



Factors Influencing Pro-environmental Behavior to Use Public Transport: A Predictive Approach

Tak Jie Chan¹✉, Nur Soleha Mohd Halmeem², and Jessica Samson³

¹ Faculty of Applied Communication, Multimedia University, Selangor, Malaysia

t.j.chan@mmu.edu.my

² Faculty of Education, Languages, Psychology and Music, SEGi University, Selangor, Malaysia

³ School of Communication and Creative Design, SEGi University, Selangor, Malaysia

Abstract. Pro-environmental behavior has become a topic of study in sustainability research. This research aims to examine the factors influencing the public's pro-environmental behavior to use public transport. The study utilized the extended Theory of Planned behavior, where the determinants being examined comprise attitude, subjective norm, perceived behavioral control, economic benefits, and media attention. This study employed a quantitative method and applied a purposive sampling technique with 175 valid respondents recorded. The data analysis techniques utilized were descriptive analysis and partial least square through the Statistical Package of Social Science version 26 and Smart-PLS 3.3.9. The findings indicated that only attitude and perceived behavioral control are the predictors of pro-environmental behavior to use public transport, whereas subjective norms, economic benefits, and media attention were not the predictors. The study contributes to the sustainability scholarship by incorporating economic benefits and media attention as an important construct to expand the TPB theory with the societal factors, which provide relevant strategies for the ministry of transport and public transportation companies. Conclusion, implications, and suggestions for future study were also discussed.

Keywords: Pro-environmental behavior · extended theory of planned behavior · public transport · media attention · economic benefits · sustainability

1 Introduction

Pro-environmental behaviors are actions that cause the least harm to the environment and promote sustainability [1, 2]. The behaviors can be recycling, carpooling, using public transport, supporting, or buying green products. As of 2019, National Transport Policy (NTP) which was launched by the former Prime Minister, recorded that only 20% of the Malaysian population used public transport and aimed to increase public transport usage to 40% [3].

[4] has reported that in 2017, pollutants emission to the atmosphere were from motor vehicles which was as much as 70.4%. On the account of the reports and environmental issues, specifically air pollution in Malaysia, using public transport is an environmental-friendly behavior that will help to reduce the environmental issue.

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Furthermore, most of the studies done that used the theory of planned behavior (TPB) to explain green behaviors were based on different countries with different cultural backgrounds. For instance, [5] did research on intentions to carpool in Cairo, Egypt, whereas pro-environmental behavior among stakeholders in Portuguese higher education institutions also has been found [6] and Lithuania [7]. [8] studied the roles of green knowledge and green attitude in the green purchasing behavior of the youth in Ghana, Africa. Besides that, [9] and [10] studied the green purchasing behaviors in Germany and Vietnam respectively. [11] did research on students' consumption intentions of genetically modified food at a university in China, and study from the Indonesia [12], and other developing countries such as Colombian and Nicaraguan [13] have also been found. Studies based on Malaysian recycling behaviors [14] have also been found. Most importantly, there is a dearth of research urged to be done on public transport usage as a pro-environmental behavior and sustainable development in Malaysia setting [15, 16].

Researchers that study determinants of behavior or intentions stemmed from [17] TPB theory. Many studies have been done to extend the theory by including probable determinants of behavior besides the three original components, namely attitude, subjective norm, and perceived behavioral control. This current study seeks to include additional variables to the original theory suggested by [5] which is economic benefits. In addition, media attention as suggested by [11] that is concerning communication aspects was included to further extend the theory. Therefore, this research aims to test the applicability of the extended TPB theory and the potential factors to the pro-environmental behavior of using public transport.

2 Literature Review

2.1 Theoretical Foundation

TPB was utilized by many scholars to explain people's behavior on an environmental sustainability topic. The TPB explains how people's behavior is influenced by their intentions [17]. For instance, [5] studied carpooling, [8] and [10] explored green purchasing, [18] analyzed collaborative consumption, [14] studied recycling, and [19] researched sustainable consumption behavior, where those past studies indicated the applicability of TPB as a prominent theoretical framework in explaining environmental behavior.

2.2 Relationship Between the Variables

Attitude is one of the variables that influence behavioral intentions. According to a past study done by [10], they hypothesized that attitude positively influences green purchase intention. In addition, [5] hypothesized that attitude significantly impacts intentions. In their study, the context is intentions to carpool, which is also a way to sustain the environment. Besides that, [19] hypothesized and confirmed that attitude has a positive relationship with sustainable consumption. In [14] study, they hypothesized that attitude and recycling behavior have a positive relationship. Similarly, [8] also constructed a hypothesis that stated attitude has significantly influenced green purchasing behavior. This has further aligned with the study of [20], who found that a pro-environmental

attitude positively influences employee green behavior. Furthermore, a study done by [9], made a similar hypothesis that stated attitude positively affects green purchasing behavior to protect the environment. However, this hypothesis could not be confirmed in her study. Based on the above discussion, this study hypothesized that:

H1: Attitude toward the environment positively influences the pro-environmental behavior of using public transport.

The subjective norm is the next component in the TPB theory. Scholars such as [10], pointed out that subjective norms positively influence green purchasing intention, and [5] also agreed that subjective norms significantly impact carpooling intentions that lead to pro-environmental behavior. Other studies were done by [14, 19] also pointed out that subjective norms and recycling behavior have a positive relationship. This has also been supported by numerous studies [6, 21, 22], who found that norm perception or subjective norms will have a positive influence on the pro-environmental behavior. Based on the above notion, the study hypothesized:

H2: Subjective norms positively influence the pro-environmental behavior of using public transport.

[5] suggested that perceived behavioral control significantly impacts carpooling intentions. [19] also agreed that perceived behavioral control has a positive relationship with purchasing intentions that leads to sustainable consumption behavior. This has been further supported by the studies of [6, 23], who found that perceived behavioral control has the greatest impact on the pro-environmental behavior. Besides, a study by [24], found that perceived behavioral control is a mediator between attitudes and marine responsible behavior. With the aforementioned empirical evidence from various past studies, this study believes that the relationship between perceived behavioral control and pro-environmental behavior is positive and hypothesized:

H3: Perceived behavioral control positively influences the pro-environmental behavior of using public transport.

The economic benefit is an extrinsic motive that helps consumers to save time and money [18]. [5] extended [17] framework and hypothesized that economic benefits have a significant impact on behavioral intentions. This hypothesis was also confirmed in their research. In addition, [25], highlighted the notion on the adoption of circular economy approaches would require profound changes in environmental manufacturing practices and consumption patterns among consumers in the Russian context. This has further aligned with the study by [26], that economic preferences (altruism) significantly predicted pro-environmental behavior. Based on the above discussion, the study hypothesized:

H4: Economic benefits positively influence the pro-environmental behavior of using public transport.

A study done by [11] in China, also incorporated another additional variable to [17] TPB model. In their study, media attention is one of the communication factors that was incorporated into the TPB framework to study university students' intention to consume genetically modified food in China. According to [11], there have been conflicting views on genetically modified food (GMF) that resulted in negative effects from the views. [11] assumed that people's attention to GMF news would likely reduce their intentions to consume GMF. Following this assumption, they hypothesized that media attention to GMFs is negatively related to consumers' intentions towards GMFs. However, media attention was found to have no relationship with the intention to consume GMFs.

Besides, [21] findings argued that information released by social media about will help to encourage pro-environmental behavior. This has congruent with the study of [27], where they found that haze-related efficacy messages were positively related to pro-environmental behavioral intention, which supported the findings of [28], that media attention positively impact the pro-environmental behavior. Based on the discussion, it is suggested that it is vital to disseminate distinctive media messages to audiences which is beneficial for practitioners to tailor specific messages when they carry out environmental campaigns. Thus, the current study expected that media attention to express the messages of benefits using public transport, the more likely people would use public transport. So, the current study hypothesized:

H5: Media attention positively influences pro-environmental behavior of using public transport.

3 Methodology

3.1 Research Design

This study applied quantitative research. Quantitative research is described as a systematic exploration of the phenomenon through the collection of measurable data and the application of statistical, mathematical, or algorithmic methods [29]. According to [30], survey design is a suitable method to apply in this study as it allows the researchers effectively to measure the attitudes and opinions of respondents in a large population.

3.2 Sampling Procedure

According to [31], the most suitable and acceptable sample size in research is between 50 to 500 respondents. Thus, as many as 200 data of respondents were collected. This is supported by [32], a sample size of more than 30 and less than 500 respondents is relevant for most of the social science research. Hence, the current study has 175 valid responses, it is still deemed sufficient for statistical analysis purposes. This has supported the notion of [33], who mentioned that the minimum sample size in partial least square structural equation modeling has to be more than 160 ($n > 160$).

This study used the purposive sampling method to collect data. The scope of this study is only for public transport users. Hence, a screening question was inserted in the questionnaire to filter the public transport users. The aforementioned question is "Do you use public transport?".

3.3 Measurement

For the demographic section, the variable comprised gender, age, nationality, employment status, race, and their purpose of using public transport. A question such as “Do you use public transport?” was included to distinguish the valid respondents.

To examine the factors, this section was segmented into attitude (ATT), subjective norm (SN), and perceived behavioral control (PBC) which are the basic elements of [17] TPB model. ATT consisted of 5 items, which it was referenced from [5, 10], SN has 3 items which adapted from [5, 10, 34] and PCB also consists of 3 items adapted from [5, 19, 34] respectively. As for economic benefits, the section included 3 questions adapted from [5]. Economic benefits items were measured in the form of interval data (Likert scale) with 1 = Strongly Disagree and 5 = Strongly Agree. Lastly, for media attention section consisted of 5 items adapted from [11]. This variable was measured with a Likert-type scale with 1 = No Attention At All and 5 = Very Close Attention. To operationalize using public transport as a pro-environmental behavior, 3 questions were adopted from [35]. All of the questions in this section were in the form of close-ended questions and intervals (Likert scale) with 1 = Strongly Disagree and 5 = Strongly Agree.

3.4 Common Method Bias

The current study’s response data was self-reported, and the identical questionnaire was administered at a single point. As a result, of this study utilizing Harman’s single factor (statistical method) and procedural approach, the data were evaluated for common method bias (CMB) [36]. The results showed that the first component explained 28.626% (<50%) of the overall variations. As a result, CMB is not an issue in the present study.

3.5 Data Analysis and Statistical Significance

Structural equation modeling partial least square was used as the data analysis technique. As the current study implied to test the theoretical framework based on the perspective of prediction which justifies the use of PLS-SEM [37, 38]. This has further supported the notion of [39], that the prediction analysis is timely in research as it provides new observations within and outside of the sample.

4 Results and Discussion

Based on Table 1, more than half of the respondents are female (60.6%) and male (39.4%) respectively. The highest percentage of the age group is 21 to 25 (33.1%). This shows that public transport users are more likely used by young adults. The assumption that can be deduced here is that young adults are likely to use public transport as most of them have a relatively lower income and do not own any private vehicles. Hence, they would opt for less costly options. Furthermore, the majority of the respondents are local people (95.4%). Besides that, as much as 36.6% of the respondents are unemployed. It can be assumed that unemployed people are less likely to own private vehicles which may be

Table 1. Profile of respondents (n = 175)

Variable (s)	<i>f</i>		%
Gender	Male	69	39.4
	Female	106	60.6
Age	≤20	57	32.6
	21–25	58	33.1
	26–30	12	6.9
	31–35	6	3.4
	>40	42	24.0
Nationality	Local	167	95.4
	International	8	4.6
Employment Status	Full-time	62	35.4
	Part-time	12	6.9
	Unemployed	64	36.6
	Others	37	21.1
Race	Malay	158	90.3
	Chinese	4	2.3
	Indian	5	2.9
	Others	8	4.6
Purpose of using public transport	Work	38	21.7
	Education	26	14.9
	Leisure	88	50.3
	Others	23	13.1

due to their low ability to obtain loans from financial institutions. Moreover, most of the respondents are of Malay race which contributes to 90.3% of the respondents who use public transport. The purpose of using public transport is mainly for leisure (50.3%), followed by for work purposes (21.7%). Other purposes include education (14.9%) and other reasons (13.1%). Most people use public transport for leisure purposes because they are easily accessible and time-saving to get to multiple destinations. Most people would also opt for public transport to avoid traffic congestion.

4.1 Measurement Model

For the measurement model, convergent validity and discriminant validity were assessed. The convergent validity of the measurement model was ascertained through factor loadings, average variance extracted (AVE), and composite reliability (CR) [40]. As presented in Table 2, the factor loadings were all greater than 0.6 which complied with [41]. In

Table 2. Convergent validity

Variables	Items	Item deleted	Loadings	Cronbach's Alpha	CR	AVE
Attitudes (ATT)	ATT1	ATT3	0.801	0.788	0.875	0.701
	ATT2	ATT5	0.891			
	ATT4		0.817			
Economic Benefits (EB)	EB1		0.838	0.712	0.837	0.635
	EB2		0.660			
	EB3		0.876			
Media Attention (MA)	MA1	MA3	0.642	0.820	0.869	0.628
	MA2		0.742			
	MA4		0.850			
	MA5		0.909			
Perceived behavioral control (PBC)	PBC1		0.814	0.767	0.859	0.671
	PBC2		0.756			
	PBC3		0.883			
Pro-environmental behavior (PEB)	PEB1		0.912	0.918	0.948	0.859
	PEB2		0.947			
	PEB3		0.921			
Subjective norm (SN)	SN2	SN1	0.850	0.553	0.817	0.691
	SN3		0.812			

addition, the CR and AVE obtained were also higher than 0.7 and 0.5, respectively [40]. Hence, all the convergent validity criteria were met.

Discriminant validity is established if all the HTMT values obtained are less than the required threshold of HTMT_{.85} [42]. As shown in Table 3, all the HTMT values were less than HTMT_{.85} indicating that discriminant validity is ascertained. The collinearity issue was assessed using the variance inflation factor (VIF) with a cutoff value of 3.3 as suggested by [43]. The VIF values as presented in Table 5 were all less than 3.3 indicating no collinearity problem.

4.2 Structural Model

The structural model was performed using bootstrapping procedure with a resample of 5,000 as suggested by [44] for improving the accuracy level of the estimation. The structural model assesses all the relationships between the constructs, and their corresponding beta and t-values. The results are shown in Table 4 (Fig. 1).

The predictors of attitude ($\beta = 0.449$, $t = 6.310$, $p = 0.000$), and perceived behavioral control ($\beta = 0.282$, $t = 3.671$, $p = 0.000$) were found to have a significant positive relationship with pro-environmental behavior. However, subjective norms ($\beta = -0.084$, $t = 1.246$, $p = 0.106$) Economic benefits ($\beta = -0.013$, $t = 0.164$, $p = 0.435$), and media

Table 3. Discriminant validity using HTMT ratio

	ATT	EB	MA	PBC	PEB	SN
ATT						
EB	0.487					
MA	0.241	0.378				
PBC	0.543	0.769	0.156			
PEB	0.621	0.365	0.169	0.469		
SN	0.736	0.615	0.255	0.758	0.414	

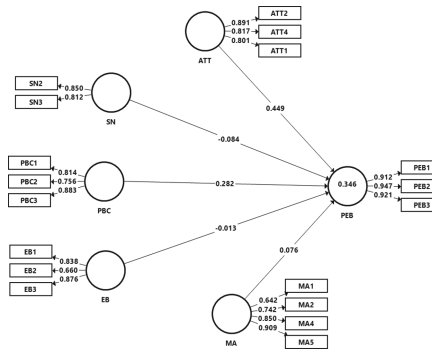


Fig. 1. Structural model

Table 4. Direct effects

	Relationship	Std. beta	Std. error	T-values	P	LL (5%)	UL (95%)	D
H1	ATT -> PEB	.449	.071	6.310**	.000	.325	.560	S
H2	SN -> PEB	-.084	.067	1.246	.106	-.197	.021	NS
H3	PBC -> PEB	.282	.077	3.671**	.000	.160	.413	S
H4	EB -> PEB	-.013	.082	.164	.435	-.148	.123	NS
H5	MA -> PEB	.076	.064	1.196	.116	-.071	.156	NS

** $p < 0.01$, * $p < 0.05$, 1-tailed test

LL=Lower Limit; UL = Upper Limit; S=Supported; NS = Not supported

attention ($\beta = 0.076, t = 0.196, p = 0.116$) are no significant with the pro-environmental behavior. Hence, H₁ and H₃ is accepted, where H₂, H₄, and H₅ was rejected. The R² of 0.346 suggesting there is 34.6% of the variation in pro-environmental behavior was explained by the determinants as the exogenous variables.

Furthermore, f^2 , which signifies the importance of the exogenous construct in explaining the variance in the endogenous construct [40], based on which f^2 value

Table 5. VIF, R^2 , f^2 , and Q^2 values

Variable(s)	PEB			
	R^2	Q^2	f^2	VIF
ATT	0.346	0.291	0.215	1.434
SN			0.007	1.603
PBC			0.067	1.803
EB			0.000	1.608
MA			0.008	1.122

VIF = Variance Inflation factor

Table 6. PLSpredict

	PLS-SEM		LM		PLS-SEM - LM		Interpretation
	RMSE	Q^2_{predict}	RMSE	Q^2_{predict}	RMSE	Q^2_{predict}	
PEB3	0.676	0.249	0.676	0.248	0.000	0.001	
PEB2	0.623	0.307	0.622	0.309	0.001	-0.002	weak
PEB1	0.651	0.214	0.650	0.217	0.001	-0.003	

of 0.35 is considered a large effect size, 0.15 as a medium effect size, and 0.02 depict small effect size [45]. As shown in Table 5, the generated results show that subjective norm (0.007), perceived behavioral control (0.067), economic benefits (0.000), and media attention (0.008) exert a weak effect on the pro-environmental behavior, while the attitude (0.215) exerts a medium effect on the pro-environmental behavior.

PLS predict was used to examine the predictive power of the model under study. Based on Table 6, the results of the PLS-SEM model are compared to the results of the naïve linear regression (LM) benchmark model. As all Q^2_{predict} values are more than zero, hence, it can proceed with the comparison of both models. The comparison of predictive power (PLS-SEM –LM) is carried out using the root mean squared error (RMSE), which has high symmetrically distributed prediction errors [46]. When the RMSE statistical values of the PLS-SEM model are compared to the naïve LM benchmark model, the majority of the indicators show that the RMSE values of PLS-SEM are higher than the RMSE values of the naïve LM benchmark. Therefore, it suggested that the model has weak predictive power for pro-environmental behavior.

Consistent with past studies that used the TPB model to examine green behavior [5, 10], the attitude has a positive significant influence on public transport usage as a pro-environmental behavior. The attitude was found to have the most effect on pro-environmental behavior. This means that the public has a positive attitude towards using public transport where the spreading awareness amongst the public is the key to creating a more positive attitude to encourage the behavior of environmental friendliness, which is aligned with the numerous study [8, 14, 19, 20].

Secondly, the subjective norm was found not significantly related to pro-environmental behavior. This means that the views and opinions of those who are important to the respondents have little influence on their decision to use public transport as a pro-environmental behavior. [34] who also examined pro-environmental travel behavior amongst urban residents, have concluded that subjective norm is normally regarded to have a weak correlation with the outcome variable.

In addition, perceived behavioral control is a predictor which predicts the pro-environmental behavior, which supported H3. Perceived behavioral control refers to the easiness of conducting the behavior which has related to the person's past experiences. This has aligned with the study of [6] and [12] that perceived behavioral control has a significant effect on pro-environmental behavior. This can be further explained that the ministry of transport as well as the public transport companies, such as Prasarana and KTM had tried to improve their services, such as providing time table for the arrival time of the public transport, which ease the passenger/stakeholders to plan their journey. This has aligned with the notion of [34], to successfully promote the public's green behavior, the perception of difficulty in using public transport has to be addressed such as improving the conditions and infrastructure of public transport, the efficiency of its operations and making them more convenient as well as easily accessible to the public.

[5] studied the intentions of carpooling in the Egyptian context and found that economic benefit has a significant impact on the dependent variable. They have concluded that due to the increase in financial challenges, people opted for cost-saving options. In the present study's context, the economic benefit is not the predictor, which rejected H4. This can be concluded that people opt to use public transport, not because of cost savings, which contradicted the findings of [26]. The possible explanation is that the study was conducted in Klang Valley, where the cost of living is moderate-high, hence, respondents did not perceive well on using public transport as a pro-environmental behavior can help to reduce the cost, rather than citizens opt for public transport to avoid traffic congestion, especially during peak hours of work.

Lastly, consistent with the findings of [11], media attention does not have a significant relationship with pro-environmental behavior to use public transport, which rejected H5. The finding of the relationship between media attention and pro-environmental behavior is contrary to the expectations of the present study, where respondents pay little attention to news about public transport users on the media. The possible explanation is that the current demographic of the respondents is made up of young adults, where their focus on information on media is mostly on the entertainment purpose rather than on social issues such as pro-environmental behavior.

5 Conclusion

In conclusion, the present study has examined the constructs in the TPB model by [17], with the addition of economic benefits and media attention. The basic determinants of the TPB model such as attitude and perceived behavioral control are the predictors of pro-environmental behavior in using public transport. As for subjective norm, economic benefits, and media attention is not significantly related to pro-environmental behavior to use public transport.

5.1 Implications

5.1.1 Academic Implications

From an academic perspective, this study has contributed to the extension of the TPB model by [17]. The theory was extended by including two additional factors which are economic benefits and media attention. In prior studies, economic benefits were shown to have a significant impact on behavioral intentions. As for media attention, the current study finding is consistent with the prior study. It has been found that there are also no relations with using public transport as a pro-environmental behavior. The extension of the TBP model by including economic benefits and a communication factor (media attention) helped in determining the public's true intentions to use public transport, whether or not the public use it mainly for environmental concerns or personal benefits. This current study was done to reexamine prior studies' findings so future researchers can further refine it by applying it in a different context.

5.1.2 Practical Implications

With the findings, it is urged that the government and the public transportation companies must collaborate and come out with new proactive initiatives to encourage the citizens to use public transport as part of the pro-environmental behavior. For instance, the government with the public transport companies can come out promotions such as monthly travel passes or giving a discount for the students as well as elderly citizens to encourage them to use public transport.

Besides, the public transport companies with the Malaysian Communications and Multimedia Commission (MCMC) can advertise the advantages of using public transportation through the new media platform, to reach more younger generation which is techno-savvy, rather than focus on the traditional media.

In addition, to make more public use the public transport and achieved the pro-environmental behavior, the public transportation must improve its services such as the punctuality of the public transport, the conditions and infrastructure of the public transport, and the efficiency of its operations to avoid the citizen's skeptic and bad perception about the public transport, where it is crucial in shaping the positive attitude of the citizens towards the usage of the public transportation.

Besides, the improvement from the public transportation companies can be explained through the notion of perceived behavioral control, where the citizens can perceive the adequate resources (e.g., frequency, punctuality, affordable fees, and discount of the public transport) and ability to control those barriers. Hence, this will further generate positive word-of-mouth and people will recommend to their friends and family to use public transport in the future.

5.2 Limitations and Suggestions for Future Research

This research only focused on the urban entity, which is in Klang Valley, hence, future researchers should include both urban as well as rural area residents, and include respondents from different states as the intentions and behavior of using public transport may vary.

The current research only looks from the perspective of positivism, and the deductive approach by testing the TPB theory. Future researchers should approach similar studies by conducting a qualitative study to apprehend the public's green behavior in-depth.

To further understand the public's intentions and behavior to use public transport, future researchers can incorporate and examine other variables such as pro-environmental skepticism [47], social media incivility on public transport [48], public transport patronage [49] to name a few to test the mediating and moderating effects to make the model more robust and contribute to the sustainability scholarship.

Appendix

Attitude

1. I find using public transport is a wise move.
2. I think using public transport is a good and positive thing.
3. I think public transport is the best form of travel.
4. I think using public transport is important to reduce environmental impact.
5. If I can choose between using public transport and other forms of travel, I prefer using public transport.

Subjective Norm

1. My family and close friends persuade me to use public transport.
2. My family and close friends support me in using public transport.
3. The social environment encourages me to use public transport.

Perceived Behavioral Control

1. I think using public transport is entirely within my control.
2. Public transport is readily accessible to me.
3. To use public transport in the near future would be easy.

Economic Benefits

1. Using public transport helps to cut my travelling costs.
2. Using public transport saves my time.
3. Using public transport improves my economic situation overall.

Media Attention

1. How much attention do you pay to stories related to public transport usage in print newspapers?
2. How much attention do you pay to stories related to public transport usage on television?
3. How much attention do you pay to stories related to public transport usage on radio?
4. How much attention do you pay to stories related to public transport usage on the Internet?
5. How much attention do you pay to stories related to public transport usage on social media?

Pro-environmental Behavior

1. Using public transport reduces traffic congestion.
2. Using public transport reduces air pollution.
3. Overall, using public transport lowers the environmental impact.

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