PENA TEKNIK
JURNAL ILMIAH ILMU - ILMU TEKNIK

Vol. 9, No.1, Maret (2024)
p-ISSN 2502-8952
e-ISSN 2623-2197
https://ojs.unanda.ac.id/index.php/jiit/index

Gamification: Strategy to Pull the Intention of DKI Jakarta Residents (Choice User) to Use Public Transportation

Dian Siskawati [1, 2, *], Puspita Dirgahayani [3]

[1] *Master's Program in Transportation, School of Architecture, Planning and Policy Development, Institut Teknologi Bandung, Indonesia*
[2] *Budget Revision & Non-Tax Revenue Staff, Secretariat of the Directorate General of Land Transportation, Ministry of Transportation, Indonesia*
[3] *School of Architecture, Planning and Policy Development, Institut Teknologi Bandung, Indonesia*
** Corresponding Author E-mail: disisin31@gmail.com*

Keywords

Gamification; Choice User; Pull Strategy; Theory of Planned Behaviour; PLS-SEM

Abstract

The higher practice of private car use in DKI Jakarta amid the implementation of the TDM strategy that continues to be developed leads to increased traffic congestion, which in turn causes economic losses, deteriorated air quality, and an increase in acute respiratory tract infection cases. Innovation is needed in the pull strategy of DKI Jakarta residents to suppress this behavior, especially those who have (access to) private vehicles to switch to public transportation. This study tries to analyze the effect of gamification on the behavioral intentions of DKI Jakarta residents (choice users) to use public transit for their daily activities (school/college/work). Modifications to the Theory of Planned Behavior (TPB) were carried out to investigate the influence of gamification through attitudes and behavioral control on behavioral intentions to use public transportation. The theory was tested using questionnaire data from 200 respondents with SEM-PLS analysis. The elements of points, levels, rewards, and games are used as indicators of gamification. This study shows that gamification positively and significantly affects attitudes and behavioral control. The study findings confirm the significant positive influence of attitudes on behavioral intentions to use public transportation. The results of this research can also be used as material for consideration in pull strategy (TDM) policy innovation in DKI Jakarta.

1. INTRODUCTION

The high usage of private vehicles by residents of DKI Jakarta post-COVID-19 pandemic has led to an increase in the congestion index of the capital from 34 percent to now reaching 53 percent (tomtom.com, 2023). Based on the population of DKI Jakarta in 2023, which is 10.6 million people, it is estimated that the number of motorized vehicle movements within DKI Jakarta itself reaches 22.4 million per day. The congestion that occurs results in a surge in air pollution, ultimately impacting the increase in cases of Acute Respiratory Tract Infection (ARI) in DKI Jakarta, reaching 200,000 cases, whereas, during the pandemic, ARI cases were only 50,000 (kompas.com, 2023). Data from the Ministry of Environment and Forestry (KLHK) shows that the transportation sector contributes 67.04 percent to the high air pollution in DKI Jakarta. In addition to air pollution, a study by the Jakarta-Bogor-Depok-Tangerang-Bekasi Transportation Management Agency (BPTJ) of the Ministry of Transportation in 2021 stated that the economic losses due to congestion in the Jabodetabek agglomeration reached IDR 71.4 trillion per year and the wastage of fuel amounted to 2.2 million liters.

To curb the use of private vehicles and their associated impacts, the government has implemented Transport Demand Management (TDM) policies. TDM involves applying strategies and policies to maximize the efficiency of urban transportation systems (pull strategy) by restricting the use of private vehicles (push strategy). One form of pull strategy implemented by the government and public transportation operators in DKI Jakarta is providing various public transportation options and improving their services. These public transportation options include road-based systems (Microtrans and TransJakarta), rail-based systems (MRT

doi http://dx.doi.org/10.51557/pt_jiit.v9i1.2521
article history: Received December 22, 2023; Received in revised from March 2, 2024; Accepted March 4, 2024;
Available online March 10, 2024.

This is an open access article under the **CC-BY-SA** license

and LRT), as well as pedestrian and cyclist facilities. The KRL Commuter line also serves the DKI Jakarta area and its agglomeration. Improved services further support the variety of transportation options through the integration of modes (fare, routes, and stops/stations) and the availability of mobile applications (C-Access, MRTJ, TiJe, JakLingko, and LRTJ) to support the mobility of public transportation users.

Although TDM strategies have been implemented, private vehicle usage in DKI Jakarta is rising. Therefore, innovative approaches are needed to attract more residents of DKI Jakarta to use public transportation and mitigate the ongoing impacts of private vehicle usage. Yen et al. (2023b) state that a new concept is introduced in TDM, namely the use of gamification concepts in public transportation services to create more enjoyable, exciting, or addictive elements to enhance user engagement.

In the public transportation trip planner application in DKI Jakarta, some gamification elements, namely points and rewards, have already been implemented. However, the scheme for earning points and obtaining various rewards needs to be better explained, and many residents still need to be made aware of it. Given this situation, there is a thought about how the gamification scheme could be made more transparent and known to DKI Jakarta residents, especially those with preferences for modes of transportation (choice users). Will it attract residents to use public transportation? Therefore, this research aims to analyze the influence of implementing a gamification scheme on the intention of DKI Jakarta residents, specifically choice users, to use public transportation, using the theory of planned behavior framework.

2. LITERATURE REVIEW

2.1 Transport Demand Management (TDM)

The strategy of influencing public transportation preferences or travel behavior is referred to as transportation demand management (TDM) or mobility management in Europe. Tumlin (2012) defines TDM as a strategy to enhance the efficiency of the entire transportation system by shifting from private vehicles to public transportation or adjusting travel times outside of peak hours. TDM consists of various policies and programs that transform travel behavior to be more efficient, including changes in modes, destinations, routes, and travel times (Litman, 2008). TDM is crucial in developing long-term congestion avoidance strategies that focus on addressing the root causes of congestion to handle travel demand sustainably (Dinh Toan et al., 2023). There are two strategies to achieve the goal of transportation system efficiency in TDM: the "push" strategy by making the use of private vehicles less attractive and the "pull" strategy by making the use of other transportation modes more appealing; in this case, public transportation.

Wang et al. (2020) define the pull strategy as the positive attractiveness of using public transportation, while the push strategy is the negative attribute of using private vehicles. The push strategy aims to change individual behavior by explicitly making driving private vehicles more challenging. In contrast, the pull strategy seeks to change behavior by making alternative uses of private vehicles more appealing, namely by improving the quality of public transportation (Keizer et al., 2019). The improvement of public transportation quality is achieved through 1) integrated services, 2) the provision of dedicated bus lanes, 3) intersection priority, and 4) enhancing public transportation infrastructure for driving comfort and safety. Push and pull strategies should be implemented simultaneously to achieve maximum benefits and effectiveness in TDM. If fully implemented at an economically justified level, TDM would reduce the costs of motor vehicle congestion by 25-50 percent, although the exact impact is challenging to predict and varies depending on geographical, demographic, and economic conditions (Litman, 2008).

2.2 Gamification

Gamification is defined as incorporating video game elements into non-game systems to enhance user experience and engagement (Deterding et al., 2011). In gamification, core services are enhanced by adding rule-based services to provide a gaming experience that generates motivation and desired behaviors (Hamari et al., 2014; Huotari & Hamari, 2011, 2017). In gamification, promotional elements such as rewards, coupons, discounts, and loyalty programs are integrated into a unified strategy that encourages the desired behavior (Kaur et al., 2023). (Kaur et al., 2023) state that the enjoyment perceived from elements (story, aesthetics,

dynamics, and rewards) in gamification enhances consumers' or customers' intention to shop, thereby leading to behavioral intent. Setting goals (e.g., offering rewards) that encourage consumers to complete specific missions in gamification makes consumers enjoy the process and gain perceptions related to self-efficacy, ultimately enhancing purchasing behavior (Che et al., 2023).

The implementation of gamification strategies in the field of transportation, as one of the strategies in transport demand management (TDM), is generally done to reduce congestion during peak hours, promote the use of public transportation, and encourage safe driving behavior (Yen et al., 2023a). Gamification schemes, such as point systems, are applied to evaluate sustainable transportation usage, including public transportation and non-motorized transport such as cycling and walking. The accumulation of these points can later be redeemed for various rewards such as cashback or vouchers. Castellanos (2016), in their research, states that there is a shift in mode preferences that offer significant points in gamification schemes. The reward system through point accumulation in the study by (Koo et al., 2013) can also increase an individual's distance traveled using public transportation. Research results (Tsirimpa et al., 2019) conclude that the use of public transit can be influenced by materialistic motivations such as rewards through gamification schemes, where the level of rewards offered affects individual behavior changes (Yen et al., 2023b) state that in designing gamification schemes, policymakers must carefully consider the rewards offered. The implementation of gamification in the transportation sector in Indonesia was first carried out by online-based transportation, including Gojek through GoClub, where aspects of affordability in the program manifested in elements such as points, rewards, and missions have a high persuasive level that impacts the increased motivation of customers to continue transactions (Shahisa & Aprilianty, 2022).

2.3 Choice User

In understanding travel behavior, the approach commonly taken in the transportation sector involves identifying travelers into two groups: captive riders and choice riders. Captive riders are individuals who do not have mode choices and, therefore, must use public transportation (Jacques et al., 2013). Choice riders are defined as those who have mode choices but, for specific reasons, choose to use public transportation for their mobility (Jin et al. in (Krizek & El-Geneidy, 2007)). The terminology "choice riders" does not include travelers in the category of non-users of public transportation.

In this study, the term "Choice User" is used based on Sohn & Yun (2009), which refers to travelers who own private vehicles regardless of their choice to use private vehicles (car/motorcycle) or public transportation based on their respective utilities. (Guerra, 2022) also states that someone can be categorized as a choice user when they do not have a private vehicle but have access to or are transported by private vehicles owned by friends, family, or colleagues. (Krizek & El-Geneidy, 2007) The focus of choice users on public transportation is related to safety, the comfort of the provided service, service reliability, service type, and other supporting facilities. Therefore, choice users are more sensitive to negative potential changes in public transportation because they possess alternative mobility choices (Krizek & El-Geneidy, 2007).

2.4 Theory of Planned Behavior (TPB)

The theory of planned behavior (TPB) was initially proposed by Icek Ajzen and modified by subsequent scholars. It is used in this study to address how gamification can pull the intention of DKI Jakarta residents to use public transportation. Several studies on travel behavior, particularly mode choice, have also used extensions and modifications of TPB (Ali et al., 2023; Bandyopadhyaya & Bandyopadhyaya, 2022; Dirgahayani & Sutanto, 2020; Donald et al., 2014; Ishikawa et al., 2019; Zhao & Gao, 2022). TPB posits three variables that form intention: attitude, subjective norm, and perceived behavioral control. Attitude is an individual's evaluation of the benefits of the behavior, the subjective norm is the social pressure perceived by an individual to perform or not perform a behavior, and perceived behavioral control is an individual's perception of the ability or opportunity to perform a behavior (Ajzen, 1991).

Based on the explanation of gamification, it is assumed in this study that gamification elements such as points, levels, and rewards will make individuals perceive that public transportation behavior is advantageous (attitude). The enjoyment of playing games in gamification will influence an individual's perception of self-efficacy, anticipating barriers (behavioral control) to using public transportation, such as long waiting times and travel times. These attitudes and behavioral control will ultimately influence the intention to use public transportation. The modified TPB results are presented in Figure 1, with the following research hypotheses:

H1: Gamification positively influences attitude.

H2: Gamification positively influences behavioral control.

H3: Attitude positively influences intention.

H4: Behavioral control positively influences intention.

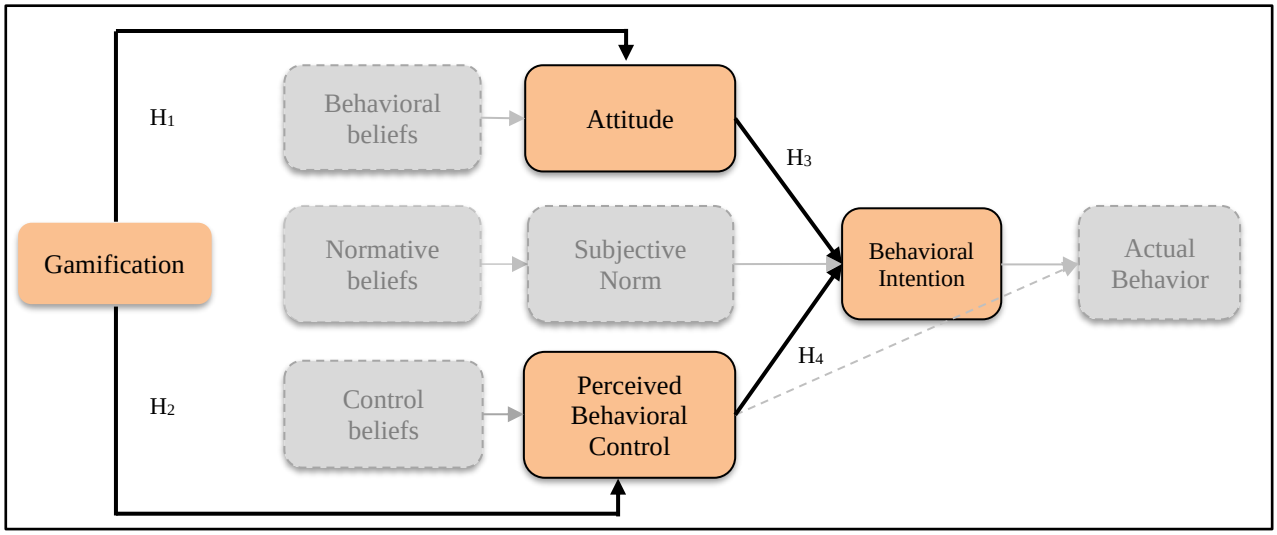


Figure 1. Proposed Constructs and Research Hypotheses. Source: Modification of Ajzen's Theory of Planned Behavior (1991).

3. METHODOLOGY

The method in this research is quantitative, utilizing primary data collected through a questionnaire instrument and distributed through social media platforms such as WhatsApp, Instagram, and Facebook stories.

3.1 Population and Sample

The population in this study consists of residents of DKI Jakarta who engage in daily activities (school/college/work) within the Jakarta area and fall into the category of choice users. Therefore, the sampling technique employed in this study is nonprobability purposive sampling, which is a sampling technique that does not provide equal opportunities for every member of the population to be selected as a sample based on specific considerations. The sample criteria for this study are 1) residents of DKI Jakarta; 2) engaging in activities (school/college/work) in DKI Jakarta; 3) aged 17 to 49 years (the minimum age limit for having a driver's license, the largest age group in the current population composition of DKI Jakarta, and familiar with technology); and 4) owning (having access to) private vehicles. Due to the large population size and the limited time for collecting questionnaires (three weeks), the sample calculation uses the Slovin method with a margin of error of 7% (for large populations, the usual margin of error is 10%). Therefore, the sample size to be used is 204 samples. From the questionnaire distribution, 223 respondents were obtained, but after examination and data cleaning, valid data from 200 respondents were employed.

3.2 Questionnaire Design

The questionnaire in this study consists of 2 parts: (1) a section of questions regarding respondent characteristics (age, gender, type of activity, education, domicile, activity location, possession of driver's license, ownership of private vehicle, modes of activity, and travel chain), and (2) a section of statements related to the research constructs. At the beginning of the second part of the questionnaire, an explanation of the offered gamification scheme is provided, along with examples of applied gamification that respondents may have accessed (Figure 2).

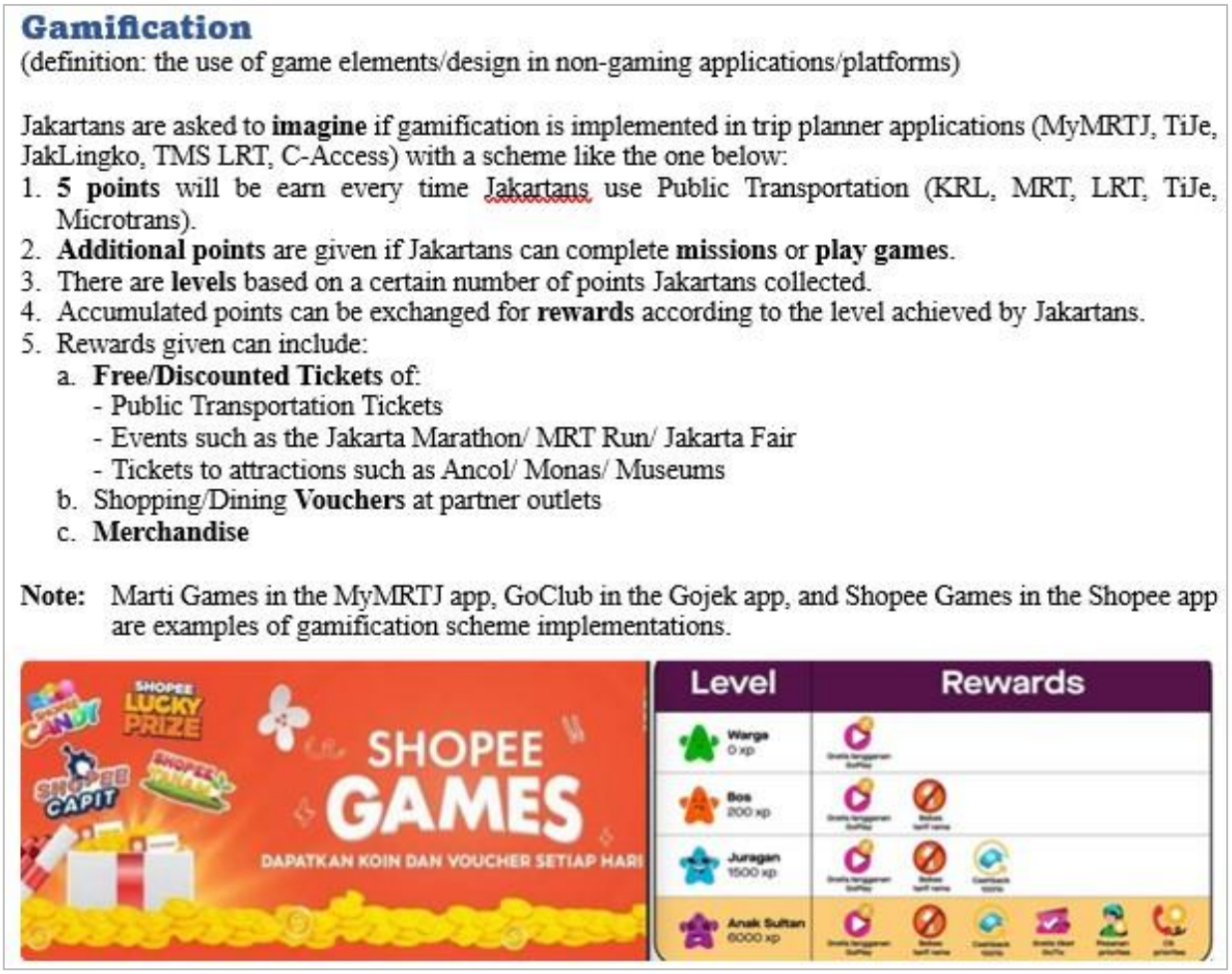


Figure 2. Explanation of the gamification scheme in the Likert scale questionnaire section.

After reading and understanding the offered gamification scheme, on the next page, respondents are asked to respond to statements regarding the influence of gamification on the intention to use public transportation (Table 1) in the form of a Likert scale with a range of 5 (strongly disagree, disagree, neutral, agree, and strongly agree).

Table 1. Constructs and Statement Items

No	Indicator	Item
Gamification		
1	G1	I am motivated to collect points to reach a certain level in the gamification scheme.
2	G2	I am motivated to collect points to obtain specific rewards (free/discounted tickets, vouchers, and merchandise) in the gamification scheme.
3	G3	I enjoy spending my leisure time playing games or completing missions in the gamification scheme.

No	Indicator	Item
4	G4	I can ward off boredom when playing games or completing missions in the gamification scheme.
5	G5	The rewards (free/discounted tickets, shopping vouchers, merchandise) offered motivate me to participate in the gamification scheme.
6	G6	I feel appreciated through rewards (free/discounted tickets, vouchers, and merchandise) that I can obtain by redeeming points/achieving certain levels in gamification.
Attitude		
1	SP1	I am appreciated or rewarded for using public transportation if rewards (free/discounted tickets, vouchers, and merchandise) through the gamification scheme are implemented.
2	SP2	If the gamification scheme is implemented in the trip planner application, I can obtain diverse rewards according to my preferences.
Perceived Behavioral Control		
1	KP1	I can alleviate boredom while waiting for public transportation by playing games and collecting points on the trip planner application.
2	KP2	My journey using public transportation would be more enjoyable if I could play games while collecting points on the trip planner application.
Intention		
1	NP1	I have/will reduce the use of private vehicles (motorcycle/car) in my daily activities (school/college/work).
2	NP2	I will continue/start using public transportation in my daily activities (school/college/work).
3	NP3	I will continue/start encouraging those around me to use public transportation more often in their daily activities (school/college/work).
4	NP4	I will use public transportation more often in my daily activities (school/college/work).

3.3 Analysis Method

The pilot survey was conducted by distributing questionnaires through WhatsApp groups at the office, among teacher colleagues, and to professors to gauge respondents' understanding from each category of workers, students, and university students regarding the questions and statements in the questionnaire. Validity and reliability tests were conducted on 60 pilot survey respondents' data to validate the questionnaire instrument in this study. Based on calculations using SPSS 2.6, it was found that all statement items were valid and reliable, as evidenced by the calculated value (r) > the table value and Cronbach's Alpha (α) > 0.7. An analysis was conducted on 200 respondent's data set to examine the influence of gamification on the intention to use public transportation using PLS-SEM with the following considerations (Hair et al., 2017):

1. Can be used to analyze the development of theoretical constructs.
2. Relationships between measurement indicators and variables can be reflective or formative indicator models.
3. Can be used in modeling analysis with relatively small and non-normally distributed samples.

4. DISCUSSION AND ANALYSIS

4.1 Analysis

The analysis section will explain the descriptive statistical analysis results of respondents' characteristics data and the results of PLS-SEM calculations to answer the hypotheses and research questions. The results of PLS-SEM are reviewed and evaluated using two systematic evaluation processes, namely the evaluation of the measurement model (outer model) to measure the reliability and validity of the research instrument and the evaluation of the structural model (inner model) to measure the predictive ability of the model.

4.1.1 Descriptive Statistics

Descriptive statistics were analyzed on the 200 data sets related to respondent characteristics (age, gender, type of activity, education, domicile, activity location, ownership of driver's license, ownership of private vehicle, mode of activity, and travel chain) (Table 2). It is found that the majority of respondents are aged between 24-39 years (54%), female (57.5%), engaged in daily work activities (72.5%), have a bachelor's degree or equivalent (44%), reside in East Jakarta (53%), carry out activities in East Jakarta (30.5%), have driver's licenses A & C (48.5%), own at least two private vehicles (38.5%), travel daily using private vehicles (73.5%), and do not have a trip chain (55%).

Table 2. Demographics and Travel Behavior of Respondents

	N	%		N	%
Age			**Activity Location**		
17-23	58	29%	Central Jakarta	73	36,5%
24-39	108	54%	North Jakarta	7	3,5%
40-49	34	17%	East Jakarta	61	30,5%
			South Jakarta	50	25%
Gender			West Jakarta	9	4,5%
Female	115	57,5%			
Male	85	42,5%	**Driver's License**		
			None	48	24%
Activity			SIM A	25	12,5%
School	39	19,5%	SIM C	30	15%
College	16	8%	SIM A + C	97	48,5%
Work	145	72,5%			
			Vehicles Ownership		
Education Degree			One vehicle	58	29%
Junior High	38	19%	Two vehicles	77	38,5%
Senior High	17	8,5%	Three vehicles	37	18,5%
Diploma 1/2/3	11	5,5%	>Three vehicles	28	14%
Bachelor	88	44%			
Master/Doctor	46	23%	**Activity Mode**		
			Private Vehicle	147	73,5%
Domicile			Public Transportation	53	26,5%
Central Jakarta	23	11,5%			
North Jakarta	13	6,5%	**Trip Chain**		
East Jakarta	106	53%	Yes	90	45%
South Jakarta	43	21,5%	No	110	55%
West Jakarta	15	7,5%			

4.1.2 Evaluation of Measurement Model (outer model)

The constructs of gamification, attitude, behavioral control, and intention in this study are reflective measurement models. Hair et al. (2017) state that the assessment of reflective measurement models includes composite reliability to evaluate internal consistency, outer loading, and average variance extracted (AVE) to assess convergent validity and discriminant validity.

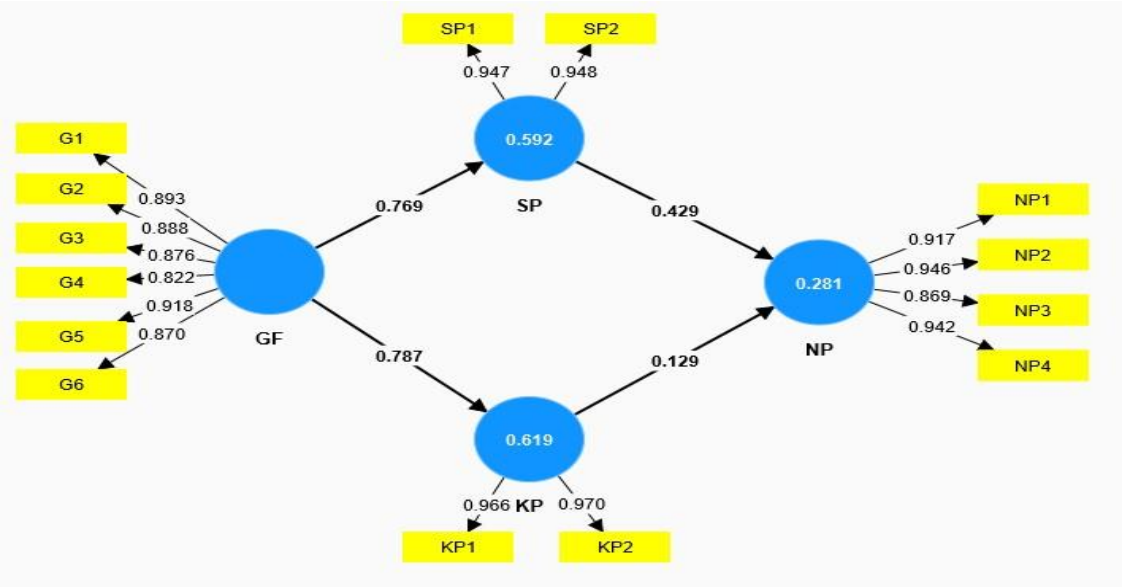


Figure 3. Results of PLS Algorithm Calculation

Internal Consistency Reliability

Two references were used to measure internal consistency reliability: Cronbach's alpha value >0.70 and composite reliability with the criteria that values from 0.6 to 0.7 are acceptable, values from 0.7 to 0.9 are reliable, and values >0.95 are unreliable. The following table shows the results of the PLS Algorithm measurement, indicating that all constructs in the model are reliable.

Table 3. Internal Consistency Reliability

Construct	Cronbach's Alpha (α)	*Composite Reliability*	Result
Gamification	0,940	0,941	Reliable
Attitude	0,885	0,885	Reliable
Perceived Behavioral Control	0,933	0,935	Reliable
Intention	0,938	0,943	Reliable

Convergent Validity

A convergent validity assessment was made based on the outer loading values of each statement item and the AVE (Average Variance Extracted) construct values. The construct is considered valid if the outer loading values and AVE values meet or exceed the threshold (OL > 0.7 and AVE > 0.5). From Figure 2 (PLS Algorithm calculation results), it can be observed that all items have outer loading values > 0.7, proving that the constructs in this study are valid. The AVE construct values are also > 0.5, indicating validity, as shown in the following table.

Table 4. Average Variance Extracted (AVE)

Construct	AVE	Result
Gamification	0,771	Valid
Attitude	0,897	Valid
Perceived Behavioral Control	0,937	Valid
Intention	0,845	Valid

Discriminant Validity

the HTMT (Heterotrait-Monotrait) values were used to measure discriminant validity in this study with a threshold below 0.9. Hair et al. (2017) recommended HTMT because it is more sensitive and accurate in detecting discriminant validity. Based on the PLS Algorithm calculation, all construct values were below 0.9, indicating that discriminant validity is fulfilled.

4.1.3 Structural Model Evaluation (inner model)

Once ensuring that the construct model is valid and reliable, the next step is to evaluate the structural model, which includes testing for collinearity and hypothesis testing (path coefficients, p-value, confidence interval, and f-square). The testing is performed using the bootstrapping method in PLS-SEM.

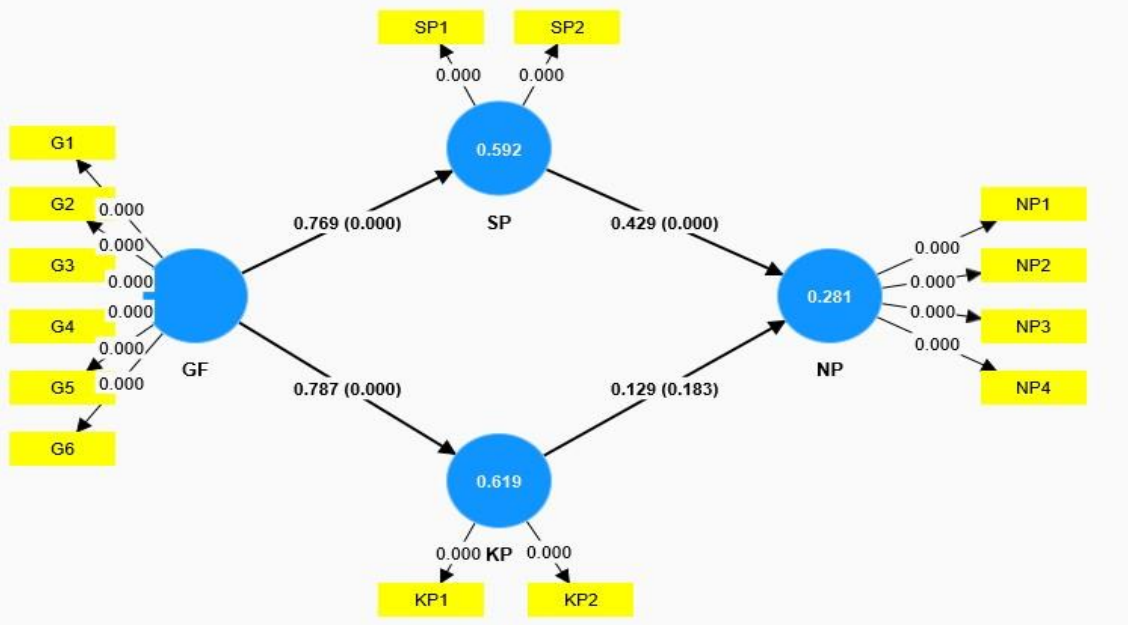


Figure 4. Results of PLS Bootstrapping Calculation

Collinearity assessment

The VIF values of all sets of predictor constructs were examined to assess the collinearity of the structural model, with values needing to be below 3, indicating no multicollinearity. Based on the calculations (Table 4), it is known that the estimated results show inner VIF values below 3, meaning there is no multicollinearity between variables, and these results reinforce that the parameter estimates in PLS-SEM are robust (unbiased).

Table 5. Variance Inflation Factor (VIF)

Hypothesis	VIF	Result
Gamification → Attitude	1,000	No Multicollinearity
Gamification → PBC	1,000	No Multicollinearity
Attitude → Intention	2,104	No Multicollinearity
PBC → Intention	2,104	No Multicollinearity

Hypothesis Testing

The constructs in this study involved three types of variables: exogenous variable (gamification), mediating variables, which are attitude and behavioral control, and endogenous variable (intention). Therefore, hypothesis testing is conducted by examining direct effects and indirect effects.

Direct Effect

The hypothesis testing for direct effects is assessed through three calculations: path coefficient, p-value with a criterion of less than 0.05 indicating a significant influence, and f-square indicating the magnitude of the effect (0.02 = low, 0.15 = moderate, and 0.35 = high). The following table shows the results of the direct hypothesis testing.

Table 6. Direct Effect Hypothesis Testing

Hypothesis	*path coefficient*	*p-value*	*Confidence interval*	*f-square*	Result
Gamification → Attitude	0,769	0,000	0,700 - 0,829	1,449	Significant
Gamification → PBC	0,787	0,000	0,718 - 0,845	1,627	Significant
Attitude → Intention	0,429	0,000	0,227 - 0,616	0,122	Significant
PBC → Intention	0,129	0,183	(0,061) - 0,319	0,011	Not Significant

Results of direct effect hypothesis testing:

H1: Accepted

A positive and significant influence exists between the gamification variable and attitude, as indicated by the p-value (0.000 or <0.05). Implementing gamification in public transportation platforms influences attitude formation by 76.9% (path coefficient). The upper threshold value of the confidence interval indicates that if gamification is applied with an attractive scheme (points, levels, and rewards), its influence on attitude formation can reach 82.9%. The f-square value of 1.449 indicates that gamification highly influences attitude formation.

H2: Accepted

There is a positive and significant influence between the gamification variable and behavioral control, as indicated by the p-value (0.000 or <0.05). Implementing gamification in public transportation platforms influences behavioral control formation by 78.7% (path coefficient). The upper threshold value of the confidence interval indicates that if gamification is applied by incorporating games, its influence on behavioral control formation can reach 84.5%. The f-square value of 1.627 indicates that gamification highly influences behavioral control formation.

H3: Accepted

There is a positive and significant influence between the attitude variable and intention, as indicated by the p-value (0.000 or <0.05). Positive attitudes resulting from the implementation of gamification on public transportation platforms influence the intention to use public transportation by 42.9% (path coefficient). The upper threshold value of the confidence interval indicates that if positive attitudes are enhanced, it can increase the intention of DKI Jakarta residents in the choice user category to 61.6%. However, the f-square value of 0.122 indicates that the significance of the influence of attitude on the intention to use public transportation is relatively moderate.

H4: Rejected

There is a positive but insignificant influence between the behavioral control variable and intention, as indicated by the p-value (0.183 or >0.05). Behavioral control formed through the presence of games in the gamification scheme only has an influence of 12.9% (path coefficient) on the intention to use public transportation. The f-square value of 0.011 also supports the low significance of behavioral control on the intention to use public transportation.

Indirect Effect

In assessing the indirect effects of gamification on intention, in addition to the path coefficient and p-value, the f-square value cannot be used to determine the magnitude of indirect influence through mediating variables. Instead, the statistic upsilon (v) is utilized. Lachowicz et al. (2018) state that the mediating effect of a mediating variable is calculated using the statistic upsilon (v), with the formula being the square of the path coefficients from each of its exogenous latent variables. Interpretation of the results of the statistic upsilon (v) follows the study by Ogbeibu et al. (2021), which is 0.075 (low mediating effect), 0.195 (moderate mediating effect), and 0.295 (high mediating effect).

Table 7. Indirect Effect Hypothesis Testing

Hypothesis	*path coefficient*	*p-value*	*Confidence interval*	*upsilon (v)*
Gamification → Attitude → Intention	0,333	0,000	0,172 - 0,482	0,109
Gamification → PBC → Intention	0,101	0,190	(0,048) - 0,257	0,010
Gamification → Intention	0,432	0,000	0,302 - 0,556	-

Results of testing indirect effects hypotheses:

1. Attitude plays a positive and significant role in mediating the gamification variable on the intention to use public transportation, as indicated by the p-value (0.000 or < 0.05). However, the mediating effect is relatively low, as shown by upsilon (v) = 0.109. Attitude mediates 33.3 percent of the intention to use public transportation.
2. Behavioral control has a positive but not significant role in mediating the gamification variable on the intention to use public transportation, as indicated by the p-value (0.190 or > 0.05), and its mediating effect is also very low, reflected in the upsilon (v) value = 0.010. Behavioral control can only mediate the intention to use public transportation by 10.1 percent.
3. Overall, the influence of implementing gamification on the intention to use public transportation is positive and significant (p-value = 0.000). The 95% confidence interval suggests that gamification (games, points, levels, rewards) will influence the intention by 30.2 percent. If gamification is made more attractive, it will affect the intention to use public transportation by 55.6 percent.

4.1.4 Theory Testing

PLS-SEM is a variance-based analysis that tests the theoretical model and focuses on predictive studies. Therefore, it is necessary to test whether the proposed model provides accurate and fitting predictions (good fit). Evaluations were conducted using the determinant coefficient (R2), predictive relevance (Q2), SRMR, and NFI to assess the constructs or the model built in this study.

R-Square

The coefficient of determination (R-square) measures the model's predictive power. The R2 criteria with values of 0.75 is considered strong, 0.50 is moderate, and 0.25 is weak. The following table shows the results of the PLS Algorithm calculations for the coefficient of determination.

Table 8. *R-Square*

Variable	*R-Square*	Result
Attitude	0,592	Moderate
Perceived Behavioral Control	0,619	Moderate
Intention	0,281	Weak

Based on the above R-square calculations, it is known that gamification is moderate in predicting the attitude variable, with 59.2 percent predicted by gamification and 40.8 percent by other variables. Gamification is also considered moderate in predicting the behavioral control variable, with 61.9 percent predicted by gamification and 38.1 percent by other variables. Attitude and behavioral control combined are weak in predicting the intention variable, with 28.1 percent predicted by attitude and 71.9 percent by other variables.

***Predictive Relevance* (Q^2)**

In evaluating the model's predictive power, besides using the R-square value, an assessment is also conducted on the Q-square, which indicates the predictive power or predictive relevance of the model beyond the sample. A Q2 value greater than 0 indicates accurate predictive relevance, while a 0 or below indicates a lack of predictive relevance. Using the PLSpredict/CVPAT method (Table 9), it can be stated that the proposed model has accurate predictive relevance.

Table 9. *Predictive Relevance*

Variabel	Q^2 *Predict*	Result
Attitude	0,587	Reliable
Perceived Behavioral Control	0,616	Reliable
Intention	0,240	Reliable

SRMR & NFI

A model is considered a good fit if it has an SRMR value less than 0.08 or 0.1 and an NFI above 0.9. Based on the PLSpredict calculations, the SRMR value obtained is 0.054, below 0.08, and the NFI value is 0.9 (rounded). Therefore, the model's constructs have a good fit.

4.2 Discussion

Based on the analysis using PLS-SEM, it is found that the reward element in gamification has the highest outer loading value; this indicates that the variety of rewards obtained through gamification schemes is the most influential factor in Jakarta residents' intention to use public transportation, categorized as choice users. Free/discounted tickets for returning to using public transportation, events like Jakarta Marathon/MRT Run/Jakarta Fair, shopping/dining vouchers, and merchandise can motivate Jakarta residents in the choice user category to use public transportation. This result aligns with a study by Tsirimpa et al. (2019), which found that the rewards obtained through gamification schemes influence individual behavior change, particularly in sustainable transportation use (public transportation, cycling, and walking).

Regarding direct effects, gamification has a positive and significant impact on shaping attitudes and behavioral control. The results show that collecting points to reach a certain level and obtaining rewards shapes a positive attitude by 78.7%, and the presence of games (gaming) on the platform shapes behavioral control by 76.9%. Furthermore, the positive and significant effect of attitude on the intention to use public transportation is observed. Based on the study findings, attitude has a 42.9% effect on the intention to use public transportation, although this effect is small. The two statements related to the variety of rewards in the

gamification scheme that respondents can obtain according to their preferences and validating the feeling of being appreciated for using public transportation significantly shape attitudes towards the additional benefits of using public transportation through gamification. Considering that most respondents in this study have at least two private vehicles and use them in their daily activities, the existence of rewards becomes an added value they can gain from switching to using public transportation. This result aligns with a study by Shahisa and Aprilianty (2022) regarding aspects such as rewards, points, and missions that have a high level of persuasion in motivating customers to continue transactions on online transportation platforms.

For the influence of the behavioral control variable on the intention of Jakarta residents to use public transportation, the results show a positive but insignificant effect, only 12.9%. The mediating effect of behavioral control also indicates a low influence because the indicators used to measure the behavioral control variable in this study are related to the enjoyment of playing games, while no simulation was conducted. Therefore, respondents do not directly perceive the enjoyment of playing games in warding off boredom while waiting or using public transportation. A study by Yen et al. (2023a) can also be referenced, stating that perceived enjoyment from gamification has no direct relationship with intention but is mediated by perceived ease of use, and the mediating effect is low. The difference in results between this study and the studies by Ali et al. (2023), Dirgahayani & Sutanto (2020), and Matubatuba & De Meyer-Heydenrych (2022) could be an alternative reason why behavioral control in this study is not significant. These studies stated that behavioral control has a positive and most significant influence (largest predictor) on the intention to use public transportation. In both studies, the main service attributes of public transportation (accessibility, fare, schedule information, travel time, frequency, comfort, and safety) were used to measure behavioral control. In other words, behavioral control is strongly influenced by primary services rather than complementary services like gamification. Considering that the respondents in this study are choice users, accessibility, frequency, travel time, comfort, and safety significantly impact their transportation mode choice decision.

In addition to direct effects, this study also analyses the indirect effects of gamification variables on the intention to use public transportation through the mediating variables of attitude and behavioral control. The attitude variable positively and significantly mediates the gamification variable with the intention to use public transportation by 33.3%, indicating that the assessment of the benefits obtained through attractive gamification motivates choice users' intentions to start or continue using public transportation. In other words, if choice users perceive that gamification provides more value benefits, it will increase the likelihood of them having the intention to start or continue using public transportation by 33.3%. The behavioral control variable in this study has not been able to become a mediator, with its influence only at 10.1%. The magnitude of the influence of the mediation variables is indeed low. Still, considering the limitations of using significant upsilon (v) in a simple model (parsimonious model), the mediating influence in this study is accepted (Lachowicz et al., 2018). Overall, the indirect influence of gamification on the intention to use public transportation using the TPB framework is positive and significant at 43.2%, indicating the potential of gamification to attract the intentions of Jakarta residents categorized as choice users to use public transportation.

5. CONCLUSION & RECOMMENDATION

5.1 Conclusion

Pulling more residents of DKI Jakarta, especially those in the choice user category, to use public transportation requires innovative pull strategies that align with the times. This research explores one strategy currently being widely applied in the context of Transportation Demand Management (TDM), namely gamification, to see the possibilities of it becoming an alternative innovation. By modifying the TPB constructs, it is assumed that if residents are aware of and understand the gamification scheme (points, levels, rewards, games) in the trip planner application, it will influence their attitudes and control over behavior and ultimately affect the intention to use public transportation.

Based on the analysis, gamification impacts the intention to use public transportation mediated by the attitude variable. Indicates that the appreciation of the behavior of choice user category residents using public

transportation through various rewards can motivate them to start/continue using public transportation. The result states that behavioral control has a positive but insignificant impact in mediating gamification, and the intention to use public transportation should not be seen as a failure of this research. Instead, it can serve as a foundation for further research to simulate games and observe the real impact of gaming elements in gamification in shaping behavioral control. It is also essential to understand that gamification is a form of development from the core services of public transportation. Therefore, gamification strategies must be integrated with improving the primary public transportation services to attract Jakarta residents, especially choice users, to use it.

5.2 Limitations

In this study, game simulations were not conducted within the offered gamification scheme (only asking respondents to imagine), so the respondents did not have an authentic experience related to gamification. This study also did not examine the influence of gamification on subjective norms as a mediating variable for the intention to use public transportation. More than 200 respondents are needed to strengthen the research findings further. Based on PLS-SEM calculations, the results of testing the theory and constructs used in this study show that the proposed model is appropriate and has accurate predictive relevance, even though its predictive power is still in the moderate and weak categories. Therefore, improvements are needed in the statement items to make them more accurate in predicting the model.

5.3 Recommendation

The research results can provide input for the government and public transportation operators to enhance their pull strategy innovations, especially regarding the variety of rewards that can be obtained from public transportation. Public transportation operators need to explain what rewards can be obtained from collected points or achieved levels in the trip planner application to attract more residents of DKI Jakarta, especially choice users, to use public transportation. These rewards must be tailored to the interests, habits, and conditions of DKI Jakarta residents. Rewards that incentivize participation in events or visits to tourist attractions organized by the Jakarta provincial government can ultimately serve as effective means of publicity.

6. REFERENCES

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-T

Ali, N., Nakayama, S., & Yamaguchi, H. (2023). Using the extensions of the theory of planned behavior (TPB) for behavioral intentions to use public transport (PT) in Kanazawa, Japan. *Transportation Research Interdisciplinary Perspectives*, *17*(November 2022). https://doi.org/10.1016/j.trip.2022.100742

Bandyopadhyaya, V., & Bandyopadhyaya, R. (2022). Understanding public transport use intention post-COVID-19 outbreak using the modified theory of planned behavior: A case study from a developing country perspective. *Case Studies on Transport Policy*, *10*(4), 2044–2052. https://doi.org/10.1016/j.cstp.2022.09.002

Castellanos, S. (2016). Delivering modal-shift incentives by using gamification and smartphones: A field study example in Bogota, Colombia. *Case Studies on Transport Policy*, *4*(4), 269–278. https://doi.org/10.1016/j.cstp.2016.08.008

Che, T., Peng, Y., Zhou, Q., Dickey, A., & Lai, F. (2023). The impacts of gamification designs on consumer purchase: A use and gratification theory perspective. *Electronic Commerce Research and Applications*, *59*(April). https://doi.org/10.1016/j.elerap.2023.101268

Deterding, S., O'Hara, K., Sicart, M., Dixon, D., & Nacke, L. (2011). Gamification: Using game design elements in non-gaming contexts. *Conference on Human Factors in Computing Systems - Proceedings*, *May* 2425–2428. https://doi.org/10.1145/1979742.1979575

Dinh Toan, T., Hoi Lam, S., Meng, M., & Diew Wong, Y. (2023). Travel demand management policies: A case study of Singapore and transferability potentials for Hanoi. *Case Studies on Transport Policy*, *11*(October 2022). https://doi.org/10.1016/j.cstp.2022.100934

Dirgahayani, P., & Sutanto, H. (2020). The effect of transport demand management policy on the intention to use public transport: A case in Bandung, Indonesia. *Case Studies on Transport Policy*, *8*(3), 1062–1072. https://doi.org/10.1016/j.cstp.2020.03.004

Donald, I. J., Cooper, S. R., & Conchie, S. M. (2014). An extended theory of planned behavior model of the psychological factors affecting commuters' transport mode use. *Journal of Environmental Psychology*, *40*, 39–48. https://doi.org/10.1016/j.jenvp.2014.03.003

Guerra, E. (2022). What the heck is a choice rider? A theoretical framework and empirical model. *Journal of Transport and Land Use*, *15*(1), 165–182. https://doi.org/10.5198/jtlu.2022.2096

Hamari, J., Koivisto, J., & Sarsa, H. (2014). Does gamification work? - A literature review of empirical studies on gamification. *Proceedings of the Annual Hawaii International Conference on System Sciences*, 3025–3034. https://doi.org/10.1109/HICSS.2014.377

Huotari, K., & Hamari, J. (2011). " Gamification " from the perspective of service marketing " Gamification " from the perspective of service marketing. *CHI 2011 Workshop "Gamification," January 2011*, 11–15.

Huotari, K., & Hamari, J. (2017). A definition for gamification: anchoring gamification in the service marketing literature. *Electronic Markets*, *27*(1), 21–31. https://doi.org/10.1007/s12525-015-0212-z

Ishikawa, T., Dirgahayanib, P., & Fujiwarac, A. (2019). Empirical Analysis of the Effects of Implementing Mobility Management atInadequately Mass Transit Developed Area-A Case of Bandung, Indonesia. *Journal of the Eastern Asia Society for Transportation Studies*, *13*, 1853–1872.

Jacques, C., Manaugh, K., & El-Geneidy, A. M. (2013). Rescuing the captive [mode] user: An alternative approach to transport market segmentation. *Transportation*, *40*(3), 625–645. https://doi.org/10.1007/s11116-012-9437-2

Kaur, J., Lavuri, R., Parida, R., & Singh, S. V. (2023). Exploring the Impact of Gamification Elements in Brand Apps on the Purchase Intention of Consumers. *Journal of Global Information Management*, *31*(1), 1–30. https://doi.org/10.4018/JGIM.317216

Keizer, M., Sargisson, R. J., van Zomeren, M., & Steg, L. (2019). When personal norms predict the acceptability of push and pull car-reduction policies: Testing the ABC model and low-cost hypothesis. *Transportation Research Part F: Traffic Psychology and Behaviour*, *64*, 413–423. https://doi.org/10.1016/j.trf.2019.06.005

Koo, Y., Lee, M., & Cho, Y. (2013). A point card system for public transport utilization in Korea. *Transportation Research Part D: Transport and Environment*, *22*, 70–74. https://doi.org/10.1016/j.trd.2013.03.007

Krizek, K., & El-Geneidy, A. (2007). Segmenting Preferences and Habits of Transit Users and Non-Users. *Journal of Public Transportation*, *10*(3), 71–94. https://doi.org/10.5038/2375-0901.10.3.5

Lachowicz, M. J., Preacher, K. J., & Kelley, K. (2018). A novel measure of effect size for mediation analysis. *Psychological Methods*, *23*(2), 244–261. https://doi.org/10.1037/met0000165

Litman, T. (2008). Mobility management: innovative management strategies to transport problems. Canada: Victoria Transport Policy Institute.

Matubatuba, R., & De Meyer-Heydenrych, C. F. (2022). Developing an intention to use amongst non-users of the Bus Rapid Transit (BRT) System: An emerging market perspective. *Research in Transportation Business and Management*, *45*(May). https://doi.org/10.1016/j.rtbm.2022.100858

Ogbeibu, S., Jabbour, C. J. C., Gaskin, J., Senadjki, A., & Hughes, M. (2021). Leveraging STARA competencies and green creativity to boost green organizational innovative evidence: A praxis for sustainable development. *Business Strategy and the Environment*, *30*(5), 2421–2440. https://doi.org/10.1002/bse.2754

Shahisa, A., & Aprilianty, F. (2022). The Effect of Gojek's Gamification Strategy (GoClub) Towards Customer Loyalty. *Asian Journal of Research in Business and Management*, *4*(3), 214–228. https://doi.org/10.55057/ajrbm.2022.4.3.20

Sohn, K., & Yun, J. (2009). Separation of car-dependent commuters from normal-choice riders in mode-choice analysis. *Transportation*, *36*(4), 423–436. https://doi.org/10.1007/s11116-009-9209-9

Tsirimpa, A., Polydoropoulou, A., Pagoni, I., & Tsouros, I. (2019). A reward-based instrument for promoting multimodality. *Transportation Research Part F: Traffic Psychology and Behaviour, pp. 65*, 121–140. https://doi.org/10.1016/j.trf.2019.07.002

Tumlin, J. (2012). Sustainable Transportation Planning. John Wiley & Sons, Inc., New Jersey. 241

Wang, S., Wang, J., & Yang, F. (2020). From willingness to action: Do push-pull-mooring factors matter for shifting to green transportation? *Transportation Research Part D: Transport and Environment*, *79*(96). https://doi.org/10.1016/j.trd.2020.102242

Yen, B. T. H., Mulley, C., & Meza, G. (2023a). Exploring the attitudes and perceptions influencing user participation in gamification schemes for TDM. *Research in Transportation Economics*, *99*, 101300. https://doi.org/10.1016/j.retrec.2023.101300

Yen, B. T. H., Mulley, C., & Meza, G. (2023b). Understanding the potential policy transfer of gamification schemes for behavior change in public transport and road safety. *Research in Transportation Economics*, *99*(8 May 2023), 101299. https://doi.org/10.1016/j.retrec.2023.101299

Zhao, P., & Gao, Y. (2022). Public transit travel choice in the post-COVID-19 pandemic era: An application of the extended Theory of Planned behavior. *Travel Behaviour and Society*, *28*(April), pp. 181–195. https://doi.org/10.1016/j.tbs.2022.04.002