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# Factors Affecting Consumers' Green Commuting

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As Chinese air pollution and other environmental problems were paid much attention by the public, appeals about reducing private car use and adopting public transport had come into being. In view of this context, the current study extended the theory of planned behavior by including environmental concerns to explore the effect of subjective factors on consumers' green commuting. A questionnaire study was conducted among commuters living in Beijing and Shanghai to collect data. By using structural equation modeling, the research confirmed that green commuting was mostly predicted by the factor of intentions. The article closed with discussion of theoretical and practical implications.

*Keywords*: green commuting, environmental concerns, planned behavior, factors

## INTRODUCTION

Private car gains its popularity in Chinese cities as residents' living standards keeping enhance in recent years, while this tendency also leads to environmental problems. The transport system, with huge emissions of CO2and using considerable quantities of fossil energy, is one of the main sources of heavy air pollution in big cities such as Beijing and Shanghai. This situation becomes increasingly serious because of un-environmental friendly commuting. Under this context, China government and governments in other countries are trying to alleviate air pollution and energy usage by means of legislation, taxation, and public relations. For example, Australia governments implemented the carbon tax since 2012, though it was highly argued; a variety of brochures about knowledge of the advantages of taking public transport were handed out, etc. Therefore, besides improving the efficiency of energy utilization as well as developing new energy, an important aspect that cannot be ignored is the effect of public behavior on socio-economic environment. Finding and analyzing the psychological factors which influence consumers' green consumption has gradually become a hotly debated topic. Extant studies illuminated that consumers' environmental awareness stimulated green

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consumption via influencing behavioral attitudes and intentions. Subjective factors such as perceived behavior controls and social norms can also influence commuting mode choice.

Green commuting, generally refers to the environmental friendly travel mode such as taking bus/subway, walking, riding bicycles and carpooling, the main purpose of which is to reduce energy usage and CO2 emission. There were several studies about travel mode choice (Koetse and Hoen 2014), and the popular social psychological theory for explaining behavioral choice-the theory of planned behavior was proved to have a robust explanatory power (Bamberg and Schmidt 2001; Harland et al. 1999; Heath and Gifford 2002).

This paper was structured as follows. It started with a brief literature review in environmental concerns, attitudes, intentions and perceived behavior control. Based on the literature review, a conceptual model explaining green commuting was presented. Then, data analysis was implemented by means of multivariate statistical method to verify theoretical hypotheses. Finally, conclusions, limitations and implications were discussed.

***State of the literature***

- The theory of planned behavior has been widely used in research on green consumption. However, few study explored the psychological factors of green commuting based on the theory of planned behavior.
- Case study was employed to investigate the difference of green commuting between groups. The results showed that residents who lived in an area with a high population were more likely to adopt green commuting.
- Until now, the extant research about green commuting was mainly carried out under the context of developed countries.

***Contribution of this paper to the literature***

- This study explores psychological determinants of green commuting behavior by using structural equation model, under the context of developing countries. Respondents of this research live in Beijing and Shanghai.
- The study extends the theory of planned behavior by incorporating the variable of environment concern, therefore could offer a slightly new framework to explore green commuting behavior.
- The results of the study show that the highest scored path includes factors of environmental concern, attitudes, intentions, and green commuting behavior in sequence. And this indicated that green commuting was mainly influenced by intentions.

## Determinants of Green Commuting Behavior

The theory of planned behavior (TPB), originated from the theory of reasoned action (TRA), is one of the most popular theories in field of behavior decisions. The TRA suggests that the closest determinant of volitional behavior is the individual's intention to engage in that behavior. Intentions represent an individual's conscious motivation to make an effort to engage in a specific behavior (Fishbein and Ajzen 1975), and a stable causal relationship between the two factors had been fully demonstrated (Bang Hae-Kyong et al.2000; Feldman et al.1988). However, some scholars believe that behavior is not only influenced by intention (Thomas and Schultz 2000), namely the presence of restrictions, such as limited skills, chances, or external conditions can make behaviors hard to be predicted within the realm of the TRA. By adding perceived behavior control (PBC) as an additional predictor (Ajzen 1991), the TPB has a broader explanatory power toward non-volitional behavior.

Perceived behavior control can mediate behavior by changing situational factors like economic cost, efficiency, and ease of use, which reflects the individual's perception of the ease or difficulty in performing the task (Ajzen 1991). If green commuting costs too much, rational consumers will not or only occasionally implement

green commuting because of the low level of perceived behavior control, despite their willingness to adopt this kind of travel mode. Thus, green commuting is not only influenced by intentions. Steg (2003) stated that personal advantages, such as freedom, comfort and convenience may be evaluated as more essential than environmental consequences associated with traditional travel mode.

## Determinants of Green Commuting Intentions

The TPB postulates that behavior is predicted by intentions, which in turn are predicted by three social-cognitive factors: attitudes, subjective norms and perceived behavior control. The concepts of attitudes and subjective norms are generated from the TRA, and the former represents individual's positive or negative feelings (evaluative affect) about performing the target behavior, while the latter demonstrates personal perception that most people who are important to him think he should or should not perform the target behavior (Fishbein and Ajzen 1975). Social learning theory indicates that individual's behavior is an observed consequence owning to the interaction of inner factors and environmental factors (Bandura 1977). Social norms served as an important environmental factor, was expected to have direct influence on behavior. Past researcher suggested that individual-consuming decisions were largely influenced by the attitudes of friends, family, and other groups that were important to the individual consumer (Childers et al.1992; Nye and Hargreaves 2010; Fornara et al.2011; Valkila and Saari 2013). And individual consumer was more likely to act in a manner corresponding with group beliefs (Miniard et al. 1983; Osterhus 1997). In fact, collectivism culture results in that social outcomes play an important role in Chinese consumers' perceived value. In other words, evaluations made by others and group members are key factors affecting consumption choice. Especially when the relationship between the overuse of private cars and PM2.5 air pollution had become a hot topic in Chinese society, the suggestion of green commuting made by reference groups would affect commuters' willingness for green travel.

In addition, Fishbein and Ajzen (1975) stated that the formation of attitudes could be interpreted from two aspects: one was salient beliefs toward a particular behavior, and another was the outcome of evaluations. Hofstede (1991) indicated that collectivism may result in greater self-monitoring and that would further intensify consumers' self-monitoring attitudes. By contrast, individualism may strengthen consumers' need for uniqueness and bolster their self-expression attitudes. Based on the theory mentioned above, Bian and Forsythe (2012) made a cross cultural comparison research concerning purchase intention for luxury brands and discovered that Chinese students demonstrated greater need for uniqueness than U.S. students. The increasingly global integration as well as individualism trend lead to gradually cultural change (Brewer and Chen 2007), thus consumers may incline to buy private vehicles to demonstrate their social status. By adding the factor of environment concerns, the study explored whether subjective norms or environment concern would affect more on green commuting intention during the period of social label changing from collectivism to individualism in China.

*Therefore, the hypothesis can be termed as:*

*H1: intentions and perceived behavior control influence green commuting directly;*

*H2: attitudes, perceived behavior control and subjective norms influence of green commuting directly*

## Environmental Concerns and Its Effect on Green Commuting

Although the TPB reflects a robust explanatory power in behavior decision, many scholars are still questioning its integrity (Perugini and Bagozzi 2001). For the research of green commuting, we emphasized not only the selection of individual travel patterns, but also the effect of consumers' environmental concern. Environmental concern had been treated as evaluation of, or an attitude towards facts, one's own behavior, or others' behavior with consequences for the environment (SjÎberg 1989; Takala 1991; Putrawan, 2015; Erdogan & Marcinkowski, 2015). Since the extended TPB model can explain consumers' self-interest consideration, social effects consideration and environmental effects consideration, so it can evaluate the determinants of environment friendly behavior in a wider range.

Fishbein and Ajzen (1975) considered that general attitudes did not have direct influence on behavior, but could affect behavioral intentions directly. Research had demonstrated that there was a positive relationship between environmental concerns and consumer behavior, but whether it is a direct correlation are still inconclusive. Many scholars had pointed out that consumers with higher level of environmental concerns would be more likely to exert environmental friendly consumption (Chan 1999; Laroche et al. 2001). Despite Roberts(1996) stated that high level of environmental concerns would not actually led to behavioral changes, one of the explanations to expound this conflict was the "situation-specific cognition" theory proposed by Bamberg and Schmidt (2003), which indicated that only situation-specific cognition was direct determinant of specific behaviors, and the weak direct relationship between environmental concern and specific environmental friendly behaviors was due to the incorrect assumption that general attitudes like environmental concern were direct determinants of specific behaviors. Paulssen (2014) proved that environmental concerns could influence the attitudes of adapting public transport rather than intention. Therefore, the enhancement of environmental awareness would lead to positive attitudes toward green commuting among consumers, but could not yet affect behavioral intentions directly. Thus, environmental concern can only influence attitude directly rather than intention.

Therefore, the hypothesis can be termed as:

*H3: environmental concerns influence attitude directly;*

Based on the above analysis, a conceptual model is proposed in Fig. 1.

## Purpose of the Study

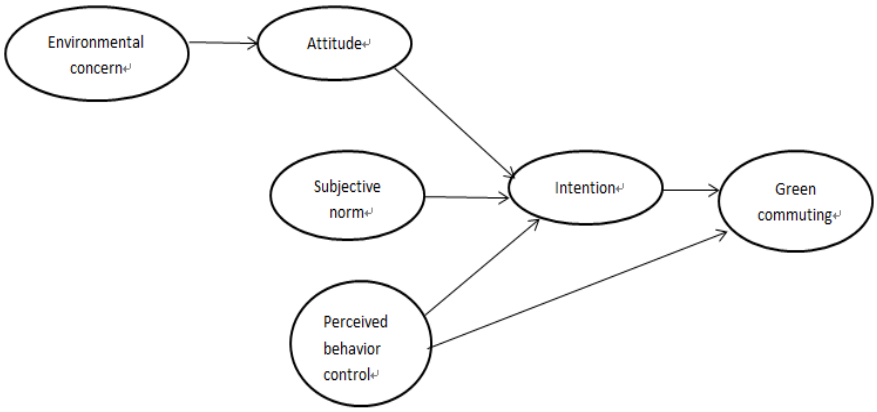


**Figure 1.** Conceptual mode

The purpose of the study is to explore the influence of subjective factors on green commuting in Chinese society. Some studies on travel mode choice extended the theory of planned behavior by incorporating certain factors, such as habit. In order to explore the factors affecting Chinese consumers' green commuting, the current study added environmental concern as a general attitude to detect the effect of subjective factors in a wider range.

## METHODOLOGY

### Sample and Population

The sample comprised consumers owing a private car, therefore they could choose their travel mode between driving a private car and using public transports, riding bicycle or walking. This kind of respondents widely spread in metropolis such as Beijing and Shanghai, and their commuting habits have vital influence on traffic situation and atmospheric pollution.

The survey was based on a random sample of 1355 commuters, who lived in Beijing or Shanghai. The questionnaire was self-administered, and was handed out and collected on the internet. The questionnaire used in the survey comprised three parts, including subjective factors, commuting behavior and the socio-demographic profile of the respondents. Descriptive statistics for the sample's socio-demographic profile could be figured out in Table 1.

### Data Collection Tools

The measurement instruments in this research were rooted in past literature and self-developed items according to the concepts and characteristics of green commuting. Attitudes, intentions, subjective norms and green commuting were adjusted in line with the reality of Chinese traffic situations and commuting infrastructure. Given 7-point Likert scales may lead to ambiguity for respondents, 5-point scales were adopted.

Items about the environmental concern and perceived behavior control were self-developed. The former represented individuals' predispositions toward long-term environmental consequences of green commuting, and the later measured the influence of objective conditions such as economic costs and the availability of commuting infrastructure.

Schultz (2001) distinguished three clusters of environmental concerns that may affect behavior-specific attitudes and environmental behavior; namely, egoistic, altruistic, and biospheric environmental concerns. A person may choose public transports for expense saving (egoistic), for alleviate possible mental hazards posing on others (altruistic), or for prevent atmospheric pollution that may trample plants and animal species (biospheric). In this research, biospheric concerns were selected to tap the relationship between commuters and the environment.

The items of perceived behavior control have been discussed in past literature. The time and effort needed to evaluate and search for products were part of the cost of consumption. Taylor and Todd (1995) acknowledged that external resource constraint provided two kinds of control beliefs: one relating to resource factors such as time and money cost that may hinder usage; another relating to technology

**Table 1.** Sample's socio-demographic profile (%)

| | | | | |
|---|---|---|---|---|
| ***Gender*** | | | | |
| Male | Female | | | |
| 70.9 | 29.1 | | | |
| ***Age*** | | | | |
| <20 | 20~30 | 31~40 | 41~50 | >50 |
| 1.3 | 36.2 | 38.1 | 14.8 | 9.6 |
| ***Marital status*** | | | | |
| Married | Single | Other | | |
| 50.8 | 42.3 | 6.9 | | |
| ***Place of residence*** | | | | |
| Urban | Outskirts | rural | | |
| 38.5 | 45.2 | 16.3 | | |
| ***Educational level*** | | | | |
| Primary education | | Secondary education | | Tertiary education |
| 2.7 | | 37.1 | | 60.2 |

compatibility issues. The study indicated that only the former was significant determinant of PBC. Thus, expenses, time-consuming and available are the main factors selected to evaluate the influence of objective conditions on PBC.

The attitudes scale was adapted from the study of Maloney (1975); the three statements try to illuminate the strength of agreement toward green commuting. To evaluate respondents' intention, the three statements were selected from the extant scales (Chan 2001; Taylor and Todd 1995). The items about subjective norms were used to evaluate the influence of reference groups' attitudes and behaviors on consumers. The respondents' answer about three green commuting items was used to investigate consumers' commuting habit and examine the effort they had already taken to implement green commuting. These items were adapted from the extant scale (Chan 2001).

## Data Analysis

After collection, the data was analyzed by using the statistical techniques such as confirmatory factor analysis and structural equation model analysis. Both factor analysis method and structural equation model (SEM) were used to estimate multiple and interrelated dependence relationships.

## RESULTS

## Measurement Model

In order to gain a robust understanding of the interdependent relationship between the various constructs, structural equation model was applied to test the proposed conceptual model as figure 1 shows. Thus estimating the measurement model was necessary to test the validity of the scale. The normality was evaluated through the skewness and kurtosis coefficients. None of the variables presented skewness and kurtosis coefficients indicative of severe violations of normality.

All indicators shown in Table 2 revealed that all variables are statistically significant within the realm of specific concepts to a 0.05 level of significance. The internal consistency levels of each factor near or exceed the minimum level of 0.7 recommended by Hair et al. (1998) and Del Barrio Garcia and Martinez (2000). Factors like intention (88.1%) and green commuting (84.2%) have the greatest internal reliability.

Validity analysis toward the scale was also needed before using it as a measurement instrument to analyze structural equation model. Content validity and

**Table 2.** Reliability and validity for the scale items of constructs

| *Factors* | *Environmental concern* | *Attitude* | *Intention* | *Subjective norm* | *Perceived behavior control* | *Green commuting* |
|---|---|---|---|---|---|---|
| Cronbach's Alpha | .670 | .835 | .881 | .810 | .775 | .842 |
| CR | .626 | .823 | .883 | .834 | .805 | .822 |
| AVE | .456 | .608 | .716 | .632 | .590 | .608 |

*Note.* CR = composite reliability, AVE = average variance extracted.

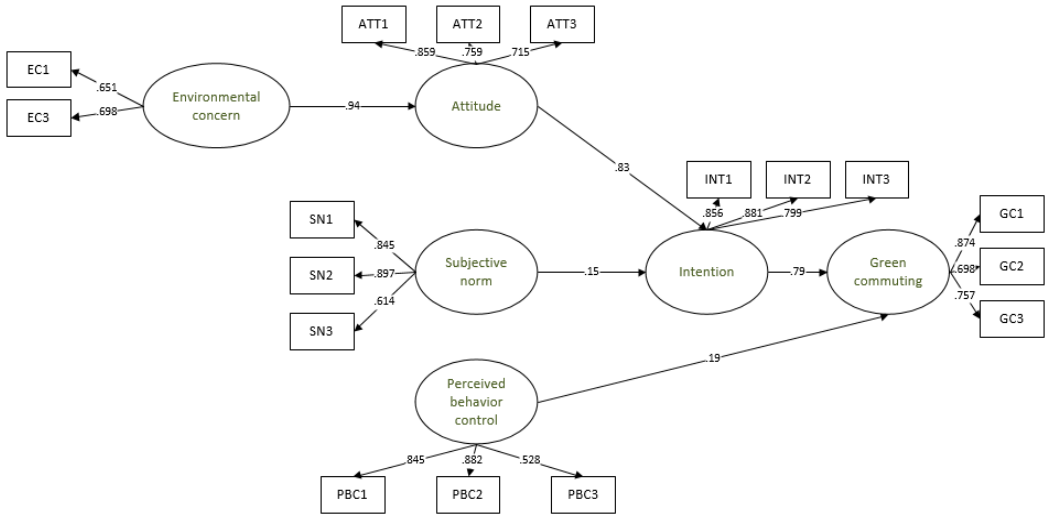


**Figure 2**. Theoretical and empirical connections

construct validity are two mainly components in evaluating validity. Since all the items are adapted from related literature's questionnaires or generated based on fully discuss conducted by experts, it's reasonable to conclude that the scale has enough content validity.

According to the results of confirmatory factor analysis of the measurement model, we eliminated EC2 item for its individual reliability values below 0.5, so as to ensure the measurements have better convergent validity. All of factor loading were more than 0.5, which could be seen in Figure 2. In table 2, we could discern that the estimated model covers all assumptions pertaining to convergent. Convergent validity is assessed through the AVE (all estimated >0.5 except for environmental concern with minute lower than 0.5) as well as CR (all estimated >0.7 except for environmental concern).

Former research illustrated that all the latent factors were uni-dimensional measurements, factors' associated error was generated by method effect, and measurement errors thrived from using the same kind of measure tool. Thus all the adjustments to the model were made within single factors and based on modification indexes according to the theoretical consideration. After all these steps, the measurement model displays good levels of fit: chi square/degree of freedom (CMIN/DF) = 7.115; goodness-of-fit index (GFI) = 0.907, comparative fit index (CFI) = 0.938, root mean square error of index (RMSEA) = 0.048.

## Structural Model

The two stage model strategy states that after confirming the acceptability of the measurement model, the calculation of structural model will be expected as the next stage. The estimation model was set out in Fig 2.

The final structural model was slightly different with the original model. The path coefficient between perceived behavior control and intentions was not significant (path coefficient=0.033; p=0.085), which means perceived behavior control did not reveal itself as antecedent variable toward intentions of green commuting. Thus H2 was partly rejected. We deleted this path in order to improve the overall model fit, and then calculate the goodness-of-fit indicators again.

The adjusted model showed good levels of overall fit (CMIN/DF =7.095; GFI = 0.907; CFI = 0.938; RMSEA = 0.047), all path coefficients were significant, which could be observed by figure 2.

The results of this study confirmed that the main path was composed of environmental concern, attitudes, intentions and green commuting, and this path had enough explanatory power about green commuting. All the path coefficients between antecedent variable and consequence variable in this path were above 0.7. Specifically, the path coefficients between environmental concerns and attitudes reached the highest point of 0.94, and this result was unanimous with founds of several studies (Chan 1999; Laroche et al. 2001). And it also indicated that general environmental concerns had direct influence on situation-specific cognition, which was in accordance with the earlier study (Bamberg 2003). Therefore, the statement of H3 was proved. As far as the relationships among attitudes, intentions and green commuting had been confirmed, it was possible to state that the linkages of them were significant.

The directly impact of perceived behavior control on intention had not been proved by this research, which was inconsistent with the earlier research (Gollwitzer 1993). Green commuting, due to the high reproducibility of daily travel, was different with green product consumption and the moderate situational pressure did not stimulate consumers' intention to implement green commuting.

According to the analysis results, green commuting intentions were partly influenced by subjective norms while green commuting behavior was affected by perceived behavior control, and that implied reference group behaviors and social expectations could only increase consumers' green commuting willingness rather than green travel behavior. Enhancing consumers' perceived behavior control was an effective measure to promote green commuting. Moreover, combining the main reasons that social expectations exerted influence on behavioral decision with Chinese society situation (Schwartz, 1977), it was discovered that social expectations would be activated if individual was obligated to obtain or enhance the welfare of the group to which the individual belonged. According to results of the study, social expectations were not as important as before during this culture change period.

Both intention and perceived behavior control could influence green commuting behavior directly; path coefficient between intentions and green commuting was 0.79, higher than the path coefficient between perceived behavior control and green commuting (0.19, as calculated). Intentions were mainly influenced by attitudes, while attitudes almost totally were explained by environmental concern, therefore it could be deduced that individuals' positive attitude toward green commuting mainly

generated from personal environmental tendencies. Perceived behavior control had directly impact on behavior rather than intentions, which meant willingness could not be simply changed via economic incentives and well-constructed infrastructure, while those who possessed positive intention more likely to concern objective conditions and self-interest. Further conclusion could be deduced via combining the above discussion: collectivism affects intentions of green commuting while individualism affects actual behavior.

This phenomenon was related to "culture change" mentioned above in the literature review. Although China does not change its societal identity or social label as a collective society, it may adapt some individualistic elements as a result of economic development and international exchange (Bian and Forsythe 2012). This discovery may well explain why Chinese are fond of discussing and reposting current affairs on social media, while reluctant to protect collective right via practical action. Moreover, distinctions between social strata were noticeable in Chinese society and had profound impact on consumption behaviors (Bian and Forsythe 2012). The sample was composed primarily of male (70.9%), and Chinese traditional male chauvinism inspired male consumers' need of unique to highlight their social status and avoid being labeled as "lower-class citizen" (Bardhi 2012). Thus if a male commuter possessing private car choose green commuting, it's more likely that this decision comes from his own intentions, self economic, time saving and convenient needs, rather than social calling for environmental protection.

## DISCUSSION

The results of this study suggested that consumers with higher environmental concern would have positive attitudes on green commuting. Therefore, it was essential for government and non-governmental organizations to put emphasis on informing the urgency of protecting environment so as to increase commuters' awareness of the environmental issues via adapting various media. For example, leaflets, billboard, press, and television advertisements can be applied to inform the public the severity of atmospheric pollution.

Negative social perspective, such as perspective of materialism, can inevitably prevent the prevalent of green commuting. Development towards a sustainable transport system requires significant changes to the organization of daily activities and daily travel. Such changes have to stem from changes occur on the public and form a commuting habit. In order to realize it, behavioral mode should be set up by the government; notions of "riding bicycle/taking bus is equal to protecting environment" should be established.

This research also had some limitations, which could be improved by further study. Firstly, in order to conveniently get access to commuters living in Beijing and Shanghai, the questionnaire was handed out and collected on the internet. This way did not obey the random sampling method, thus the collected data probably mainly reflected the subjective factors of consumers who were addicted to online surfing. Future research can have better solution in this aspect, if research time and financial budget are allowed.

Given the assumption that metropolis consumers displayed a snapshot of Chinese culture change, commuters in Beijing and Shanghai became the convenient sample of the present study. Subsequent research can compare structural variance among

commuters living in well-developed and underdeveloped cities, which could provide a clearer idea illuminating the impact of individualism and collectivism on the choice of travel mode.

Nonetheless, the present research was mainly adapted from well-developed theories which were proved to be more suitable in explaining possession-based consumption rather than access-based consumption, such as green commuting and exhibit visit (Chen 2009). Therefore, it was difficult to reveal the unique characteristic of green commuting. Future study can take qualitative analysis as a beginning, proposing specific travel-mode-choice model via in-depth interview and brain storming, and then to test the model by empirical research.

## CONCLUSION

Based on the responses of commuters lived in Beijing and Shanghai, this empirical study of green commuting was carried out in relation to subjective factors including environmental concerns, attitudes, intentions, subjective norms and perceived behavior control. Structural equation model was adapted to study the interrelationship of factors mentioned above and their influence on citizens' intentions and actual practice behavior on green commuting.

The results obtained by the estimated model identified the significant path of the structural model, including factors of environmental concern, attitudes, intentions, and green commuting in sequence. And this highest scored path indicated that green commuting was mainly influenced by intentions. Moreover, this research combined the reality of Chinese culture change to explore the influence of collectivism and individualism on green commuting.

## RECOMMENDATIONS

The approach of this study, incorporating environmental concern into the theory of planned behavior, could offer a slightly new framework for research to explore green commuting.

According to the study, green commuting behavior was mainly explained by intentions, and enhancing commuters' environmental concern would contribute to improve intentions indirectly. Since the direct effect of perceived behavior control on green commuting had been proved in the current study, increasing the development of transport infrastructure and providing corresponding external conditions can help to reduce the handicaps consumers would encounter when adopt green commuting. Meanwhile, creating a sense that public transport is easy and convenient will be benefit to promote green commuting and create a new lifestyle about travel.

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