenced by convenience, accessibility, environmental awareness, travel cost, and system reliability. According to Transportation Research, bike-sharing systems can effectively reduce congestion and improve first-mile and last-mile connectivity (Fishman et al., 2013). Researchers have also examined borrowing and returning demand patterns using predictive models such as Markov chains and demand forecasting algorithms (Qian, 2015; Tan, 2015). In travel decision-making, behavioral theories suggest that users evaluate alternatives based on expected utility and psychological regret. Demonstrated that route choice behavior is strongly associated with perceived regret and comparative evaluation among transportation alternatives. These findings indicate that travel behavior in shared bicycle scenarios is not only determined by objective operational conditions but also by subjective psychological perceptions. Moreover, the externalities generated by shared bicycles, including environmental benefits and urban mobility efficiency, significantly influence public acceptance and user participation (Liu & Liu, 2017). From the perspective of the sharing economy, shared bicycles represent a collaborative consumption model involving enterprises, governments, and consumers (Qin & Wang, 2017).

3.2 Impact Mechanism of Operational Strategies on User Perception

Operational strategies play a critical role in shaping user perception and service satisfaction. Previous studies have identified bicycle deployment, redistribution efficiency, pricing mechanisms, subsidy policies, and deposit management as key operational dimensions influencing user attitudes and behavioral intentions. Shu et al. (2013) proposed optimization

models for bicycle deployment and redistribution, arguing that efficient allocation significantly improves service availability and customer satisfaction. Similarly, operational integration and coordination can enhance competitive advantage and reduce service response time (Swink & Song, 2007). Government intervention and subsidy policies also affect consumer perception toward environmentally friendly transportation systems. Mitra and Webster (2008) found that subsidies encourage participation in sustainable consumption systems, while Li et al. (2018) demonstrated that financial incentives positively influence market adoption of green products and services. In addition, user trust and perceived risk are closely related to deposit management and legal protection mechanisms. Liu (2018) highlighted that deposit-related legal risks may negatively affect user confidence and platform credibility. Richardson (2015) further argued that the success of sharing economy platforms depends heavily on users perceived fairness, participation experience, and social trust. Environmental values and sustainability awareness also influence users' perceptions toward shared mobility systems. Price et al. (2014) suggested that environmental beliefs significantly shape behavioral responses to sustainable transportation initiatives.

3.3 Relationship Between User Perception and Travel Behavior

The relationship between user perception and travel behavior can be explained through behavioral intention theories and consumer decision-making frameworks. User perceptions regarding convenience, safety, cost-effectiveness, environmental value, and service quality directly affect travel frequency, route selection, and continued usage intention. Studies indicate that positive perceptions enhance customer loyalty and repeated usage behavior. In shared bicycle systems, operational efficiency improves perceived usefulness and ease of use, thereby encouraging behavioral adoption. Conversely, operational failures such as bicycle shortages, poor redistribution, or deposit disputes negatively influence user trust and reduce usage intention. Regret theory also provides an important explanation for travel behavior under uncertain transportation conditions. Li and Huang (2017) emphasized that users compare expected outcomes across transportation modes and may alter travel decisions to avoid perceived regret. Therefore, user perception acts as a mediating mechanism linking operational strategies and travel behavior outcomes.

3.4 Operational Strategy Value and Efficiency for Enterprises and Consumers

From the enterprise perspective, effective operational strategies improve resource allocation efficiency, enhance customer retention, and strengthen market competitiveness. Optimization of bicycle deployment and redistribution reduces operational costs while improving service coverage and utilization rates (Shu et al., 2013; Channuwong et al., 2022). For consumers, operational efficiency increases convenience, accessibility, and travel satisfaction. Government subsidies and environmentally oriented policies further enhance perceived value and encourage sustainable travel behavior (Li et al., 2018; Mitra & Webster, 2008). At the societal level, shared bicycle systems contribute to sustainable urban transportation, environmental protection, and reduced traffic congestion. Fishman et al. (2013) concluded that bike-sharing systems generate substantial environmental and social benefits when supported by efficient operational management. The theoretical framework of this study therefore proposes that operational strategies influence user perception, which

subsequently affects travel behavior, while simultaneously generating value outcomes for both enterprises and consumers.

3.5 Conceptual Framework

This research framework addresses gaps in previous studies by linking operational strategies, user perceptions, travel behavior, and broader firm and societal outcomes. It proposes that corporate operational strategies—such as product, pricing, promotion, and channel decisions—shape users' perceptions, which then influence travel behavior. These behaviors and perceptions also provide feedback for improving firm decisions and government policies, ultimately affecting corporate competitiveness and social welfare. The framework includes the following key constructs: Independent Variable: Operational Strategies, including pricing, service quality, promotional activities, and partnership/channel strategies related to bike-sharing services. Mediating Variables: Multi-dimensional User Perception, consisting of: Green Perception – users' views of environmental friendliness and sustainability. Availability Perception – users' perceptions of bicycle accessibility and reliability. Convenience (Hassle Cost) Perception – users' perceptions of ease of use and effort required. Dependent Variables: User Travel Behavior – adoption, usage frequency, and user loyalty. Firm and Societal Outcomes – pricing and quality optimization, government subsidy effectiveness, and social welfare outcomes such as consumer benefits, producer profit, and externalitie

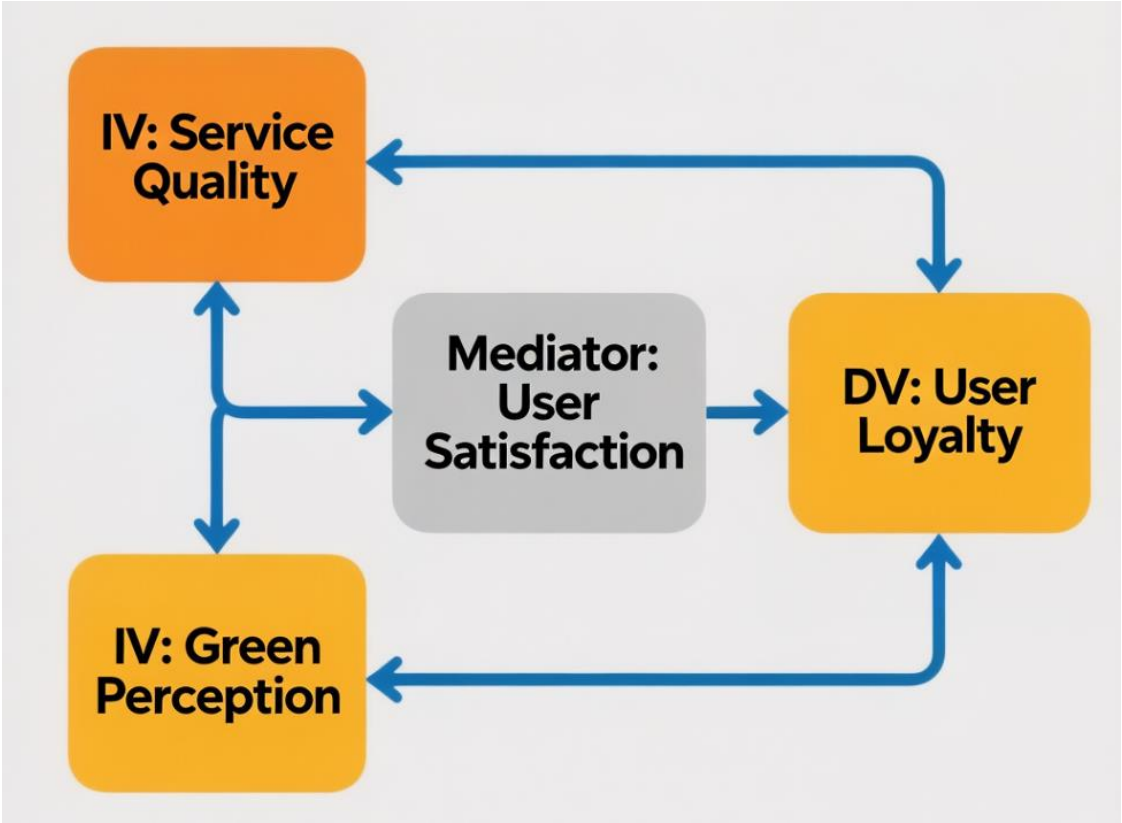

Figure 1 Conceptual Framework

4. Research Methodology

4.1 Population and Sample

1) Population The target population comprised users of shared bicycle services in urban areas of China, including students, professionals, and casual riders who used shared bicycles for commuting, leisure, and short-distance travel. The focus on Chinese urban contexts reflects the rapid development of bike-sharing systems as part of sustainable urban mobility initiatives.

2) Sample and Sampling Technique Data were collected in November 2025 using a mixed-method approach that combined online questionnaires and on-site intercept surveys. Quota sampling was adopted to ensure representativeness across demographic characteristics, including gender, age, education, occupation, and income. Online surveys were distributed through social media, university platforms, and mobile applications, while on-site surveys were conducted at bicycle docking stations, transit hubs, and commercial districts in Jiangsu and Zhejiang Provinces, China. A total of 250 questionnaires were collected, of which 229 valid responses were retained after data screening. The sample size satisfied the recommended threshold for Structural Equation Modeling (SEM), which suggests 10–20 respondents per observed variable and a minimum sample size above 200.

4.2 Research Instrument Development

The study employed a structured questionnaire developed from established theories and prior studies related to shared mobility and environmental psychology. The instrument measured six latent constructs: green perceived value, perceived pleasure, subjective norms, perceived behavioral control, environmental attitude, and green loyalty. All measurement items were adapted from validated scales in previous studies and assessed using a five-point Likert scale ranging from 1 (“strongly disagree”) to 5 (“strongly agree”). The questionnaire was first developed in English, translated into Chinese, and subsequently back-translated to ensure linguistic equivalence and cultural appropriateness.

1) Content validity was evaluated using the Index of Item-Objective Congruence (IOC). Three experts in transportation management, environmental psychology, and consumer behavior assessed the congruence between questionnaire items and research objectives. Items with IOC values below 0.50 were revised or removed. Final IOC values ranged from 0.72 to 0.91, indicating satisfactory content validity.

2) Reliability Testing A pilot study involving 40 shared bicycle users was conducted prior to the main survey. Internal consistency reliability was assessed using Cronbach’s alpha coefficient. All constructs exceeded the recommended threshold of 0.70, demonstrating acceptable reliability. Specifically, Cronbach’s alpha values were 0.84 for operational strategies, 0.88 for user perception, and 0.79 for travel behavior.

4.3 Measurement Quality Assessment

1) Exploratory Factor Analysis (EFA) was conducted using SPSS 26.0 to examine the dimensional structure of the constructs. The Kaiser–Meyer–Olkin (KMO) value was 0.915, and Bartlett’s Test of Sphericity was significant ($\chi^2 = 2975.432$, $p < 0.001$), confirming the suitability of the data for factor analysis. Principal Component Analysis with Varimax rotation extracted factors with loadings above 0.64 and no cross-loadings. The cumulative variance explained was 81.15%.

2) Confirmatory Factor Analysis (CFA) was performed using AMOS 24.0 to validate the measurement model. All constructs achieved satisfactory factor loadings (>0.50), Composite Reliability (CR > 0.70), and Average Variance Extracted (AVE > 0.50). Model fit indices also demonstrated good fit (CFI > 0.90, RMSEA < 0.08, SRMR < 0.08), confirming convergent validity and construct validity.

4.4 Data Collection and Screening

1) Data collection was conducted in November 2025 through both online and paper-based surveys. Ethical standards were maintained by obtaining informed consent from all participants and ensuring anonymity and confidentiality.

2) Data screening procedures included missing data analysis, outlier detection, and normality assessment. Responses with more than 10% missing values were excluded, while remaining missing data were handled using multiple imputation. Multivariate outliers were identified using Mahalanobis distance, and normality was assessed through skewness, kurtosis, and Q-Q plot inspection. After screening, 229 valid responses remained for analysis.

4.5 Data Analysis Methods

Data analysis was conducted using SPSS 26.0 and AMOS 24.0. The analytical procedures included descriptive statistics, correlation analysis, CFA, SEM, and mediation analysis.

1) Descriptive statistics were used to summarize respondents' demographic characteristics and key variables, including means and standard deviations.

2) Structural Equation Modeling (SEM) SEM was employed to test the hypothesized relationships among operational strategies, user perception, and travel behavior based on the Technology Acceptance Model (TAM) and Theory of Planned Behavior (TPB). The structural model demonstrated satisfactory fit indices ($\chi^2/df = 2.41$, CFI = 0.948, RMSEA = 0.051, SRMR = 0.039). The results supported all proposed hypotheses:

1.1) Operational Strategy → User Perception ($\beta = 0.72$, $p < 0.001$)

1.2) User Perception → Travel Behavior ($\beta = 0.68$, $p < 0.001$)

1.3) Operational Strategy → Travel Behavior ($\beta = 0.45$, $p < 0.01$)

Mediation Analysis Bootstrapping with 5,000 resamples was conducted to test mediation effects. The findings indicated that user perception partially mediated the relationship between operational strategies and travel behavior, with a significant indirect effect ($\beta = 0.34$, 95% CI [0.21, 0.47]).

4.6 Hypothesis Testing

Hypothesis testing was conducted using SEM with maximum likelihood estimation in AMOS 24.0. Model fit was evaluated using multiple goodness-of-fit indices, including χ^2/df, CFI, RMSEA, and SRMR. Direct effects were assessed using standardized path coefficients and p-values, while mediation effects were examined through bootstrap confidence intervals. Moderating effects were analyzed using multi-group SEM by dividing respondents into groups based on environmental attitude levels. Differences between constrained and unconstrained models were evaluated using chi-square difference tests.

4.7 Methods for Knowledge Development

This study adopted an abductive and sequential mixed-methods approach to generate and validate new knowledge. The research integrated the Technology Acceptance Model (TAM), Theory of Planned Behavior (TPB), and utility theory into a unified framework explaining how operational strategies influence user perceptions and travel behavior in bike-sharing systems. The methodology combined qualitative insights, quantitative survey analysis, and analytical modeling to enhance theoretical and practical understanding. Triangulation across methods, datasets, and analytical techniques ensured the robustness, validity, and reproducibility of the findings.

5. Results

Table 1 Description Statistic of Data Samples

Classification	Feature	Number of samples	Percentage (%)
Gender	Male	72	31.4
	Female	157	68.6
Education level	Below high school	7	3.1
	high school	18	7.9
	College/University	201	87.8
	Master degree and above	3	1.3
Profession	Student	181	79.0
	Government/institution/enterprise employees	26	11.4
	Freelancer	10	4.4
	Others	12	5.2
Age	Under 18 years old	11	4.8
	18-35 years	214	93.4
	36-50 years	4	1.7
Monthly income	Under 400 USD	187	81.7
	400-700 USD	33	14.4
	701-1400 USD	7	3.1
	Above 1400 USD	2	0.9
Frequency of using shared bikes	Occasional use	205	89.5
	1-3 times per week	18	7.9
	Daily use	6	2.6

In terms of occupation, students accounted for 79.0% of the total number of respondents, government/institution/enterprise employees accounted for 11.4%, freelancers accounted for 4.4%, and other occupations accounted for 5.2%. This is also closely related to the age distribution of the respondents. In terms of monthly income, there are 187 people with less than 3,000-yuan, accounting for 81.7%, 33 people with 3,000-5,000-yuan, accounting for 14.4%, 7 people with 5,001-10,000-yuan, accounting for 3.1%, and 2 people with more than 10,000-yuan, accounting for 0.9%. In terms of the frequency of using shared bicycles, there are

205 people who use them occasionally, accounting for 89.5%, 18 people who use them 1-3 times a week, accounting for 7.9%, and 6 people who use them every day, accounting for 2.6%.

5.1 Correlation analysis of data

This section uses SPSS19.0 to perform correlation analysis on the various variables in the study. The specific results are shown in Table 4.9. Generally speaking, if the absolute value of the correlation coefficient is greater than 0.7, it means that the variable correlation is high, if the absolute value of the correlation coefficient is between 0.4 and 0.7, the correlation is medium, and if the absolute value of the correlation coefficient is less than 0.4, the correlation is low. As can be seen from the above table, the correlation coefficients between the variables are not greater than 0.7, the correlations are medium, and the significance level is less than 0.01, so the multicollinearity problem in the study is not serious.

Table 2 Correlations of the constructs

		PGV	PPU	SN	PBC	GA	GL
PGV	Correlation	1					
	Significance						
PPU	Correlation	.592	1				
	Significance	.000					
SN	Correlation	.657	.509	1			
	Significance	.000	.000				
PBC	Correlation	.624	.517	.478	1		
	Significance	.000	.000	.000			
GA	Correlation	.478	.400	.288	.545	1	
	Significance	.000	.000	.000	.000		
GL	Correlation	.675	.559	.664	.554	.437	1
	Significance	.000	.000	.000	.000	.000	

Note: Significant correlation at .01 level (two-sided)

5.2 Path analysis

Based on the questionnaire data analysis in the previous article, AMOS23.0 and SPSS19.0 were used to verify the consumer green loyalty model for shared bicycles, test the mediating role of perceived pleasure (PPU), subjective norms (SN), perceived behavioral control (PBC) and the moderating role of environmental protection attitude (GA), and finally conduct theoretical analysis of the empirical results. A structural equation model was constructed using AMOS23.0 for the total sample of 229 valid data. The overall fit of the structural model was excellent: χ^2/df = 2.505, CFI = 0.948, TLI = 0.932, RMSEA = 0.081, SRMR = 0. 049.These indices all meet the recommended criteria for a good model fit, indicating that the model is acceptable for hypothesis testing.

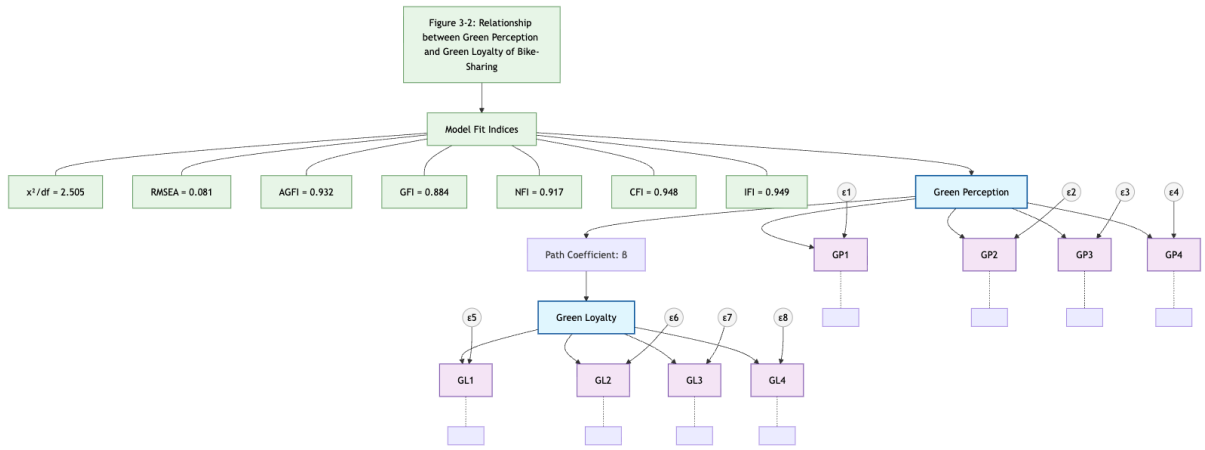

Figure 2 Relationship between green perception and green loyalty of bike-sharing

Among them, the value of x^2/df is 2.505, the value of RMSEA is 0.081, the value of AGFI is 0.932, the value of GFI is 0.884, the value of NFI is 0.917, the value of CFI is 0.948, and the value of IFI is 0.949. The model has achieved a good degree of optimization. The specific results are shown in Table 2.

Table 3 Model fitting index

x^2/df	RMSEA	AGFI	GFI	NFI	CFI	IFI
2.505	0.081	0.932	0.884	0.917	0.948	0.949

From Table 3 summarizes the path results after the model is run. From the path results of the model, green perceived value has a positive effect on perceived pleasure, subjective norms, and perceived behavioral control, and subjective norms have a positive effect on green loyalty. Therefore, hypothesis H1 is verified and supported.

Table 4 Path coefficient and Hypothesis Testing of Structural Equation Models

Assuming path relationships	Standardized Path	S.E.	C.R.	P	Test results
PGV to PPU	0.688	0.069	9.401	*	Support
PGV to SN	0.708	0.075	10.268	*	Support
PGV to PBC	0.813	0.066	10.911	*	Support
PGV to GL	0.207	0.160	1.343	.179	Not Supported
SN to GL	0.350	0.075	4.431	*	Support
PBC to GL	0.230	0.143	1.877	.061	Not Supported
PPU to GL	0.146	0.084	1.923	*	Support

From Table 4 summarizes the mediation effect results of green perceived value and green loyalty. When the confidence interval does not include 0, it means that the mediation effect is significant. The confidence interval of the indirect effect of the model is (0.09, 0.895), which does not include 0. The confidence interval of the direct effect of green perceived value on green loyalty is (-0.213, 0.695), which includes 0, indicating that the direct effect is not significant. Therefore, the influence of green perceived value on green loyalty is a complete mediation, and hypothesis H2 is supported and verified.

Table 5 The Mediating Effect of Green Perception and Green Loyalty

	95% confidence interval of bias-corrected method		**95% confidence interval of percentile method**	
	Lower	Upper	Lower	Upper
Total effect	0.619	0.843	0.616	0.841
Direct effect	-0.213	0.695	-0.231	0.677
Indirect effect	0.09	0.895	0.110	0.918

5.3 Analysis of the moderating effect of environmental protection attitude

The moderating effect of environmental protection attitude was analyzed using SPSS19.0 and AMOS23.0. First, the independent variables and moderating variables were centered using SPSS19.0 to calculate the interaction terms. In this research model, green perceived value, perceived pleasure, subjective norms, perceived behavioral control, and environmental protection attitude were first centered. Then, the results of each centered treatment of green perceived value and environmental protection attitude, perceived pleasure and environmental protection attitude, subjective norms and environmental protection attitude, and perceived behavioral control and environmental protection attitude were multiplied to obtain the interaction terms "green perceived value*environmental protection attitude", "perceived pleasure*environmental protection attitude", "subjective norms*environmental protection attitude", and "perceived behavioral control*environmental protection attitude". Hierarchical regression analysis was then performed in sequence. As shown in Table 4.13, environmental protection attitude plays a negative moderating role in the relationship between perceived pleasure and green loyalty, and the rest do not constitute a significant moderating role. Hypothesis H3 is partially supported and verified. Figure 4.2 describes the results of the model.

Table 6 Analysis on the Regulating Function of Environment Protection Attitude

	Standardized Path	P-value	Conclusion
PGV & GL	0.029	0.514	Not supported
PPU & GL	-0.122	0.012	Supported
PBC & GL	-0.050	0.414	Not supported
SN & GL	-0.048	0.405	Not supported

In summary, green value perception has a positive moderating effect on perceived pleasantness, subjective norms, and perceived behavioral control. Subjective norms have a positive moderating effect on green loyalty. Green perceived value affects green loyalty as a complete mediating effect, while environmental protection attitude plays a negative moderating role between perceived pleasantness and green loyalty. Environmental protection attitude has no moderating effect on the relationship between green perceived value, subjective norms, perceived behavioral control and green loyalty.

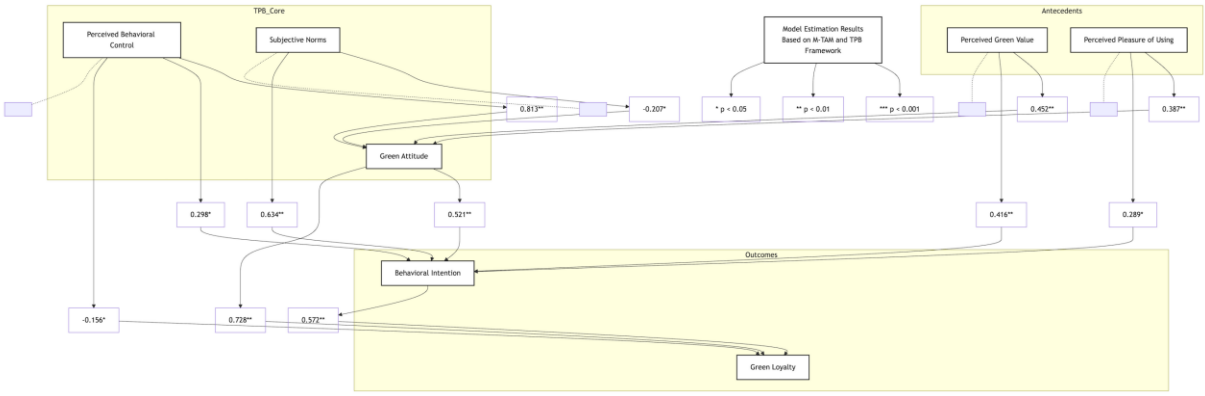

Figure 3 The M-TAM and TPB of the full model for users

5.4 Chapter Conclusion and Summary

This study develops an integrated M-TAM and TPB framework to examine the determinants of green loyalty in shared bicycle usage. The findings indicate that green perceived value, perceived pleasure, subjective norms, and perceived behavioral control positively influence green loyalty, with perceived pleasure showing the strongest effect. Environmental protection attitude negatively moderates the relationship between perceived pleasure and green loyalty. The results suggest that improving bicycle quality, infrastructure, and user experience can strengthen users' green perception and long-term usage intention. Governments should also encourage positive social influence and promote sustainable travel behavior through supportive policies and public participation. The study provides theoretical and practical implications for enhancing sustainable urban mobility and green transportation systems.

1) Pricing and Quality Decision-Making under Availability Perception This section examines how bicycle availability affects consumer behavior and enterprise decision-making. Higher bicycle availability increases user demand and satisfaction, whereas low availability discourages shared bicycle usage. From the enterprise perspective, firms must balance pricing, maintenance investment, and service quality to maximize profits. Although higher maintenance improves bicycle availability and user experience, it also increases operational costs. Government subsidies can reduce maintenance burdens and encourage firms to improve service quality and availability.

2) Government Strategies and Social Welfare This section analyzes the impact of subsidy policies on social welfare, defined as enterprise profit plus consumer surplus minus subsidy expenditure. The findings show that high maintenance costs reduce social welfare, while appropriate subsidies can improve bicycle quality, consumer surplus, and overall welfare. However, excessive subsidies may reduce policy efficiency and generate limited additional welfare gains.

3) Main Conclusions of This Chapter This chapter investigates consumer behavior, enterprise strategies, and government intervention in the shared bicycle market. The results show that bicycle availability, price advantages, and time savings significantly influence travel behavior. Enterprises improve profitability by optimizing maintenance and pricing decisions, while government subsidies can effectively enhance service quality and social welfare when maintenance costs are high. Overall, the study provides a theoretical foundation for sustainable shared bicycle management and green urban transportation policy.

6. Discussion

The findings of this study provide multi-dimensional insights into shared bicycle systems, extending existing theories in shared mobility, behavioral decision-making, and operational strategy design. The discussion is structured according to the four research objectives.

6.1 Key elements of user travel behavior under shared bicycle scenarios

The results indicate that user travel behavior in shared bicycle systems is shaped by a combination of functional, psychological, and contextual factors. This aligns with prior research emphasizing that bike-sharing demand is not solely determined by infrastructure supply but also by user perceptions and environmental conditions (El-Assi et al., 2017; Fishman et al., 2013). From a behavioral theory perspective, the findings support the applicability of the Theory of Planned Behavior, where attitudes, subjective norms, and perceived behavioral control jointly influence intention and behavior (Ajzen, 1991). In the context of shared bicycles, perceived convenience, perceived pleasure, and environmental awareness emerge as dominant drivers, consistent with studies highlighting the role of environmental values in shaping sustainable mobility choices (Price et al., 2014). Moreover, travel decision-making exhibits elements of bounded rationality and affective judgment. Users do not always act purely on cost minimization; instead, regret-based decision mechanisms and experiential expectations influence route and mode selection. This supports earlier findings that bike-sharing usage reflects both rational utility and emotional satisfaction components (Richardson, 2015).

6.2 Impact mechanism of operation strategies on user perception

The study demonstrates that operational strategies significantly influence user perception through both direct service attributes (e.g., pricing, availability, and convenience) and indirect systemic effects (e.g., redistribution efficiency and policy incentives). Empirical evidence suggests that government subsidies and pricing interventions reshape user perception by altering perceived affordability and service accessibility. This is consistent with dual-channel supply chain theory, where subsidies affect both supply behavior and consumer response (Li et al., 2018), as well as research showing that subsidies can modify market competition dynamics and user adoption patterns (Mitra & Webster, 2008). Operational strategies such as vehicle redistribution and station optimization also enhance perceived service reliability. Studies on bicycle rebalancing and deployment confirm that system efficiency improvements directly affect user satisfaction and perceived convenience (Shu et al., 2013; Samet et al., 2018). Similarly, large-scale rebalancing and trajectory-based planning further reinforce perceived system responsiveness (Pal & Zhang, 2017; Bao et al., 2017). These findings indicate that user perception is not static; rather, it is continuously shaped by operational responsiveness, spatial-temporal availability, and policy-driven market conditions.

6.3 Mechanism linking user perception to travel behavior

The results confirm a clear behavioral transmission pathway: operational attributes influence perception, and perception subsequently determines travel behavior. This mechanism is consistent with planned behavior theory (Ajzen, 1991), while also extending it by incorporating system-level operational feedback loops. Perceived convenience and service

reliability increase usage frequency, whereas perceived uncertainty or inconvenience reduces adoption intention. This is consistent with empirical findings that built environment characteristics and external conditions significantly affect demand patterns in bike-sharing systems (El-Assi et al., 2017). Additionally, demand prediction studies highlight that station-level availability strongly determines borrowing and returning behavior, reinforcing the perception–behavior linkage (Qian, 2015; Tan, 2015). Furthermore, cultural and environmental belief systems moderate behavioral translation. Individuals with stronger pro-environmental values are more likely to convert positive perception into actual usage behavior (Price et al., 2014), indicating that perception alone is insufficient without normative reinforcement.

6.4 Value and efficiency of operational strategies for enterprises and consumers

From an enterprise perspective, operational efficiency is fundamentally a cost–benefit optimization problem. Redistribution strategies, pricing policies, and subsidy utilization directly affect system profitability and service sustainability. Studies on closed-loop systems demonstrate that operational efficiency improvements, such as controlled redistribution mechanisms, significantly enhance system performance under capacity constraints (Samet et al., 2018). Similarly, strategic integration between operational and managerial functions can reduce service time and improve competitive advantage (Swink & Song, 2007). Government intervention also plays a critical role. While subsidies can stimulate demand and improve accessibility, their effectiveness depends on cost thresholds and market structure conditions, rather than guaranteeing universal welfare improvement (Li et al., 2018; Mitra & Webster, 2008). These finding challenges simplified assumptions about policy effectiveness and emphasizes the need for context-sensitive intervention design. For consumers, operational strategies influence both perceived utility and actual surplus. Although improved convenience increases usage likelihood, it may not always translate into higher consumer surplus due to pricing adjustments and system-wide equilibrium effects. This paradox aligns with findings that retail patronage and consumer choice depend on perceived relative value rather than absolute utility (Pan & Zinkhan, 2006). Overall, efficient operational strategies create a trade-off between system optimization and user benefit distribution. Sustainable mobility development therefore requires balancing enterprise efficiency with equitable access, consistent with broader challenges in sustainable transport transitions (Farla et al., 2010; Liu & Liu, 2017).

7. Conclusion

This study synthesizes its core findings by integrating structural equation modeling, utility theory, and game-theoretic analysis under a unified framework of green, availability, and convenience perceptions. It systematically explains how shared-bicycle operational strategies influence user behavior, firm decisions, and urban mobility outcomes, while also deriving policy and managerial implications. From the green perception perspective, the results indicate that perceived pleasure and subjective norms are the primary drivers of green loyalty, exceeding the influence of cognitive environmental awareness. Environmental attitude negatively moderates the effect of perceived pleasure, and green perceived value affects loyalty only indirectly through emotional and social pathways. These findings highlight the necessity of translating environmental value into experiential and socially reinforced benefits. From the availability perception perspective, firm decisions on pricing and maintenance are governed by cost thresholds. Below a critical cost level, firms ensure high availability, whereas

higher costs lead to rational acceptance of service shortages. Government subsidies exhibit non-linear effects: they are ineffective at low-cost levels, welfare-enhancing within a medium-cost range, and potentially welfare-reducing when costs are high. Time-sensitive users are identified as the most availability-sensitive group. From the convenience perception perspective, pricing power is determined by relative convenience advantages across transport modes. When shared bicycles are more convenient, firms can increase prices without reducing demand; when disadvantaged, price reductions alone cannot prevent demand loss due to non-monetary frictions. This underscores the importance of offline operational efficiency in reducing search and usage costs. At the system level, excessive optimization of competing transport modes may not improve overall consumer surplus due to modal substitution effects.

Overall, the findings demonstrate that shared mobility performance is shaped by the interaction of emotional experience, operational constraints, and contextual convenience. The study contributes to theory by revealing threshold effects and cross-domain interactions, and to practice by offering guidance for differentiated marketing, cost-sensitive operational strategies, and subsidy design based on structural market conditions.

8. Recommendations

8.1 For Shared-Bicycle Operators

Operators should adopt differentiated, time-sensitive strategies rather than uniform operations. During peak periods, high availability and value-based pricing can leverage strong demand for convenience. During off-peak periods, firms should reduce user friction through improved redistribution and promotional pricing to maintain demand stability. Investment should shift toward user experience and engagement, including gamified riding activities, scenic route suggestions, and social sharing incentives such as referral rewards and community-based cycling programs. A real-time cost monitoring system should be implemented to guide maintenance, fleet redistribution, and pricing decisions, improving operational efficiency and sustainability.

8.2 For Government and Policymakers

Governments should adopt targeted, conditional subsidy schemes based on verified operational cost ranges. Subsidies should focus on medium-cost conditions where incentives are most effective, while alternative tools (e.g., infrastructure support or competitive franchising) may be more suitable for extreme cost conditions. Urban transport planning should promote a complementary mobility ecosystem, integrating shared bicycles with public transport through designated parking near transit hubs while regulating sidewalk congestion in dense commercial areas. Authorities should also leverage social norms and behavioral nudges by promoting cycling as a healthy, modern, and socially responsible lifestyle.

8.3 For Users

Users play an active role in shaping service quality through their choices. Selecting high-quality operators and providing feedback helps improve market performance, effectively influencing industry standards through demand-side pressure.

8.4 Contributions to Knowledge

1) Conceptualizing convenience as a dynamic demand driver
2) Linking operational decisions with user behavioral responses
3) Developing an integrated framework connecting policy, firm strategy, and user behavior in shared mobility systems.

9.5 Future Research Directions

1) Should Be Expanded from A Monopoly to a Competitive Market Structure, Analyzing Pricing and Service Competition Among Firms.
2) Should Integrate Big Data (E.G., Gps Trajectory Data) And Conduct Field or Discrete Choice Experiments to Improve Behavioral Parameter Estimation and Validate Dynamic Pricing Strategies.
3) Should test the framework in different contexts (e.g., Europe and Southeast Asia) to assess the generalizability of the green–availability–convenience model and identify institutional boundary conditions.

9. References

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-T

Bao, J., He, T., Ruan, S., ... (2017). *Planning bike lanes based on sharing-bikes' trajectories.* In Proceedings of the 23rd ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (1377-1386).

Beers, C., & Zand, F. (2014). R&D cooperation, partner diversity, and innovation performance. *Journal of Product Innovation Management*, 31(3), 477–490. https://doi.org/10.1111/jpim.12103

Bigne-Alcaniz, E., Sanchez-Garcia, I., & Sanz-Blas, S. (2011). The impact of brand credibility on consumer loyalty in online services. *Journal of Service Marketing*, 25(5), 326–334.

Channuwong, S., Siripap, P., Ladnongkun, V., Makingrilas., J. (2022). The model of marketing strategies influencing customer satisfaction of supermarkets in Bangkok areas. The Journal of MCU Peace Studies, 10(2), 472-487. https://doi.org/10.2478/ejes-2018-0047

Chen, J. (2018). Pricing strategy and government subsidy in internet-based bike-sharing systems: A bi-level programming approach. *Transportation Research Part C: Emerging Technologies*, 92, 1–18.

Ding, H. (2017). The development and current status of bike-sharing systems in Japan: Implications for urban transport planning. *Journal of Transport Geography*, 62, 1–10.

El-Assi, W., Mahmoud, M. S., & Nurul Habib, K. (2017). Effects of built environment and weather on bike sharing demand: A station level analysis of commercial bike sharing in Toronto. *Transportation*, 44, 589–613.

Farla, J., Markard, J., Raven, R., & Coenen, L. (2010). Sustainability transitions in the making: A closer look at actors, strategies and resources. *Research Policy*, 41(6), 991–1001.

Fishman, E., Washington, S., & Haworth, N. (2013). Bike share: A synthesis of the literature. *Transport Reviews*, 33(2), 148–165.

Ji, Y., et al. (2014). Simulation analysis of electric bike-sharing systems: User demand and service availability. *Simulation Modelling Practice and Theory*, 42, 1–15.

Kaspi, M., Raviv, T., & Tzur, M. (2017). Service quality in bike-sharing systems: The effect of unavailable bicycles. *Transportation Research Part B: Methodological*, 99, 63–84.

Liu, T. X. (2018). *Research on the legal issues and risks of shared bicycle deposits (Master's thesis, Capital University of Economics and Business).* (Translated from Chinese)

Li, Y., Zhang, T., & Zhao, J. (2018). Financial incentives and adoption of green transportation services. *Journal of Cleaner Production*, 172, 234–243.

Liu, C., & Liu, Y. (2017). Externalities and public acceptance of bike-sharing systems in urban transport. *Journal of Transport Geography*, 58, 34–42.

Liu, J. L., & Liu, Z. L. (2017). Research on the externality analysis and development strategy of shared bicycles. *Transport Research*, 4(3), 1–7. (Translated from Chinese)

Liu, Y. (2018). Trust, risk, and legal issues in shared mobility platforms. *Information & Management*, 55(4), 467–477.

Mitra, S., & Webster, S. (2008). Competition in remanufacturing and the effects of government subsidies. *International Journal of Production Economics*, 111(2), 287–298.

Pan, Y., & Zinkhan, G. M. (2006). Determinants of retail patronage: A meta-analytical perspective. *Journal of Retailing*, 82(3), 229–243.

Pal, A., & Zhang, Y. (2017). Free-floating bike sharing: solving real-life large-scale static rebalancing problems. *Transportation Research Part C: Emerging Technologies*, 80, 92-116.

Price, J. C., Walker, I. A., & Boschetti, F. (2014). Measuring cultural values and beliefs about environment to identify their role in climate change responses. *Journal of Environmental Psychology*, 37(3), 8-20.

Qian, X. (2015). Demand prediction and usage pattern analysis in bike-sharing systems using Markov chains. *Procedia Engineering*, 137, 582–589.

Qin, H., & Wang, L. (2017). Collaborative consumption in the sharing economy: A case of bike-sharing systems. *International Journal of Information Management*, 37(6), 521–528.

Richardson, L. (2015). Performing the sharing economy. *Geoforum*, 67, 121–129.

Samet, B., Couffin, F., Zolghadri, M., Barkallah, M., & Haddar, M. (2018). Performance Analysis and Improvement of the Bike Sharing System Using Closed Queuing Networks with Blocking Mechanism. *Sustainability*, 10(12), 4663.

Shu, J., Chou, M. C., Liu, Q., Teo, C. P., & Wang, I. L. (2013). Models for effective deployment and redistribution of bicycles within public bicycle-sharing systems. *Operations Research*, 61(6), 1346-1359.

Swink, M., & Song, M. (2007). Effects of marketing-manufacturing integration on new product development time and competitive advantage. *Journal of Operations Management*, 25(1), 203-217.

Tan, Y. L. (2015). *Research on supply and demand of public bicycle stations based on Markov chain model.* (Master's thesis, Xi'an Jiaotong University). (Translated from Chinese).