Psychological Factors Influencing Behavioral Intention of Using Future Sky Train: A Preliminary Result in Phnom Penh

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Abstract

Based on the Theory of Planned Behavior (TPB), the commuter's intentions to use future urban rail transport in Phnom Penh, the Capital City of Cambodia, are measured within a sample of motorcyclists. This study is an application of the theory of planned behavior to investigate psychological factors that can potentially help explaining the likelihood of future urban rail usage. A set of survey questionnaire is conducted with TPB core constructs, namely, subjective norm, attitude and perceived behavioral control. Questionnaire is used to ask potential passengers, motorcyclists, who travel along the Kampuchea Krom and Russian Boulevards, a planned sky train line linking the Central Market in CBD to the airport. The result from the structural equation model reveals that attitude, subjective and perceived behavioral control significantly influence the behavioral intention towards future sky train usage. The outcome of the study can help understanding commuter's current behavior and shade some ideas on the feasibility of such an investment in terms of potential demand.

Keywords: Psychological factors, Future sky train, Theory of planned behaviour.

1. Introduction

Many developing cities, including Phnom Penh city, are now facing motorization problem. Currently 80 percent of total traffic in Phnom Penh city is made up of motorcycle[1]. The serious traffic congestion always happen on the ring roads and the large number of the traffic volume is normally occurred at morning and evening peak hours. The traffic congestion and traffic accidents, especially by motorcycles, are one of the most serious social issues in Phnom Penh. The number of registered vehicles has been increasing at a rate of about 15 percent each year and approximately 77 percent of all registered vehicles are motorcycles[2].

The major reason of increasing number of motorcycles in Phnom Penh city is because of improper public transportation system in the city. Most of urban public transports rely on motor-taxi, tricycle and taxi-cars which are the only available modes. Currently, in order to increase the mobility in city, Municipality of Phnom Penh has a plan to build an urban rail transportation system. Commuters may not be familiar to this new system. Therefore, the investigation of psychological factors that can help explaining the likelihood of taking future urban rail transport will be revealed in this study. It will be useful to understand the commuter's current behavior.

1.1 Current traffic situation in Phnom Penh

Traffic situation in Phnom Penh has been gradually worsening due to the rapid increase of vehicles caused by the concentration of population in the capital. Urban traffic congestion has grown to critical proportions in some areas, where the absence of traffic control devices at several critical intersections and the poor condition of road surfaces and drainage on secondary roads and local streets exacerbate operational inefficiencies. Lack of road user discipline, inadequate regulations, poor use of traffic management measures, and low levels of enforcement are particular problems and greatly reducing the effective capacity of the road systems and contributing to safety concerns for all road users.

Literature reviews showed the traffic problems in Phnom Penh city. JICA (2001) pointed out the problem of traffic management which causes traffic congestion, high traffic accidents and air pollution. The traffic problem was mostly because of the deteriorated road condition and inappropriate road facilities, inefficient traffic control, illegal usage of sidewalks, lack of discipline of drivers and pedestrians, and lack of public transport services in the city.

Sambath N. et al. (2005) showed that the traffic problem in Phnom Penh was occurred because of the population growth and non improvement of transport system. In this sense, the urban area has been sprawled and the travel demand has been excess the supplies causing the traffic congestion. The traffic congestion has caused the reduction of economic activities and the augmentation of transport costs, which strongly affect the metropolitan economy. At the mean time, air and noise pollution has also occurred. Moreover, traffic congestion had a significant impact on the communities' livability.

Recently, traffic accidents in Cambodia have become a major subject and a big concern of the Royal Government of Cambodia, and are considered as the second major crisis after AIDS. In 2009, the report of Cambodia Road Crash and Victim Information System (RCVIS) reported that 2078 of casualties resulting from 601 crashes. Among them, 201 were fatalities and 680 were severely injured and 1,660 vehicles were involved in those crashes[5].

1.2 Public transportation in Phnom Penh

Phnom Penh city is lack of public transport services. Most of transport system is dominated by the private transport modes, which result in higher risk of accident and less reliability. Various modes of public transport are currently operated in city. There are mainly eight modes of public transport operating in Phnom Penh. Those modes are:

1. Buses and taxi-buses are mainly operated for the inter-city service.
2. Taxi-Car mostly stands by at the airport waiting for the passengers.
3. Motorcycle-taxi and three wheels motor-taxi are a kind of para-transit. They are the major public transport mode in the city area.
4. Tricycle is also a common public transport mode, which mostly operate for a short-distance transport.
5. Another Para-transit is Motorumoks, which are operated in the suburban area and used mainly by factory workers to commute and by farmers to transport their product to the market.
6. Railways consists of 2 routes in the country, but not used for urban transport.
7. River transport is operated for both intra-city and inter-city services.
8. Air transport is operated on international routes and domestic routes[3].

1.3 Future urban planning

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 3 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. Roads will be also improved to have a specific lane for cars, motorcycles, and pedestrians (see Figure 1). It is necessary to construct a new sky rail system which will provide a smooth, reliable, environmentally friendly and safe transit system along the selected corridor with adequate passenger capacity. This sky rail system will improve the convenience of Phnom Penh citizens, the business community and tourists from other countries. It also will prevent economic loss and discouragement of workers, shoppers and students due to chronic traffic congestion.

The main focus of this study is the 10-km sky rail airport line, starting from the New Central market in CBD to Phnom Penh International Airport along Kampuchea Krom and Russian Boulevard. This sky rail airport line totally has 7 stations, 3 substations and 1 depot (see Figure 2). From the feasibility study, this project cost about

US$309.3 million. The project will start in 2014 and is expected to finish and operate in 2017[1].
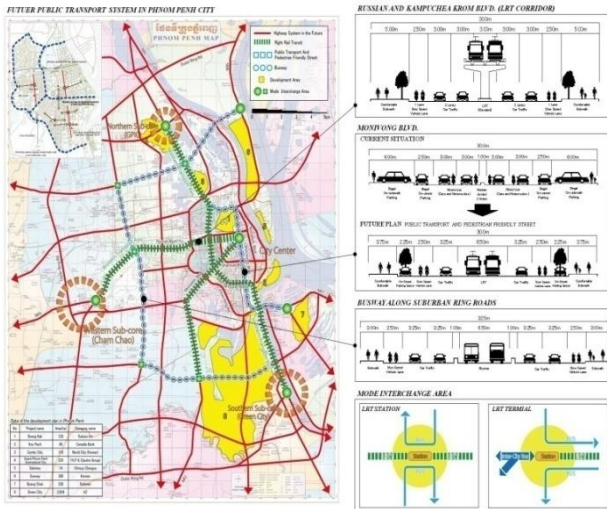
Fig. 1 Future Public Transportation Systems in Phnom Penh[1]

Fig. 2 Sky rail airport line[1]

Given aforementioned traffic issues, the main traffic management issue is made up by motorcycles and also because of the insufficient urban public transportation system, that is why a new public transportation system, sky rail, has been planned in order to provide high mobility services between the urban core and suburban core, to minimize social impact and to minimize the traffic congestion by reducing the conflicting traffic. The travel demand management (TDM) or mobility management (MM) can be used to induce commuter to use more public transportation. However, 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, the objective of this study is to investigate the psychological factors that can help explaining the likelihood of using future sky train in Phnom Penh city. Theory of Planned Behavior

(TPB) will be used as a methodology in this research study in order to know the factors affecting the commuters' intention.

2. Literature review

The Theory of Planned Behavior (TPB) was proposed by Icek Ajzen in 1985 through his article "From intentions to actions: A theory of planned behavior". The theory was developed from the Theory of Reasoned Action (TRA), which was proposed by Martin Fishbein together with Icek Ajzen in 1975. TPB is regarded 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 (see Figure 3). The more positive a person's attitude and subjective norm is, and greater their perceived control, the stronger is their intention to perform the behavior [6].

Attitude toward behavior is determined as a person's general feeling of favorableness or un-favorableness for that behavior.

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.

Perceived behavioral control is determined as a person's perception of the ease or difficulty of performing a behavior.

Behavioral intention is defined as a willingness to try to perform the behavior and the behavior refers to a defined action.
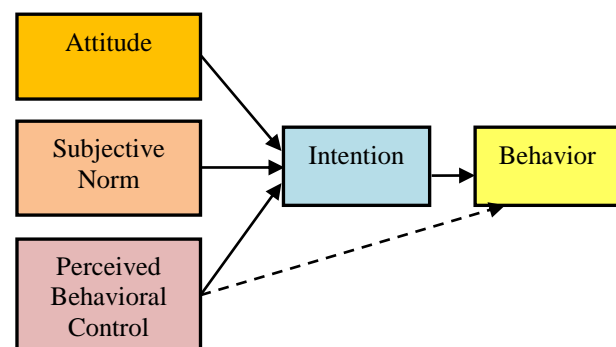
Fig. 3 Theory of planned behavior (TPB)

The theory of planned behavior has been successful in predicting such diverse behaviors as choosing a career, deciding to donate blood, or deciding to use helmets, among many others. The theory has also been used in transportation research

to predict behaviors. For example, Warner and Aberg (2006) applied the TPB on transportation research related to the driver's decision to speed. This study predicted the driver's everyday speeding behavior, using the structural equation modeling. It was found that the independent variables stipulated in the theory afforded a level of prediction of driver's self-reported speeding as well as of their logged speeding. Attitude towards speeding, subjective norm, and perceived behavioral control were significant determinants of self-reported speeding. Self-reported speeding and subjective norm contributed to the prediction of driver's logged speeding. Whereas perceived behavioral control did not directly contribute may be due to the possibility that drivers with several years of experience already take into account the actual control.

Another application of TPB on transportation research is done by Lam and Hsu (2006) in Taiwan. This study investigated the behavioral intention of choosing a travel destination applying the theory of planned behavior (TPB) model as a research framework. It was an extension of TPB by adding one more variable, past behavior, on the core constructs variable (attitude, subjective norm, and perceived behavioral control). 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 (2009) extended the theory of planned behavior (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. In this study, questionnaire was mailed to 500 people drawn from the public driving license records. The questionnaires included two different driving scenarios: speeding in an urban area and dangerous overtaking. The outcome of this study found that all variables within TPB are significant relationship. Descriptive norms and past behavior presented the strongest relationship with intention to violate. It 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, Díaz (2002) applied the TPB to investigate pedestrians' intentions to violate traffic regulations. In this study, pedestrians' attitudes towards traffic violations and self-ratings of violations, errors and lapse were measured among a sample of 146 pedestrians. The reported violations, errors and lapses appear causally related to the intention to violate regulations and this in turn with positive attitudes, subjective norms and perceived behavioral control. It was found that young people have more positive attitude towards committing violations as pedestrians than adults; men are more frequent violations of the traffic rules than women.

Elliot et al. (2003) applied TPB to driver's compliance with speed limits. In the study, data were collected from 598 drivers by using questionnaires including TPB variables, demographic information, and self-reported prior behavior and self-reported subsequent behavior. Results showed that attitude, subjective norm and perceived behavioral control were positively associated with behavioral intention of compliance with speed limits.

From the literature reviews, it can be seen that no past studies have been conducted between psychological factors and the behavioral intention of future urban rail transport. As Phnom Penh commuter, no implication was found. Thus, there is still a research gap to further explore the potential of psychological methods to predict commuter's behavioral intention.

3. Methods
3.1 Participants

Respondents are voluntarily recruited from the commuters who travel along the study line; from Phnom Penh International airport to Central market will ask to complete the questionnaires. The target of our survey is aimed to respondents who are riding motorcycle and motorcycle-taxi 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 line, comparing with other road users such as private car users. The survey is done with 8 people, students from Institute of Technology of Cambodia. Before conducting a field survey, they have been trained with the developed survey forms until they fully understood how to explain the questionnaire to the respondents. A first question to be asked to the respondents is whether they are using this road corridor on a regular basic. Some of similar sky train pictures had been used to make the respondents easily to understand. A total of 488 respondents were useable for data analysis.

Among the respondents, 73 percent are male. 50 percent of the total respondents are in range of 15-25 years old. Approximately one third of the total respondents were students. The majority of the respondents have monthly income in range of $101-$200 and nearly half of the respondents come from the house hold more than 5 members.

3.2 Measurements

The survey questionnaire contains two sections. The first part of the questionnaire asks the respondents' socioeconomic information and travel information. The second part consists of commuter's intention to use future sky rail which involved the items for psychological measures. Three-sheet survey form is done in double translation: English into Khmer and Khmer into English. The first page of the survey form covers the introduction and the map showing the future public transportation system in Phnom Penh City and the location of the study area. The second page comprise of the socio-economic status and trip characteristics. And the last page consists of the psychological questions using to analyze the commuter's intention toward sky rail using.

All psychological items used in the questionnaire are measured based on a seven-pont Likert scale with "Strongly disagree" and "Strongly agree" at each end point.

Attitude is measured by asking the respondents to rate five statements: *"I prefer using the future urban rail transit"* (Q01), *"I have good feeling toward using future urban rail transit"* (Q02), *"Using future urban rail transit is desirable to me"* (Q03), *"Using future urban rail transit is beneficial to me"* (Q04) and *"Using future urban rail transit is the right thing to do"* (Q05).

Subjective norm is measured by asking the respondents to rate six statements: *"My friends or my family want me to take urban rail transit"* (Q06), *"If I took the urban rail transit, my friend or my family would have no problem with it"* (Q07), *"My friends or my family would agree with using the future urban rail transit"* (Q08), *"My friends or my family think that I should use future urban rail transit"* (Q09), *"Most of my friends will use future urban rail transit"* (Q10), *"I feel under social pressure to use future urban rail transit"* (Q11).

Perceived behavioral control is measured by using five statements: *"It is easy for me to use future urban rail transit"* (Q12), *"I am confident that I can use future urban rail transit"* (Q13), *"Whether I use future urban rail transit is completely up to me"* (Q14), *"The decision to use future urban rail transit is under my control"* (Q15), *"I could use future urban rail transit if I want to"* (Q16). Similarly, behavioral intention is measured with five statements: *"I should use urban rail transit"* (Q17), *"In regard to my decision, I will use future urban rail transit"* (Q18), *"I want to use future urban rail transit"* (Q19), *"I plan to use future urban rail transit"* (Q20) and *"I will make an effort to use future urban rail transit"* (Q21).

3.3 Statistical analysis

In this paper, structural equation modeling (SEM) is used for analysis. The model to be tested strictly followed the TPB concept:
H_1: Respondent's attitudes are positively related to the behavioral intention of using future sky train.
H_2: Respondent's subjective norms are positively related to the behavioral intention of using future sky train.
H_3: Respondent's perceived behavioral controls are positively related to the behavioral intention of using future sky train.

Analysis of moment structures (AMOS) software is selected for structural equation modeling analysis. The overall fit of the model is evaluated against a number of recommended fit statistics and fit indices. The Root Mean Square Error of Approximation (RMSEA) is used to evaluate how well the model fit the population covariance. It is evaluated as absolute fit measures. The RMSEA 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[12]. The Normed Fit Index (NFI) and the Comparative Fit Index (CFI) are evaluated as the indices of choice. The value for both NFI and CFI range from 0 to 1 can be considered as a good fit of the model[12].

4. Result

The homogeneity of the psychological items such as attitude, subjective norm, perceived behavioral control and behavioral intention is evaluated by means of the Cronbach's alpha coefficients. The Cronbach's alpha indicates the overall reliability of a questionnaire and the acceptable value of Cronbach's alpha range from 0.7 to 0.8 whereas the value substantially lower indicates unreliable scale[13].

From the Table 1, it can be seen that the scales for attitude, subjective norm, perceived behavioral control and behavioral intention can be used for the analysis with acceptable reliability.

Figure 4 presents the results of the estimation model. In this model, we hypothesized that the behavioral intention towards future sky train usage could be explained by attitude, subjective norm and perceived behavioral control.

The goodness of fit statistics indicates that this model moderately fits the data. Specifically, the RMSEA value of 0.081 is lower than the upper limit of 0.10 and NFI value of 0.869 and CFI value of 0.897 are better in range of the cutoff value of 0 to 1. The standardized direct effects on the behavioral intention are 0.42 for attitude, 0.13 for subjective norm, and 0.85 for perceived behavioral control.

psychological factor

Constructs	No. items	Cronbach's Alpha (α)	Mean	SD.
AT: Attitude	5	0.88	5.74	0.99
SN: Subjective norm	6	0.74	5.03	0.94
PBC: Perceived behavioral control	5	0.82	5.74	0.94
BI: Behavioral intention	5	0.89	5.65	0.97

As hypothesized, attitude, subjective norm and perceived behavioral control is found to have a significantly positive influence on behavioral intention towards future sky train usage.

Table 1 Mean and standard deviation for each
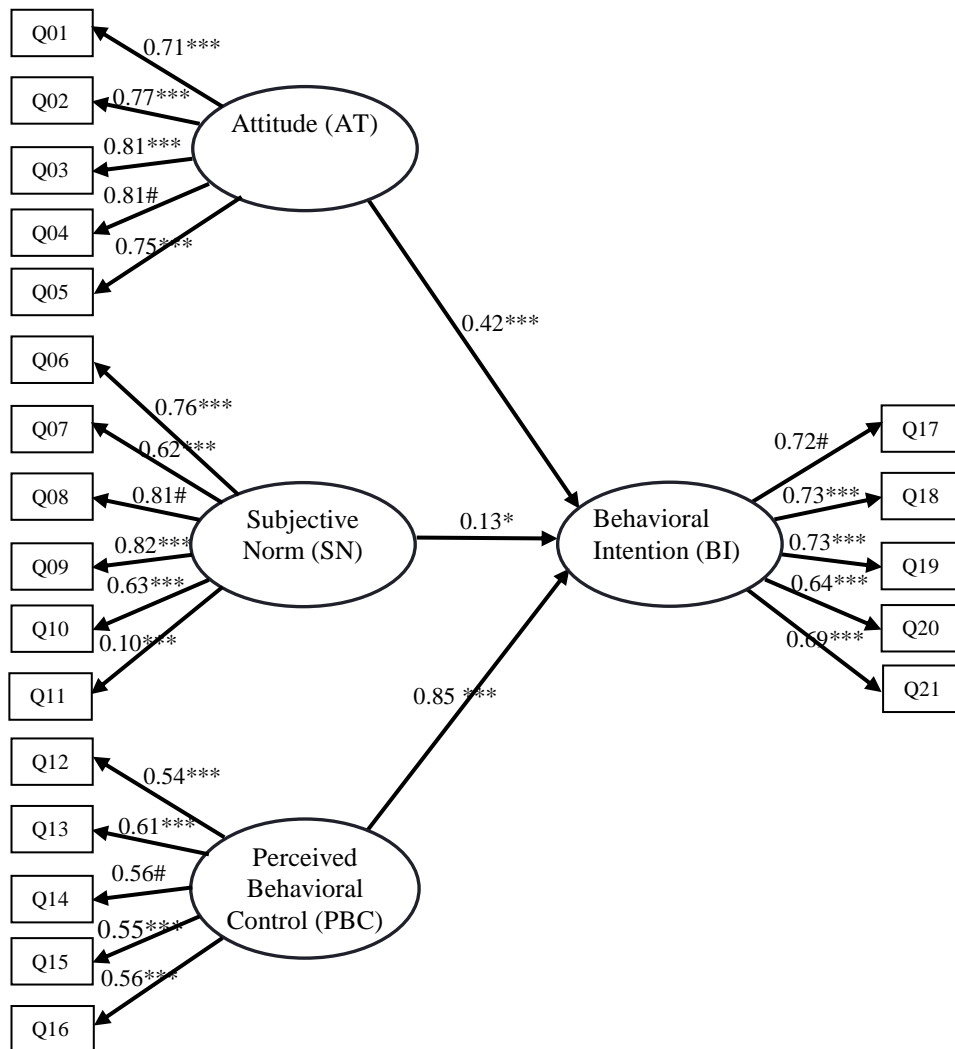
χ^2=760.192, d.f.=182,
CFI=0.897, NFI=0.869, RMSEA=0.081
Note: # Value fixed at 1.00; * p<.05, *** p<0.001
Fig. 4 Result of Structural Equation Model

5. Discussion and conclusion

The result from structural equation model reveals that the behavioral intention towards future

sky train usage is significantly influenced by attitude, subjective norm and perceived behavioral control. It is found that the perceived behavioral control is the highest influencing determinant on behavioral intention. This may be because of the fact that Phnom Penh's respondents take their perception of ability to take future sky train in account.

From our finding, it should be noted that the behavioral intention towards future sky train usage can be investigated by the theory of planned behavior. Consequently, it can be implied that the attitudes, subjective norm and perceived behavioral control would be the most effective way in changing the behavioral intention of using public transport.

In conclusion, the strategies to induce road users to use more public transport should be aimed at attitude, subjective and perceived behavioral control. To the authors' knowledge, this study is among the early studies regarding psychological factors that could affect travel behavior for Phnom Penh's commuters. Further study is called for to investigate other psychological factors, i.e. moral obligation, awareness of consequences, socio economic variables and travel characteristics which can help understanding Phnom Penh commuters' behavioral intention toward future sky train usage.

6. Acknowledgment

References

[1] JETRO (2008). Study on Phnom Penh City Sky rail airport line project in Kingdom of Cambodia.

[2] IRITWG (2009). Overview of Transport Infrastructure Sectors in the Kingdom of Cambodia. *(Infrastructure and Regional Integration Technical Work Group)*

[3] JICA, 2001. The Study on the Transport Master Plan of the Phnom Penh Metropolitan Area in the Kingdom of Cambodia. *Final report.*

[4] Sambath N. et al. (2005). Identification of the Transportation Improvement Project in Phnom Penh Considering Traffic Congestion Level. *Journal of the Eastern Asia Society for Transportation Studies*, Vol.5

[5] RCVIS (2009): *Cambodia Road Crash and Victim Information System*, Monthly report.

[6] Ajzen I. (1991). The theory of planned behavior, Organizational Behavior and Human Decision Process, Vol. 50, No. 2, 179-211.

[7] Warner H., Aberg L. (2006), Drivers' Decision to Speed: A study Inspired by the Theory of Planned Behavior, *Transportation Research Part F*, 427-433.

[8] Lam T., Hsu H.C. (2006), Predicting Behavioral Intention of Choosing a Travel Destination, *Tourism Management*, 589-599.

[9] Forward, E. (2009), The Theory of Planned Behavior: The Role of Descriptive Norms and Past Behavior in the Prediction of Drivers' Intentions to Violate, T*ransportation Research Part F12*, 198-207.

[10] Dìaz E.M (2002), Theory of Planned Behavior and Pedestrian's Intentions to Violate Traffic Regulations, *Transportation Research Part F5,* 169-175.

[11] Mark A. Elliott et al. (2003), Driver's Compliance with Speed Limits: An Application of the Theory of Planned Behavior, *Journal of Applied Psychology*, Vol.88, No.5, 964-972.

[12] Byrne, B. M. Structural Equation Modeling with AMOS: Basic Concepts, Applications, and Programming, 2nd Edition, *Routledge, Taylor & Francis Group*, New York, 2009.

[13] Wright. B.D. Discovering Statistics Using SPSS, *SAGE Publication*, 2005.