

Analysis of the Choice of Commuter Line Electric Rail Train (KRL) Modes and Transjakarta Buses for the Bekasi City - East Jakarta Route

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ABSTRACT: Transportation is one of the problems that becomes a measure of the success of a city. Bekasi City, as the gateway and buffer for the capital city of Jakarta, has high mobility due to the density of the city of Jakarta. This study aims to determine the characteristics and factors that influence mode selection, mode selection models that can explain probabilities, as well as people's preferences in choosing the Commuter Line Electric Train (KRL) and Transjakarta Bus transportation modes used by the people of Bekasi City to East Jakarta. Data was collected using a questionnaire survey using the Stated Preference method, distributed offline and online. Furthermore, the data from the survey were processed using regression analysis to evaluate the relationship between the response variable, namely the choice of travelers on a numerical scale (Y), with changes in the analyzed attributes, namely the difference in travel costs (X1), travel time (X2), and the departure time of each mode (X3). The results of the linear regression analysis using the SPSS version 28 program obtained the mode selection model, namely $(UMRT - UTJ) = 0.662 + 0.044.X1 - 0.014.X2 + 0.025.X3$. The conclusion obtained from the results of this study is that the KRL Commuter Line is the preferred mode of transportation compared to the Transjakarta Bus with the Bekasi - East Jakarta route, and the travel cost attribute is the most influential in the transportation mode selection model.

KEYWORDS: Mode Selection, Transjakarta, KRL Commuter Line, Stated Preference

I. INTRODUCTION

Transportation is one measure of the success of a city. This is because transportation is an essential factor in assessing the quality of social life [1]. Public transportation is expected to overcome various problems, such as traffic jams and the environmental impact of vehicle pollution. The high mobility of urban residents in activities such as schooling, working, and fulfilling their daily needs requires significant travel time. Therefore, the percentage of traffic congestion will be higher if people prefer private vehicles over public transportation. Several studies have shown that drivers can spend between 45 minutes and 1 hour traveling from home to their destination, with a weighted percentage of that time reaching 40% - 60% [2].

The rapid development and increasing use of cars are causing traffic jams in big cities in Indonesia [3]. The Indonesian government continues monitoring congestion problems in big cities with highly mobile populations. Rapid technological developments can help improve the quality of service and choice of public transportation facilities. To meet the need for transportation, people in the Jabodetabek area can choose several choices of public transportation facilities, including Bus, Mass Rapid Transit (MRT), Transjakarta Bus, KRL Commuter Line Indonesia, and

Light Rail Transit (LRT) [4]. Communities can determine the transportation mode to use by considering the excellent service level, short travel time, and economical prices [5]. The quality of a service or product in the mode of transportation can be considered by measuring user satisfaction. Therefore, service and user satisfaction will be the primary key in transportation service business activities that can improve the quality of public transportation in Indonesia [6].

Bekasi City, as the gateway and buffer for the capital city of Jakarta, has high mobility due to the density of the city of Jakarta [7]. Bekasi City, as the gateway and buffer for the capital city of Jakarta, has high mobility due to the density of the city of Jakarta [8]. The Commuter Line Electric Rail Train (KRL) is still the mode of public transportation that the people of Jabodetabek rely on today. This is supported by data from the Central Statistics Agency, where Commuter Line Electric Train (KRL) users in the Jabodetabek operational area in January 2023 reached 22,717,000 users [9]. The high interest of Commuter Line Electric Train (KRL) users is not directly proportional to the number of fleets available, resulting in long queues at each station. In addition, the short waiting time also causes physical fights between passengers intending to be able to enter the train car [10].

Based on the above background, it is necessary to conduct research related to the selection of modes of transportation to determine the characteristics of users, what factors influence, the probability of mode selection, and people's preferences on the Bekasi City route to East Jakarta between the Commuter Line Electric Train (KRL) and the Bus Transjakarta.

II. RESEARCH METHOD

In order to obtain accurate and reliable research results, it is essential to carry out the research methodology and stages in a structured and systematic manner [11]. The primary data collection technique was carried out using questionnaires distributed offline by giving questionnaires around the Transjakarta Train Station and Bus Shelters or online via Google form. Meanwhile, secondary data was obtained from the Central Bureau of Statistics for the City of Bekasi, PT. Commuter Line Indonesia and PT Transportasi Jakarta. This research was conducted in four locations, namely Bekasi Station and East Bekasi Station, as well as two Transjakarta Bus Stop areas in Summarecon Bekasi and Bulak Kapal, East Bekasi.



Figure 1: Research location

The plan made to carry out the research requires an accurate and practical analysis. To carry out a good analysis, complete and accurate data and information are needed, as well as a strong understanding of the related basic concepts [12]. After the analysis phase is complete, the research results can be explained through tables and pie chart diagrams in order to produce conclusions that can be drawn. Research variable data, namely travel costs, travel time, and headway of the KRL Commuter Line and Transjakarta Bus with the route Bekasi - East Jakarta, were obtained through a preliminary survey.

A. Questionnaire Data Testing

It is essential to test the questionnaire data to ensure the reliability and validity of the data so that the research results can be trusted and used to make decisions or make recommendations [13]. The following is the process of testing the questionnaire data.

Validity Test refers to the evaluation step of whether or not a measurement instrument has validity. The Pearson Product Moment method is used to test validity in this study's context. The method used to measure validity with this method is to compare the calculated value (r_{count}) with the value in the following table (r_{table}):

1. If the value of $r_{\text{count}} > r_{\text{table}} = \text{Valid}$
2. If the value of $r_{\text{count}} < r_{\text{table}} = \text{Invalid}$

Reliability refers to the extent to which a measurement instrument can be relied upon or trusted. The basic principles used in making decisions regarding reliability are as follows:

1. If the Cronbach Alpha value is > 0.60 , then the questionnaire is considered reliable or consistent.
2. If the Cronbach Alpha value is < 0.60 , then the questionnaire is considered to have no reliability or consistency.

The normality test is used to evaluate whether the distribution of the residual values follows a typical distribution pattern. The basic principle in deciding this test is stated as follows:

1. If the Significance value is > 0.05 , then the distribution of residual values follows a typical pattern.
2. If the Significance value is < 0.05 , then the distribution of residual values does not follow the typical pattern.

B. Statistical Testing

Statistical testing in this research is F test and T test. The F test is usually used to determine whether or not two or more data groups have the same variance. The basis for deciding on the F Test is as follows:

1. Based on a comparison between the F_{count} value and the F_{table} value:
 - a) If the value of $F_{\text{count}} > F_{\text{table}}$, it means that variable X has a significant influence on variable Y.
 - b) If the value of $F_{\text{count}} < F_{\text{table}}$, it means that variable X has no significant effect on variable Y.
2. Based on probability (P_{value}):
 - a) If the $P_{\text{value}} < 0,05$, it means that variable X has a significant influence on variable Y.
 - b) If the $P_{\text{value}} > 0,05$, it means that variable X has no significant effect on variable Y.

Hypothesis testing using the T-test on the regression coefficient was carried out to evaluate the impact of each variable in the utility difference equation separately. The basis for deciding on the T-test is as follows:

1. Based on a comparison between the T_{count} value and the T_{table} value:
 - a) If the value of $T_{\text{count}} > T_{\text{table}}$, it means that variable X has a significant influence on variable Y.
 - b) If the value of $T_{\text{count}} < T_{\text{table}}$, it means that variable X has no significant effect on variable Y.
2. Based on probability (P_{value}):
 - a) If the $P_{\text{value}} < 0,05$, it means that variable X has a significant influence on variable Y.
 - b) If the $P_{\text{value}} > 0,05$, it means that variable X has no significant effect on variable Y.

C. Stated Preference

In the Stated Preference analysis, regression techniques are used to model the rating choices made by respondents. The

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method used to collect information about preferences in this study is Point Rating. The Point Rating method will be used to obtain information about the measurements in this study through the answers given by the respondents. The Point Rating Scale on the respondents' answers is presented in Table 1 below:

Table 1. Point Rating

Point Rating	Respondents Answer
1	Choose KRL Commuter Line
2	Maybe choose KRL Commuter Line
3	Balanced choice
4	Maybe choose the Transjakarta Bus
5	Choose the Transjakarta Bus

The Point Rating obtained will be converted into a numerical scale representing the individual's response to the choice statement. The transformation will use the binomial logit model to convert the probability for each Point Rating into a numerical scaled value. The numerical scale value will then become the dependent variable in the regression analysis. At the same time, the independent variable is the difference in attribute values between the KRL Commuter Line and the Transjakarta Bus.

D. Mode Selection Probability

This study's mode selection probability calculation was carried out using a binomial logit model. The equation that describes the shape of the binomial logit model is formulated as follows:

1. Probability of using mode 1:

$$P_{KRL} (1) = \frac{1}{1 + e^{U_{KRL} - U_{TJ}}}$$

2. Probability of using mode 2:

$$P_{TJ} (2) = 1 - P_{KRL} = \frac{e^{U_{KRL} - U_{TJ}}}{1 + e^{U_{KRL} - U_{TJ}}}$$

Where:

- P_{KRL} = Opportunity to choose KRL Commuter Line mode.
- P_{TJ} = Opportunity to choose the Transjakarta Bus mode.
- U_{KRL} = Utility or KRL Commuter Line mode selection value.
- U_{TJ} = Utility or value for choosing the Transjakarta Bus mode.
- e = Exponential.

This study assumes that the utility function ($U_{TJ} - U_{MRT}$) has a linear form. Therefore, the utility value can be calculated through the multiple linear regression equation obtained using the SPSS program. The utility function is stated in the following equation.

$$U_{KRL} - U_{TJ} = a + b_1(X_{1KRL} - X_{1TJ}) + b_2(X_{2KRL} - X_{2TJ}) + b_3(X_{3KRL} - X_{3TJ})$$

Where:

- $U_{KRL} - U_{TJ}$ = Utility value of both modes.
 - a = Constant parameters.
 - b_1 s/d b_3 = Regression parameters.
 - X_1 s/d X_3 = Variables that influence travel behavior.
- After the utility value ($U_{TJ} - U_{MRT}$) is obtained, an analysis can be carried out to calculate the probability of selecting each mode.

III. RESULT AND DISCUSSION

A. Preliminary Survey

A preliminary survey was conducted to obtain actual data regarding the modes of transportation for the KRL Commuter Line and Transjakarta Buses on the Bekasi City – East Jakarta route. The data sought includes travel costs, travel time, and headway of each mode of transportation. The following are the results of the data obtained from this survey:

Table 2. Existing Conditions for Each Trip Attribute

No.	Travel Attributes	KRL Commuter Line	Transjakarta Bus
1	Travel costs from Bekasi to East Jakarta (X1)	Rp. 3.000	Rp. 3.500
2	Travel time from Bekasi to East Jakarta (X2)	± 30 minutes	± 45 minutes
3	Departure Headway for Bekasi City – East Jakarta (X3)	± 10 minutes	± 10 minutes

Based on the preliminary survey results, it is known that the existing condition of the travel cost variable (X1) for the KRL Commuter Line is Rp. 3,000, while for the Transjakarta Bus, it is Rp. 3,500 with the Bekasi City – East Jakarta route. Thus, there is a difference of Rp. 500 between the two modes of transport. In the existing conditions, the travel time variable (X2) for the KRL Commuter Line and the Transjakarta Bus with the Bekasi City - East Jakarta route has a difference of about 15 minutes. The existing condition of the headway variable or the waiting time for departure (X3) on the Commuter Line KRL and Transjakarta Buses with the Bekasi City - East Jakarta route is the same.

B. Characteristics of Respondent

In this study, the data analyzed came from 100 respondents' answers, including individuals who had used the KRL Commuter Line and Transjakarta Bus modes of

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transportation to travel from Bekasi City to East Jakarta. The characteristics of KRL Commuter Line and Transjakarta bus users can be grouped into three categories: social demographic characteristics, characteristics of travelers, and characteristics of travelers.

In discussing the socio-demographic characteristics of the respondents, the observed variables included gender, age, last education, and occupation of each respondent.

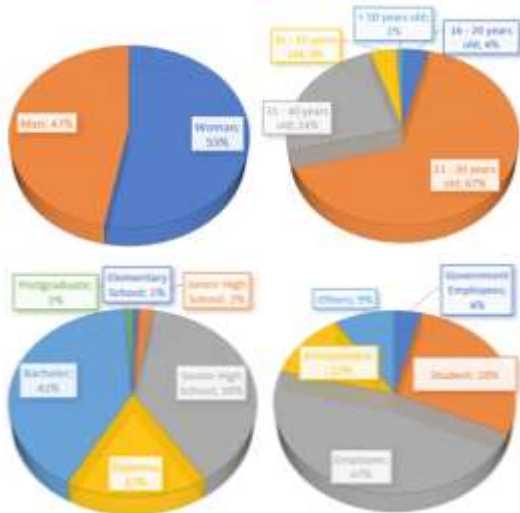


Figure 2: Pie Chart Respondents' Social Demographic Characteristics

From Figure 2 above, the characteristics of the 100 respondents, when analyzed by gender, show that 47% were male and 53% female. When grouped by age, most respondents (67%) are aged 21 to 30 years. Regarding recent education, most respondents (41%) have a Bachelor's degree. Meanwhile, the majority of respondents (47%) work as employees.

In discussing the characteristics of travelers, several variables are observed, namely household structure, monthly income level, driving license ownership, and private vehicle ownership of each respondent.

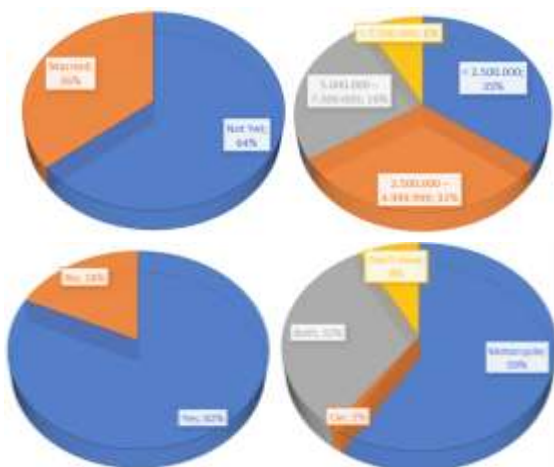


Figure 3: Pie Chart Characteristics of Travelers

Based on Figure 3 above, out of 100 respondents, when analyzed by considering marital status, it can be seen that 36% are married, while the remaining 64% are not married. If grouped by income, most respondents (35%) have a monthly income of under IDR 2,500,000. Regarding SIM ownership, most respondents (82%) have a SIM. Meanwhile, most respondents (59%) owned private vehicles such as motorcycles.

In discussing travel characteristics, several variables are observed, including the reasons for selecting the mode, the background for choosing the mode, the frequency of use of the mode in a week, and the purpose of the trip for each user of the mode of transportation.

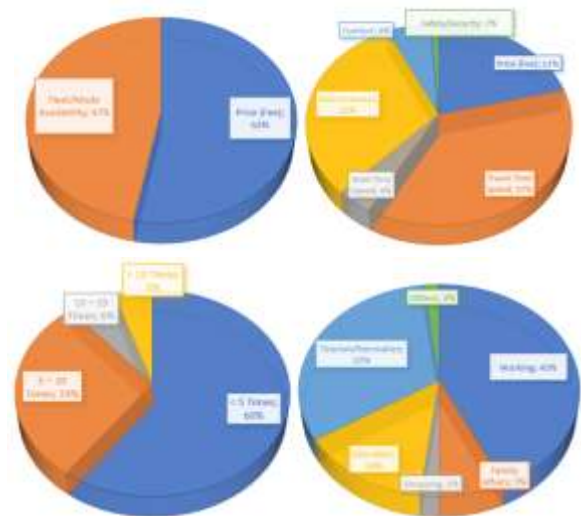


Figure 4: Pie Chart Travel Characteristics

Based on Figure 4 shown above, when the information from 100 respondents was analyzed by taking into account the reasons for choosing a mode of transportation, it can be seen that 47% decided on a mode of transportation based on fleet availability, while the other 53% prioritized travel cost considerations. If sorted based on the choice of mode, the majority of respondents (37%) chose the mode of transportation with consideration of the speed of travel time. Regarding the frequency of using the mode during a week, most respondents (60%) use the mode less than five times a week. On the other hand, most respondents (43%) use this mode of transportation for business or work purposes.

C. Questionnaire Validity, Reliability, and Normality Test

This test involves selected data from 100 respondents, which consists of 17 question items related to the characteristics of the respondents and factors that influence the choice of mode as well as 15 question items related to the research variables. This test aims to analyze and evaluate the acceptance level of respondents to the research questionnaire design. Furthermore, a validity, reliability, and normality test analysis was carried out using SPSS version 28.

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In validity test, the main objective is to determine the validity of an item statement. An item statement is considered valid if the total item correlation value corrected (r_{count}) exceeds the table correlation value (r_{table}). By involving 100 respondents and using a 5% confidence, a

significance or table value of 0.1966 was obtained. The results of testing the validity of the question items related to the research variables, namely travel costs, travel time, and headway using the help of SPSS version 28 software, are as follows:

Table 3. Results of Research Variable Validity Test

No.	Question	r_{count}	r_{table}	Description
1	Condition 1 on Difference in Travel Cost Attributes (X1.1)	0,892	0,1966	Valid
2	Condition 2 on Difference in Travel Cost Attributes (X1.2)	0,886	0,1966	Valid
3	Condition 3 on Difference in Travel Cost Attributes (X1.3)	0,868	0,1966	Valid
4	Condition 4 on Difference in Travel Cost Attributes (X1.4)	0,831	0,1966	Valid
5	Condition 5 on Difference in Travel Cost Attributes (X1.5)	0,892	0,1966	Valid
6	Condition 1 on Difference in Travel Time Attributes (X2.1)	0,835	0,1966	Valid
7	Condition 2 on Difference in Travel Time Attributes (X2.2)	0,885	0,1966	Valid
8	Condition 3 on Difference in Travel Time Attributes (X2.3)	0,843	0,1966	Valid
9	Condition 4 on Difference in Travel Time Attributes (X2.4)	0,836	0,1966	Valid
10	Condition 5 on Difference in Travel Time Attributes (X2.5)	0,740	0,1966	Valid
11	Condition 1 on Difference in Departure Headway Attributes (X3.1)	0,867	0,1966	Valid
12	Condition 2 on Difference in Departure Headway Attributes (X3.2)	0,821	0,1966	Valid
13	Condition 3 on Difference in Departure Headway Attributes (X3.3)	0,806	0,1966	Valid
14	Condition 4 on Difference in Departure Headway Attributes (X3.4)	0,768	0,1966	Valid
15	Condition 5 on Difference in Departure Headway Attributes (X3.5)	0,893	0,1966	Valid

The results of testing the validity of the 15 question items related to the research variables indicate that all question items are valid because the r_{count} value is greater than the r_{table} value, so all question items can be used in subsequent statistical tests.

The reliability test aims to evaluate the consistency of the questionnaire. The results of the reliability test of question items related to the research variables, namely travel costs, travel time, and headway using the help of SPSS version 28 software, are as follows:

Table 4. Research Variable Reliability Test Results

Cronbach's Alpha	N of Items
0,971	15

Table 4 shows that Cronbach's alpha value is 0.971 with 15 questions (items declared valid on the validity test). Thus, it can be concluded that each question item has reliability or a high confidence level and can be trusted in the measurements taken.

The normality test determines whether the residual values have a normal distribution. The Kolmogorov-Smirnov method was used in this test because the number of respondents was more than 30. This significance value was obtained from the results of the analysis using the following SPSS software version 28:

Table 5. Results of the Research Variable Normality Test

Model	Sig.
Travel Expenses (X1)	0.146
Travel Time (X2)	0.173
Headway (X3)	0.109

Table 5 above shows that the significance value for the travel cost research variable (X1) is 0.146 or greater than 0.05. Therefore, the data is declared normally distributed. The significance value for the travel time research variable (X2) is 0.173 or greater than 0.05. Thus, the data is typically distributed. The significance value for the headway research variable (X3) is 0.109 or greater than 0.05. Therefore, the data is typically distributed.

D. Data Transformation

This study used regression analysis to obtain the utility difference function equation between KRL Commuter Line and Transjakarta Bus. Regression analysis was carried out based on stated preferences, where respondents chose the rating. This rating choice is an individual response to the rating point shown in the semantic scale (Table 1). This semantic scale is then transformed into a numerical scale, which is a value that reflects an individual's response to the choice statement, using a linear transformation of the binomial logit model on the probability for each rating point. This numerical scale value becomes the dependent variable in the regression analysis, while the difference in value between the KRL Commuter Line and Transjakarta Bus attributes becomes the independent variable. The process of transformation and data processing is carried out as follows:

1. Choice probability values represented by point rating values 1, 2, 3, 4, and 5 are standard scale values, namely 0.9; 0.7; 0.5; 0.3; and 0.1.

2. To obtain a numerical scale value for each choice probability, a binary logit linear transformation model is used based on the following equation:

$$Y = \ln \frac{p}{1 - p}$$

3. After the transformation from the semantic scale to the numerical scale, the results of the research questionnaire survey were calculated based on the respondents' choices of changes in one of the attributes for each respondent. This calculation is based on the condition of the existing mode.

E. Mode Selection Model

The results of the data transformation were then processed using SPSS version 28 using regression analysis to evaluate the relationship between the response variables, namely the

choice of travelers on a numerical scale (Y), with changes in the attributes analyzed, namely the difference in travel costs (X1), travel time (X2), and the departure time of each mode (X3).

Model		Unstandardized Coefficients		Standardized Coefficients		t	Sig.
		B	Std. Error	Beta			
1	(Constant)	.662	.073			9.025	<.001
	Cost	.044	.009	.629		4.914	<.001
	Time Travel	-.014	.010	-.189		-1.426	.157
	Headway	.025	.011	.327		2.407	.018

a. Dependent Variable: Transportation

Figure 5: SPSS Test Output Results for Coefficients on Attributes X1, X2 and X3

The following is the equation for the utility difference between KRL Commuter Line and Transjakarta Bus obtained from the SPSS output data:

$$U_{KRL} - U_{TJ} = 0,662 + 0,044 X_1 - 0,014 X_2 + 0,014 X_3$$

Where:

X1 = Travel Expenses.

X2 = Travel Time.

X3 = Headway or Fleet Waiting Time.

F. Statistical Testing

The following are the SPSS output results from the ANOVA test or F-test:

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	15,228	3	5,076	52,496	<.001 ^b
	Residual	9,282	96	.097		
	Total	24,510	99			

a. Dependent Variable: Transportation
b. Predictors: (Constant), Headway, Time Travel, Cost

Figure 6: SPSS Output ANOVA Test

Based on the ANOVA or F-test results by including attributes in the comparison between Commuter Line KRL and Transjakarta Buses, a F_{count} of 52,496 is obtained with a P_{value} of 0.001. Because the F_{count} value is more significant than F_{table} and P_{value} is less than 0.05, it is concluded that the attributes of Travel Cost, Travel Time, and Headway Waiting Time together affect the utility of selecting a mode of transportation. This means that these three attributes significantly influence the choice between KRL Commuter Line and Transjakarta Bus.

The results of the T-test for each attribute can be seen in Figure 5 before. Recapitulation of the T-test results on the travel cost attribute (X1), travel time (X2), and headway (X3) are presented in the following table:

Table 6. Existing Conditions for Each Trip Attribute

Model	T _{count}	Sig.	Influence
Travel Expenses (X1)	4,914	0,001	Influence
Travel Time (X2)	-1,426	0,157	Has No Effect

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Headway (X3)	2,407	0,018	Influence
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G. Transportation Mode Selection Analysis

Recapitulation of the probability of choosing a mode based on changes in the attributes of travel costs (X1) and travel

time (X2). Moreover, headway (X3) is presented in the following table:

Table 7. Recapitulation of the Probability of Mode Selection Based on Attribute Changes

No.	Choice	Numerical Scale Value	Δ Cost (X1)	Δ Travel Time (X2)	Δ Headway (X3)	$U_{KRL} - U_{TJ}$	P_{KRL}	P_{TJ}	P_{KRL} (%)	P_{TJ} (%)
1.	1.a	-2,1972	-500	-15	0	-2,132	0,894	0,106	89,4	10,6
	1.b	0	500	-15	0	2,306	0,091	0,909	9,1	90,9
	1.c	-0,8473	-1000	-15	0	-4,351	0,987	0,013	98,7	1,3
	1.d	0	1000	-15	0	4,525	0,011	0,989	1,1	98,9
	1.e	-2,1972	0	-15	0	0,087	0,478	0,522	47,8	52,2
2.	2.a	-2,1972	-500	0	0	-2,153	0,896	0,104	89,6	10,4
	2.b	-0,8473	-500	-5	0	-2,146	0,895	0,105	89,5	10,5
	2.c	0,8473	-500	-10	0	-2,139	0,895	0,105	89,5	10,5
	2.d	0,8473	-500	-15	0	-2,132	0,894	0,106	89,4	10,6
	2.e	2,1972	-500	-20	0	-2,126	0,893	0,107	89,3	10,7
3.	3.a	-2,1972	-500	-15	-5	-2,145	0,895	0,105	89,5	10,5
	3.b	0,8473	-500	-15	5	-2,120	0,893	0,107	89,3	10,7
	3.c	-0,8473	-500	-15	-10	-2,158	0,896	0,104	89,6	10,4
	3.d	0	-500	-15	10	-2,107	0,892	0,108	89,2	10,8
	3.e	-2,1972	-500	-15	0	-2,132	0,894	0,106	89,4	10,6

The results of the analysis of the selection of KRL Commuter Line and Transjakarta Bus modes of transportation for the Bekasi City – East Jakarta route are as follows:

1. Travel Expenses

Based on the results of the analysis presented in Table 7, the probability in each mode for changes in the travel cost attribute (X1) and other attributes remains constant as follows:

- a. If there is a change in the cost attribute with a trip cost simulation (X1), the Transjakarta Bus is Rp. 500 compared to the Commuter Line KRL, while the difference in other attributes remains by the existing conditions; the probability of choosing the Commuter Line KRL is 89.4%, while the probability of choosing the Transjakarta Bus is 10.6%. Thus, the KRL Commuter Line is preferred compared to the Transjakarta Bus.
- b. If there is a change in the cost attribute with a trip cost simulation (X1), the Commuter Line KRL is more expensive, Rp. 500 compared to the Transjakarta Bus, while the difference in other attributes remains by the existing conditions, the probability of choosing the KRL Commuter Line is 9.1%, while the probability of choosing the Transjakarta Bus is 90.9%. Thus, the Transjakarta

Bus is preferred compared to the KRL Commuter Line.

- c. If there is a change in the cost attribute with a trip cost simulation (X1), the Transjakarta Bus is Rp. 1000 compared to Commuter Line KRL, while the difference in other attributes remains by existing conditions; the probability of choosing Commuter Line KRL is 98.7%, while the probability of choosing Transjakarta Bus is 1.3%. Thus, the KRL Commuter Line is preferred compared to the Transjakarta Bus.
- d. If there is a change in the cost attribute with a trip cost simulation (X1), the Commuter Line KRL is more expensive, Rp. 1000 compared to the Transjakarta Bus, while the difference in other attributes remains by the existing conditions, the probability of choosing the KRL Commuter Line is 1.1%, while the probability of choosing the Transjakarta Bus is 98.9%. Thus, the Transjakarta Bus is preferred compared to the KRL Commuter Line.
- e. If there is a change in the cost attribute with the trip cost simulation (X1), KRL Commuter Line and Transjakarta Bus are the same. In contrast, the difference in other attributes remains by the existing conditions; then, the probability of choosing the KRL Commuter Line is 47.8%, while the probability of

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choosing the Transjakarta Bus is 52.2%. Thus, the Transjakarta Bus is preferred compared to the KRL Commuter Line.

2. Travel Time

Based on the results of the analysis presented in Table 7, the probability in each mode for changes in travel time (X2) and other attributes remains as follows:

- a. If there is a change in the travel time attribute with the simulation of travel time (X2), the Transjakarta Bus is the same as the Commuter Line KRL. In contrast, the difference in other attributes remains by the existing conditions. The probability of choosing the Commuter Line KRL is 89.6%, while the probability of choosing a Bus Transjakarta is 10.4%. Thus, the KRL Commuter Line is preferred compared to the Transjakarta Bus.
- b. If there is a change in the travel time attribute with the simulation travel time (X2) of the Transjakarta Bus 5 minutes longer compared to the KRL Commuter Line, while the difference in other attributes remains by the existing conditions, then the probability of choosing the KRL Commuter Line is 89.5%. At the same time, the probability of choosing the Transjakarta Bus is 10.5%. Thus, the KRL Commuter Line is preferred compared to the Transjakarta Bus.
- c. If there is a change in the travel time attribute with the simulation travel time (X2) of the Transjakarta Bus 10 minutes longer compared to the Commuter Line KRL, while the difference in other attributes remains by the existing conditions, then the probability of choosing the Commuter Line KRL is 89.5%. At the same time, the probability of choosing the Transjakarta Bus is 10.5%. Thus, the KRL Commuter Line is preferred compared to the Transjakarta Bus.
- d. If there is a change in the travel time attribute with the simulation travel time (X2) of the Transjakarta Bus 15 minutes longer compared to the Commuter Line KRL, while the difference in other attributes remains in accordance with the existing conditions, then the probability of choosing the Commuter Line KRL is 89.4% while the probability of choosing the Transjakarta Bus is 10.6%. Thus, the KRL Commuter Line is preferred compared to the Transjakarta Bus.
- e. If there is a change in the travel time attribute with the simulation travel time (X2) of the Transjakarta Bus 20 minutes longer compared to the Commuter Line KRL, while the difference in other attributes remains by the existing conditions, then the probability of choosing the Commuter Line KRL is 89.3%. At the same time, the probability of choosing

the Transjakarta Bus is 10.7%. Thus, the KRL Commuter Line is preferred compared to the Transjakarta Bus.

3. Departure Waiting Time (Headway)

Based on the results of the analysis presented in Table 7, the probability in each mode for changes in departure waiting time or headway (X3) and other attributes remains the following:

- a. If there is a change in the travel time attribute by simulating the waiting time for departure or headway (X3) of the Transjakarta Bus, which is 5 minutes longer than the Commuter Line KRL, while the difference in other attributes remains by the existing conditions, then the probability of choosing the Commuter Line KRL is 89.5%. At the same time, the probability of choosing the Transjakarta Bus is 10.5%. Thus, the KRL Commuter Line is preferred compared to the Transjakarta Bus.
- b. If there is a change in the travel time attribute by simulating the waiting time for departure or headway (X3), the KRL Commuter Line is 5 minutes longer than the Transjakarta Bus. In contrast, if the difference in other attributes remains by the existing conditions, then the probability of choosing the KRL Commuter Line is 89.3%. At the same time, the probability of choosing the Transjakarta Bus is 10.7%. Thus, the KRL Commuter Line is preferred over the Transjakarta Bus.
- c. If there is a change in the travel time attribute by simulating the waiting time for departure or headway (X3) of the Transjakarta Bus 10 minutes longer than the KRL Commuter Line, while the difference in other attributes remains by the existing conditions, then the probability of choosing the KRL Commuter Line is 89.6%. At the same time, the probability of choosing the Transjakarta Bus is 10.4%. Thus, the KRL Commuter Line is preferred over the Transjakarta Bus.
- d. If there is a change in the travel time attribute by simulating the waiting time for departure or headway (X3), the KRL Commuter Line is 10 minutes longer than the Transjakarta Bus. In contrast, the difference in other attributes remains by the existing conditions, then the probability of choosing the KRL Commuter Line is 89.2%. In contrast, the probability of choosing the Transjakarta Bus is 10.8%. Thus, the KRL Commuter Line is preferred over the Transjakarta Bus.
- e. If there is a change in the travel time attribute with the simulated waiting time for departure or headway (X3) for KRL Commuter Line and Transjakarta Bus are the same. In contrast, the difference in other attributes remains by existing conditions, then the

probability of choosing the KRL Commuter Line is 89.4%, while the probability of choosing the Transjakarta Bus is 10.6%. Thus, the KRL Commuter Line is preferred over the Transjakarta Bus.

IV. CONCLUSIONS

Based on the social demographic characteristics of the respondents, out of 100 respondents, when analyzed by gender, it consisted of 47% male and 57% female. When grouped by age, most respondents (67%) are aged 21 to 30 years. Regarding recent education, most respondents (41%) have a Bachelor's degree. Meanwhile, the majority of respondents (47%) work as employees.

Based on the characteristics of the travelers, considering their marital status, 36% of them were married, while the remaining 64% were not. If grouped by income, most respondents (35%) have a monthly income of under IDR 2,500,000. Regarding SIM ownership, most respondents (82%) have a SIM. Meanwhile, most respondents (59%) owned private vehicles such as motorbikes.

Based on the characteristics of the trip, taking into account the reasons for choosing the mode of transportation, 47% decide on the mode of transportation based on fleet availability. In comparison, 53% prioritize travel cost considerations. If sorted based on the choice of mode, the majority of respondents (37%) chose the mode of transportation with consideration of the speed of travel time. Regarding the frequency of using the mode during a week, most respondents (60%) use the mode less than five times a week. On the other hand, most respondents (43%) use this mode of transportation for business or work purposes.

The results of the modal selection analysis carried out using the binomial logit model yield a value of the difference in the utility function between KRL Commuter Line and Transjakarta Bus ($UKRL - UTJ = 0.662 + 0.044.X1 - 0.014.X2 + 0.025.X3$). In the current condition, there is a cost difference of Rp. 500 with the more expensive Transjakarta Bus, the difference in travel time is 15 minutes longer for Transjakarta Buses, and there is no difference in headway or travel time, the probability or proportion of users choosing the KRL Commuter Line is 89.4%, while only 10.6% who choose Transjakarta Bus.

Factors that can influence the choice of transportation modes by public transportation users in this study are travel costs and waiting time or headway. In addition, other possibilities are influenced by other factors, such as service quality, perceptions, and people's tastes towards public transportation modes. All of these factors ultimately affect the user's tendency to choose a particular mode of transportation in making a trip.

REFERENCES

1. Rachmadi, P.: Dilema Sosial Pengguna Transportasi Jakarta: Survai Penilaian dan Niat Menggunakan Transportasi Publik di Jakarta. *Jurnal Perkotaan*. 10, 1–21 (2018)
2. Iclodean, C., Cordos, N., Varga, B.O.: Autonomous Shuttle Bus for Public Transportation: A review, (2020)
3. Saleh, S.M., Sugiarto, S., Hilal, A., Ariansyah, D., Hasan Rd, M., Hasyimi Rd, A.: A Study on The Traffic Impact of The Road Corridors Due to Flyover Construction at Surabaya Intersection, Banda Aceh of Indonesia. 2020, 20021 (2017)
4. Isradi, M., Molina, P., Rifai, A.I., Mufhidin, A., Prasetijo, J.: Evaluasi of Performance and Services of Integrated Transportation System (Case Study: Connecting Line between MRT Dukuh Atas Station and KRL Sudirman Station). (2021)
5. Pratandari, S.: Analisis Faktor-Faktor yang Mempengaruhi Perilaku Masyarakat dalam Memilih Transportasi Umum Perkotaan KRL Commuter Line Indonesia. (2019)
6. Sugiarto, Dewi, D.P., Junaedi, E.: Pengaruh Moda Transportasi Berbasis Aplikasi Terhadap Pilihan Masyarakat dalam Menentukan Moda Transportasi dan Dampaknya Terhadap Pendapatan Driver Ojek Online. *Derivatif: Jurnal Manajemen*. 14, (2020)
7. Dermawan, W.B., Imamsyah, A.: Analysis of Parking Space Requirements in Grand Galaxy Park Mall and Performance of Boulevard Raya Roads Jakasetia, Bekasi City. *Journal of World Conference (JWC)*. 2, 162–169 (2020)
8. Badan Pusat Statistik Kota Bekasi, <https://bekasikota.bps.go.id/indicator/12/29/1/jumlah-penduduk-kota-bekasi.html>
9. Badan Pusat Statistik, <https://www.bps.go.id/indicator/17/72/1/jumlah-penumpang-kereta-api.html>
10. Yulita, H., Wijaya, B.: Pengaruh Kualitas Pelayanan Transportasi Publik terhadap Kepuasan Konsumen. *Management and Accounting Expose*. 3, 1–12 (2020)
11. A. I. Rifai, S.P.H.A.G.C. and P.P.: Genetic Algorithm Applied for Optimization of Pavement Maintenance under Overload Traffic: Case Study Indonesia National Highway. *Applied Mechanics and Materials*. 845, 369–378 (2016)
12. A. I. Rifai, S.P.H.A.G.C.P.P. and P.C.: The Data Mining Applied for the Prediction of Highway Roughness Due to Overloaded Trucks. *International Journal of Technology*. 6, 751–761 (2015)

“Analysis of the Choice of Commuter Line Electric Rail Train (KRL) Modes and Transjakarta Buses for the Bekasi City - East Jakarta Route”

13. Subekti, S.: Kepuasan Penumpang Terhadap Pelayanan Terminal Domestik di Bandar Udara Adi Sucipto Yogyakarta. *Warta Penelitian Perhubungan*. 29, 277–288 (2018)