

## **Examining the Utilization of the Bicycle Rental System through Customer Satisfaction Index**

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### **Abstract**

*The Taipei City government in Taiwan has developed transportation for shorter distances that produces little pollution and consumes little energy: the “YouBike” bicycle rental system. This study intends to uncover the utilization of and satisfaction with YouBikes among the general public in Taiwan. This study combines the indicators of the American Customer Satisfaction Index and the European Customer Satisfaction Index. We adopt a questionnaire survey and conduct analysis with a structural equation modeling to discover the bilateral impacts between each latent variable. The results show that image, perceived quality, and perceived value have a positive impact on customer satisfaction, while customer satisfaction has a positive impact on customer loyalty. We hope to provide these results for the executive authority of YouBike as a reference for attracting more participants to utilize YouBike bicycles, and engage themselves to care for the earth through concrete actions.*

**Keywords:** YouBike, American Customer Satisfaction Index, European Customer Satisfaction Index, Structural Equation Modeling

### **1. Introduction**

The Taipei City government has already established public transportation venues so as to construct a green city and reduce carbon emissions. Also, utilizing modern radio frequency identification (RFID) technology, the city government has cooperated with GIANT to set up a green, automated, electronic public bicycle rental system that is environmentally friendly and requires no management personnel: “YouBike.” Because “YouBike” is a new mode of transportation and a recreational channel for citizens in Taipei, this study intends to understand the general public’s current utilization of and satisfaction with “YouBike.” Accordingly, we combined the American Customer Satisfaction Index by Fornell *et al.* (1996) with the European Customer Satisfaction Index by Cassel and Eklof (2001) as a basis for establishing the research structure and hypotheses of this study. We conducted a survey on customer satisfaction among individuals with experience using YouBike, and adopted a structural equation model to further examine the impact of each latent variable on customer satisfaction and customer loyalty.

These rental bicycles “YouBike” adopt modern RFID technology, which manages the rental process effectively. It also integrates electronic payment systems such as EasyCard and credit cards, and provides the opportunity for users to rent a bicycle at location A and return it to location B. The Taipei City government expects to encourage more individuals to utilize public transportation systems, and achieve the objectives of environmental protection and energy saving; meanwhile, constructing a brand-new commuter culture.

The first customer satisfaction model was the Swedish Customer Satisfaction Barometer (SCSB), constructed by a team led by Fornell. The model included five latent variables, which are customer expectation, perceived value, customer satisfaction, customer complaints, and customer loyalty.

After the SCSB, the US government entrusted Fornell's team and the National Quality Research Center of Michigan Business School, U.S.A., to develop the American Customer Satisfaction Index (ACSI) for its project of service standardization in September, 1993. The ACSI model included the six latent variables of customer expectation, perceived quality, perceived value, customer satisfaction, customer complaints, and customer loyalty. The ACSI was announced and came into effect in 1994; its major functions are to analyze the value of products perceived by customers through quantitative methods, and to use it as a reference for quality improvement.

Following the successful experiences of the SCSB and the ACSI, Cassel and Eklog (2001) proposed the European Customer Satisfaction Index (ECSI). The ECSI model was established cooperatively by the European Organization for Quality (EOQ), the European Foundation for Quality Management (EFQM), and the European Academic Network for Customer-Oriented Quality Analysis, consisting of eleven well-known universities recommended by various countries in the European Union. Its purpose was to measure and explain customer satisfaction and loyalty, providing a reference to enterprises for improving their operations. The ECSI model was based on the ACSI model, and revised to add the prerequisite aspect of image, and delete the aspect of customer complaints. It was done mainly because the ECSI model believed that image has a certain degree of impact on customer loyalty. In addition, the aspect of perceived quality in the model includes the two parts of perceptible product quality and perceptible service quality, which examine the hardware aspect of products and the quality of service-related elements, respectively.

Customer satisfaction has been broadly applied. In addition to discussing ACSI or ECSI alone, many domestic and foreign researchers have also examined the combined impact of ACSI and ECSI on customer satisfaction, and have applied it to different fields. This study summarized in Table 1 the literature from scholars who have applied customer satisfaction models to different fields in recent years.

**Table 1: Relevant Studies on the Customer Satisfaction Model**

Author(s) (year)	Title	Abstract
Fornell et al. (1996)	The American Customer Satisfaction Index - Nature, Purpose, and Findings	The authors discuss the nature and purpose of ACSI and explain the theory underlying the ACSI model. The authors conclude with a discussion of the implications of ACSI for public policymakers, managers, consumers, and marketing in general.
Cassel and Eklof (2001)	Modeling Customer Satisfaction and Loyalty on Aggregate Levels - Experience from the ECSI Pilot Study	This study is based on an evaluation of the stability and robustness of empirical results from the European Customers Satisfaction Index (ECSI) pilot survey round. In spite of the fact that European customers, product supplies, and cultural environments are different, it is possible to specify a common structural model to be used in such diverse industries as telecom, banking, and supermarkets throughout 11 European countries.
Hsu (2008)	Developing an Index for Online Customer Satisfaction: Adaptation of the American Customer Satisfaction Index	This study proposed an index for online customer satisfaction, which is adapted from the American Customer Satisfaction Index (ACSI). This study found that the satisfaction score of PChome Online is similar to the average for the online retail industry in the ACSI.
Zhang et al.(2008)	Empirical Study on the Student Satisfaction Index in Higher Education	This article established the college student satisfaction model according to the theoretical frameworks of the ACSI and the ECSI, and the empirical research showed that the model possesses strong applicability.
Li (2008)	Research on the Relationship between Customer Satisfaction and Loyalty--the Application of ECSI to the Cellular Phone Industry	This study examined the relationship between variables in the ECSI model. It selected the keenly competitive cellular phone industry as the research topic, and university students - who use cellular phones most frequently - as the research subject for empirical analysis.
O'Sullivan et al. (2009)	Empirical Evidence of the Stock Market's (mis) Pricing of Customer Satisfaction	The study reexamined two ACSI-based trading strategies considered in prior research, and Applied a methodology which deals with three interlinking issues: risk adjustment, abnormal returns estimation, and portfolio aggregation. The study found that the trading strategies do not provide compelling evidence that the market mis-prices the value of customer satisfaction.

## 2. Research Hypotheses and Model Structure

Based on the basic theories of the ACSI and ECSI proposed respectively by Fornell *et al.* (1996) and Cassel and Eklof (2001), this study gave each construct an operational definition in accordance with the characteristics of this research subject.

Gronroos (1990) believed that expectations may differ according to customer perceptions and appraisals of corporate image or reputation. The better the customers' perceived corporate image is, the higher their expected standards will be (Kotler, 1973; Mazursky and Jacoby, 1986; Clow *et al.*, 1998). In addition, corporate image also enables customers to develop an expected standard of the company's products or services (Paul and Olson, 1987). Loudon and Bitta (1988) suggested that brand image may impact consumers' perceptions of a company, and they will purchase products from companies that have a good image. Therefore, companies with a good image are prone to earn consumer trust and preference. Fredericks and Slater (1998) also highlight in their study that image is a factor associated with customers' perceived value. Image is a clue containing abundant information; mentioning the name of a company may awaken consumers to the brand image they remember, affecting the perceived quality, perceived value, and inclination to purchase (Zeithaml, 1988).

Smeltzer (1997) mentioned that in a trading relationship between a buyer and a supplier, "corporate identity," "corporate image," and "corporate reputation" can result in trust or distrust between the two parties, which further impacts the result of their perceptions. Namely, corporate image can affect on customer satisfaction; therefore, corporate image has a positive impact on customer satisfaction and customer purchase intention. Aaker (1991) proposed that the construction of a positive brand image may increase consumer purchase intention and satisfaction, so that they are willing to recommend it to others. Dobni and Zinkhan (1990) and Low (2000) believed that product image is a type of loyalty when consumers come in contact with a product; a product with a positive image is prone to be preferred by consumers and to encourage consumers to develop customer loyalty (Romaniuk and Sharp, 2003). Meanwhile, using customers of the European aviation industry as their research subject, Zins and Guttman (2000) showed that corporate image has a positive impact on customers' perceived value, customer satisfaction, and customer loyalty.

Based on the empirical results from the researchers discussed previously, we proposed our hypotheses H1 to H4.

*H1:* The "Image" of the executive authority of YouBike has a positive impact on users' "Expectations."

*H2:* The "Image" of the executive authority of YouBike has a positive impact on users' "Perceived Value."

*H3:* The "Image" of the executive authority of YouBike has a positive impact on users' "Customer Satisfaction."

*H4:* The "Image" of the executive authority of YouBike has a positive impact on users' "Customer Loyalty."

Fornell *et al.* (1996) discovered in their study that consumer expectations can predict quality, value, and customer satisfaction; namely, customer expectation is positively correlated to perceived quality and perceived value. Customer knowledge developed in their experiences may lead to an accurate expectation and a correct prediction of the current quality standard. Accordingly, customer expectations can be reflected in perceived quality and perceived value. We therefore proposed our hypotheses H5 and H6.

*H5:* User "Expectations" of YouBike has a positive impact on users' "Perceived Value."

*H6:* User "Expectations" of YouBike has a positive impact on users' "Perceived Quality."

Zeithaml (1988) indicated that price, brand name, and advertisement quality may impact perceived quality, perceived value, and further consumer purchase behavior. Grewal *et al.* (1998) also suggested that the impact of shop name, brand name, and price on consumer purchase inclination proves that brand name may affect perceived quality, and perceived value; and in the end, purchase intention. Chen and Dubinsky (2003) also confirmed that perceived quality has a positive impact on consumers' perceived value. Overall perceived quality is a factor directly associated with customer satisfaction. It is an assessment of consumer experiences, and is expected to have a positive impact on customer satisfaction (Fornell *et al.*, 1996). In a study on perceived product quality, Rai *et al.* (2002) confirmed that system quality and information quality are significantly correlated with customer satisfaction while verifying the information systems success model proposed by DeLone and McLean, in addition to Seddon. DeLone and McLean (2004) applied the information systems success model to an e-commerce success model, considering that system quality and information quality may have impacts on customer satisfaction.

Based on these empirical results, we propose our hypotheses H7 and H8.

*H7: Users' "Perceived Quality" has a positive impact on users' "Perceived Value."*

*H8: Users' "Perceived Quality" has a positive impact on users' "Customer Satisfaction."*

According to Bojanic's (1996) study on perceived value and customer satisfaction, perceived value has a positive impact on customer satisfaction. Patterson and Richard (1997) conducted an empirical study on the relationships among perceived performance, perceived value, customer satisfaction, and re-purchasing behavior among four consulting firms and eight private organizations; and they indicated that perceived value indeed has a positive impact on customer satisfaction, and higher customer satisfaction may result in a strong intention to re-purchase. Anderson and Sullivan (1993) indicated that customer satisfaction has a positive impact on customer re-purchasing behavior, and that customer re-purchase is a behavior resulting from customer loyalty. Namely, there is a positive correlation between customer satisfaction and customer loyalty. Meanwhile, Heskett *et al.* (1994) also suggested that in a service-profit chain, customer loyalty is under a direct and positive influence of customer satisfaction. Amin (2011) indicated that customer satisfaction has a statistically significant positive effect on customer loyalty. Mistakes in products or services may result in customer complaints during consumption; in other words, customer complaints are caused by their perceived feeling or emotion of dissatisfaction (Bearden and Teel, 1983). Singh and Shefali (1991) found a simple linear relationship between the degree of customer dissatisfaction and customer complaints. However, negative reviews only increase significantly when the degree of dissatisfaction reaches a certain standard, forming a non-linear relationship. Additionally, a higher degree of dissatisfaction will lead to stronger negative attitudes and increased complaining behavior. Therefore, we propose hypotheses H9 to H11.

*H9: Users' "Perceived Value" has a positive impact on users' "Customer Satisfaction."*

*H10: Users' "Customer Satisfaction" has a positive impact on users' "Customer Loyalty."*

*H11: Users' "Customer Satisfaction" has a negative impact on users' "Customer Complaints."*

Fornell and Wernerfelt (1987) suggested in their conclusion that as long as dissatisfied customers are convinced to continue their consumption, they would become more loyal. Actively coping with complaints can contribute to positive reviews; while conversely, failing to deal with complaints properly may accelerate the drain of customers. As customers are more likely to complain to their relatives or friends, their loyalty would weaken. Furthermore, Tong (2004) discovered in her study that complaints indeed have a negative impact on customer loyalty. As a result, H12 is proposed.

*H12: Users' "Customer Complaints" have a negative impact on users' "Customer Loyalty."*

Based on the above research hypotheses of each construct, the research model of this study is presented in Figure 1.

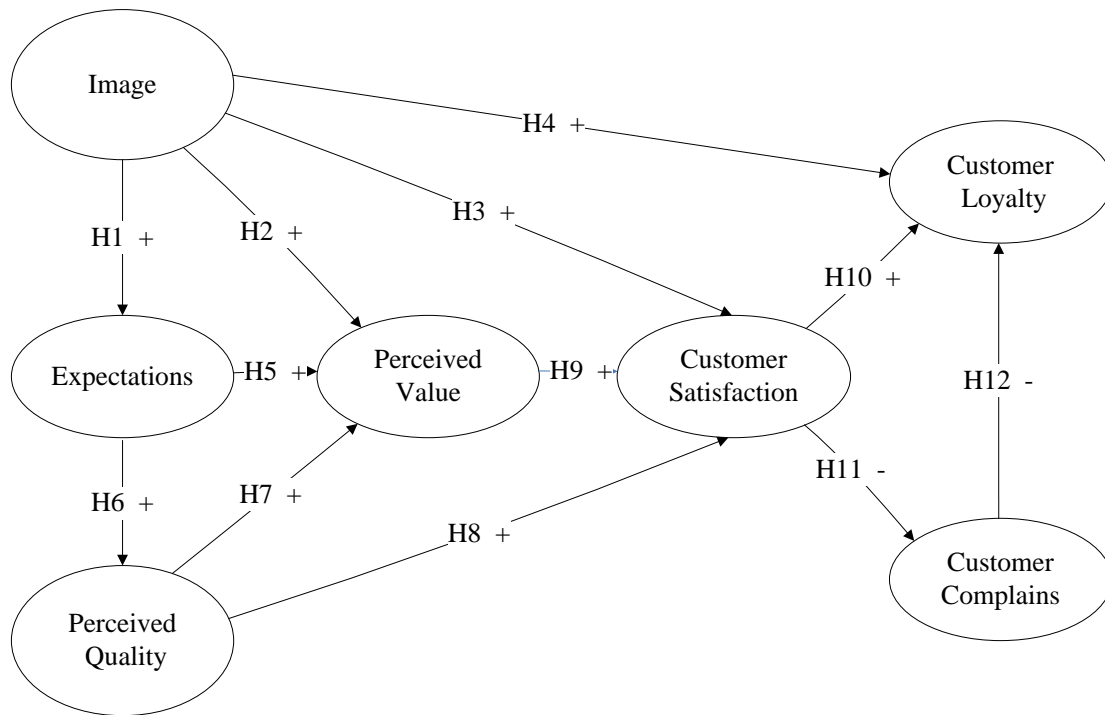


Figure 1: Research Model

3. Data Analysis

This study examined the factors associated with users’ employment of the RFID automated electronic rental system and their impact on user satisfaction and loyalty. Therefore, this study combined the ACSI and ECSI models proposed respectively by Fornell *et al.* (1996) and Cassel and Eklof (2001). We developed question items for each construct, and a formal questionnaire based on these items was verified by experts. We adopted a five-point Likert scale as the measurement for all questions.

This study selected individuals who had experience with renting “YouBike” bicycles in Taiwan as the research subject. Among a total of 156 questionnaires that were collected, 153 copies were valid samples, a return rate of 98 %. The overall reliability of the questionnaire Cronbach’s  $\alpha$  was 0.8, indicating a quite reliable internal consistency. Meanwhile, as the scale of this questionnaire was based on the ACSI and ECSI models established by Fornell *et al.* (1996) and Cassel and Eklof (2001), revised according to the research topic and verified by experts from the related fields, it has a certain level of content validity. Demographic data of the research subject in this study is shown in Table 2.

**Table 2: Descriptive Analysis of the Sample**

Items	Category	Sample size	%
Gender	Male	90	59 %
	Female	63	41%
Age	20 or under	11	7 %
	21~30	78	51%
	31~40	42	28 %
	41~50	19	12 %
	Over 50	3	2 %
Education	Junior high school and below	7	4 %
	High (vocational) school	27	18 %
	University/College	95	62 %
	Graduate School and above	24	16 %
Occupation	Students	32	21 %
	Military, civil, and teaching staff	16	10 %
	Service personnel	38	25 %
	Professionals in industry and commerce	47	31 %
	Doctor, lawyer, writer, etc.	8	5 %
	Agriculture, forestry, fishery, livestock farming	1	0.6 %
	Homemaker	5	3.4 %
	Other	6	4 %
Commonly used transportation method	Bicycle	12	8 %
	Scooter	55	36 %
	Car	22	14.3 %
	Bus	22	14.3 %
	MRT (mass rapid transit)	37	24 %
	Railway	5	3.4 %
	High speed rail	0	0
Monthly average frequency of bicycle rental	1-5	77	50 %
	6-10	29	19.3 %
	11-15	29	19.3 %
	16-20	8	5 %
	21-25	5	3.2 %
	More than 26	5	3.2 %
Major reason for employing this bicycle rental system	Transportation to work, school	16	10 %
	Commute over short distances	53	35 %
	Recreation and leisure	81	53 %
	Other	3	2 %
Region of Residence	Taipei City	63	41 %
	New Taipei City	62	40 %
	Other	28	19 %

We adopted a confirmatory factor analysis (CFA) to determine the fitness of the model and the casual relationship among the constructs. We portrayed the relational model and path diagram of the latent and observable variables using a structural equation model. The research model included seven constructs and twelve hypotheses in total, with the constructs involving one latent independent variable and six latent dependent variables. The confirmatory factor analysis conducted in the results show that the factor loading, error variance, and t-value of each question item in the study all fall within the intervals of an ideal value.

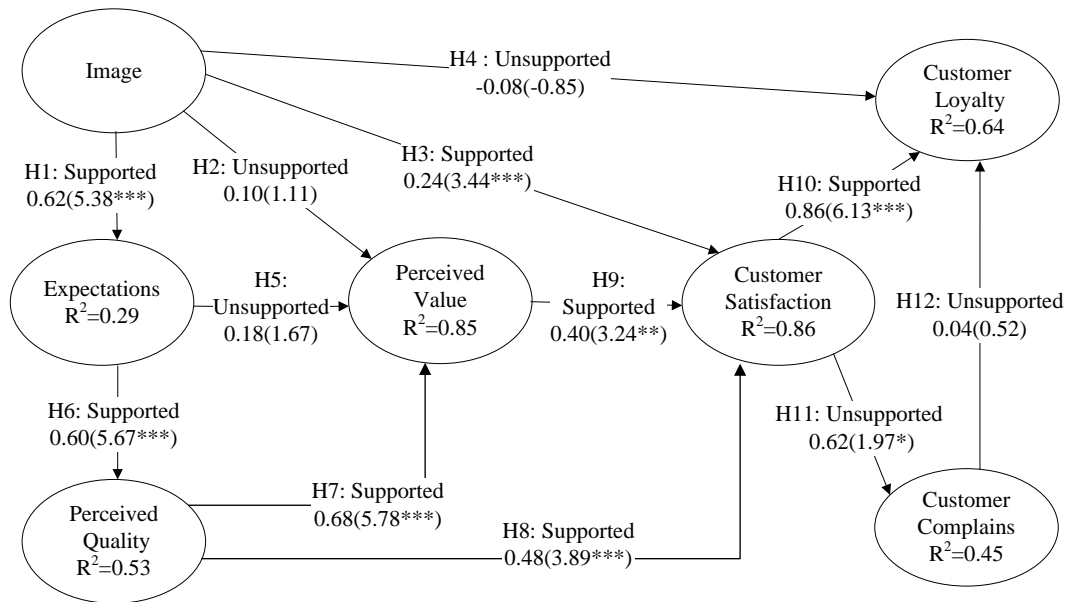
According to Bagozzi and Yi (1998), a complete evaluation on model fitness needs to be conducted on the different aspects of preliminary fit criteria, fit of the internal structure of the model criteria, and the overall model fit criteria. Results presented in Table 3 show that all three aspects of this study have satisfied the evaluation standard. Among all goodness of fit indexes in this study, only the goodness of fit index (GFI) and the adjusted goodness of fit index (AGFI) values of 0.77 and 0.73, respectively, were slightly lower than 0.8; all other indexes have satisfied the standard. Hair *et al.* (1995) believed that although it is better when GFI and AGFI are closer to 1, there is no definite standard. There is also no definite standard when using AGFI values; instead, different conditions of model complexity, variables, and sample size need to be taken into consideration. Huang (2004) suggested that the fitness of a research model should be determined based on the majority rule. Thus, overall, our research model has satisfactory goodness of fit.

**Table 3: Goodness-of-Fit Criteria and Test Results**

Measurement items	Criteria	Results
<b>Preliminary fit criteria</b>		
Factor loading	0.5-0.95	Partially compliant
Error variance	non-negative	Compliant
<b>Fit of internal structure of model criteria</b>		
IR (Individual item reliability)	> 0.5	Partially compliant
CR (Composite reliability)	> 0.6	Compliant
AVE (Average variance extracted)	> 0.5	Partially compliant
Parameter estimates	t-value > 1.96	Compliant
<b>Overall model fit criteria</b>		
$\chi^2$ /d.f. (normed Chi-square)	< 2	Compliant ( $\chi^2$ /d.f.=1.39)
GFI (Goodness of fit index)	> 0.8	Partially compliant (GFI=0.77)
AGFI (Adjusted goodness of fit index)	> 0.8	Partially compliant (AGFI=0.73)
RMR(Root mean square residual)	< 0.05	Compliant (RMR=0.005)

**4. Research Result**

This study proposed twelve hypotheses using the theoretical model of the LISREL test. The path coefficient and t-value of each hypothesis is presented in Figure 2.



**Figure 2: Path Coefficients and Relationships of Research Variables**

Notes: The figure below each hypothesis is the path coefficient, and the parenthesized value is the t-value. \* indicates that the t-value is greater than 1.96, p < 0.05; \*\* indicates that the t-value is greater than 2.58, p < 0.01; \*\*\* indicates that the t-value is greater than 3.29, p < 0.001.

According to our results, the “Image” of the executive authority of YouBike has a positive impact on user “Expectations” of, and “Customer Satisfaction” with YouBike; indicating that if the executive authority of YouBike can enhance its popularity, user expectations of YouBike before utilization should be significantly improved. Meanwhile, if the authority can earn the identification and favorable impressions of the general public, they would be able to promote YouBike without problems, to receive better evaluations from users, and to improve customer satisfaction. However, no significant correlation was found between the “Image” of the authority and users’ “Perceived Value” and “Customer Loyalty” regarding YouBike. It suggests that the overall value perceived by the users after employing YouBike is not affected by the overall image and reputation of the executive authority of YouBike. On the contrary, the functions or features that are considered by the users as necessary should be emphasized to attract more users. In addition, as YouBike is currently a brand-new mode of transportation for users, many of them are still unfamiliar with it; therefore, user loyalty to YouBike has not yet been completely established. Consequently, we suggest that the executive authority should strongly promote YouBike, increasing its exposure and enabling users to learn about its advantages, so that users’ perceived value of and customer loyalty to YouBike can be improved.

With regards to expectations, it was found that user “Expectations” of YouBike are not significantly correlated to their “Perceived Value” of it, but that it has a positive impact on “Perceived Quality.” The study shows that users tend to inquire into YouBike before renting a bicycle; thus, they build up expectations for YouBike before using it, which are later transferred to YouBike. Based on the collected information, users expect YouBike bicycles to be equipped with the functions or features the users have learned about. It can be concluded that the executive authority of YouBike should actively inquire into user preferences to satisfy their expectations. Our study discovered that users currently consider that the price of renting YouBike bicycles is slightly high, so their overall reviews of YouBike are not as anticipated. The executive authority of YouBike should place importance on this aspect.

This study also found that users’ “Perceived Quality” of YouBike has a positive impact on “Perceived Value” and “Customer Satisfaction”; there was also a positive effect of users’ “Perceived Value” of the executive authority on “Customer Satisfaction.” It suggests that, after renting a YouBike bicycle, if its functions or features meet user needs, users are likely to generate positive overall reviews of YouBike, and their overall satisfaction will be further affected.

With regard to “Customer Satisfaction,” results show that user “Customer Satisfaction” has a positive impact on “Customer Loyalty” and “Customer Complaints.” This result demonstrates that although YouBike is a new mode of transportation, users are mostly satisfied with its overall performance, resulting in their inclination to continue using YouBike bicycles and indicating gradually established customer loyalty. Our survey shows that though users are satisfied with YouBike, they tend to have complaints about it, and propose relevant suggestions to the executive authority, for they hope that YouBike can continue to improve on its shortcomings. Peng (2008) also indicated that customer complaints are inevitable no matter how satisfying a customer service is. Companies should not regard the level of customer complaints as the single indicator for the quality of their services. A more accurate concept is that service personnel should fulfill their duties to increase customer satisfaction, while customer complaints are taken care of through a formal channel.

Finally, no significant correlation was found between “Customer Complaints” about YouBike and “Customer Loyalty.” When a formal complaint management system operates properly, customer complaints will not be a major factor associated with customer loyalty. Therefore, when users are dissatisfied with YouBike and generate complaints, if a reporting channel exists and service personnel can respond appropriately, allowing users to appreciate their sincerity, the drain of customers due to customer complaints can be eased.

## **5. Conclusions**

In the hope of achieving the objectives of energy saving, carbon reduction, and protection of the environment, the Taipei City government in Taiwan has developed “YouBike,” a public commuter bicycle rental system of low pollution and energy consumption as a mode of transportation over short distances. Combining the ACSI and the ECSI, this study examined customer satisfaction and customer loyalty to YouBike among the Taiwanese general public.



Our research results show that users are mostly satisfied with YouBike. The most important factor affecting user satisfaction with YouBike is users' perceived quality of YouBike, followed by the image of YouBike. It is thus indicated that user satisfaction with YouBike is influenced by the image of the executive authority of YouBike, and their actual feelings when using YouBike bicycles. Accordingly, we suggest that the executive authority of YouBike should strongly promote its use and actively advocate the slogans of energy saving, carbon reduction, and environmental protection to establish an environmentally-friendly image and earn the trust of the general public. In addition, the executive authority of YouBike should learn about actual user needs; they should present the features or functions of the bicycles so as to enhance user appreciation. We believe that doing so will encourage public intention to employ YouBike bicycles and improve customer satisfaction. This study also discovered that users believe that the price of YouBike bicycles should be reduced and more precise instructions for the rental system should be provided, so that the general public can employ YouBike bicycles without problems. Furthermore, public opinion suggests that if users can be affected by the sincerity of service personnel, their satisfaction can be enhanced and their loyalty established. Accordingly, we believe that the executive authority of YouBike should value user suggestions and respond actively to customer complaints so that users will continue to use this bicycle rental system and develop customer loyalty.

With these results, this study expects to provide the executive authority of YouBike with a direction for future improvement, so they can effectively improve user satisfaction and loyalty; thus attracting more individuals to rent YouBike bicycles, and further accomplishing a concrete action towards the goal of environmental protection.

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