

Exploring Factors Affecting Commuter's Behavioral Intention towards Future Urban Rail Transport: An Application of Theory of Planned Behavior

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1. Introduction

Like other developing cities, Phnom Penh are now facing traffic problem which occurs because of the population growth and non-improvement of transport system. Other sources of traffic problem are due to 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. In addition, inadequate regulations, poor use of traffic management measures, and low levels of enforcement also aggravate the problem [1]. The number of vehicle has been increasing at about 15 percent each year and approximately 77 percent of all vehicles are motorcycles [2]. Motorcycles, both private and public (motor-taxi), account to nearly 80 percent of total traffic in and around city [3]. 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 Phnom Penh city. The sky rail systems are designed to link the traffic from the suburban-cores to downtown.

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 sky rail in Phnom Penh city.

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 perceived control, the stronger is their intention to perform the behavior. The behavioral intention is determined by three core constructs, namely, attitude toward the specific behavior, subjective norms and perceived behavioral control [4].

For instance, in Taiwan Yang C. et al. [5] 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 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. Lam T. et al. [6] 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. Similarly, Heath Y. et al. [7] applied the TPB successfully to predict the use of the public transportation among university student's bus ridership. The study was an extension of TPB by adding several useful variables: descriptive norms, moral (personal) norms, environmental values and perceived responsibility for and awareness of the problems caused by car use. In China, Zhou R. et al. [8] 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.

It can be seen that no past studies have been conducted to investigate potential relationships between psychological factors and the behavioral intention of future urban rail transport. 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. Methods

This paper investigates the Phnom Penh commuters' behavioral intention toward future urban rail transport usage by using sets of structural equation models.

First, we develop the basic model containing only TPB variables, i.e. attitude, subjective norm, and perceived behavioral control. Second, we augment the fit of the model 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 sky train, i.e. attitudinal beliefs on symbolic, instrumental, and social orderliness aspects. The last set of structural equation model, we test whether 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.

2.1 Measurements

Our target subjects to only motorists and motor-taxi users due to the fact that this group of road users represents the highest proportion in the traffic stream, and they are more likely to change their travel mode to the proposed rail line, compared with other road users such as private car users. Respondents were randomly recruited and asked to complete the questionnaires. A total of 550 of questionnaire surveys are distributed and 398 respondents are useable for data analysis.

The survey questionnaire consists of three sections. The first section asks the respondents' socioeconomic and travel characteristics, while the second section consists of psychological items used to analyze the commuter's intention toward future urban rail transport. The last part of the

questionnaire additionally asks respondents about their opinions and attitudes on the future urban rail transportation usage.

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).

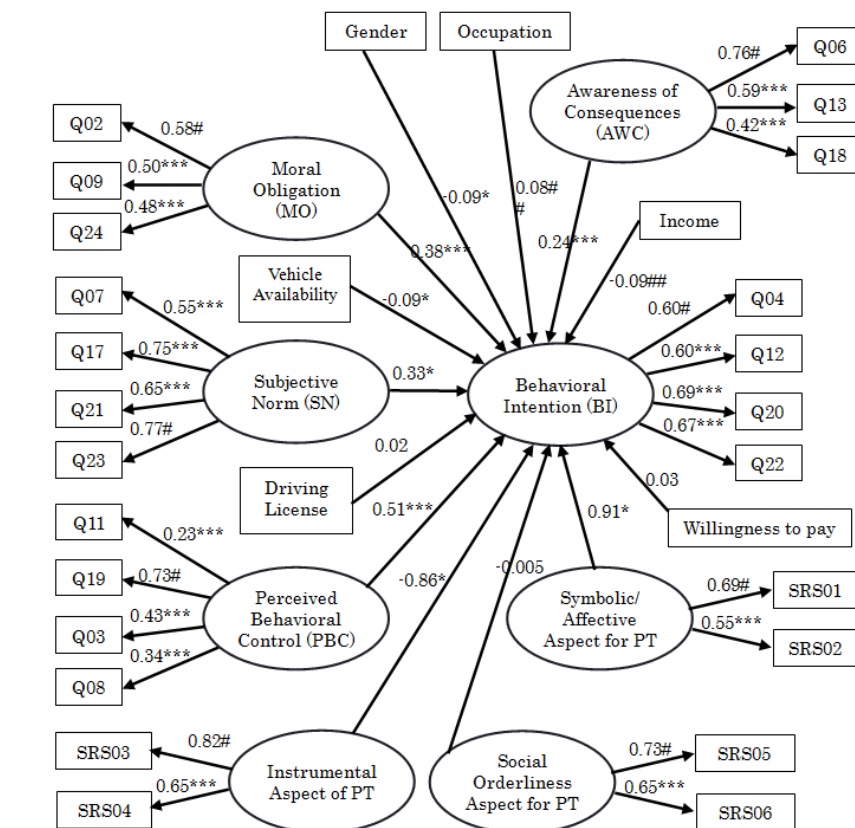
In addition to the above TPB variables, we additionally measure moral obligation and the awareness of consequences since these psychological variables may also have effects on the intention. Moral obligation is measured by asking the respondents to rate three statements: "Using Sky Rail System on a regular 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).

2.2 Statistical 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 [9]. 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 [10]. Another research by Byrne [11] 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 [12].

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, -0.89 for instrumental aspect, -0.09 for income, 0.008 for occupation, -0.09 for gender, 0.02 for driving license, 0.91 for symbolic/affective aspect, -0.09 for vehicle availability, and 0.02 for willingness to pay. We observed that socioeconomic variables, respondents' occupation, income and gender are found to significantly influence the behavioral intention. In particular, gender and income are found to be negative influence on the behavioral intention. Similarly for travel characteristic variables, vehicle availability is negative influence on the behavioral intention, while the estimated coefficient for driving license is positive but not statistically significant. Overall, this model yields a χ^2 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.



$$\chi^2=1037.514, d.f=355, NFI=0.771, CFI=0.834, RMSEA=0.071$$

Note: # Value fixed at 1.00; ## $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

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

4. Conclusions and Discussions

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 theory of planned behavior. The behavioral intention toward future urban rail transport usage is also influenced by the moral obligation and awareness of consequences. Increasing the level of moral obligation and awareness of consequences may be reasonable to reduce the private vehicle usage in the future. Moreover, the determinants of attitudes, which in this case consist of symbolic/affective, instrumental and social orderliness attitudinal aspects, are also found to be of statistical significance. Consequently, it can be implied that intervention of attitudes would be the most effective way in changing the behavioral intention of using urban public transportation.

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. The actual behavior towards future urban rail transport usage is yet to be investigated. Further study is called for when the project is implemented.

5. References

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