

Effects of Perceived Benefits and Perceived Costs on Passenger's Intention to Use Self-ticketing Kiosk of Taiwan High Speed Rail Corporation

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Abstract: Firms are incorporating self-service technologies into their operations, which result cost savings. But the cost savings cannot be accomplished unless customers embrace and use these new services. Taiwan High Speed Rail Corporation (THSRC) collaborated with 7-Eleven for the self-ticketing system-ibon. But the utilization was not as expected. Thus, this study was exploring the factors which influence THSR passenger's acceptance toward ibon ticketing system. We apply and extend the technology acceptance model (TAM) to determine the external variables of intention to use self-ticketing system. We added four key constructs (two related to perceived benefits and two related to perceived costs) as external variables to the TAM. Further apply structural equation modeling to test the predictions, the research results showed that the perceived benefits (monetary benefits and non-monetary benefits) and perceived costs (monetary costs and non-monetary costs) had influence on the intention to use ibon. This study also proposed some managerial implications and suggestions for future research.

KeyWords: perceived benefits, perceived costs, self-ticketing, Taiwan High Speed Rail Corporation, technology acceptance model

1. INTRODUCTION

Nowadays, many firms are incorporating self-service technologies into their operations, which result cost savings. But the cost savings cannot be accomplished unless customers embrace and use these new services. The firms may tremendous investing in both time and money to design, implement, maintain, and manage these self-service technologies. A wide range of SSTs options are available, but most consumers use only a few of them (Barczak et al. 1997). In order to increase the service efficiency, reduce personnel costs and human error for high speed rail station, and release the crowds of the ticket window during the rush hours, Taiwan High Speed Rail Corporation (THSRC) collaborated with 7-Eleven for the self-ticketing kiosks (ibon). Passengers can buy the tickets via ibon in 7-Eleven convenience stores. However, THSRC investigated the ticket purchase behavior of passengers and found that the rate of ibon utilization was low, which doesn't meet their expectation. Thus, it is critical for THSRC to understand the behavioral and psychological issues related to passengers' reactions to these self-ticketing kiosks.

There are many researchers focus on the adoption of new technology service or product. Davis (1989) proposed Technology Acceptance Model (TAM) which shows that perceived usefulness and perceived ease of use affect the individual's attitude toward and use of that technology service or product. And, it has received empirical support via numerous studies (Venkatesh and Davis, 1996; 2000; Igarria et al., 1995; Lin and Lu, 2000; Petrus and Nelson, 2006). Researchers keep exploring whether the TAM's variables are mediators of the effect of external variables and which external variables are important in spite of a great number of supports for the TAM (Venkatesh, 2000; Venkatesh and Brown, 2001). It means that the external variables of TAM among services or products may different from each other or the external variables of TAM are not always invariably. Hence, it is necessary to exploring the external variables appropriate for the ibon ticketing kiosks.

Passengers may evaluate both pro and con of buy ticketing via ibon ticketing kiosks and then decide use it or not. Prior researches show that cost, such as perceived access barriers which related to technology, could influence the use of personal technology (Hoffman et al., 2000; Venkatesh and Brown, 2001). And vast researchers focus on the effects of benefit, such as perceived system performance which related to technology, on the usage of technology (Davis, 1989; Venkatesh and Davis, 1996; 2000). Nevertheless, either benefit or cost related to the behavior of buying tickets via self-ticketing kiosks or promotion tactics, such as discount and surcharge, rarely been discussed in the previous research. These benefits and costs could also influence the willingness of using self-ticketing kiosks via either perceived usefulness or perceived ease of use. For example, the color of the mobile is not related to the function of mobile, but consumer may evaluate the mobile with red color is more useful than the mobile with black color when they prefer the red color.

Thus, the purpose of this research is discuss the THSR passenger's acceptance toward ibon ticketing kiosks and exploring whether the TAM's variables are mediators of the effect of perceived benefits and perceived costs, and which external variables (benefits and costs) are important. We also conclude the research by discussing its theoretical and managerial implications.

2. LITERATURE REVIEW AND HYPOTHESES

2.1 Self-ticketing Kiosk of THSRC

On April 21st 2010, Taiwan High Speed Rail Corporation (THSRC) provided a service that passengers can buy tickets via self-ticketing kiosk (ibon) in the President Chain Store Corporation (7-Eleven). The service increases not only the location where passengers can buy and get the tickets by themselves, but also convenience.

The ibon, of President Chain Store Corporation, provides ticket booking, paying and issuing service (not including non-reserved seat, group ticket and handicap-friendly seats), with 10 NTD charged for each. THSRC added refund service on ibon on June 1st, 2012. The refund service is available 30 minutes before the departure time and can be done through the process on ibon and counter in 7-Eleven with 20 NTD charged for each. To attract more customers to use ibon service, this reduces the human resource cost and shortens the lines in the station, 7-Eleven dominants the series of marketing strategy. With the counterfoil, customers can have "buy one and get one for free" discount in Starbucks, "buy the large size and get a small size for free" discount in ColdStone, and etc.

There are some ways that passenger could obtain the THSRC tickets, show in Table 1. Passengers could make reservation for the seat on the web site, or form convenience stores (ibon), or via mobile software (T express), or interactive voice response service, or kiosk and ticket booth in the station. And then, they could collect paper tickets from the ticket booth in station, self-ticketing kiosk in station, convenience stores, and obtain virtual (QR code) tickets form the mobile software. However, purchasing the tickets from the ticket booth in the station is the only way for passenger to choose the prefer seat type (window or aisle). And only adult tickets and children tickets are available at the ticketing kiosk in the station. The alliance promotion, such like discount for the Starbucks coffee shop, Coldstone ice cream store and so on, only apply to the tickets collecting from the convenience store (ibon). Furthermore, there is the situation of queue length occur at the ticket booth and kiosk in the station frequently.

Table 1 the channels of obtaining THSRC ticket

Type of ticket	Collecting channel	Reservation channel
Physical paper ticket	Ticket booth in the station	<ul style="list-style-type: none"> ● Ticket booth in the station ● Kiosk in the station ● Web site (online) ● Voice response service (call) ● Convenience store (ibon) ● Mobile (T express)
	Kiosk in the station	<ul style="list-style-type: none"> ● Kiosk in the station ● Web site (online) ● Voice response service (call) ● Convenience store (ibon) ● Mobile (T express)
	Convenience store (ibon)	<ul style="list-style-type: none"> ● Web site (online) ● Voice response service (call) ● Convenience store (ibon) ● Mobile (T express)
Virtual (QR code) ticket	Mobile (T express)	<ul style="list-style-type: none"> ● Web site (online) ● Voice response service (call) ● Convenience store (ibon) ● Mobile (T express)

2.2 Perceived Benefit and Perceived Cost of Buying Tickets via ibon Kiosks

There are many researchers focus on the antecedents of intention to use the self-service technology, such like enjoyment (Davis, Bagozzi, and Warshaw 1992), perceived fun (Weijters, Rangarajan, Falk, and Schillewaert 2007), technology readiness (Parasuraman 2000), Perceived risk (Ellen, Bearden, and Sharma 1991), Technology anxiety (Parasuraman 2000), and Need for interaction (Dabholkar 1996). And the previous use of related technology will increase perceived of self-confidence and ability and may further influence on the intention to use the technology (Bowen 1986; Mohr and Bitner 1991). However, our research concentrated on the perceived benefits (e.g. promotion, location, etc.) and perceived costs (e.g. handle fees, risk of keeping tickets, etc.), which are not directly related to the function of ticketing system, affect passengers purchasing behavior. There were various definitions of external

variables influence consumers' using intention in the past; the definition would depend on each research. This study intends to discuss the factors that passengers of THSR use ibon to buy tickets then compare the strength between the factors. Through a survey, we found that promotion and convenience account for higher proportion that can increase customers' willingness to use ibon. On the other hand, money and risk costs are the main reason that has negative influence. Therefore, this study divides the external variables into two dimensions: benefits and costs.

For the benefits, functional benefit, providing customers with functional utility, includes saving time, providing popular suggestions or buying decisions, exchanging useful information, and possessing convenience (Jin, Park & Kim, 2010; Marzo-Navarro et al., 2004; Reynolds & Beatty, 1999). Emotional benefit is according to consumers' emotion. It provides customers with a positive feeling when they purchase or use a particular brand (Aaker, 1999). Chen (2008) found that adding benefits would have a stronger effect on purchase intention for his research about internet marketing and perceived purchase benefits on consumers' purchase intentions.

For the costs, transaction costs are the cost of using the price mechanism or the cost of carrying out a transaction by means of an exchange on the open market (Coase, 1937). In Chen (2003)'s research "the usage intention on personalized services provided by online bookstores", she proved that transaction costs influence the using intention.

2.3 Technology Acceptance Model

In 1986, Davis proposed the Technology Acceptance Model (TAM). TAM is based on Fishbein and Ajzen's Theory of Reasoned Action (TRA), which examines the relationship between attitudes and behavior. TAM can assess and predict user's acceptance and usage of new information technology. There are five influencing factors in the model: external variables, perceived usefulness, perceived ease of use, attitude toward use, and intention to use. Davis asserts that external variables will affect perceived usefulness and ease of use, while perceived usefulness and ease of use influence attitude, which in turn influence behavioral intention. The model is shown in Figure 1.

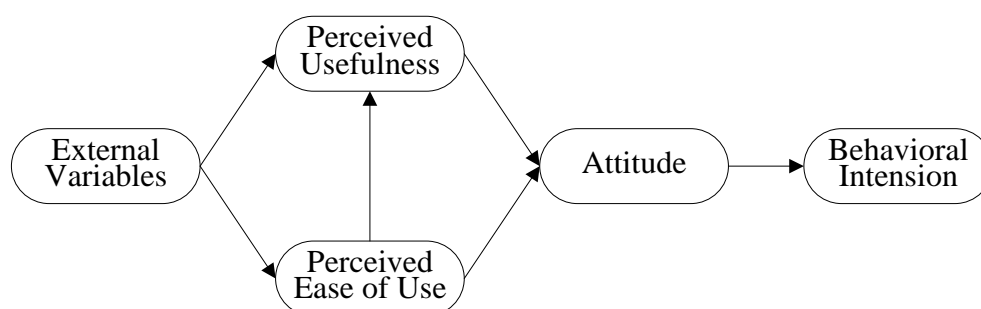


Figure 1 TAM Model

According to the references above, this study classified the promotion for ibon ticketing as monetary benefits, and the convenience of using ibon ticketing system as non-monetary benefits. Davis (1989) TAM shows that external variables have directly influence on perceived usefulness and perceived ease of use. This study proposes H₁

and H₂ hypotheses as follows:

H₁: Perceived benefits have a positive effect on perceived usefulness.

H_{1a}: Perceived monetary benefits have a positive effect on perceived usefulness.

H_{1b}: Perceived non-monetary benefits have a positive effect on perceived usefulness.

H₂: Perceived benefits have a positive effect on perceived ease of use.

H_{2a}: Perceived monetary benefits have a positive effect on perceived ease of use.

H_{2b}: Perceived non-monetary benefits have a positive effect on perceived ease of use.

For this study, we further divided perceived costs into two parts: monetary costs and non-monetary costs. Passengers' may perceive monetary and non-monetary costs while using ibon ticketing system. Monetary costs includes the handling fee when making payment or refunding. Non-monetary costs include the perceived risk that passengers keep the tickets after buying it. Thus, we propose H₃ and H₄ hypotheses as follows:

H₃: Perceived costs have a negative effect on perceived usefulness.

H_{3a}: Perceived monetary costs have a negative effect on perceived usefulness.

H_{3b}: Perceived non-monetary costs have a negative effect on perceived usefulness.

H₄: Perceived costs have a negative effect on perceived ease of use.

H_{4a}: Perceived monetary costs have a negative effect on perceived ease of use.

H_{4b}: Perceived non-monetary costs have a negative effect on perceived ease of use.

According to Davis (1989) TAM, if a user percept that the use of tech-product is easy and simple and then using the tech-product will enhance the performance. This study proposes H₅ hypothesis as follows:

H₅: Perceived ease of use has a positive influence on perceived usefulness.

According to Davis (1989) TAM, if a user percept that using the tech-product can enhance the performance, and then he will feel more positive while using it. This study proposes H₆ hypothesis as follows:

H₆: Perceived usefulness has a positive influence on attitude toward use.

According to Davis (1989) TAM, if a user percept that the use of tech-product is easy and simple, then he will feel more positive while using it. This study proposes H₇ hypothesis as follows:

H₇: Perceived ease of use has a positive influence on attitude toward use.

According to Davis (1989) TAM, if a user feel more positive while using the tech product, then he has more intention to use it. This study proposes H₈ hypothesis as follows:

H₈: Attitude has a positive influence on behavioral intention.

Base on the literature reviews stated above, this study proposes a research model (as shown in Figure 2). The research model is used to examine four key constructs (two related to perceived benefit and two related to perceived cost) as external variables to the TAM. The model suggests that the TAM's variables are mediating the relationships between external variables (perceived benefits and perceived costs) and attitude toward the ibon self-ticketing kiosks.

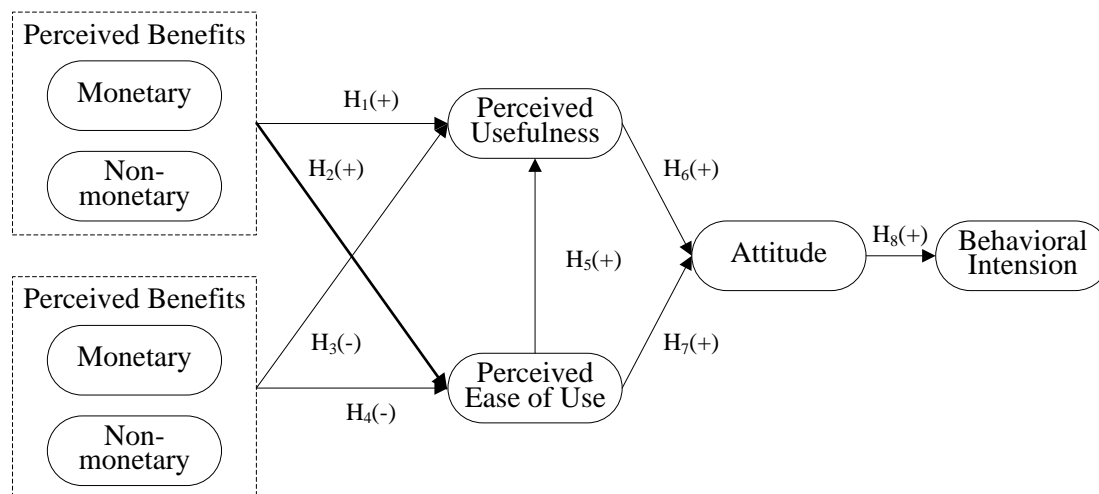


Figure 2 Research model

3. RESEARCH METHOD

3.1 Measurement

This study employed thirty-two manifest variables as multiple indicators for eight latent variables in the research model. A Likert five-level scale is applied to all questions to allow subjects to rate each construct variable (1 stands for “strongly disagree” and 5 for “strongly agree”).

This study defined external variables as two categories, perceived benefits and perceived costs, and further divided into four constructs: perceived monetary benefits, perceived non-monetary benefits, perceived monetary costs, and perceived non-monetary costs. Perceived monetary benefits indicate that passengers can obtain or feel the monetary related benefit if they buying the tickets via ibon ticketing system. This study referred to Kao (2004), and defined the monetary benefits as price reduction, coupon, and conditional sale. Then designed the four questions, including “It’s favorable buying THSR tickets through 7-11 ibon if I can get a ticket discount”, “It’s favorable using 7-11 ibon to buy THSR tickets if it contains no surcharge”, “It’s favorable purchasing THSR tickets through 7-11 ibon and meanwhile get a 7-11 product coupon”, and “It’s favorable using 7-11 ibon to buy HSR tickets and can get a buy one coffee get one coffee free coupon”. And this study designed five questions, including “Location of the ibon system is near my living space”, “I can find out where ibon is available pretty fast”, “It’s helpful that the amount of location of ibon is greater”, “It’s time-saving to use ibon buying the tickets“, and “It’s fast to use ibon buying the tickets” to measuring non-monetary benefits which express the benefits passengers from buying tickets via ibon ticketing system and these benefits are not

related to the monetary gain.

External variables-perceived costs denotes the costs passengers have to spend or take if they using ibon ticketing system. This study defined the monetary costs as the extra fee of using ibon compared to buying the tickets in the station and designed three questions, including “It’s a burden that buying and canceling the ticket require surcharge”, “I think it’s an extra payment that buying ticket through ibon requires surcharge”, and “It’s unnecessary to charge money with cancelation of tickets through ibon”. For non-monetary costs, this study referred to Tsaur and Wang (2001), and designed four questions, including “I may worry about losing the tickets bought form ibon”, “The tickets from ibon are easily ruined”, “The tickets from ibon are hard to keep”, and “I think it’s pretty annoying that I need to keep the tickets after buying them”.

In regard to perceived usefulness, according to Davis (1989), this study designed four questions, including “Buying tickets through ibon reduces my inconvenience”, “It’s efficient to buy tickets through ibon”, “ibon system can simplify the process of purchasing”, and “In general, I think ibon self-ticketing system is useful”.In regard to perceived ease of use, according to Davis (1989), this study designed four questions, including “The operation of ibon ticketing system is easy to learn”, “The interface of ibon ticketing system is understandable”, “I can easily conduct my purchase via ibon”, and “Overall, I think the ibon ticketing system is easy to use”.

In regard to attitude toward use, refer to Fishbein and Ajzen (1975) and Liu (2006), this study defined it as the degree of positive or negative preference that passengers of Taiwan high speed Rail toward ibon ticketing system. Then designed four questions, including “It’s a good idea to buy tickets through ibon”, “I find it easy and fun during my purchase via ibon”, “I like to use ibon to buy tickets”, and “I think ibon ticketing system is a convenient way of buying tickets”.

For behavioral intention to use, this study defined it as the behavior intention of using ibon ticketing system (Davis, 1989; Fishbein and Ajzen, 1975; Liu, 2006). Then designed four questions, including “I prefer to use ibon to make my purchase although there may be a queue“, “I am willing to use ibon ticketing system next time”, “I will recommend others to use ibon ticketing system”, and “Overall, I am willing to use ibon to buy tickets”.

3.2 Data Collection

This research conducted a questionnaire survey of the passengers of THSR at Hsinchu station. In order to let passengers have ample time and more willingness to fill the questionnaire, the survey was conducted in the seating area. The survey period was across one week including weekend and weekday. This study applied structural equation modeling (SEM) to test the hypotheses and our research model. In general, the sample size should be large than 200 in order to reduce the sampling error (Hatcher, 1998). This study dispatched total 334 copies at Taipei and Taoyuan THSR stations in order for meet the basic requirements for SEM to be valid.

3.3 Analysis

The paths in the research model were analyzed using structural equation modeling (SEM). Analysis followed a two-step procedure based partly on the approach recommended by Anderson and Gerbing (1988). The first step applied confirmatory factor analysis (CFA) to develop a measurement model that has an acceptable fit to

data. The second step then tests the theoretical model (or structural model) via path analysis to ensure that the structural model is meaningful and statistically acceptable.

Technically, the chi-square test may be statistically insignificant for a better fitness in SEM analysis. However, in practice, the chi-square test is extremely sensitive to sample size and departures from multivariate normality, frequently resulting in rejection of a well-fit model (Hoyle, 1995). Therefore, chi-square/degree-of-freedom (df) ratio can be used as an index of goodness-of-fit (James et al., 1982; Jöreskog and Sörbom, 1993). The acceptable chi-square/df ratio is less than 5 (less than 3 is better) (Jöreskog and Sörbom, 1993; Hatcher, 1998). Many fitness indices exist, such as goodness of fit index (GFI), GFI adjusted for degrees of freedom (AGFI) should exceed 0.8. Notably, root mean square residual (RMR) should be less than 0.08, and root mean square error of approximation (RMSEA) should be less than 0.05 (Hatcher, 1998).

4. RESULTS

4.1 Sample and Reliability Analysis

This survey dispatched total 334 questionnaires and got 322 copies recovered and valid. The effective sample recovery rate was 96.4%. Among the sample structure shown in Table 2, female is more than male (55.72%), most respondents were between 20~29 years old (51.50%). Other jobs, students and service industry were 29.82%, 27.41% and 25.90%. 227 respondents (68.37%) has ever used ibon to buy THSR tickets. 172 respondents (51.81%) directly used ibon to buy tickets and 54 respondents (16.26%) were booking by other ways (online or mobile phone) then get tickets via ibon ticketing system.

Table 2 Sample

Sex	Number	%	Average monthly rides	Number	%
Female	185	55.72%	Once or less	154	46.39%
Male	147	44.28%	2~4	125	37.65%
			5 above	53	15.96%
Age	Number	%	Purpose of trip	Number	%
Under 19	24	7.22%	Business	72	21.69%
20~29	171	51.50%	Travel	59	17.77%
30~39	99	29.82%	Work	50	15.06%
40~49	25	7.53%	Home	67	20.18%
50~59	12	3.61%	Visit	24	7.23%
60 above	1	0.30%	Others	60	18.07%
Job	Number	%	Ever use ibon or not	Number	%
Student	91	27.41%	yes	227	68.37%
Service	86	25.90%	No	103	31.02%
Public servant	39	11.75%	No answer	2	0.60%
Household	6	1.81%	The way to use	Number	%
Own business	11	3.31%	Directly use ibon to buy	172	51.81%
Others	99	29.82%	Booking by other ways	54	16.26%
			No answer	106	31.93%

4.2 Confirmatory Factor Analysis

The measurement model was tested by confirmatory factor analysis (CFA), and the quality of the measurement model was assessed on relative model fit index, reliability, convergent validity, and discriminant validity. This research demonstrates measurement reliability using Conbach’s α and composite reliability. For perceived monetary benefits, perceived non-monetary benefit, perceived monetary costs, perceived non-monetary costs, perceived usefulness, and perceived costs, the reliability coefficients (Conbach’s α) presented in the questionnaire were 0.726, 0.873, 0.824, 0.829, 0.901, 0.919, 0.869, and 0.853 respectively. All the values of Cronbach’s α were greater than 0.7. Thus, this means all constructs adopted in this research are highly reliable.

There are eight latent variables in the measurement model: perceived monetary benefits, perceived non-monetary benefits, perceived monetary cost, perceived non-monetary costs, perceived usefulness, and perceived ease of use, attitude, and behavioral intention. The results of measurement model fitness indices are shown in Table 3.

Table 3 Result of measurement model fitness indices

	Chi-square	<i>df</i>	Chi-square/ <i>df</i>	GFI	AGFI	RMR	RMSEA
M ₀	733.701	436	1.681	0.862	0.832	0.170	0.045
M ₁	442.427	296	1.495	0.901	0.874	0.053	0.039

Note: M₀ is the initial model; M₁ is the adjusted model

Confirmatory factor analysis is primarily used to validate or confirm the attribute of parameters in the factor analysis or the number of factors involved. The results of measurement model fitness indices prior to adjustment are shown as Table 2. In the initial model (M₀), the ratio of Chi-square/*df* is less than 3 that mean a good fitness. However, the RMR is large than 0.08. It means that the fitness indices of initial model (M₀) are not good enough. In the measurement model, each indicator variable is predicted to load just one factor; that is, none of the indicators are complex variables (measuring multiple latent variables; Hatcher, 1998). According to the Lagrange multiplier test, V₀₅ and V₀₆ should be the measurable variable of non-monetary benefits, V₂₄ should be the measurable variable of perceived ease of use, V₂₆ should be the measurable variable of attitude, and V₂₉ should be the measurable variable of behavioral intention. However, V₀₅, V₀₆, V₂₄, V₂₆, and V₂₉ also had relationship with other construct variables, that means V₀₅, V₀₆, V₂₄, V₂₆, and V₂₉ are complex variables (measuring multiple latent variables) and should be removed from the measurement model (Hatcher, 1998). After modification which removed the complex variable V₀₅” Location of the ibon system is near my living space”, V₀₆” I can find out where ibon is available pretty fast“, V₂₄” Overall, I think the ibon ticketing system is easy to use”, V₂₆,”I find it easy and fun during my purchase via ibon”, and V₂₉” I prefer to use ibon to make my purchase although there may be a queue”, the Chi-square/*df* of M₁ was fallen to 1.495. In addition, GFI, AGFI, have closed to 0.9. RMSEA was under 0.05 and the RMR was below 0.05. According to the results, the indices show that acceptable fitness of measurement model after adjusted.

The result of measurement model characteristic analysis is shown in Table 3. All of the standardized factor loadings are statistically significant, and above the threshold of 0.5. The results of composite reliability assessment, in each constructs also

suggested an acceptable reliability with composite reliability estimates ranging from 0.746 (perceived monetary benefits) to 0.933 (perceived ease of use). Hatcher (1998) suggests that the minimally acceptance level of composite reliability should exceed 0.6. Thus, this also means all constructs adopted in this research are highly reliable. The research further estimate the average variance extracted (AVE), which assess the amount of variance that is capture by an underlying construct in relation to the amount of variance due to measurement error (Fornell and Lacker 1981). All estimations of AVE in Table 4 exceed the threshold of 0.5 suggesting by Fornell and Lacker (1981). Therefore, in the consideration for all constructs, we can infer that our measurement model performs fairly well.

Table 4 Analysis of measurement model

Construct	Standardized factor loading	Composite reliability	Average Variance Extracted
Perceived monetary benefits (PMB)		0.746	0.531
V ₀₁ It's favorable buying THSR tickets through 7-11 ibon if I can get a ticket discount	0.579***		
V ₀₂ It's favorable using 7-11 ibon to buy THSR tickets if it contains no surcharge	0.706***		
V ₀₃ It's favorable purchasing THSR tickets through 7-11 ibon and meanwhile get a 7-11 product coupon	0.736***		
V ₀₄ It's favorable using 7-11 ibon to buy HSR tickets and can get a buy one coffee get one coffee free coupon	0.576***		
Perceived non-monetary benefits (PNB)		0.861	0.717
V ₀₇ It's helpful that the amount of location of ibon is greater	0.626***		
V ₀₈ It's time-saving to use ibon buying the tickets	0.891***		
V ₀₉ It's fast to use ibon buying the tickets	0.922***		
Perceived monetary costs (PMC)		0.824	0.667
V ₁₀ It's a burden that buying and canceling the ticket require surcharge	0.681***		
V ₁₁ I think it's an extra payment that buying ticket through ibon requires surcharge	0.793***		
V ₁₂ It's unnecessary to charge money with cancelation of tickets through ibon	0.862***		
Perceived non-monetary costs (PNC)		0.861	0.666
V ₁₃ I may worry about losing the tickets bought from ibon	0.758***		
V ₁₄ The tickets from ibon are easily ruined	0.848***		
V ₁₅ The tickets from ibon are hard to keep	0.763***		
V ₁₆ I think it's pretty annoying that I need to keep the tickets after buying them	0.747***		
Perceived usefulness (PU)		0.910	0.750
V ₁₇ Buying tickets through ibon reduces my inconvenience	0.806***		
V ₁₈ It's efficient to buy tickets through ibon	0.899***		
V ₁₉ ibon system can simplify the process of purchasing	0.872***		
V ₂₀ In general, I think ibon self-ticketing system is useful	0.809***		
Perceived ease of use (PE)		0.933	0.837
V ₂₁ The operation of ibon ticketing system is easy to learn	0.950***		
V ₂₂ The interface of ibon ticketing system is understandable	0.933***		
V ₂₃ I can easily conduct my purchase via ibon	0.836***		
Attitude (AT)		0.836	0.683
V ₂₅ It's a good idea to buy tickets through ibon	0.743***		
V ₂₇ I like to use ibon to buy tickets	0.832***		
V ₂₈ I think ibon ticketing system is a convenient way of buying tickets	0.806***		
Behavioral Intention (BI)		0.900	0.777
V ₃₀ I am willing to use ibon ticketing system next time	0.908***		
V ₃₁ I will recommend others to use ibon ticketing system	0.814***		
V ₃₂ Overall, I am willing to use ibon to buy tickets	0.875***		

Note : ***indicates t-test has reached the significance level (p < 0.001)

With the regard to discriminant validity, which show in the Table 5 should be greater than the variance shared between the construct (Fornell and Lacker 1981). The results suggest that the measurement model has adequate discriminant validity, because the average variance extracted by each of the scales was greater than the shared variance between the construct and all other constructs.

Table 5 Discriminant validity

	PMB	PNB	PMC	PNC	PU	PE	AT	BI
PMB	0.729							
PNB	0.372	0.847						
PMC	0.100	0.077	0.817					
PNC	0.083	-0.207	0.255	0.816				
PU	0.348	0.671	-0.050	-0.245	0.866			
PE	0.337	0.637	-0.111	-0.268	0.857	0.915		
AT	0.358	0.708	-0.080	-0.289	0.822	0.806	0.826	
BI	0.395	0.591	-0.187	-0.322	0.720	0.668	0.825	0.881

The **bold** numbers on the diagonal are the square roots of the AVE. Off-diagonal elements are correlations among constructs.

4.3 Path Analysis

Path analysis was used to test our casual structural model with 8 hypotheses (H₁~H₈). The result of structural model fitness indices are shown in Table 6. The ratio of Chi-square/*df* was 1.556 which was smaller than 3. Though GFI and AGFI were closed to 0.9 in accepted range for exceed 0.8. The RMR was below 0.08 and RMSEA was below 0.05. Overall, this structural model met the required standards and had acceptable fitness.

Table 6 Result of structural model fitness indices

Chi-square	<i>df</i>	Chi-square/ <i>df</i>	GFI	AGFI	RMR	RMSEA
476.171	306	1.556	0.893	0.868	0.060	0.041

The number of path coefficient amongst the latent variables is shown in Table 7 and Figure 3. As a rule, that t-value exceeds 1.96 means it reaches the significance level, and the hypotheses is supported. For external variables, the path estimates showed that non-monetary benefits had a positive impact on perceived usefulness, monetary benefits had a positive impact on perceived ease of use, non-monetary benefits had a positive impact on perceived ease of use, monetary costs had a negative impact on perceived ease of use, and non-monetary costs had a negative impact on perceived ease of use. Furthermore, perceived usefulness and perceived ease of use are the antecedences of attitude, and attitude had a positive impact on behavioral intention. Most of the path coefficients were consistent with the predictions in this study, besides three external variables didn't have significant influence on perceived usefulness. Thus, the results validated hypotheses H_{1b}, H_{2a}, H_{2b}, H_{4a}, H_{4b}, H₅, H₆, H₇, and H₈, except for H_{1a}, H_{3a} and H_{3b}.

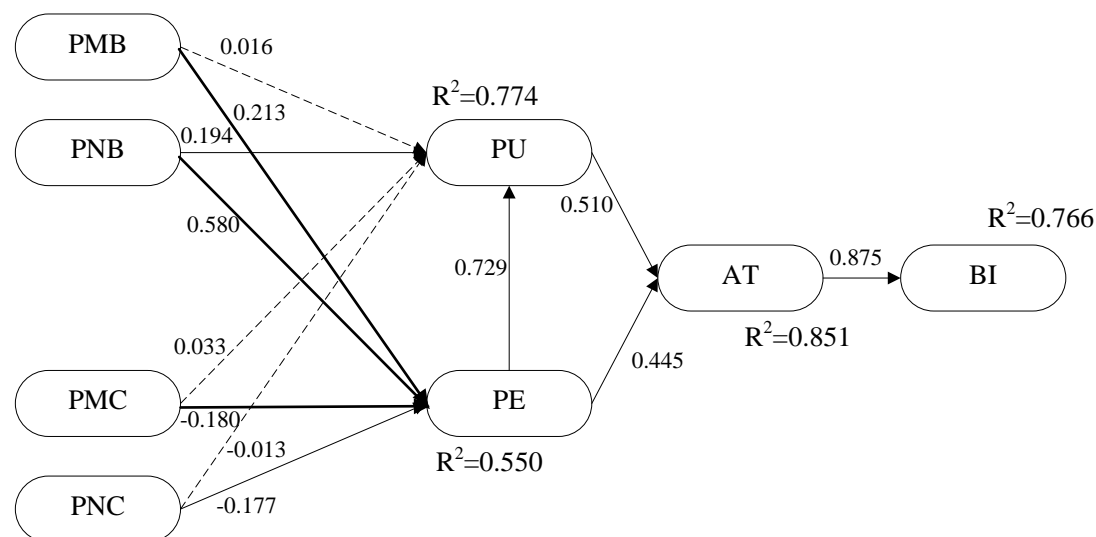
Table 7 Path analysis of research model

	Standardized path coefficients	t-value
H _{1a} : Monetary benefits→ Perceived usefulness	0.016	0.273
H _{1b} : Non-monetary benefits→ Perceived usefulness	0.194*	2.359
H _{2a} : Monetary benefits→ Perceived ease of use	0.213**	3.041
H _{2b} : Non-monetary benefits→ Perceived ease of use	0.580***	6.473
H _{3a} : Monetary costs→ Perceived usefulness	0.033	0.683
H _{3b} : Non-monetary costs→ Perceived usefulness	-0.013	-0.252
H _{4a} : Monetary costs→ Perceived ease of use	-0.180**	-3.170
H _{4b} : Non-monetary costs→ Perceived ease of use	-0.177**	-2.795
H ₅ : Perceived ease of use→ Perceived usefulness	0.729***	6.910
H ₆ : Perceived usefulness→ Attitude	0.510***	3.742
H ₇ : Perceived ease of use→ Attitude	0.445**	3.277
H ₈ : Attitude→ Behavioral Intention	0.875***	11.723

Note : ***indicates t-test has reached the significance level $p < 0.001$;

**indicates t-test has reached the significance level $p < 0.01$;

*indicates t-test has reached the significance level $p < 0.1$



(The dotted line indicates t-test doesn't reach the significance level of $p < 0.1$)

Figure 3 Results of structural model

The results show that non-monetary benefits exhibited significant directly influence on perceived usefulness. And perceived ease of use is the mediators of the effect of monetary benefits, monetary costs, and non-monetary costs on perceived usefulness. Moreover, perceived benefits had more influence on perceived ease of use than perceived costs. The total effect of perceived ease of use on attitude was 0.817 (indirect effect: 0.729×0.510 ; direct effect: 0.445), and perceived usefulness on

attitude was 0.510.

5. CONCLUSIONS AND DISCUSSIONS

In conclusion, the model structure presented in this research has been faithfully tested. The data supports the most relationships among the six variables through the causal paths of eight hypotheses. According to the research results, perceived benefits (either monetary or non-monetary) and perceived costs (either monetary or non-monetary) are important external variables influence the passengers' behavioral intention of using ibon ticketing system. And the TAM's variables are mediators of the effects of perceived benefits and perceived costs. The influence of benefits on behavior intention is greater than the costs either mediated by perceived usefulness or mediated by perceived ease of use.

Among the relationships between external variables and TAM's variables, only non-monetary benefits had directly influence on perceived usefulness. It means that more locations of ibon and more time saving may make passengers perceived usefulness of ibon and further to using it. Moreover, both promotion activities (monetary benefits) and convenience of ibon (non-monetary benefits) had positively influence on passengers perception of weather ibon is easy to use. For benefits cost, both surcharge of buying ticketing and risk of keeping ticketing had negative influence on passengers perception of weather ibon is easy to use. And the influence of benefits on perceived ease of use is larger than the influence of costs on perceived ease of use. Thus, when THSRC plan to increase the rate of ibon utilization, it is better to increase convenience of ibon and promotion activities than decreasing the keeping risk of ticketing and surcharge of buying tickets.

Nevertheless, the effects of promotional activities (monetary benefits) on attitude are greater than the effects of convenience of ibon (non-monetary benefits) on attitude and the effects of perception of risks (non-monetary costs) are greater than the effects of surcharge on attitude (monetary benefits). Generally speaking, when we buy something, we hope that the price of the goods will be cheaper or discounts. But in purchasing tickets by ibon, we will hope that the tickets can get more benefits feelings or more substantive gains. Thus increasing benefits incentives is easy to enhance the user wishes to use ibon to purchase ticket than reducing tickets costs. It can prompt passengers to use ibon to purchase tickets and raise ibon utilization rate.

By comparison with reducing costs like lower fees or reducing the perceived risk, passengers will prefer benefits incentives. According to our study, we would recommend that if managers want to enhance utilization rate of ibon, they can consider developing strategies about benefits, such as promotional activities or increasing the convenience. Moreover, our model can discuss the use of ibon tickets, but also can be used in the study of other perceptions. We can classify target into the benefits and costs to be discussed.

With regards to suggestions for future research, due to the constraints of research budgets and time limitations, we were unable to exercise greater control over subjects and samples collected. It is suggested that follow-up researches expand the sample range and increase the number of samples. Second, researchers interested in conducting follow-up studies may consider expanding the scope of research to include the influences of other competitive modes or adding adjustment variables like TR and previous experience to discuss the influence of personal characters. Finally, classification of variables in the model, we can consider adding more variables to

explore relationship of influencing factors and benefits and costs can also do a more detailed classification.

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