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Exploration on the Behavior Patterns of Public Bicycle Users in Kaohsiung City from the Perspective of Theory of Planned Behavior and Structural Equation Model

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Abstract: Recently, the awareness of energy conservation, carbon emission reduction, and environmental protection in Taiwan has begun to gradually improve, and bicycles have become an important vehicle for residents. In 2009, Kaohsiung began promoting public bicycle sharing. The number of users in that year amounted to 140,000. By 2015, the accumulated number of users reached nine million. This study adopted the Theory of Planned Behavior (TPB) to explore the factors influencing the behavioral intentions of public bicycle users, including the three dimensions of attitude, subjective norm, and perceived behavioral control, and probed into the relationship between the factors influencing the behavioral intentions of public bicycle users in Kaohsiung City and the dimensions. This study used a questionnaire to collect data and SPSS & AMOS for statistical analysis. The empirical results demonstrated that the most prominent factors influencing the behavioral intentions of public bicycle users in Kaohsiung City included perceived behavioral control, attitude, and subjective norm, in order. Among the influencing factors in the three dimensions, personal interests, main groups, and self-competence had a positive and significant correlation. Administrators should provide more incentives related to the three influencing factors to encourage the public in Kaohsiung City to use public bicycles more frequently as their short-distance travel mode, so as to achieve the purposes of saving energy, reducing carbon emissions, and protecting the urban environment.

Keywords: Theory of Planned Behavior (TPB); Public bicycles; Structural Equation Model (SEM)

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1. Introduction

The rapid popularization of private vehicles has also brought about environmental problems such as pollution, global warming, and climate change, as well as traffic jams. The 2015 data of the Taiwan Environmental Protection

Administration indicate that the amount of carbon dioxide discharged by vehicles accounted for 14.60% of the total emissions in Taiwan, only second to industrial emissions, which accounted for 47.84%. Jäppinen et al. 2013 [1] pointed out that it is efficient to take public transport or ride a bicycle in many cities in Europe, as that such actions can reduce air pollution, traffic jams, and carbon emissions. Karel 2007 [2] argued that riding a bicycle is faster than walking. Compared with private cars, bicycles can reduce energy consumption, air and noise pollution, and traffic jams. Furthermore, a bicycle sharing system can help achieve the goal of sustainable transportation, as well as reduce traffic jams, air pollution and carbon dioxide emissions in cities [3]. As a substitute for walking, public bicycles can reduce cost and pollution, and they promote health [4].

The public bicycle system of Kaohsiung City was officially put into use in March 2009. At present, there are 400 leasing stations, and the maximum turnover rate in one month is 6.54 times/bicycle/day. In 2016, the number of users was reached 12million. Apparently, the public bicycle sharing system of Kaohsiung City has been well received by users. The bicycles are widely used and contribute to the creation of a low-pollution environment in Kaohsiung City. Nevertheless, few studies have been conducted on the behavioral intentions behind the use of public bicycles in Kaohsiung City. This study aimed to explore the use of public bicycles in Kaohsiung City, investigate the behavioral attitude and perceived behavior of the users, and analyze the behavior patterns of public bicycle users in Kaohsiung City.

The Theory of Planned Behavior (TPB) was proposed by Ajzen in 1985. TPB utilizes the three main variables of attitude, subjective norm, and perceived behavioral control to predict the behavioral intention and behavior of individuals to participate in a specific activity. TPB asserts that the behavior of use is guided by behavioral beliefs, normative beliefs, and control beliefs [5]. Moore and Benbasat 1991 [6] proved that beliefs are decomposed into multidimensional forms, the relationship between beliefs and behavioral intentions, as well as the factors influencing behavioral intentions. Taylor and Todd 1995 [7] decomposed attitude into perceived usefulness, perceived ease of use, and compatibility, divided subjective norm into main groups and sub-groups, and separated perceived behavioral control into self-efficacy, perceived facilitation of resources, and perceived facilitation of technologies.

On the basis of TPB, this study analyzed the attitude, subjective norm, and perceived behavioral control of public bicycle users in Kaohsiung City, as well as the key factors influencing behavioral intention and actual behavior. In addition, structure equation modeling (SEM) coupled with the verification function of multiple regression and factor analysis, was also used to analyze the relationship among correlation coefficients. This study then applied (SEM) to verify the strategies to enhance the policy implementation, operation, and management of public bicycles in Kaohsiung City.

2. Materials and Experiment

2.1 Study Framework

The main factors influencing behavioral attitude are behavior belief and outcome evaluation. Subjective norm is affected by normative belief and motivation to comply, and perceived behavioral control is mainly influenced by control belief and perceived facilitation [8]. Based on this, the structure of this study included attitude, subjective norm, perceived behavioral control, behavioral intention, and actual behavior. Variables were structuralized to improve the explanatory power of the model. In addition, the factors affecting attitude were classified into perceived ease of use, perceived usefulness, and environmental awareness. The factors influencing subjective norm were classified into family members, friends, colleagues, and media policies, and the factors affecting perceived behavioral control were classified into self-ability and perceived facilitation. This study proposed a research framework to explore the behavior patterns of public bicycle users in Kaohsiung City, as shown in Figure 1:
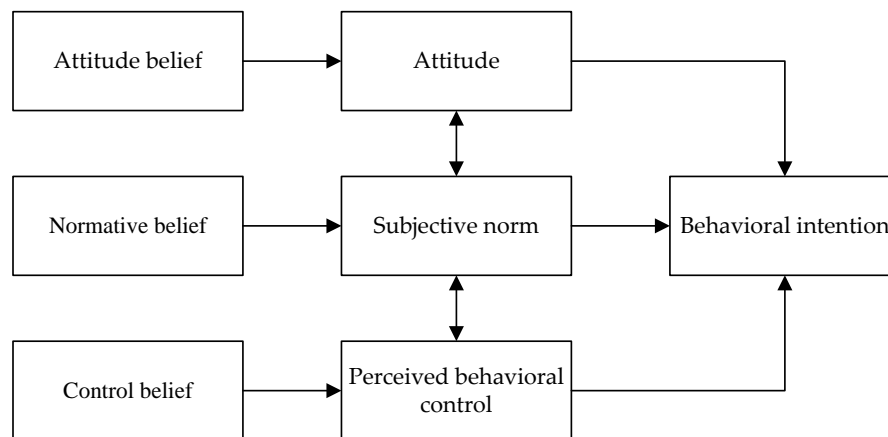

Figure 1. Research framework to explore the behavior patterns of public bicycle users in Kaohsiung City1

2.2 Study Hypotheses

This study proposed behavioral attitude, subjective norm, and perceived behavioral control as the three main variables determining behavioral intention. The more active the attitude is greater for the persons on whom it has an important influence. The perceived behavioral control is strong effect the behavioral intention. Based on the above, this study proposed three hypotheses as listed the following:

H1: The users' attitude will positively and significantly affect their behavioral intentions.
H2: The users' subjective norms will positively and significantly affect their behavioral intentions.
H3: The users' perceived behavioral control will positively and significantly affect their behavioral intentions.
H4: The users' personal interests will positively and significantly affect their

attitudes.

H5: The users' environmental awareness will positively and significantly affect their attitudes.

H6: Main groups will positively and significantly affect their subjective norm.

H7: Sub-groups will positively and significantly affect their subjective norm.

H8: The users' self-ability will positively and significantly affect their perceived behavioral control.

H9: The facilitating conditions will positively and significantly affect users' perceived behavioral control.

2.3. Operational Definition

This study explored the causality between the intention to use public bicycles and the use of public bicycles from the perspectives of the attitude, subjective norms, and perceived behavioral control of residents in Kaohsiung City. The operational definitions of the variables involved was listed in Table 1.

Table 1. Definition of variables1

Variable	Operational definition
Attitude	The users' positive or negative comments on the public bicycle system of Kaohsiung City.
Subjective norms	The degree of influence of their family members, friends, or those who support and encourage the users' use of the public bicycle system of Kaohsiung City.
Perceived behavioral control	The degree of influence of self-ability on the use of public bicycles in Kaohsiung City.
Behavioral intention	The possibility and willingness of users to reuse or recommend Kaohsiung's public bicycle system in the future.
Personal interests	The benefits that users can obtain after using Kaohsiung's public bicycle system.
Environmental awareness	The degree of influence of awareness of environmental protection on the users of Kaohsiung's public bicycle system.
Main groups	The degree of influence of main groups (e.g. family members, friends, classmates, and colleagues) on the use of Kaohsiung's public bicycle system.
Sub-groups	The degree of influence of sub-groups (e.g. newspapers, magazines, TV channels, and ads on the MRT) on the use of Kaohsiung's public bicycle system.
Self-ability	The self-assessment of users to successfully lease a public bicycle in Kaohsiung City.
Facilitating conditions	The degree of convenience of external resources perceived by users of Kaohsiung's public bicycle system.

2.4 Questionnaire Design

The questionnaire of this study contained six parts, including attitude, subjective norm, perceived behavioral control, behavioral intention, actual behavior, and basic data on the respondents. A Likert six-point scale was adopted for scoring. Based on their feelings, experiences, or opinions after using public bicycles, the respondents filled in different scores. Each question had six options for scoring, including strongly disagree, disagree, somewhat disagree, somewhat agree, agree, and strongly agree.

The questionnaire was formally conducted from March 12 to April 12, 2017. A total of 420 copies of the questionnaire were sent out, all of which were collected. There were 412 valid copies and eight invalid ones, with a recovery rate of 98%.

2.5 Statistical Analysis

This study used SPSS for statistical analysis and SEM for data analysis, including descriptive statistical analysis, item analysis, reliability analysis, and SEM analysis. Descriptive statistical analysis refers to the frequency distribution and statistical analysis of the basic information collected and research dimensions so as to obtain the average, standard deviation, maximum value, and minimum value of each variable and understand the distribution of samples in each dimension, including gender, age, occupation, and educational level.

Reliability analysis aims to see if the data collected is internally consistent, and it is tested by Cronbach's α, which is often used in Likert's Attitude Scale. If Cronbach's α is above 0.7, it indicates reliability; if it is between 0.35 and 0.7, it implies that the reliability is acceptable; if it is below 0.35, it means low reliability [9].

SEM includes two basic forms: manifest variables, which can be identified through observation or investigation, and latent variables, which cannot be accurately or directly obtained via observation or investigation, but instead must be inferred through the manifest variables. The measurement model analysis used in this study included verification factor analysis, the univariate and multivariate normal test, the convergence validity and discriminant validity test, and fit analysis.

3 Test Results and Discussion

3.1 Results of Descriptive Statistical Analysis

This study employed descriptive statistical analysis to summarize the basic characteristics of public bicycle users in Kaohsiung, including gender, age, occupation, educational level, and place of residence, as shown in Table 2. The total number of valid questionnaires was 412. The proportions of female and male respondents were 47.1% and 52.9%, respectively. There was no significant difference in gender. The respondents were between 16 and 30 years old. The users of public bicycles decreased as their age increased. This could possibly be due to

stable financial capacity, as residents above 40 years old tended to use private cars rather than public bicycles for commuting or shopping. Hence, their utilization rate of public bicycles was low.

In terms of occupation, most of the users of public bicycle were students, accounting for 55.8%, followed by office workers, accounting for 38.8%. It could be seen that most of the public bicycle users in Kaohsiung were students aged between 16 and 20 years old. In regard to place of residence, most of the respondents lived in Kaohsiung City, accounting for 92.7%, implying a regional trend of public bicycle users. The frequency of visitors riding a public bicycle was low.

Table 2. Frequency of using public bicycles by the respondents

Variable	Sample Category	Frequency	Percentage(%)
Gender	Male	194	47.1
	Female	218	52.9
Age	≤15 years old	15	3.6
	16-20 years old	178	43.2
	21-30 years old	107	26
	31-40 years old	66	16
	41-50 years old	31	7.5
	51-60 years old	13	3.2
	$\geq$ 61 years old	2	0.5
Occupation	Student	230	55.8
	Office worker	160	38.8
	Housekeeping	15	3.6
	Unemployed	7	1.7
	Retired	0	0
Educational level	Elementary School	3	0.7
	Junior high school	13	3.2
	Senior high school	156	37.9
	University	219	53.2
	Master and above	21	5.1
Place of residence	Kaohsiung City	382	92.7
	Others	30	7.3

3.2 Factor Analysis and Reliability Analysis

The structure of the questionnaire in this study covered the three dimensions of attitude, subjective norm, and perceived behavioral control. It explored the correlation between the factors influencing the behavioral intentions of public bicycle users in Kaohsiung City and the dimensions. This study conducted Kaiser-Meyer-Olkin (KMO) analysis, and then used principal component analysis to extract the factors with an eigenvalue greater than 1.

The contents of the questionnaire included: (1) attitude toward the use of Kaohsiung's public bicycle system, including 10 items such as comments, personal

interests, and awareness of environmental protection of users; (2) the subjective norm of use of Kaohsiung's public bicycle system, including 10 items that were adopted to understand the degree of influence on the use of public bicycles; (3) the perceived behavioral control of use of Kaohsiung's public bicycle system, including 11 items such as self-ability assessment and external support capacity; and (4) the intention to use Kaohsiung's public bicycle system and the usage behavior of the bicycles, including eight items that were adopted to understand the possibility and willingness to use the bicycles.

As shown in Table 3, this study verified the component reliability of the four dimensions of the use of Kaohsiung's public bicycle system, that is, attitude, subjective norm, perceived behavioral control, and behavioral intention. The Cronbach's α value of all dimensions were greater than 0.7. Bagozzi & Yi (1988) [10] stated that average variation extraction aims to observe latent variables. The standard value must be greater than 0.5. It could be seen that all the latent variables for the dimensions of attitude, subjective norm, perceived behavioral control, and behavioral intention could applied the willingness to use public bicycles in Kaohsiung City.

Table 3 Reliability analysis of the behavior to use public bicycles in Kaohsiung City

Dimension	Code	Items measured	Average Mean	Standardized Coefficient	Cronbach's α
Attitude	AT1	Ride a public bicycle preference	3.599	0.919	0.858
	AT2	Benefits of riding a public bicycle	3.717	0.886	
	AT3	Personal demand to ride a public bicycle	3.000	0.886	
	PI1	Influence of riding a public bicycle on personal health	3.769	0.980	
	PI2	Influence of riding a public bicycle on personal transportation cost	3.515	1.009	
	PI3	Influence of riding a public bicycle on efficiency of transfer.	3.142	1.034	
	PI4	Compliance of riding a public bicycle with a motor function	3.396	1.111	
	EA1	Influence of riding a public bicycle on energy conservation and carbon reduction	4.192	0.769	
	EA2	Influence of riding a public bicycle on the improvement of the living environment	3.892	0.696	
	EA3	Influence of riding a public bicycle on environmental conservation	3.969	0.777	
Subjective norm	SN1	Influence of others on one's use of a public bicycle	2.465	0.833	0.913
	SN2	Influence of others' opinions on one's use of a public bicycle	2.772	0.969	
	MG1	Influence of family members on one's use of a public bicycle	2.631	1.035	
	MG2	Influence of friends on one's use of a public bicycle	2.459	0.932	

Dimension	Code	Items measured	Average Mean	Standardized Coefficient	Cronbach's α
	MG3	Influence of colleagues on one's use of a public bicycle	2.225	0.941	
	MG4	Influence of classmates on one's use of a public bicycle	2.414	0.958	
	SG1	Influence of relevant reports on one's use of a public bicycle	2.235	0.790	
	SG2	Influence of relevant medium reports on one's use of a public bicycle	2.197	0.786	
	SG2	Influence of advertising on one's use of a public bicycle	2.432	0.959	
	PBC1	Self-assessment on the opportunities to use a public bicycle	3.576	1.294	
	PBC2	Perceived behavior of use of Kaohsiung City's public bicycles	2.224	0.918	
	PBC3	Time available to use a public bicycle	1.824	0.774	
	SA1	Personal ability to successfully lease a public bicycle	3.661	1.041	
	SA2	Personal proficiency in leasing a public bicycle	3.402	0.848	
Perceived behavioral	SA3	Personal proficiency in checking the public bicycle leasing system via the Internet	3.472	0.933	0.709
	FC1	Satisfaction with special offers for renting a public bicycle	2.766	1.169	
	FC2	Satisfaction with the information on renting a public bicycle	2.565	1.149	
	FC3	Satisfaction with the after-sales service of public bicycles	2.169	1.018	
	FC4	Satisfaction with the design of public bicycles	2.161	0.887	
Behavioral intention	BI1	Possibility to recommend others to use a public bicycle	2.063	0.250	0.912
	BI2	Willingness to continue to use a public bicycle	1.938	0.250	

This study applied SPSS 17.0 and AMOS (analysis of Moment Structure) 17.0 conducted to reveal the causal relationship among variables, test the fit of the model, and verify the hypotheses on perceived behavioral control and behavioral intention of public bicycle users in Kaohsiung City. Furthermore, it adopted the maximum likelihood model (MLM) to estimate the parameters. If the indicators related to the fit were not favorable, SEM was used for modification to meet the criteria of the fit indicators. For modification, this study referred to the modification index (MI) provided by Amos 17.0. Modification was conducted on the premise of having no influence on integrity.

Ding et al. (1995) [11] held that the adoption of MLM must meet the

hypothesis of multivariate normality. Therefore, the Mardia coefficient was used to test if the sample structure could meet the basic requirements of multivariate normality. This study quoted the parameter fit assessment standards of SEM, which are summarized in Table 4. The absolute values of the skewness coefficient were between -0.940 and -0.063, all of which were less than 3. The absolute values of the kurtosis coefficient were between -1.008 and 1.230, all of which were less than 10. Hence, the samples of this study could be regarded as normal and compliant with the univariate normal distribution. The observation item p = 32, p (p + 2) = 1088. The Mardia coefficient was 64.687 and less than 1088, indicating that the Mardia coefficient of each dimension in this study met the standard. Thus, MLM in SEM could be used to estimate the parameters.

Table 4. Distribution of skewness and kurtosis coefficients

Variable		skew	composite reliability (CR)	kurtosis	composite reliability (CR)
Attitude	AT1	-0.816	-6.765	1.100	4.558
	AT2	-0.801	-6.637	1.065	4.411
	AT3	-0.290	-2.406	-0.197	-0.815
Personal interests	PI1	-0.894	-7.405	1.230	5.094
	PI2	-0.819	-6.783	0.530	2.196
	PI3	-0.390	-3.229	-0.240	-0.993
	PI4	-0.739	-6.126	0.321	1.331
Environmental awareness	EA1	-0.847	-7.021	0.401	1.661
	EA2	-0.812	-6.728	0.307	1.272
	EA3	-0.790	-6.544	0.264	1.094
Subjective norms	SN1	-0.486	-4.031	-0.169	-0.698
	SN2	-0.659	-5.457	0.181	0.751
Main groups	MG1	-0.614	-5.085	-0.060	-0.25
	MG2	-0.604	-5.004	-0.076	-0.316
	MG3	-0.500	-4.140	-0.540	-2.236
	MG4	-0.530	-4.391	-0.369	-1.529
Sub-groups	SG1	-0.228	-1.885	-0.622	-2.576
	SG2	-0.240	-1.992	-0.712	-2.949
	SG3	-0.308	-2.555	-0.467	-1.935
Perceived behavioral control	PBC1	-0.940	-7.793	0.911	3.776
	PBC2	-0.298	-2.467	-0.662	-2.743
	PBC3	0.063	0.521	-0.808	-3.346
Self-ability	SA1	-0.793	-6.574	0.425	1.761
	SA2	-0.598	-4.953	0.542	2.245
	SA3	-0.684	-5.669	0.548	2.271
	SA4	-0.588	-4.871	0.212	0.878
Facilitating conditions	FC1	-0.122	-1.01	-0.706	-2.923
	FC2	-0.213	-1.769	-0.786	-3.256
	FC3	-0.083	-0.684	-1.008	-4.175
	FC4	0.052	0.427	-0.851	-3.528
Behavioral intention	BI1	-0.499	-4.131	-0.108	-0.447
	BI2	-0.610	-5.056	0.120	0.497

Variable	skew	composite reliability (CR)	kurtosis	composite reliability (CR)
Multivariate			297.32	64.687

3.3 Confirmatory Factor Analysis (CFA)

Measurement model analysis is used to find the internal structural model fit and learn the relationship between manifest and latent variables, and CFA is used to verify the reliability, convergence, and validity of each dimension [12]. During measurement model analysis, latent variables cannot be used directly for measurement and estimation, which must be inferred through the manifest variables [13]. Bagozzi & Yi (1988) [10] suggested three commonly used measurement indicators, including factor load, composite reliability, and average variance extracted (AVE). Hair et al. 2010 [14] regarded a composite reliability (CR) of 0.7 as an acceptable threshold, while Fornell & Larcker (1981) [15] suggested the CR value should be above 0.6. Moreover, suggesting that the Average Variance Extracted (AVE) must be greater than 0.5.

Base on, this study classified the behavior patterns of the users of public bicycles in Kaohsiung City into a first-order and six-factor measurement model to conduct first order confirmatory factor analysis.

As shown in Figure 2, the first-order & six-factor measurement model included six dimensions: personal interests (PI), environmental awareness (EA), main groups (MG), sub-groups (SG), self-ability (SA), and facilitating conditions (FC). Table 5 shows the reliability and validity analysis of the first-order & six-factor measurement model. In the analysis of the first-order & six-factor measurement model, the AVE of PI and FC was below 0.5. As a result, in line with the principle of MI < 3.84, the variable relationship of the measurement model was modified. After PI1 and PI4 were deleted, CR became 0.67, which was above 0.6, and AVE became 0.504, which was above 0.5. After FC1, FC2, FC3, and FC4 were deleted, the AVE still failed to go above 0.5.

Thus, this study deleted the path from FC to perceived behavioral control (PBC). After modification, CFA of all the questions in the first-order & six-factor measurement model was conducted again, as shown in Tables 6 and 7. All the questions were above the standards and met the fit criteria, indicating that the measurement model had good convergence validity and validity.
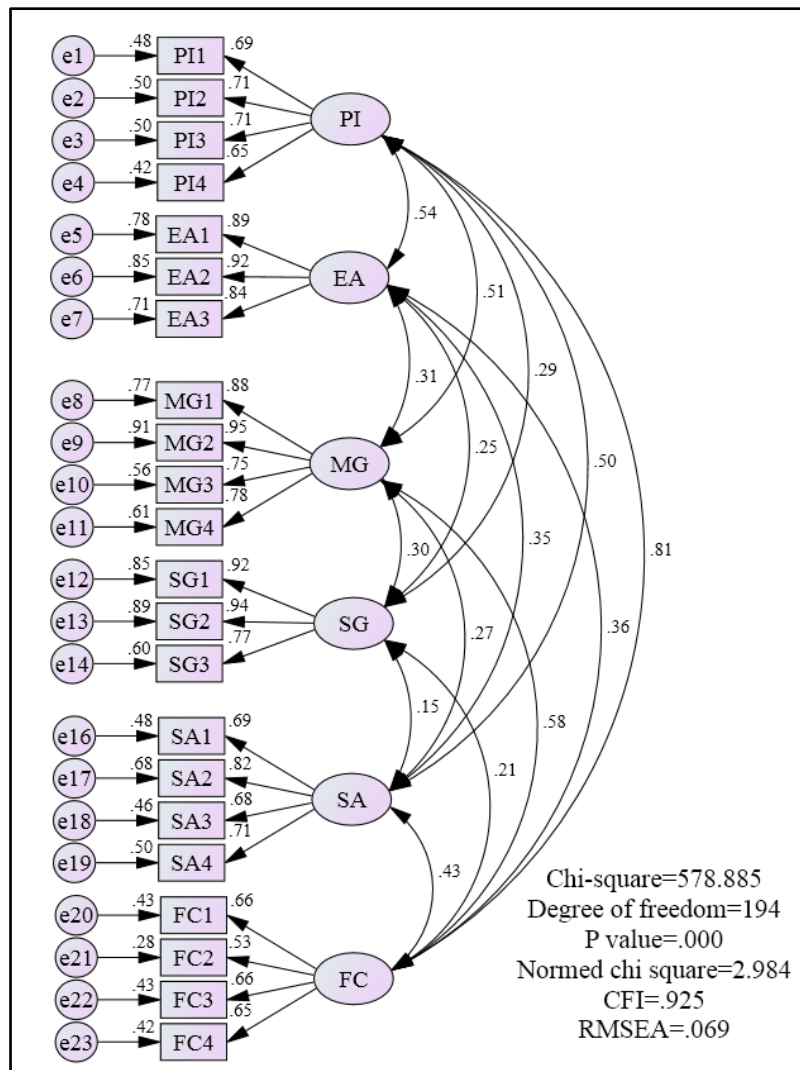
Figure 2. Confirmatory factor analysis of first-order & six-factor measurement model

Table 5. Reliability and validity of first-order & six-factor measurement model

Variable	Code	Factor load > 0.5	C.R. t-value	SMC > 0.20	CR ≧0.70	AVE > 0.50
Personal interests	PI1	0.69	7.46***	0.48	0.784	0.477
	PI2	0.71	11.15***	0.50		
	PI3	0.71	11.11***	0.50		
	PI4	0.65	11.9***	0.42		
Environmental awareness	EA1	0.89	7.35***	0.78	0.915	0.781
	EA2	0.92	6.73***	0.85		
	EA3	0.84	11.78***	0.71		
Main groups	MG1	0.88	11.57***	0.77	0.907	0.712
	MG2	0.95	11.58***	0.91		
	MG3	0.75	12.34***	0.56		
	MG4	0.78	9.31***	0.61		
Sub-groups	SG1	0.92	6.97***	0.85	0.911	0.774
	SG2	0.94	11.11***	0.89		
	SG3	0.77	10.53***	0.60		

Variable	Code	Factor load > 0.5	C.R. t-value	SMC > 0.20	CR ≧0.70	AVE > 0.50
Self-ability	SA1	0.69	5.31***	0.48		
	SA2	0.82	13.1***	0.68	0.817	0.529
	SA3	0.68	12.81***	0.46		
	SA4	0.71	6.77***	0.50		
Facilitating conditions	FC1	0.66	5.31***	0.43		
	FC2	0.53	12.85***	0.28	0.720	0.394
	FC3	0.66	11.66***	0.43		
	FC4	0.65	8.25***	0.42		

Table 6. Coefficient estimation after modification of first-order & six-factor measurement model

Path			Coefficient estimation	Standardized coefficient	p value
PI2	<---	PI	1	0.69	—
PI3	<---	PI	1.142	0.725	***
EA1	<---	EA	1	0.885	—
EA2	<---	EA	1.141	0.923	***
EA3	<---	EA	1.033	0.843	***
MG1	<---	MG	1	0.877	—
MG2	<---	MG	1.1	0.953	***
MG3	<---	MG	0.961	0.748	***
MG4	<---	MG	0.974	0.784	***
SG1	<---	SG	1	0.923	—
SG2	<---	SG	1.034	0.941	***
SG3	<---	SG	0.828	0.773	***
SA1	<---	SA	1	0.684	—
SA2	<---	SA	1.17	0.834	***
SA3	<---	SA	0.955	0.68	***
SA4	<---	SA	0.986	0.697	***

Note: *** means $p < 0.001$.

Table 7. Fit assessment and analysis of first-order & six-factor measurement model (after modification)

Indicator	Judgment value	Actual measured value	Fit
χ^2	The smaller, the better	181.604	Fit
χ^2/df	≦3	1.932	Fit
CFI	≧0.9	0.978	Fit
RMSEA	≦0.08	0.048	Fit

Note: *** means $P < 0.001$.

3.4 Fit Assessment of the Overall Model

Table 8 presents the results of the fit of the overall model. The p value of AT to EA, SN, and SG failed to reach a significant level. Each dimension and fit reached a significant level and met the standard. Therefore, this study deleted the paths from

AT to EA, from SN to SG, from AT to EA, and from SN to SG, after which the model reached a significant level and met the standard. Figure 10 presents the final model.

Table 8. Overall SEM (after modification) fit assessment and analysis (results of the second modification)

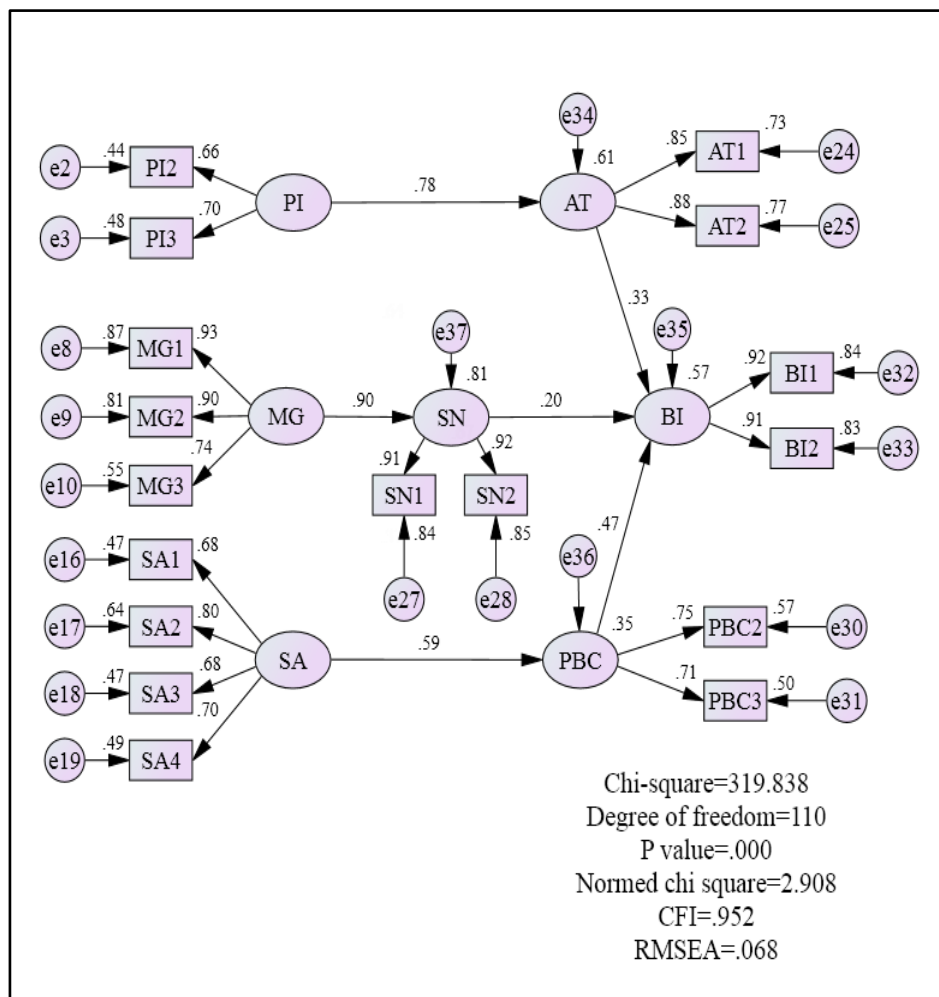| Indicator	Judgment value	Actual measured value	Fit
$\chi2$	The smaller, the better	319.838	Fit
$\chi2/df$	$\leqq3$	2.908	Fit
CFI	$\geqq0.9$	0.952	Fit
RMSEA	$\leqq0.08$	0.068	Fit

Figure 3. Analysis of overall SEM (after modification) path fit

3.5 Verification of Research Hypotheses

According to the aforementioned analysis results and path fit for the model after modification, this study conducted the following hypothesis verification, as

shown in Table 9. Personal interest was the most significant influencing factor in the dimension of attitude. Therefore, this study suggested increasing the benefits of users for handling performance, riding comfort, safety response, low prices, and transfer preferences, as well as setting up more channels to interact with users, so that public bicycle users in Kaohsiung City can access information on the benefits more easily and enhance their behavioral intention to use public bicycles.

Main group was the most prominent influencing factor in the dimension of subjective norm. The opinions and degree of support of family members and friends of public bicycle users had the most significant influences on users. This study suggested enhancing the support to use public bicycles from family members and friends so as to increase users' willingness to further use public bicycles. Self-ability was the most significant influencing factor in the dimension of perceived behavioral control. Via the interface of the public bicycle leasing system, users can successfully lease a public bicycle, which can best increase the willingness of users to ride public bicycles. Hence, the leasing devices, such as the leasing system interface, the network inquiry system, and the information presentation, which are operated by the users, should be simple and concise so as to raise the self-ability of users to rent a bicycle and improve their intention to use.

Table 9. Summary of the verification results of the hypotheses

No.	Hypothesis	Path coefficient	P Value	Result
H1	The users' attitude will positively and significantly affect their behavioral intentions.	0.327	***	Valid
H2	The users' subjective norms will positively and significantly affect their behavioral intentions.	0.203	***	Valid
H3	The users' perceived behavioral control will positively and significantly affect their behavioral intentions.	0.473	***	Valid
H4	The users' personal interests will positively and significantly affect their attitudes.	0.779	***	Valid
H5	The users' environmental awareness will positively and significantly affect their attitudes.	-0.077	0.221	Invalid
H6	Main groups will positively and significantly affect their subjective norm.	0.9	***	Valid
H7	Sub-groups will positively and significantly affect their subjective norm.	0.042	0.913	Invalid
H8	The users' self-ability will positively and significantly affect their perceived behavioral control.	0.593	***	Valid
H9	The facilitating conditions will positively and significantly affect users' perceived behavioral control.	---	---	Invalid

Note: *** means $P < 0.001$.

4. Conclusion

Through sample and actual behavior analysis, From the study test results, the

following conclusions can be drawn:

1. This study found that most of the users of public bicycles in Kaohsiung City are females, mostly between 16 and 20 years old, and students. The top purpose to ride a public bicycle is for sightseeing in the city. After riding a public bicycle, most of the users transfer to the mass rapid transit.

2. In terms of the overall model verification of the behavior patterns of public bicycle users in Kaohsiung City, the explanatory power of attitude, subjective norm, and perceived behavioral control was above 57%. They have significant and positive influences on behavioral intentions. The results indicated that the motivation of use and attitude of public bicycle users in Kaohsiung City significantly increase their behavioral intention to use public bicycles.

3. Individuals with an influence on public bicycle users in Kaohsiung City, as well as the opinions of those who support and encourage the respondents to use a public bicycle, could influence the behavioral intention of the users. The users have a higher self-ability to use the public bicycle leasing system in Kaohsiung City, their behavioral intention will be higher.

4. The verification results of the manifest variables of the behavior patterns of public bicycle users in Kaohsiung City implied that personal interest is the most significant factor influencing attitude. "Main group" is the most prominent influencing factor in the dimension of the subjective norm. The degree of influence of family members on of public bicycle users is the greatest, followed by that of friends. Self-ability is the most significant influencing factor in the dimension of perceived behavioral control.

5. The leasing devices, including the information presentation, of public bicycles influence the degree of difficulty in understanding how to use public bicycles. When users can use the public bicycle leasing system more smoothly, their perceived behavioral control of public bicycles will become stronger, and their behavioral intentions to use public bicycles will rise as well.

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