Empirical Analysis of the Effects of Implementing Mobility Management at Inadequately Mass Transit Developed Area -A Case of Bandung, Indonesia

Taiyo ISHIKAWA[1], Akimasa FUJIWARA[2] and Puspita DIRGAHAYANI[3]

[1]Non Member of JSCE, Student, Graduate School for International Development and Cooperation,
Hiroshima University (1-5-1, Kagamiyama, Higashi-Hiroshima 739-8529, Japan)
E-mail: m185110@hiroshima-u.ac.jp
[2]Member of JSCE, Professor, Graduate School for International Development and Cooperation,
Hiroshima University (1-5-1, Kagamiyama, Higashi-Hiroshima 739-8529, Japan)
E-mail:afujiw@hiroshima-u.ac.jp
[3]Non Member of JSCE, Associate Professor, School of Architecture, Planning and Policy Development,
Bandung Institute of Technology (Jl. Ganesha 10, Bandung, 40132, Indonesia)
E-mail: pdirgahayani@sappk.itb.ac.id

It is common that travel demand management (TDM) including Mobility Management (MM) is implemented after constructing mass transit system to enable attitudinal and behavioral changes with choice alternatives. The discussion of such short-term policies, therefore, tends to receive a low priority than long-term construction projects, especially in developing countries. This study attempts to argue the necessity of MM before the construction of infrastructures. As an initial stage of the final goal, this paper examines the effects of MM at the timing that mass transit has not been developed adequately. We hypothesize that MM has a positive impact on the decision-making of mass transit development through activating the future mass transit demand based on the attitude theory. The empirical analysis in Bandung turns out that providing motivational information has a positive impact on behavioral intention of future mass transit use, and the effects of motivational information are different depending on the individual attributes. The results can conclude the significance of MM implementation before the development of mass transit in developing countries.

Key Words : *mobility management, mass transit development, developing countries*

1. INTRODUCTION

Excessive use of private vehicles has been causing transport-related issues such as traffic congestion, air pollution, traffic accidents, and living diseases especially in developing countries, and mass transit development would be one of the ways to alleviate these issues. However, the decision-making of the infrastructure investment is basically conducted based on the results of the ex-ante assessment, and if the local people's demand toward the mass transit is not adequate, the ex-ante assessment would show inadequate result and it would be difficult to run the investment. In this regard, it is also essential to activate the demand of future mass transit to promote the smooth development. In this study, as the approach to activate the future demand of mass transit, we pay attention to utilize the Mobility Management (MM) as one of the travel demand management measures. MM is known as the soft traffic measure promotes behavioral modification based on "communication" with public towards a socially and environmentally desirable direction of regional mobility [1]. Introduction of MM itself has attracted attention in Australia, Europe and the United States since mid-1990, and it has been introduced in Japan around 2000's. The common point of mentioned countries is that motorization has occurred after the development of mass transit system, and MM has implemented to enable attitudinal and behavioral changes with choice alternatives [2]. Therefore, the discussion of such short-term policies tends to receive a low priority than long-term construction projects, especially in developing countries. However, given that activation of future mass transit would be significant to realize the mass transit development and solve the transport-related issues, it is also needed to consider the implementation of MM in developing countries.

In this regard, this study attempts to argue the necessity of MM before the construction of mass transit through examining the effects of MM at the timing that mass transit has not been developed adequately.

The remainder of this paper is as follows. Section 2 introduces the hypothesis model how MM could have an impact on people's behavior based on the attitude theory. Section 3 describes the methodology of the empirical study in case of Bandung, Indonesia. The results of empirical study about MM impacts toward the psychological factors and the estimation of hypothesis models are shown and discussed in Section 4. Finally, the main research findings and future tasks are summarized in Section 5.

2. HYPOTHESIS

In order to consider the mechanism how MM has an impact on behavioral modification toward altruistic and environmentally friendly behavior, various attitude theories have been examined including the theory of reasoned action (TRA) [3], the theory of planned behavior (TPB) [4], and the Norm Activation Model (NAM) [5]. Based on TRA and TPB, it is assumed that the determinants of an intention and motivation to conduct altruistic behavior have to be activated for the behavioral modification, and it is called "Behavioral Intention (BI)". In addition, based on various studies about the conditions to activate BI, activating "Moral Obligation (MO)" is considered as one of the most significant factors to promote behavioral intention [6][7]. MO is a consciousness that tries to match their actions to social norms on the principle and standard of right and wrong, and it has been used as the important determinant which explain avoiding environmentally undesirable behaviors [8][9][10]. Also, it is required that individual accepts there is a public good/bad aspect of the private actions so as to activate the individual MO, which is called "Awareness of Consequences (AC)" [5][11]. AC is the people's recognition that "cooperative action is required". For example, people need to have a cognition that the global environmental problem is a serious problem to activate MO toward environmentally conscious behavior. In addition, even if BI is formed by these psychological factors, behavior modification to cooperative behavior does not necessarily occur. This is because of the reasons include a lack of actual behavioral control, an unrealistic intention, and weakness of the intention are considered [12][13]. In order to actually prompt behavior change, it is necessary to set up an action plan and have concrete intention to execute the plan. This is an intention that includes information on when, where,

and how the behavior will be implemented, and it is called "Implementation Intention (II)" [14].

MM is the approach which promotes various transport policies based on "communication" with public towards a socially and environmentally desirable direction of regional mobility, and as the methodology of the communication, we usually provide motivational information in terms of transport use and using marketing techniques focusing on personal travel behavior [15], and provide feedback and advice about behavioral modification based on the individual travel behavior [16]. Based on Fujii & Taniguchi (2005) [14], this methodology is called as Individualized Marketing [17], Travel Blending [18], and the Travel Feedback Program [19]. When we define each method as "Motivational information providing method" and "Feedback method", the psychological mechanism of MM toward behavioral modification based on the mentioned psychological theories would be described as shown in Fig.1.
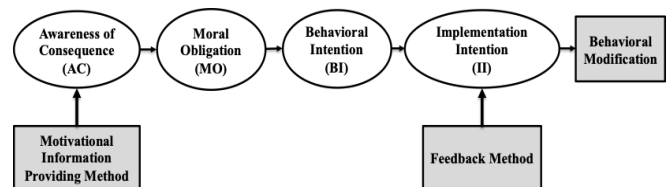

Fig.1 Behavioral modification model

However, the model shown in Fig.1 would be theorized in the situation that objective transport mode for the behavioral modification is already existed, and it would not be consisted in case of inadequately mass transit developed area. In this case, it would be difficult to activate II because the provision of the detailed data and actual image of transportation system is necessary for planning concrete action plan. Nevertheless, considering the psychological mechanisms as shown in Fig.1, there is a possibility that AC, and subsequently MO and BI could be activated as the impacts of motivational information even though II cannot be activated. As described above, BI is the determinants of an intention and motivation to conduct altruistic behavior, which means the will for using the mass transit system to reduce the excessive use of private vehicle in this study's case. Hence, activation level of BI would play an important role as the factor to assess the demand of the future mass transit. Based on aforementioned hypothesis, Fig.2 indicates the estimated behavioral modification model at inadequately mass transit developed area.

As Fig.2 shows, there is a possibility that only providing motivational information about transport use has significant impacts on AC, and subsequently MO and BI. If people accurately grasp the fact about
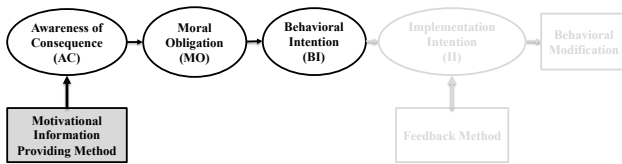
Fig.2 Estimated behavioral modification model

the effects of transport use such as the impacts of using private vehicles toward environment, it cannot be believed that only providing information can change people's psychology and behavior. However, if people do not know the fact sufficiently, the provision of the information would add new cognition, and if they misunderstand the objective state and understand it in a distorted form, the information is considered to correct people's misrecognition [20][21]. For this reason, providing motivational information about transport use is estimated to induce people's cooperative behavior, and the significance of the effects has been proved in many studies [14][22].

In addition, there is a possibility that different type of motivational information can lead to different results. Fujii, et al., (2003) [23] examined the effects of providing information toward the intentions and motivations of driving license holding with dividing the participants into risk information group, cost information group, and psychological depression information group, and they show that the activation level of intentions and the behavior was different depending on the types of information. Furthermore, if we consider the "dilution effect" which is the effect that the impact of individual information is diluted as the amount of information increases [24], selecting and providing the most influential information to each group would play an important role for inducing effective results. Therefore, in this research, we prepared some motivational information and divide into some groups based on the species of the information, and then try to examine the difference of the impacts.

Additionally, some other external factors might relate to the above model and it is necessary to contain the factors into the model as well. Firstly, private vehicle use habit will have sufficient impacts on the behavioral modification. There are many definitions of habit depends on the studies, and one of the representative definitions is "learned sequences of acts that have become automatic responses to specific cues and are functional in obtaining certain goals or end-states" [25][26]. Hence people who form the strong habit of using private vehicle means those who do not consciously choose transport mode but make the decision automatically [27]. Therefore, the possibility of forming a behavioral intention requiring a certain cognitive cost would be small [26]. Furthermore, since those who have strong habits do not make conscious decisions, they do not need to have any information

other than ordinary behavior, namely the information needed to carry out cooperative actions, thereby they tend not to have the information [28]. In these regards, an increase in frequency of using a travel mode causes the development of a habit of using this travel mode and weakens the tendency toward choosing alternative modes [29], and frequent drivers who are forced to change to mass transit for a short period continue to choose mass transit more frequently than before the forced behavioral change [27]. In consequence, there is a possibility that private vehicle use habit has impacts on behavioral intention negatively.

Secondly, general environment concern also might have an impact on behavioral modification. General environmental concern has been treated as an evaluation of, or an attitude towards facts, one's own behavior, or others' behavior with consequences for the environment [30], and it is estimated that general environmental concern may refer to both a specific attitude directly determining intentions or more broadly to a general attitude or value orientation [31]. Moreover, some studies have shown that a general environmental concern affects personal norms concerning environmental issues [32][33]. According to norm activation model, the recognition that "cooperative action is required" is necessary to be activated for activation of moral obligation and behavioral intention, and it is estimated that having a sufficient general environmental concern would be related to the awareness of consequences.

With combining the mentioned hypotheses, Fig. 3 shows the hypothesis model how providing motivational information has impacts toward behavioral intention (BI) as the proxy variable of the future mass transit demand. It is hypothesized that the awareness of consequence (AC) of excessive private vehicle use will influence moral obligation (MO). MO will influence behavioral intention (BI) to reduce excessive private vehicle use even in the inadequately mass transit developed situation. Moreover, providing motivational information about transport use is hypothesized to influence AC, and it is assumed that different type of information has different results. In addition, as the external factor, it is hypothesized that general environment concern will have positive impact on AC, and private vehicle use habit will have negative impacts on BI.

Furthermore, considering the aspects of the actual application of MM for modal shift to mass transit, the target of MM can be different depending on the final goal of the policy maker. In many cases, the goal of the MM is to mitigate traffic congestion due to the excessive use of the private vehicle, and then the target of the policy would be the private vehicle user especially car user. However, if the final goal of the policy is, for example, developing the large scale of

pedestrian road, or reducing the number of gaso-line-powered vehicle for sustainable development, the paratransit user or online transport user can be the target of the policy as well. In this regard, it would be important to analyze the impacts of MM with dividing the group based on the main transport mode to clarify the effective information to promote the modal shift efficiently depending on the final goal of the policy. Moreover, as Based on Dios & Willumsen (2011) [34] showed, the factors which affect people's mode choice can be examined with following three categories; characteristics of the trip marker (age, gender, income, vehicle ownership, et al), characteristic of trip (trip purpose, time, origin and destination, et al), and characteristic of the transportation facility (reliability of travel time, comfort and convenience, safety, et al), and there is high possibility that the differences of these characteristics can change the effects of providing information. In these reasons, we evaluate the effects of each information with dividing some groups depending on the main transport mode.
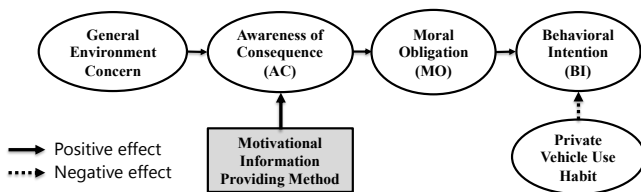

Fig.3 Hypothesis model in this study

3. METHODOLOGY

(1) Study area

In order to empirically analyze the effects of providing motivational information as a method of MM at inadequately mass transit developed area based on the hypothesized model, we picked up Bandung city in Indonesia as the case study. Bandung is the capital city of West Java, where located in a mountainous area and it provides plenty of tourism spots, hence many people visit the city especially in the weekend. In addition, as urbanization and motorization has been proceeded, urban traffic in Bandung has suffered from heavy congestion [35]. With the growth of urbanization, the number of trips per day has shown to increase 66% from 1995 to 2010, and it is estimated to be 193% by 2030 [36]. As the present transport situation, the mass transit is still lacking in Bandung, and private vehicles, online transport, and paratransit (Angkot) are the main modes that promote everyday trips. According to Bandung Central Statistics Agency, modal share of motorcycle reached around 72.2% in 2013 [37]. In addition, online transportation in which users can easily find a private

transportation to take them to the destination at a transparent with relatively inexpensive price has been popular in Indonesia especially Grab and Gojek [38]. Moreover, one of the typical paratransit in Indonesia is called Angkot, which has a capacity of 12–14 passengers and operate on fixed routes through various parts of the city [39]. However, the network of Angkot does not serve the city well and if residents do not want to or do not have ability to purchase cars, many of them either have to stick to motorcycles or adjust their residential location [40].

In these situations, Bandung city is planning to develop a new approach in improving mass transit system and promoting sustainable urban transportation such as constructing LRT for reducing auto dependency [36]. However, it is not known that how many people have demand for using the LRT, and the demand has strong impact on the feasibility analysis of the transportation development. Therefore, if the demand for using LRT is activated as the effects of MM, it would be significant to conduct MM when there is not sufficient mass transit. Furthermore, this research focuses on the behavior of young generation. The behavior of mode choice tends to be influenced by the environment that they have grown up even after they start working [41], and habits developed during adolescence will have a significant impact on the lifelong lifestyle of individuals [42]. Moreover, LRT is the project which will be held in the future, and it would make sense to consider the young generation as the main customer of the mode. Accordingly, the main focus of this research is university students in Bandung, whereby their current behavior could influence their commuting behavior not only in the present but also after they graduate and get a job.

(2) Respondents

The targets of the survey are university students, and we selected three universities where located along the corridor of the planned Bandung's Light Rail Transit, namely: Bandung Institute of Technology (ITB), Padjadjaran University (UNPAD), and Indonesia Computer University (UNIKOM). As the reason of the choices, we considered the location of these universities. As the LRT projects in Bandung, there are broadly five planned routes as shown in Fig.4, but in this research, we focus on corridor 1 which is recognized as the most important route for commuting from living area to working or studying area, and also for accessing to new station for high speed rail. In this regard, we picked up the above three universities which are located near the starting station of corridor 1.

The questionnaire was distributed through online survey. In ITB, we divided into 4 clusters depending on the location of the faculty, and we got 75 samples

in each cluster and 300 samples in total. Furthermore, we got 210 samples from UNPAD and 75 samples from UNIKOM, and in total, 585 samples could be obtained from three universities. The proportion of the sample size in each university is following the proportion of the total students of them. Table 1 presents the corresponding descriptive statistics of the sample. The balance of gender is almost equal, and the average age is around 21 years old. For the main transport mode, the all sample has divided into online transport user, private vehicle user and paratransit (Angkot) user, and then the sample number and the percentage of the modal share are shown.
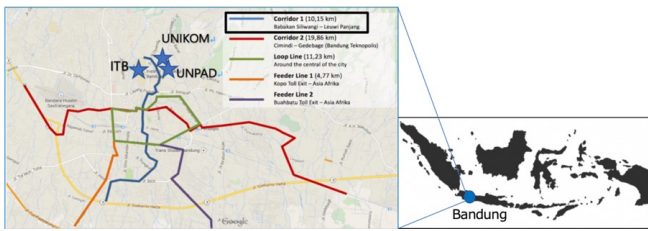

Fig.4 Planned route for LRT in Bandung

(3) Questionnaire design

Firstly, we prepared 4 motivational information: Road space and LRT use (The required road space would change, and the traffic congestion could be alleviated in Bandung); CO2 emission and LRT use (The amount of CO2 emission will be mitigated, and it will contribute to alleviate environmental problems); Obesity rate and LRT use (You can burn off more calories and the risk of being obesity would be

decreased); Accident risk and LRT use (The accident risk will be decreased, and your family and friends will not need to feel sad because of the accident). Furthermore, the above information has divided into two groups based on the species of the information: A (Information about road space and Information about CO2); B (Information about obesity rate and information about accident risk). The grouping is based on the subject of the information, which is related to individual directly or indirectly. The information of group A describes the impacts of the transport use on the individual indirectly such as the public road and environment situation, and the information of group B describes the impacts on individual directly such as the obesity rate and accident risk. As the next step, respondents were randomly assigned to two experimental groups (group A and group B) and control group. Respondents in group A was requested to read the motivational information as shown in Fig. 5. After reading the information, they are asked to complete the questionnaire. On the other hand, those in group B was requested to read the motivational information as shown in Fig. 6, and they follow the same procedure with group A. Finally, those in the control group were requested to complete the questionnaire without getting any motivational information.

In the questionnaire, firstly the simple explanation of the LRT project is described, and they are asked to answer a questionnaire in which the model's psychological factors are measured. Data for the factors, except habit, are obtained using 7-point Likert scale

Table.1 Sample descriptive statistics

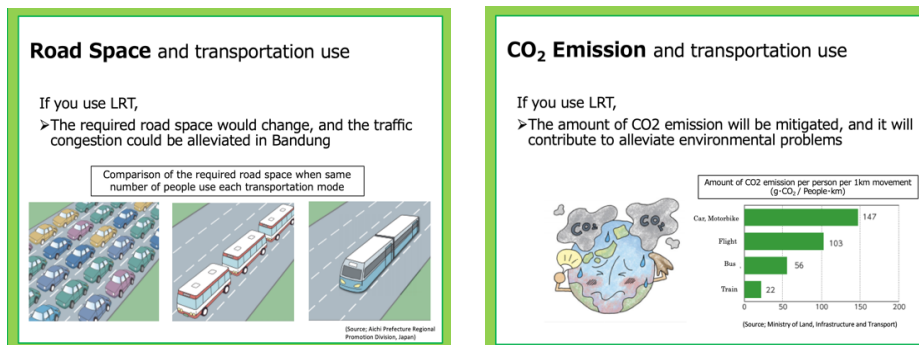|	All sample	Group A	Group B	Control group
Gender (% male)	52.0	50.6	54.1	53.9
Age (years)	M = 21.4 SD = 3.5	M = 21.4 SD = 3.4	M = 20.9 SD = 3.1	M = 22.2 SD = 3.8
Online transport	189 (32.3%)	58 (29.7%)	68 (34.9%)	63 (32.3%)
Private vehicle	296 (50.6 %)	102 (52.3%)	96 (49.2%)	98 (50.3%)
Paratransit	100 (17.1 %)	35 (17.9%)	31 (15.9%)	34 (17.4%)
Sample number	585	195	195	195

Fig.5 Motivational information (Information for group A)

with verbally defined endpoints (*fully disagree – fully agree*). For the transport use habit, we use the way to measure which has developed by Verplanken et al. (1997) [28], and exact wordings and scale antipodes used for measuring factors are shown in Table 2.

Table.2 Measurements of the psychological factors

Variable	Measurements	Scale	Cronbach's alpha
Habit	- Which transport mode do you usually use in following situation? Please choose the first answer that comes to your mind. To go to university To visit friends To watch movie To have lunch To have dinner To go to hospital To go to shopping center	Private car Private motorbike Online transport Angkot Bus Bicycle Walk Other	-
General Environment Concern	- We should pay attention to environmental problems - I am usually concerned about environmental problems - Current environmental problems cannot be ignored	7-point Likert scale ranging (*fully disagree-fully agree*)	0.807
Awareness of Consequence (AC)	- It is inappropriate to rely on private vehicle - Excessive private vehicle use is not desirable for society	7-point Likert scale ranging (*fully disagree-fully agree*)	0.844
Moral Obligation (MO)	- We should reduce excessive private vehicle use - To what extent do you think it is necessary to reduce excessive private vehicle use?	7-point Likert scale ranging (*fully disagree-fully agree*)	0.814
Behavioral Intention (BI)	- If there's LRT, I intend to reduce excessive private vehicle use in the future - If there's LRT, I intend to use LRT	7-point Likert scale ranging (*fully disagree-fully agree*)	0.881

When phycological factors are measured with Likert scale, it is desirable that multiple measurements are used. This is because it is not always possible for all individuals to correspond to the target psychological factor with only one measurement index, and it makes the measurements more reliable through statistically measuring the multiple indicators. However, when multiple psychological factors are measured, it is necessary to investigate the reliability of each variable, and one of the reliability tests is Cronbach's alpha. This test was developed by Cronbach (1951) [43] to provide a measure of the internal consistency of a test or scale; it is expressed as a number between 0 and 1. Internal consistency describes the extent to which all the items in a test measure the same concept or construct and hence it is connected to the inter-relatedness of the items within the test [44]. Usually it is recognized that the reliability is high if the alpha is more than 0.7, and the value of each factor's alpha (General environment concern; 0.807, Awareness of consequence; 0.844, Moral obligation; 0.814, Behavioral intention; 0.881) shows the high reliability, then we simply use the average scale of the measurements as the latent variable of each factor.

(4) Data analysis

To examine the effects of providing information based on the mentioned hypotheses, firstly this study uses the Analysis of Variance (ANOVA) test and Tukey's multiple comparison analysis method in the activation level of the phycological factors among two experimental groups and control group. ANOVA is a tool to check whether there's significant difference among multiple experimental groups and control groups, and Tukey's method provide the analysis of pairwise differences. However, these tests do not clarify the cause and effect of these phycological factors. Therefore, secondly this study uses the covariance-based Structural Equation Modeling (SEM) to confirm the relationship among the phycological factors which has shown in Fig.3. Furthermore, in
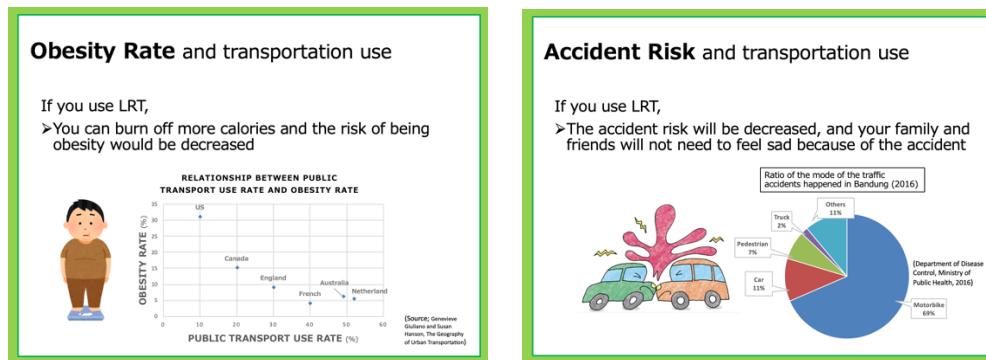
Fig.6 Motivational information (Information for group B)

order to check the effects of providing information depending on the main transport mode, this study analyzes the above methods with dividing the participants into three groups; private vehicle user, online transport user, and paratransit user.

4. RESULTS

(1) ANOVA and Turkey's multiple comparison analysis

Measures of the activation level of the psychological factors were developed by calculating the average value of the 7-point Likert scale ranging (*fully disagree - fully agree*) in each factor, and the impacts of providing information have examined based on the differences of each value among group A (Indirect information provided group), group B (Direct information provided group), and the control group (group C). Firstly, Table 3 shows the mean and standard deviation (SD) of factors in each group, and the result of ANOVA and Tukey's multiple com-

parison analysis with all sample. It can be observed that there are significant differences among the three groups in all variables based on ANOVA. Furthermore, as the detailed difference among the groups, the results of Tukey' multiple comparison analysis shows that both of the indirect and direct information toward individual have significantly much impacts on all variables comparing to the control group which didn't get any information. This result indicates that providing motivational information has significantly activated the future mass transit demand regardless of the type of the motivational information in case of all sample.

Secondly, in order to examine the differences of the information impacts depending on the main transport mode, Table 4 presents the means, standard deviations (SD), and the results of the ANOVA and Tukey's multiple comparison analysis with dividing the sample into online transport user, private vehicle user and paratransit user as the main transport mode.

With respect to online transport user, the ANOVA results report that there are significant differences

Table. 3 Result of ANOVA and multiple comparison analysis

All Sample (N = 585)

Variable	A: Indirect Information		B: Direct Information		C: No Information		ANOVA		Tukey
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*	*F*	*p*	
AC	5.49	0.91	5.60	0.96	5.02	1.02	26.21	***	A>C ***, B>C ***
MO	5.73	0.96	5.73	0.96	5.29	0.95	22.99	***	A>C ***, B>C ***
BI	5.90	1.06	5.89	1.05	5.48	1.04	18.49	***	A>C ***, B>C ***

***p<0.001, ** p<0.01, * p<0.05

Table. 4 Result of ANOVA and multiple comparison analysis based on the main use mode

Online Transport User (N = 189)

Variable	A: Indirect Information		B: Direct Information		C: No Information		ANOVA		Tukey
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*	*F*	*p*	
AC	5.47	0.80	5.61	1.09	5.07	0.99	4.59	**	A>C *, B>C **
MO	5.92	0.89	5.79	1.04	5.32	0.92	6.21	**	A>C **, B>C **
BI	6.35	0.84	6.13	0.99	5.57	0.83	6.08	**	A>C **, B>C **

Private Vehicle User (N = 296)

Variable	A: Indirect Information		B: Direct Information		C: No Information		ANOVA		Tukey
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*	*F*	*p*	
AC	5.34	0.95	5.67	0.91	4.80	1.12	19.14	***	A>C **, B>C ***
MO	5.55	1.00	5.76	0.94	4.96	1.13	15.62	***	A>C *, B>C ***
BI	5.32	1.16	5.80	1.02	5.01	1.17	12.27	***	B>C **, B>A**

Paratransit User (N = 100)

Variable	A: Indirect Information		B: Direct Information		C: No Information		ANOVA		Tukey
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*	*F*	*p*	
AC	5.97	0.86	5.34	0.79	4.91	0.76	15.13	***	A>C ***, A>B **
MO	5.97	0.84	5.50	0.85	5.24	0.76	7.21	**	A>C ***, A>B *
BI	6.06	0.95	6.05	0.79	5.59	0.81	3.29	*	A>C **

*** p<0.001, ** p<0.01, * p<0.05

among the three groups on AC, MO and BI. As the detailed difference of the groups, both of the group A and group B have significantly higher value for AC, MO, and BI comparing to the no information group, and the difference of the impacts depending on the types of information has not been visible.

With respect to private vehicle user, the ANOVA results indicate that there are significant differences among the three groups on all variables. As the results of Tukey's analysis, group B has significantly higher value for all variables comparing to the no information group. In particular, for BI, it is proven that group B has higher value than group A. This result shows that, in case of the private vehicle user, providing the direct information toward individual can affect the future demand of mass transit effectively.

With respect to paratransit user, the ANOVA results indicate that there are significant differences among the three groups on all variables. In detail, as the results of Tukey's analysis, group A has significantly higher value for all variables comparing to the no information group. Furthermore, group A has significantly higher value for AC and MO than group B. These results show that, in case of the paratransit user, providing the indirect information toward individual can affect the future mass transit demand effectively.

To sum up the results, when we analyze the information impacts on the psychological factors (AC, MO, BI) with using all sample, it is shown that providing motivational information activates the all psychological factors regardless of the type of the motivational information. This result shows that providing motivational information has positive impact on BI as the future mass transit demand. Moreover, when we analyze the information effects depending on the main use transport mode, for online transport user, both of the information have significant impact on BI regardless of the information species. In addition, for private vehicle user, group B shows significantly higher impact on BI comparing

to group A, meanwhile for paratransit user, A group has significantly higher impact on BI comparing to group B. These results indicate that, in order to activate BI, providing direct information toward individual can be more effective for private vehicle user, and providing indirect information toward individual can be more effective for paratransit user. These are the results of the ANOVA and Tukey's multiple comparison analysis, but the mechanism of the cause and effect relationship among these psychological factors are still not clear, then we further conduct the structural equation modeling.

(2) Structual Equation Modeling

In order to confirm the hypothesis of the cause and effect relationship among the phycological factors which has shown in Fig.3, this study uses the covariance-based Structural Equation Modeling (SEM). SEM is a method of examining the relationship between multiple constituent concepts as a method combining functions such as multiple regression analysis, factor analysis, and path analysis. As the way of analysis, statistical analysis software called M-plus was used with maximum likelihood estimation method. Firstly, Table 5 shows the estimation result of the SEM with all sample, online transport user, private vehicle user and paratransit user as the main transport mode. As a result of factor analysis, parameters and p-value (*** p<0.001, ** p<0.01, * p<0.05) are shown. Moreover, the result with all sample in Table 5 is indicated in the path diagram in Fig 7. This finding is observed to be consistent with the proposed hypothesis that the influence of the transport use habit on the BI is a negative value, while the other paths show positive value as shown in Fig.3. Furthermore, the overall goodness of fit of the model appears to be acceptable (Chi-squire=105.8 [p<0.001], CFI=0.977, RMSEA=0.045).

Besides, the results of SEM with dividing all sample into groups depending on the main transport mode are also shown in Table 5. As the main difference among the groups, the impacts of private
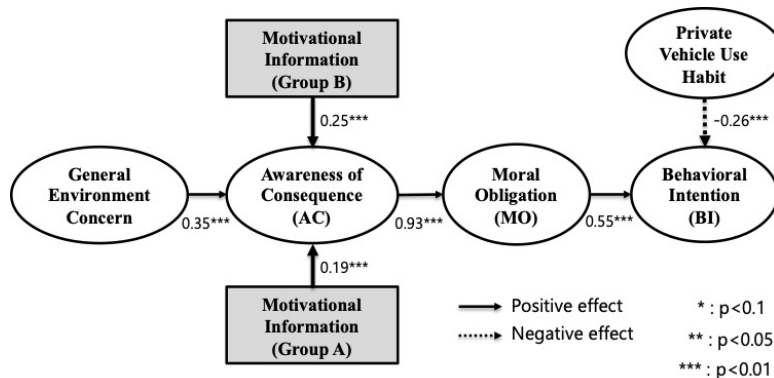

Fig.7 Result of SEM with all sample

8

vehicle use habits on BI is obvious. Although the impacts of private vehicle use habit are all negative value in all groups, only the case of private vehicle user shows the significant results. Additionally, the impacts of the information are different depending on the main mode same as shown in previous analysis. Despite the parameter of the information impact between group A and group B is almost same for online transport user group, the impact of group B (Direct information toward individual) is stronger than group A (Indirect information toward individual) for private vehicle user group, and the impact of group A is stronger than group B for paratransit user group. Except the above points, the cause and effect relationships among the psychological factors indicate same correlation sign and significant results among the groups. On top of that, the overall goodness of fit of the three models also appears to be acceptable.

(3) Discussion

The above findings show that providing motivational information has positive impacts on AC, and subsequently MO and BI in terms of future LRT project in Bandung. In addition, general environment concern has positive impact on AC, and transport use habit has negative impact on BI. Besides, as the difference of the information impacts on these psychological factors depending on the main transport mode, for online transport user, there are not obvious differences about the impacts of the information for both of group A and group B. However, the information of group B has more significant impact on AC for private vehicle user, and the information of group A has more significant impact on AC for paratransit user. In addition, the impact of private vehicle use habit on BI shows significantly only for private vehicle user.

The results of this study are basically following the conceptual model based on the attitude theories, which is shown that providing the motivational information has a positive impact on AC, and subsequently MO and BI. This concept has been proven in the results of this study even in the situation that mass transit has not been developed adequately. In addition, as the external factor, it is hypothesized that general environment concern will have positive impact on AC, and private vehicle use habit will have negative impact on BI. Furthermore, this study examined the difference of the information impacts on psychological factors depending on the main transport mode. Although Fujimoto et al., (2016) [45] analyzed the effects of providing motivational information with dividing the sample into some clusters based on individual attributes and psychological factors, the difference depending on the main transport mode is not shown. Moreover, as our recognition, there is no other study that shows the information impacts on online transport user. In this regard, this study shows the unique findings in terms of the impacts of the motivational information depending on main use transport mode.

5. CONCLUSION

It is common that Mobility Management is implemented after the construction of mass transit system with the aim of enabling attitudinal and behavioral changes with choice alternatives. Therefore, the discussion of such short-term policiesis tend to receive a low priority than long-term construction projects especially in developing countries. However, the local people's demand toward the construction

Table 5. Result of Structural Equation Modeling

	All sample		Online Transport User		Private Vehicle User		Paratransit User	
	Parameter	p value	Parameter	p value	Parameter	p value	Parameter	p value
General Environment Concern ⇒ AC	0.35	***	0.43	***	0.29	***	0.36	***
Motivational Information (Group A) ⇒ AC	0.19	***	0.17	**	0.12	*	0.47	***
Motivational Information (Group B) ⇒ AC	0.25	***	0.19	**	0.30	***	0.25	**
AC ⇒ MO	0.93	***	0.92	***	0.92	***	0.97	***
MO ⇒ BI	0.55	***	0.78	***	0.47	***	0.50	***
Private Vehicle Use Habit ⇒ BI	-0.26	***	-0.01	-	-0.21	***	-0.05	-
Sample Size	585		189		296		100	
Log-likelihood	-6537		-2043		-3378		-1044	
Chi-Squire	105.8***		69.8**		80.6***		100.2***	
CFI	0.977		0.972		0.975		0.893	
RMSEA	0.045		0.049		0.048		0.104	

*** p<0.001, ** p<0.01, * p<0.05

project is not adequate, it would be difficult to realize the project due to the results of ex-ante assessment. In this regard, this study attempts to argue the necessity of MM before the construction of infrastructures as the measures to activate the demand of the future mass transit at the timing that mass transit has not been developed adequately. We hypothesize that MM has a positive impact on the decision-making of mass transit development through activating the future mass transit demand based on the attitude theory.

An empirical study was conducted by using 585 survey data collected in Bandung, Indonesia. Since Bandung city is planning to develop LRT system, the survey was developed based on LRT project, and because the behavior of mode choice tends to be influenced by the environment that they have grown up even after they start working, this study focuses on the university students. The participants were randomly assigned to a control group and 2 experimental groups based on the type of provided motivational information so as to clarify the difference of the effects depending on the information. As the results of the analysis, major empirical findings are (1) providing motivational information about the undesirable consequence of excessive automobile use has positive impact on behavioral intention (BI) as the proxy variable of the future mass transit demand, (2) general environment concern has positive impact, and private vehicle use habit has negative impact toward BI, and (3) motivational information which is related individual directly (Information about obesity and accident risk) has more significant impact on BI for private vehicle user, and motivational information which is related to individual indirectly (Information about road space and CO_2 emission) has more significant impact on BI for paratransit user.

As the significance of the study, we hypothesized that implementing MM has positive impact on the decision-making of transport planning and project evaluation through activating BI as the future demand for mass transit system. The decision-making of transportation infrastructure investment is conducted based on the ex-ante assessment, and if the demand of the local people toward the mass transport system is not enough, the ex-ante assessment would show inadequate result and it would be difficult to run the investment and the development smoothly. In this regard, we examined the effects of MM toward the demand for future mass transit with using BI as the proxy variable, and the results show the possibility that MM can be utilized before the development of mass transit in developing countries as well.

Future research challenged are as follows. First, it would be needed to conduct further empirical studies in other cities and other generation before giving a

general conclusion. Since this study only focuses on the university students in Bandung city, it is not sufficient to conclude the effects of MM at inadequately mass transit developed area. It is also expected that there are other factors which affect the demand for future transport depending on the geographical situation and the economic situation, and then it would be desirable to develop a model with including these situations. Second, it would be necessary to consider more variety of the motivational information for conducting MM in some region. The information we used in this study was selected based on the experience of MM in Japan, however, there is the possibility that effective information cannot be same when the background and culture is different. Deeper consideration about the motivational information would be needed through more qualitative and quantitative study. Finally, it would be worth examining the impacts of MM on the supply side at inadequately mass transit developed area. Although this study focused on the effects of MM toward the customer's demand, in order to discuss the contribution to the decision-making of transport planning and project evaluation, it is needed to examine the impacts on the supply side such as the government or city office. For instance, it would be valuable to examine the change in the consciousness of stakeholders about the infrastructure development as the impacts of MM.

REFERENCES
1) Fujii, S. & Taniguchi, A. : Determinants of the effectiveness of travel feedback programs - a review of communicative mobility management measures for changing travel behaviour in Japan, *13*, 339–348, 2006.
2) Taniguchi, A., & Fujii, S. : Process Model of Voluntary Travel Behavior Modification and Effects of Travel Feedback Programs. *Transportation Research Record: Journal of the Transportation Research Board*, *2010*(0), 45–52, 2007.
3) Ajzen, I., & Fishbein, M. : A Bayesian analysis of attribution processes. *Psychological Bulletin*, *82*(2), 261, 1975.
4) Ajzen, I. : From intentions to actions: A theory of planned behavior. In *Action control* (pp. 11–39). Springer, 1985.
5) Schwartz, S. H. : Normative influences on altruism1. In *Advances in experimental social psychology* (Vol. 10, pp. 221–279). Elsevier, 1977.
6) Garling, T., & Gillholm, R. : Reintroducing attitude theory in travel behavior research: The validity of an interactive

interview procedure to predict car use. *Transportation 25, 129–146.,* 1988.

7) Lynn, M., & Oldenquist, A. : Egoistic and nonegoistic motives in social dilemmas. *American Psychologist*, *41*(5), 529, 1986.

8) Gärling, T., Fujii, S., Gärling, A., & Jakobsson, C. : Moderating effects of social value orientation on determinants of proenvironmental behavior intention. *Journal of Environmental Psychology*, *23*(1), 1–9, 2003.

9) Stem, P. C., Dietz, T., & Black, J. S. : Support for environmental protec- tion: The role of social norms. *Popidation and Environment, 8,204-222,* 1986.

10) Van Liere, K. D., & Dunlap, R. E. : Moral Norms and Environmental Behavior: An Application of Schwartz's Norm-Activation Model to Yard Burning 1. *Journal of Applied Social Psychology*, *8*(2), 174–188, 1978.

11) Schwartz, S. H., & Howard, J. A. : A normative decision-making model of altruism. *Altruism and Helping Behavior*, 189–211, 1981.

12) Garling, T., & Gillholm, R. : Reintroducing attitude theory in travel behavior research: The validity of an interactive interview procedure to predict car use. *Transportation 25, 129–146,* 1998.

13) Rise, J., Thompson, M., & Verplanken, B. : The intention-behavior relation: Implementation intention and commitment. *International Congress of Psychology*, 2000.

14) Fujii, S., & Taniguchi, A. : Reducing family car-use by providing travel advice or requesting behavioral plans: An experimental analysis of travel feedback programs. *Transportation Research Part D: Transport and Environment*, *10*(5), 385–393, 2005.

15) Jones, P. : Encouraging behavioural change through marketing and management: What can be achieved? *Presented at the 10th International Conference on Travel Behaviour Research, Lucerne, Switzerland,* 2003.

16) Taniguchi, A., & Fujii, S. : Process Model of Voluntary Travel Behavior Modification and Effects of Travel Feedback Programs. *Transportation Research Record: Journal of the Transportation Research Board*, *2010*(0), 45–52, 2007.

17) Brög, W. : Individualized marketing: Implications for TDM, CD-ROM of the proceedings of the 77th Annual Meeting of Transportation Research Board. Washington DC, 1998.

18) Rose, G., & Ampt, E. : Travel blending: an Australian travel awareness initiative. *Transportation Research Part D: Transport and Environment*, *6*(2), 95–110, 2001.

19) Taniguchi, A., Hara, F., Takano, S., Kagaya, S., & Fujii, S. : Psychological and behavioral effects of Travel Feedback Program for travel behavior modification. *Transportation Research Record 1829, 182–190,* 2003.

20) Fujii, S., Gärling, T., & Kitamura, R. : Changes in drivers' perceptions and use of public transport during a freeway closure: Effects of temporary structural change on cooperation in a real-life social dilemma. *Environment and Behavior*, *33*(6), 796–808, 2001.

21) Fujii, S., & Kitamura, R. : What does a one-month free bus ticket do to habitual drivers? An experimental analysis of habit and attitude change. *Transportation*, *30*(1), 81–95, 2003.

22) Taniguchi, A., Suzuki, H., & Fujii, S. : Mobility Management in Japan: Its Development and Meta-Analysis of Travel Feedback Programs. *Transportation Research Record: Journal of the Transportation Research Board*, *2021*, 100–109, 2007.

23) Fujii, S., Nishinaka, T., & Kitamura, R. (n.d.). An experiment of communication toward non automobile-license holder, Journal of Infrastructure Planning and Management. *Journal of Infrastructure Planning and Management, 20(4), 1003-1008, (in Japanese with English Abstract)*. 2003.

24) Aronson, E. : The Social Animal, (6th ed.), *W.H. Freem*, 1992.

25) Hull, C. L. : Principles of behavior: An introduction to behavior theory, 1943.

26) Verplanken, B., & Aarts, H. : Habit, Attitude, and Planned Behaviour: Is Habit an Empty Construct or an Interesting Case of Goal-directed Automaticity? *European Review of Social Psychology*, *10*(1), 101–134, 1999.

27) Gärling, T., Fujii, S., & Boe, O. : Empirical tests of a model of determinants of script-based driving choice. *Transportation Research Part F: Traffic Psychology and Behaviour*, *4*(2), 89–102, 2001.

28) Verplanken, B., Aarts, H., & Van Knippenberg, A. : Habit, information acquisition, and the process of making travel mode choices. *European Journal of Social Psychology*, *27*(5), 539–560, 1997.

29) Fujii, S., & Gärling, T. : Development of script-based travel mode choice after forced change. *Transportation Research Part F: Traffic Psychology and Behaviour*, *6*(2), 117–124, 2003.

30) Weigel, R. H. : Environmental attitudes and the prediction of behavior. *Environmental Psychology: Directions and Perspectives*, 257–287, 1983

31) Fransson, N., & Gärling, T. : Environmental concern: Conceptual definitions, measurement methods, and research findings. *Journal of Environmental Psychology*, *19*(4), 369–382, 1999.

32) Black, J. W., & Shankley, N. P. : The isolated stomach preparation of the mouse: a physiological unit for pharmacological analysis. *British Journal of Pharmacology*, *86*(3), 571–579, 1985.

33) Dunlap, R. E., & LIERE, K. D. : Commitment to the dominant social paradigm and concern for environmental quality. *Social Science Quarterly*, *65*(4), 1013, 1984.

34) de Dios Ortuzar, J., & Willumsen, L. G. : *Modelling transport*. John Wiley & Sons, 2011.

35) Lubis, H., Isnaeni, M., Nurjaya, S., Transport, U. B.-J. E. A. S.: Urban transport and land use planning toward the sustainable development (case study of bandung metropolitan area). *Citeseer*, 2003.

36) Tarigan, A. K. M., Sagala, S., Samsura, D. A. A., Fiisabiilillah, D. F., Simarmata, H. A., & Nababan, M. : Bandung City, Indonesia. *Cities*, *50*, 100–110., 2016.

37) *Bandung City Central Statistics Agency*. (2015).

38) Larasati, D., & Kasri, R. A. : Demand of Using Sharing-Based Transportation Services in Indonesia: Does Socio-Religious Preference Matter? *Advances in Social Science, Education and Humanities Research (ASSEHR),*

Volume 126 2nd International Conference on Indonesian Economy and Development, 2017.

39) Joewono, T. B., & Kubota, H. : The characteristics of paratransit and non-motorized transport in Bandung, Indonesia. *Journal of the Eastern Asia Society for Transportation Studies, 6, 262–277,* 2005.

40) Belgiawan, P. F., Schmöcker, J.-D., & Fujii, S. : Understanding car ownership motivations among Indonesian students. *International Journal of Sustainable Transportation*, *10:4, 295-*, 2016.

41) Simma, A., & Axhausen, K. W. : Commitments and modal usage: Analysis of German and Dutch panels. *Transportation Research Record, 1854, 22–31,* 2003.

42) Millstein, S. G., & Litt, I. F. : Adolescent health. *The Developing Adolescent (Pp. 431-456). Cambridge, MA, US:*

Harvard University Press, 1990.

43) Cronbach, L. : Coefficient alpha and the internal structure of tests. *Psychomerika.*, *16:297-334*, 1951.

44) Tavakol, M., & Dennick, R. : Making sense of Cronbach's alpha. *International Journal of Medical Education*, *2,* 53–55, 2011.

45) Fujimoto, S., Taniguchi, A., Taniguchi, M., & S. Fujii. : Measurement of effect on motivational information for mobility management. *Journal of Infrastructure Planning and Management. Journal of Infrastructure Planning and Management, 72(5), 1321-1330,. (in Japanese with English Abstract),* 2016.

(Received October 4, 2019)