Understanding Commuter's Behavioral Intention to Use Future Public Transport with An Extension of Theory of Planned Behavior

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This paper presents an extension of theory of planned behavior (TPB) to investigate the psychological factors which influence the road user's behavioral intention to use future urban public transportation. In this research, some additional psychological factors such as moral obligation, awareness of consequence and also socioeconomic variable such as age, gender, income have been added in core of TPB model. In addition, the traffic characteristics such as vehical availabity, driving license, willingness to pay and other factors also have been taken in account. The result from the analysis model using structural equation modeling can be useful for transport planners and project owners to advise or target potential transit users. The study demonstrates that the strategies to induce road users to use more public transportation should be aimed at these variable factors.

Key Words : *theory of planned behavior, behavioral intention, attitude, subjective norm*

1. INTRODUCTION

Extended from the Theory of Reasoned Action (TRA), Theory of Planned Behavior (TPB) is considered as one of the psychological theories that have been applied in the travel behavior research in predicting travel behavior. People's attitude towards the behavior, their subjective norm, and their perceived behavioral control determine their behavior indirectly via their intentions. Attitude toward behavior is defined as a person's general feeling of favorableness or un-favorableness for that behavior. It also is defined as the individual's positive or negative feelings about performing a behavior. It is determined through an assessment of one's beliefs regarding the consequences arising from a behavior and an evaluation of the desirability of these consequences[1]. Jillian et al.[2] defined that attitude is a person's overall evaluation of the behavior. It is assumed to have two components which work together: beliefs about consequences of the behavior (behavioral beliefs) and the corresponding positive or negative judgments about each these features of the behavior (outcome evaluations). Subjective norm is determined as a person's perception that most people who are important to them think he should or should not perform the behavior. Subjective norms are assumed to have two components which work in interaction: beliefs about how other people, who may be in some way important to the person, would like them to behave (normative beliefs or descriptive) and the positive or negative judgments about each belief (injunctive)[2]. Perceived behavioral control is determined as a person's perception of the ease or difficulty of performing a behavior. It has two aspects: how much a person has control over the behavior (controllability); and how confident a person feels about being able to perform or not perform the behavior (capability). And behavioral intention is defined as a willingness to try to perform the behavior and the behavior refers to a defined action[2].

From past studies, the theory has been used in transportation research to predict behaviors. For instance, in Taiwan Yang and Hsiao[3] applied the TPB to

understand travelers' intention to take high speed rail among college students. The study added two constructs, namely, novelty seeking and trust to the model of theory of planned behavior. The sample size was collected from 300 Taiwanese students. Results indicated that attitude, subjective norm and perceived behavioral control are found to have positive effects on the behavioral intention of taking high speed rail. Novelty seeking and trust also found positively influence on attitude and three antecedents of the intention in taking high speed rail. Lam and Hsu[4] investigated the behavioral intention of choosing a travel destination using the TPB model. Results showed that subjective norm, perceived behavioral control and past behavior had direct impact on behavioral intention of choosing a travel destination. In Sweden, Forward[5] extended the TPB to predict the intention to commit two different driving violations: speeding in an urban area and dangerous overtaking by adding descriptive norms, past behavior, perceived ease and perceived risk in the core structure of TPB. The outcome of this study revealed that all variables within TPB are significant relationship. Descriptive norms and past behavior presented the strongest relationship with intention to violate. It was also found that the effect of descriptive norms is greater in a situation described as risky. The effect of age and annual mileage were significant with regard to speeding indicating that young drivers and those who use the care regularly are more likely to speed. Similarly, In China, Zhou et al.[6] investigated the effects of age, gender and conformity tendency on Chinese pedestrians' intention to cross the road in potentially dangerous situations. A sample of 426 respondents was asked to complete a demographic questionnaire, a scale measuring their tendency towards social conformity, and a questionnaire based on the TPB. . Last but not least, in Thailand, Choocharukul et al. [7] extended the TPB to investigate the behavioral intention of using private car in the future work trips. The questionnaire survey was used to measure several psychological variables related to private car use for future work trips after graduation of undergraduate students. Besides, the 3 main variables of the behavioral intention: attitude, subjective norm, and perceived behavioral control, moral obligation was added as a variable to predict the behavioral intention of private car use. From literature reviews, Theory of Planned Behavior (TPB) is regarded as one of the psychological theories that have been applied in travel behavior research in predicting travel behavior. It will be used as a methodology in this research study in order to explore the factors affecting the commuters' intention. The theory mentions that people's attitude towards the behavior, their subjective norm, and their perceived behavioral control determine their behavior indirectly via their intentions. The more positive a person's attitude and subjective norm is, and the greater their per-

ceived control, the stronger is their intention to perform the behavior.

Similar to other developing cities, Phnom Penh are now facing traffic problem which occurs because of the population growth, non-improvement of transport system and other sources of traffic problems such as the deteriorated road condition and inappropriate road facilities, inefficient traffic control devices, illegal usage of sidewalks, lack of discipline of drivers and pedestrians, and lack of public transport services in the city. Improper public transportation system in the city is the main reason of increasing number of motorcycles. The rapid motorization has caused the city several detrimental effects such as vehicular delays, traffic accidents, air and noise pollutions. The future public transport system in Phnom Penh has been planned in order to increase mobility and to resolve the increasingly serious traffic problems. There will be three main lines of urban rail transports system and public bus system running in city[8]. The commuters along this corridor may not be familiar this new system. It is necessary to understand the psychological factor and commuter's intention of using future urban rail transport. Therefore, this paper will present the investigation of the psychological factors that can help explaining the likelihood of using future urban rail transportation in Phnom Penh city.

It is not known to what extent the TPB can predict the behavioral intention towards using planned public transport system, and which psychological variables will be of statistical significance. Thus, there is still a research gap to further explore the potential of psychological methods to predict commuter's behavioral intention.

2. METHODOLOGY

This paper investigates the Phnom Penh commuters' behavioral intention toward future urban rail transport usage by using set of structural equation models. We develop the basic model containing only TPB variables, i.e. attitude, subjective norm, and perceived behavioral control with addition of psychological variables, namely, moral obligation and awareness of consequences. At the same time, we introduce additional latent variables reflecting beliefs on attitudinal- aspects of future urban train (i.e. attitudinal beliefs on symbolic, instrumental, and social orderliness aspects), socioeconomic and current travel characteristics of respondents would have any effects on the behavioral intention towards future urban rail transport usage. Specifically, we test various variables, including, gender, occupation, income, vehicle ownership, willingness to pay and availability of driving license.

(1) Measurements

All psychological items used in the questionnaire are measured based on a seven-point Likert scale with "Strongly disagree" and "Strongly agree" at each end point. Subjective norm is measured by asking the respondents to rate four statements: "My friends or my family will be likely to use the Sky Rail System on a regular basis" (Q07), "Most people who are important to me will use the Sky Rail System on a regular basis" (Q17), "Most people whose opinions I value would approve my usage of the Sky Rail System on a regular basis" (Q21), and "Most of people who are important to me think that I should use the Sky Rail System on a regular basis" (Q23). Perceived behavioral control is measured using four statements: "Whether I use the Sky Rail System on a regular basis is completely up to me" (Q11), "For me, to use the Sky Rail System on a regular basis is possible" (Q19), "I could use the Sky Rail System on a regular basis if I want to" (Q03), and "The decision to use Sky Rail System on a regular basis is under my control" (Q08). Similarly, behavioral intention is measured with four statements: "I intend to use the Sky Rail System on a regular basis" (Q04), "My intention to use Sky Rail System on a regular basis instead of my existing travel mode is strong" (Q12), "I plan to use Sky Rail System on a regular basis instead of my existing travel mode" (Q20) and "I will make an effort to use Sky Rail System on a regular basis" (Q22). In addition to the above TPB variables, we additionally measure moral obligation and the awareness of consequences since these psychological variables may also have effects on the intention. Moral obligation is measured by asking the respondents to rate three statements: "Using Sky Rail System on a regular basis is the right thing to do" (Q02), "I should use the Sky Rail System because it is good for the environment" (Q09) and "I should use the Sky Rail System because it is good for society and the city" (Q24). Three statements are used to measure respondents' awareness of consequences: "Using Sky Rail System on a regular basis will reduce traffic congestion" (Q06), "Using Sky Rail System on a regular basis will reduce traffic accidents" (Q13) and "Using Sky Rail System on a regular basis will reduce air pollution" (Q18).

$\chi^2 = 1037.514$, d.f.= 355, NFI = 0.771, CFI = 0.834, RMSEA = 0.071
Note: # Value fixed at 1.00; ## p<0.10, * p<.05, ** p<.01, *** p<0.001
Gender is a dummy variable, where 1=male and 0 = female. Similarly, occupation is a dummy variable, where 1 = students and 0 otherwise. The income variable is categorical.
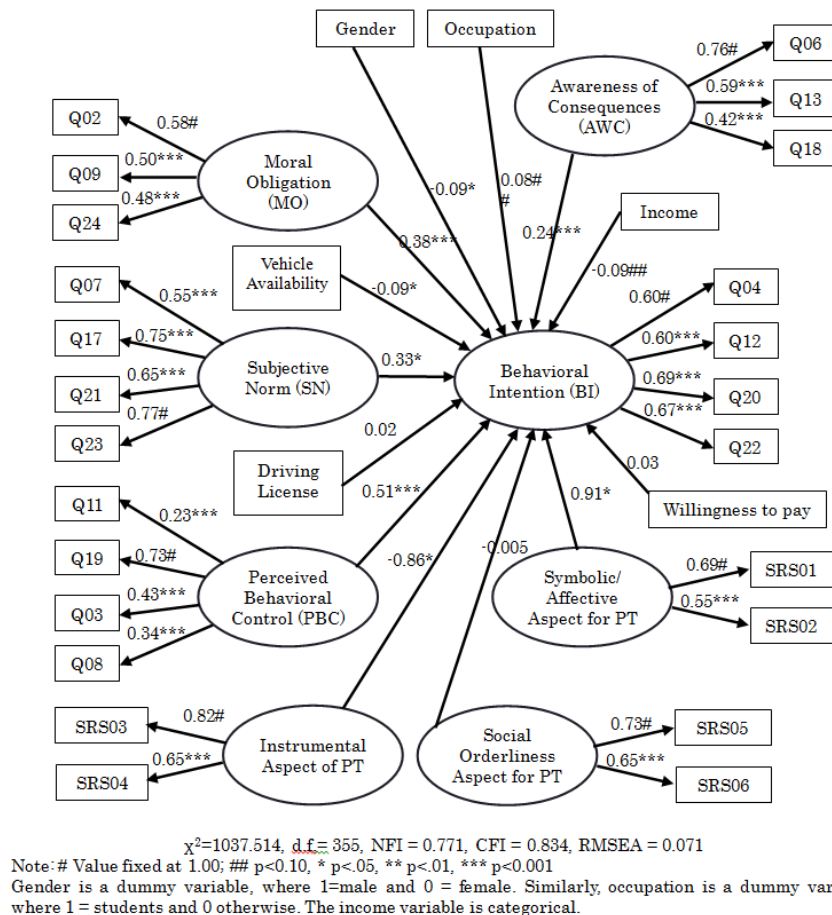
Fig.1 SEM result of the model

(2) Statisticall Analysis

In this paper, Structural Equation Modeling (SEM) is used. It is a very general, powerful multivariate analysis technique, which mostly has been used in psychology, sociology, the biological sciences, and so on. Most of the evaluation criteria are based on the chi-square statistic given by the product of the optimized fitting function and the sample size.

One rule of thumb for good fit is that the chi-square should be less than two or three times its degrees of freedom. Goodness-of-fit measures for a single model based on chi-square values include root mean square error of approximation (RMSEA), which measures the discrepancy per degree of freedom. The value of RMSEA for a good model should be less than 0.05[9]. Another research by Byrne[10] is accepted that RMSEA, the obtained value less than 0.05 indicate good fit; those ranging from 0.08 to 0.10 indicate mediocre fit and those greater than 0.10 indicate poor fit. For several goodness-of-fit indices, baseline comparison such as normed fit index (NFI), comparative fit index (CFI), a rule of thumb for most of the indices is that a good model should exhibit a value greater than 0.90[11].

3. RESULTS

From the model estimation results in Figure 1, the standardized direct effects on behavioral intention are 0.51 for perceived behavioral control, 0.38 for moral obligation, 0.33 for subjective norm, 0.24 for awareness of consequences, -0.005 for social orderliness aspect, 0.91 for symbolic/affective aspect, -0.89 for instrumental aspect, -0.09 for income, 0.008 for occupation, -0.09 for gender, -0.09 for vehicle availability, and 0.02 for driving license. Overall, this model yields a χ2 value of 1037.514 with 355 degrees of freedom, NFI value of 0.771, CFI value of 0.834 and RMSEA value of 0.071. It can be observed from the results that the model fitted the data well, although the NFI, CFI are slightly lower than 0.90.

4. DISCUSSION AND CONCLUSION

The result from structural equation model reveals that the behavioral intention towards future urban rail usage is significantly influenced by attitudes, subjective norm, perceived behavioral control, moral obligation, awareness of consequences, attitudinal aspect variables, socioeconomic variables and travel characteristics.

The instrumental attitudinal aspect, income, gender, and vehicle availability are found to influence negatively on the behavioral intention in our models. This may be because of the respondents' belief that the speed and convenience of the public transport is quite low given that they currently experience poor public transport service. Thus, this result prompts transport operators to seriously consider the quality of service of public transport, an issue that has not had much consideration in Phnom Penh. It was found that, female respondents are more likely to use sky train, and respondents who already own vehicles already or those who have high income are less likely to use the future sky train. In terms of travel characteristic variables,

driving license is not significant in the model. It can be implied that the behavioral intention of using future public transport does not depend on whether the respondents own the driving license. This finding is quite positive for transport operators since more customers in several market segments can be attracted, given that a good quality service is provided.

It is noteworthy from our findings that the behavioral intention toward future sky train usage can be investigated by the extension of theory of planned behavior. In conclusion, the present study demonstrates that the strategies to induce road users to use more public transportation should be aimed at attitudes, subjective norm, perceived behavioral control, moral obligation, awareness of consequences, and some socioeconomic and travel characteristic information. This study is an early study regarding psychological factors that could affect travel behavior for Phnom Penh's commuters. Further study is called for the prediction of behavioral intention in nonlinear SEM model.

REFERENCES

1) Ajzen I. : From intention to actions: Theory of planned behavior, 1985.
2) Jillian, et al. : Constructing Questionnaires Based on the Theory of Planned Behavior, *A Manual for Health Service Researchers.* University of Newcastle, 2004.
3) Yang C. et al. : Predicting the travel intention to take high speed rail among college students", *Transportation research part F*, pp. 277-287, 2010.
4) Lam T. et al. : Predicting behavior intention of choosing a travel destination, *Tourism management*, pp.589-599, 2006.
5) Forward, E. : The Theory of Planned Behavior: The Role of Descriptive Norms and Past Behavior in the Prediction of Drivers' Intentions to Violate. *Transportation Research Part F12*, pp. 198-207, 2009.
6) Zhou R. et al. : The effect of conformity tendency on pedestrians' road-crossing intention in china: an application of TPB, *Accident analysis and prevention*, pp. 491-497, 2009.
7) Choocharukul, K. et al. : Psychological Factors Influencing Behavioral Intention of Private Car Use in Future Work Trips, *Journal of the EASTS Vol.7*, pp. 211-222, 2007.
8) JETRO. : Study on Phnom Penh city sky rail airport line project, *Japanese External Trade Organization*, 2008.
9) Golob T.F. : Structural Equation Modeling for travel behavior research, *Transportation research part B13*, pp.1-25, 2003.
10) Byrne M.W. : Structural Equation Modeling with AMOS: basic concepts, applications, and programming, 2nd Edition, *New York: Routledge, Taylor & Francis Group*, 2009
11) McDonald R.C. et al. : Choosing a multivariate model: non-centrality and goodness of fit, *Psychological bulletin 107*, pp. 247-255, 1990.