Exploring travellers' choice motive regarding intention of bus usage

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Literature of psychological approach for traveller's mode choice behavior has underlined two main streams of traveler motivation of using transport mode. Those are self-interest motive and pro-environmental motive. Travelers are assumed to base on cost-benefit mechanism to decide mode choice regarding self-interest motive, whereas environmental obligation was blamed for deciding travelers' behavior with respect to pro-environmental motive. Although self-interest-based models was commonly found better compared to pro-environmental-based models in predicting travelers' behavior, however, conventional studies seem to ignore the important role of trip types towards travelers' mode-choice behavior. This study, therefore, aims at investigating travelers' mode-choice motive under different trip types. Results from 270 respondents in Saitama City, Japan, showed that travelers have different motives according to different trip purposes. In particular, travelers based on cost-benefit perception to decide bus use intention when go to work and go shopping. Regarding bus use intention for going to social event, traveler's perception were found to be driven by social-environmental obligation. Further effort on modeling travelers' behavior suggested that combined model that integrated both self-interest-based and pro-environment-based variables may improve modeling performance regardless trip purpose.

Key Words : *Mode-choice Motive, Travellers' Perception, Bus Service*

1. INTRODUCTION

Under a general notion regarding psychological approach for mode choice behavior presented in this study, traveler's mode choice behavior was investigated under two main streams including self-interest motive and pro-environmental motive[1)]. The theory of planned behavior[2)] can be seen as a fundamental base for the self-interest motive, whereas, pro-environmental model was developed based on norm-activation model[3)]. Of self-interest motive, travelers are assumed to base on cost-benefit mechanism to decide transport choice. Widely-known variables in self-interest-motive models include attitude, social norm, perceived behavioral control (PBC) and intention. Regarding the pro-environmental model, traveler's environmental obligation is expected to drive traveler's behavior. Variables commonly investigated in NAM model were personal norm, environmental awareness of consequences and environmental awareness of need. In the context of travel mode choice, personal norm was understood as an obligation to use transport mode.

Literature of psychological model for traveler's behavior showed several efforts comparing the performance between the above mentioned two approaches. A general consensus was that the self-interest model has a better performance compared with that of pro-environmental model. Bamberg & Schmidt (2003)[4)] examined intention of car use and self-reported car use. Various structural relationships under two fundamental forms of self-interest and pro-environmental motives were investigated. According to the results, self-interest-based variables was observed to have a better performance. Aiming to a similar purpose of comparing the two approaches, Abrahamse et al.

(2009)[5] also concluded a better performance of TPB-based models for car use compared with that of NAM-based models. In addition, a thorough literature review by Steg and Vlek (2009)[6] suggested that the NAM-based models seem to have weak predictability power in high behavioral cost domain such as travel mode-choice behavior.

Notably, literature of mode-choice studies suggested that trip purpose may take important role on travelers' mode choice because it influences the complexity of trip chain, thus leading to different mode choice. Initially, a study by Krizek (2003)[7] showed a relationship between trip purpose and the complexity of travel chain. Later, several studies suggested that complexity of trip led to different mode choice. Hensher and Reyes (2000)[8] found a less use of public transport due to increase of trip complexity. A similar finding was suggested by Cicillo and Axhausen (2002)[9] with increase of car use when the trip complexity increases. The relationship between tour complexity and mode choice was also revealed by Ho and Mulley (2013)[10].

However, conventional studies which follow psychological approach did not consider the influence of trip purpose on travelers' motive to use transport mode. Therefore, this study aims to reexamine the motivation of travelers towards mode choice decision by a replication work seeking to different trip purposes. An empirical case study from this study was considered in the context of bus service setting.

2. DATA COLLECTION

A set of questionnaires were sent to respondents living in Saitama city, Saitama Prefecture, Japan. The local bus service in the area was mainly as a feeder service for the train system. Questionnaires were randomly sent to resident houses by post. All the houses received questionnaires are not located so close to train stations to reduce the impact of the train system towards the bus service because both modes are considered as public transport mode.

Respondents were requested to use pre-paid envelope to return their feedbacks by post. All typical variables of the two approaches were investigated. Respondents were asked about their perception regarding the use of the bus service. Items were designed to capture traveler's attitude, descriptive norm, perceived behavioral control (PBC), awareness of need, awareness of consequences, personal norm and intention of using the bus service. It should be noted that traveler's attitude was considered via an aspect of affection. Detailed discussion on the components of attitude can be referred to a work by Ajzen (2001)[11]. All the measures were adopted from related theories except awareness of consequences which is expanded by an additional item representing travelers' perception of social impacts of the bus service. The argument for the expanded version of awareness of consequences was originated from a belief that travelers' obligation to use bus service should include both environmental and social aspects. In addition, three types of trips were considered including "go to work", "go shopping", and "go to social event". To provide answer, respondents were asked to select one option among set of options provided for each of the items ranged from 1 (strongly disagree) to 5 (strongly agree) in a Likert-type scale. Measures of the designed items were presented in Table 1.

Table 1 List of variables measured by the questionnaire survey

		Items	Cronbach's α
Attitude	Q1	You love to use bus in your daily life	.842
	Q2	You prefer to use bus in your daily life	
Perceived Beha-	Q1	You find no difficulty to use bus in daily life	.529
vioral Control	Q2	Your freedom to use bus in daily life is high	
Descriptive norm	Q1	Number of people using bus is currently increasing	.820
	Q2	Most of people you know currently tend to use bus more	
Awareness of need	Q1	Bus use is an urgent problem for environmental protection	.817
	Q2	You believe that using bus will help to solve environmental problems	
Awareness of con-	Q1	If you increase your bus use, you contribute to climate protection	.738
sequences	Q2	Your decision to use bus has consequences for environment improvement	

		Items	Cronbach's α
	Q3	Bus is important for elderly people.	
Personal norm	Q1	Due to values important to you, you feel obliged to use the bus as much as possible	.842
	Q2	Due to your values/principles, you feel personally obliged to use environmental friendly means of transportation such as bus	
Car use Habit	Q1	Car is your automatic mode for any trip	.683
	Q2	You have unfamiliar feeling when you do not use car for your trips	
Intention 1	Q1	Intention to use bus to go to work daily, is high	-
Intention 2	Q1	Intention to use bus to go shopping, is high	-
Intention 3	Q1	Intention to use bus to go to an social event, is high	-

Among 3000 questionnaires distributed, there were 307 (10.2%) returned questionnaires. However, due to uncompleted questionnaires, there were only 270 questionnaires (9.0%) usable for analysis.

In addition, with respect to the poor value of Cronbach's alpha coefficient of PBC (see Table 1) which implies the degree of internal consistency between measured items, this study only considered a single item to measure value of PBC. Regarding literature of PBC studies, the construct was generally assumed to cover two aspects including capacity and autonomy (e.g., Ajzen, 2005)[12]. In a specific case of the present study, the first item was designed to capture traveler's capacity of using the bus service, while the second item was designed to measure traveler's autonomy to use the bus service. Based on an assumption that travelers put the higher weight the capacity then autonomy to decide their bus use intention, the item designed for measuring traveler's capacity has been selected for further analyses.

3. RESULTS

(1) Descriptive analysis

Descriptive analyses were conducted to examine characteristics of variables. Correlations between intention to use the bus service and other investigated variables were presented in Table 2.

Table 2 Pearson's correlation between investigated variables

No	Variable	Mean	SD	1	2	3	4	5	6	7
1	Attitude	2.89	1.05	1						
2	PBC1	3.78	1.25	.333**	1					
3	DN	2.77	0.95	.379**	.144*	1				
4	AN	3.54	1.06	.327**	.179**	.136*	1			
5	AC	3.81	0.88	.331**	.146*	.173**	.753**	1		
6	PN	3.38	1.10	.475**	.198*	.257**	.537**	.600**	1	
7	CH	3.06	1.21	-.157**	-.113	-.065	-.074	-.094	-.101	1
8	IW	3.17	1.43	.383**	.239**	.172**	.264**	.258**	.369**	-.064
9	IS	2.61	1.31	.508**	.164**	.329**	.205**	.220**	.452**	-.159**
10	IE	3.14	1.26	.345**	.118	.181**	.262**	.220**	.377**	-.019

*Note:[**p<0.01;*p<0.05], PBC - perceived behavioral control, DN – descriptive norm, AN – awareness of need, AC – awareness of consequences, PN – personal norm, CH – car use habit, IW – intention to go to work (by bus), IS – intention to go shopping (by bus), IE – intention to go to (social) events (by bus)*

As can be seen from Table 2, except car-use habit, all the rest of investigated variables had significant correlation with intention of using bus regardless trip types. Respondents showed negative attitude towards the bus service with an average value of 2.89. Most of respondents found no difficulty in using the bus service in daily life (average value of PBC1 was of 3.78. They were also negative in perceiving increase of the bus usage among other travelers (mean value DN = 2.77). In addition, traveler's perception regarding necessity and environmental consequences of bus usage and environmental obligation was observed positive (all average values were above 3). Regarding perception of car-use habit, travelers were neutral (mean value of CH is 3.06). Among four trip types investigated, travelers showed a positive intention to use bus to go to work and social event (mean value of IW and IE were 3.17 and 3.14 respectively). In contrast, traveler's intention to use bus for shopping was negative (mean value of IS = 2.61).

(2) Traveler's motive for the intention of bus usage

Aiming at the comparison between self-interest motive and pro-environmental approach, regression analyses were used to examine performance of the models in predicting traveler's intention to use the bus service. Attitude, PBC and descriptive norm were included to self-interest model, while awareness of need, awareness of consequences and personal norm were variables for pro-environmental model. Performance of the model was valuated based on the value of adjusted R-square value. The higher adjusted squared indicates the better performance of model. Results were shown in Table 3.

Table 3 Comparison between self-interest and pro-environmental motives

	Self-interest approach			Pro-environment approach			
Go to work	Attitude	.453***	**AdjustedR2 = .152**	AN	.130	Adjusted R2 = .132	
	PBC1	.143*		AC	-.010		
	DN	.044		PN	.417**		
Social event	Attitude	.392***	Adjusted R2 = .112	AN	.168	**Adjusted R2 = .141**	
	PBC1	-.002		AC	-.158		
	DN	.077		PN	.421***		
Shopping	Attitude	.562***	**Adjusted R2 = .272**	AN	.009	Adjusted R2 = .199	
	PBC1	-.009		AC	-.111		
	DN	.220**		PN	.594***		

Note: PBC - perceived behavioral control, DN – descriptive norm, AN – awareness of need, AC – awareness of consequences, PN – personal norm.

According to Table 3, compared with pro-environmental model, self-interest model had a better performance regarding bus use intention to go to work. Traveler's attitude was observed to have the strongest impact towards bus use intention to work. However, pro-environmental model showed a better predictive ability in case of trip to social event. Traveler's environmental obligation was found as the key variable in deciding bus use intention for social-event trip. In addition, travelers were observed to use cost-benefit merit to select bus as transport mode for shopping trip. Traveler's attitude and descriptive norm (i.e., perception about other's trend of using bus service) were found significant in deciding bus use intention for shopping trip.

As suggested by recent studies (e.g., Klockner & Friedrichsmeier, 2011)[13], combined model seems to be an additional alternative to predict traveler's behavior, this study investigated a combined model which integrated self-interest and pro-environmental approaches. It should be noted that car-use habit was added to the model due to suggestion from literature. Results were presented in Table 4.

Table 4 Combined model for traveler's intention of bus usage

Self-interest approach combined with Pro-environment approach					
Go to work N=270	Attitude	.311***	AN	.080	Adjusted R2 = .185 *(Better than single model)*
	PBC1	.128	AC	-.004	
	DN	.015	PN	.269**	
	CH	.012			
Social event N=266	Attitude	.246**	AN	.154	Adjusted R2 = .165 *(Better than single model)*
	PBC1	-.011	AC	-.162	
	DN	.055	PN	.312**	
	CH	.043			
Shopping N=270	Attitude	.422***	AN	-.040	Adjusted R2 = .328 *(Better than single model)*
	PBC1	-.023	AC	-.133	
	DN	.186*	PN	.384***	
	CH	-.084			

Note: PBC - perceived behavioral control, DN – descriptive norm, AN – awareness of need, AC – awareness of consequences, PN – personal nor, CH - car use habit.

As can be observed from Table 4, the combined model showed better performance compared with single models (i.e., self-interest model and/or pro-environmental model). Adjusted R-square values of the combined model were higher than that of single models regardless of trip type. Traveler's attitude and environmental obligation were found to be predictors of bus use intention in either three investigated trip types. Descriptive norm was only observed to be significant towards bus use intention of going shopping.

4. DISCUSSION AND CONCLUSIONS

This study investigated traveler's motive towards bus use intention. Three types of trip have been considered including time-pressure trips (go to work and go to social event) and non-time-pressure trips (go shopping). Results from analyses showed that travelers seem to base on cost-benefit perception to decide bus use intention when go to work and go shopping. Regarding bus use intention for going to social event, traveler's perception were found to be driven by environmental obligation. Notably, among investigated models, the combined model showed the best performance.

Although literature of psychological models for traveler's mode choice behavior showed a trend to assume that self-interest approach has better predictive ability compared with pro-environmental approach[1)]. However, most of related studies considered mode choice intention in a general trip type. With three investigated trip types, this study provided a further understanding on the role oft trip type towards traveler's motivation. According to results of this study, self-interest motive was observed not to be dominant in all trip types. Travelers seem to decide their bus use intention based on environmental obligation regarding trips for social event. This finding, however, does not necessarily reject the dominant performance of self-interest approach. Traveler's bus use intention may depend on frequency of trip in daily life. Go-to-work and shopping trips are probably dominant in number of trips, thus leading to stronger traveler's self-interest motive regarding general perception of using bus in daily life.

In addition, this study provided an empirical evidence supporting to the development of combined model which integrates both self-interest and pro-environment motive. In the same trend with suggestion from literature, traveler's attitude and environmental obligation were found as predictors of bus use intention regardless of trip purpose. It should also be noted that influence of attitude towards intention was observed higher in go-to-work and go-shopping trips, whereas, that of environmental obligation was higher in case of social-event trips. This suggested that interventional policy should be developed with respect to different trip types. While a focus on improving bus service can be expected to attract more travelers to go to work and shopping, social campaign on using bus to protect environment can be a solution to increase public transport use when participating social events. Future works should focus on this interesting aspect of the bus service.

REFERENCES

1) Bamberg, S., Schmidt, P. 2003. Incentives, morality or habit? Predicting students' car use for university routes with the models of Ajzen, Schwartz and Triandis. *Environment and Behavior*, 35, 264-285.
2) Ajzen, I.., 1991. The Theory of Planned Behavior, *Organizational Behavior and Human Decision Process* 50, 179-211.
3) Schwartz, S.H., 1977. Normative influence on altruism. In L. Berkowitz (Ed.), Advances in experimental social psychology, Vol. 10, 221-279. NewYork: Academic Press.
4) Bamberg, S., Moser, G., 2007. Twenty years after Hines, Hungerford, and Tomera: A new meta-analysis of psy-cho-social determinants of pro-environmental behavior. *Journal of Environmental Psychology* 27, 14-25.
5) Abrahamse, W., Steg, L., Gifford, R., Vlek, C., 2009. Factors influencing car use for commuting and the intention to reduce it: A question of self-interest or morality?. *Transportation Research Part F* 12, 317-324.
6) Steg, L., Vlek, C., 2009. Encouraging pro-environmental behavior: An integrative review and research agenda. *Journal of Environmental Psychology* 29, 309-317.
7) Krizek, K.J., 2003. Neighborhood services, trip purpose, and tour-based travel. *Transportation* 30, 387–410.
8) Hensher, D.A., Reyes, A.J., 2000. Trip chaining as a barrier to the propensity to use public transport. *Transportation* 27, 341–361.
9) Cicillo, C., Axhausen, K., 2002. Mode Choice of Complex Tours. Association for European Transport, Cambridge, England.
10) Ho, C.Q., Mulley, C., 2013. Multiple purposes at single destination: A key to a better understanding of the relationship between tour complexity and mode choice. *Transportation Part A* 49, 206-219.
11) Ajzen, I., 2001. Nature and operation of attitudes. *Annual Review of Psychology* 52, 27-58.
12) Ajzen, I. 2005. Attitudes, personality, and behavior (2nd ed.). Milton-Keynes, England: Open University Press, McGraw-Hill.
13) Klockner, C.A., Friedrichsmeier, T., 2011. A multi-level approach to travel mode choice – How person characteristics and situation specific aspects determine car use in a student sample. *Transportation Research Part F* 14, 261-277.