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Original Article

Modeling Urban Transport Mode Options 07 Routes Terminal Guntur - Cibatu and Trains Local Economics in Cibatu – Garut Indonesia

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Abstract *- Total population that is increasing every year in Garut accompanied by an increase vehicle volume. Limitations society in choosing mode transportation push one of the efforts taken by the government to overcome congestion is to reactivate Cibatu – Garut railroad which has been inactive since 1983. This study aims know model mode choice and potential mode shift. Data collection method uses interviews or distributing questionnaire to 100 respondents. After that, data analysis using stated preference method in SPSS software. The conclusion is modal choice model based on variables from travel time, costs, waiting time, risk accident, seat avaibility, and comfortable is* $P = 0{,}664 – 0{,}009X_2 – 0{,}014X_3 – 0{,}013X_4 – 0{,}012X_5 – 0{,}019X_6 - 0{,}003X_7$*. Potential mode shift of Urban Transportation are Economic Local Train based on travel time is 3.7%, costs is 1.9%, waiting time is 4.3%, risk accident is 3%, seat avaibility 0.4%, and comfortable is 5.3%*

Keywords *- Stated Preference, Urban Transportation, Economy Local Train, Mode Choice, Potential Mode Shift*

I. INTRODUCTION

Growth in the transportation sector in Garut is influenced by several factors, one of which is the increase in population. BPS Garut (2019) recorded a population growth of 2,606,400 people which led to travelers entering or leaving the Garut area or vice versa. Transportation limitations and to unravel the congestion that occurs need a role for the government in overcoming this. In PM no. 43 of 2018 concerning RIPNAS is stated to provide safe, comfortable, and inexpensive modes of transportation, namely by reactivating / building railroads that were once inactive. Later this will become a new alternative for the community in choosing the mode of transportation because currently mass transportation that exists in Garut are buses, public transportation, and private transportation. Thus, this research is intended to support the creation of rail-based transportation to carry out a mode selection analysis using a method that describes the behavior of road users and attracts public and private vehicle users to switch to using the train. So that the modeling is obtained by explaining the probability of passengers in choosing the railroad mode and determining the potential mode transfer to switch to that mode. The location of this research is in the Guntur public transport terminal, Garut district and Cibatu station. objectives of this study are:

a) Describe the mode selection model with the perceptions of urban transport users
b) Determines the potential for modal transfer for urban transport users to train Local Economic

Ortuzar (2011) revealed that the process to determine decisions affect travel behavior of socio-economic conditions and the pattern of activity of traveling performers. This is the basis for the decision factors to determine the prediction of transportation demand. The decisions made are aimed at determining the quantity, mode distribution, route and timing of the means of transportation. One method for obtaining data about travelers' decisions istechniques *stated preference*.

II. METHOD

First step to determine a sample is to collect initial information about the population first, then divide it into similar small strata, then select a simple random sample in each of these strata. The question that often arises with research sample designs is how large a sample is needed. According to Ortuzar (1994) the recommendations for finding out the sample size needed for interviews are:

$$N> \frac{p\,(1-p)}{\left(\frac{e}{z}\right)^2 + 0.5\frac{(1-p)}{N}}$$

where,
n = number of samples
p = proportion of trips with a particular destination
e = error rate
z = normal standard variation value for the desired level of confidence
N = number of population

A. Classical Assumption Test

Tests conducted to determine or test the feasibility of the regression model to be carried out in this study. Ghozali (2016) states that in order for the resulting data to

be normally distributed, the bases that must be met for this test are: Linearity and Multicollinearity.

B. Linear Regression Analysis

An analysis from Drapper & Smith (1992), is an analytical method used for data analysis and decision making about the relationship between variables and other variables. The relationship is obtained using a mathematical equation between the independent variable and the dependent variable in the form of a simple equation

$$Y = \beta_0 + \beta_1 X_1 + \ldots \beta_n X_n \qquad (2)$$

wherein,
Y = Independent variable
X = Dependent variable
β = Constant regression
To test the value of the linear regression need to perpetration of the value of the coefficient determinansi (r^2)Partial test / t test, and test Simultaneous / F Test

C. Analysis Elasticity

Analysis of emphasis on the sensitivity of modal choice to several attributes of modal service (Sri, 2004). Elasticity means knowing the magnitude of the effect of changes in the probability of choosing mode relative to service attributes. The realization of the value of the travel demand elasticity is constant. Kraft - Sact introduces a demand model that deals with custom rates

$$Q = áC^{â} \qquad (3)$$

where
Q = travel quantity
C = fare / price

Morlok (1988) in Suraharta (2015) states the extent of Kraft's needs model by including service characteristics as the independent variable. This is because the price / tariff and service characteristics of all competing modes will influence the use or demand for these modes. In making a decision for a trip a prospective passenger will consider the fare / price, as well as service factors such as: total travel time, schedule accuracy (reliability), and comfort. Model needs *(demand)* to a mode with reference models formulated Kraft follows:

$$P = â_0 + X_{1i}^{â1} + X_{2i}^{â2} \qquad (4)$$

where
$X_{1i}^{â1}$, $X_{2i}^{â2}$ = characteristic attribute mode i
â = constant
P = probability.

III. RESEARCH METHOD

A. Data collection method

The method uses descriptive analysis, namely analysis that describes an event and then analyzes the problems that arise. Data collection was carried out by collecting literature on secondary data in the research conducted. Data collection techniques by interviewing or distributing questionnaires to urban transport users with techniques *stated preference*. The form of the survey form questions is planned for two things, first, the questions are aimed at knowing the existing conditions of the characteristics of current urban transport users. Second, the question is directed to find out the respondent's reference if there is a local economy train that has been operated on a new route as well as the proposed hypothetical conditions such as changes in costs, travel time, waiting time, and so on.

B. Data Processing Methods

After the respondent's data is collected, that is, grouping the data according to the question items in the questionnaire (Sri, 2004). Regression analysis was performed on quantitative data. Qualitative variables or data are converted into quantitative data. Variables of gender, education, occupation, purpose of travel, and reasons were measured on a nominal scale. The variables of age, income, transportation costs, travel hours were measured with an interval scale.

C. Data Analysis Methods

Sri (2004) revealed that data analysis was performed using linear regression analysis. This is in line with the *stated preference* method, namely the rating method for a regression model that applies *multiple regression*, preliminary survey testing, performs classical assumption tests, performs multiple linear regression analysis on mode choice equations, performs statistical tests, calculates the elasticity of modal choice using analysis. regression, Summing up the magnitude of the elasticity of demand at KA Local Economy with reference to the statistical test with the help of a software program *SPSS statistics 26.0*

IV. RESULT AND DISCUSSION

Analysis of survey on survey Introduction in a survey rating the attitudes of respondents to the factors which could be decisive election of use KA Elegant, answers The survey during the preliminary survey was categorized into 5 answers, namely strongly agree, agree, normal, disagree, strongly disagree. The survey data were then analyzed using a rating scale with the following answer intervals:

Strongly Agree	: 5
Agree	: 4
Regular	: 3
Disagree	: 2
Strongly Disagree	: 1

In this study the authors took 6 variables that have the highest score. He took these six variables with the consideration that there were not so many alternative travel situations. In addition, according to Kroes and Sheldon (1998) in Depira (2019) alternative recommendations for travel situations offered to good respondents are 9 to 16 scenarios. The variables referred to are as follows: Travel time, cost, waiting time, accident risk, seat availability, and comfort.

The six variables have two levels of choice. Based on the level of the number of choices, the possible combination of travel situations can be calculated. Before the reduction is carried out, it must first be known which possibilities have the dominant choices or have more advantages or disadvantages. so it is necessary to make a table regarding the different levels of choice for each variable.

Table 1. Table of Differences in Levels of Variable Choice

No	Variable	Difference in level of choice	
		*Negative (-)	**Positive (+)
1	Travel time	<10 minutes	20-30 minutes
2	Cost	<Rp 5.000	Rp 5.000-10.000
3	Departure waiting time	10-20 minutes	<10 minutes
4	Accident risk	Low	High
5	Availability of seats	Available	Unavailable
6	Comfort	Uncomfortable	Comfortable

Source: Analysis Results, 2020

A. Number of Samples

Data on the number of urban transport users in Garut is needed to predict the number of passengers in April that the local economy trains should have been operating that month. The urban transportation in question includes the number of urban transportation serving the Garut, Wanaraja and Cibatu areas and the number of urban transportation specifically for the Guntur (Garut) - Cibatu terminal route which can be seen in the table below

Table 2. Number of people using urban transportation in the area Garut, Wanaraja and Cibatu

No.	Month	Number of Passengers (person)
1	November, 2019	114,390
2	December, 2019	126,030
3	January, 2020	137,190

Source: Garut Regency Transportation Office, 2020

City transport data is data that aims to predict the number of daily urban transport passengers in the Garut, Wanaraja and Cibatu areas. This data was obtained from the Garut Regency Transportation Department.

Table 3. City Transportation Table

	Urban transport Garut Region, Wanaraja, Cibatu	Special Urban Transport Term, Guntur, Cibatu
Number of fleet	139	45
Number of seats	8	8
Load factor	0.7	0.7
Frequency/day	10 rit	10 rit

Source: Department of Transportation Garut Regency, 2020

Secondary data from Transportation Agency. It is known that the number of people using urban transportation in the Garut, Wanaraja and Cibatu areas is 137,190 people, assuming an increase in urban transportation users by 1% per month. So the number of people using urban transportation in April is 142,678 people. Percentage of users of Term. Guntur - Cibatu is calculated based on data obtained from Sri (2004) using the following formula

$$= \frac{(\text{num of modes x num of seat x LF x Freq})}{(\text{num of modes x num of seat x LF x Freq})+(\text{num of modes x num of seat x LF x Freq})} \text{ x100\%} \quad (5)$$

$$= \frac{(45x8x0,7x10)}{(45x8x0,7x10)+(139x8x0,7x10)} x100\%$$

$$= \frac{2520}{10.304} x100\%$$

$$= 24.45\%$$

These results are then used to determine the number of people using special urban transportation in April, which is = 24.45% x 142,678 people = 107,793 passengers.

The sample size needed for the roadside interview survey according to Ortuzar (1994) in Sri (2004), is calculated by formula 1. By taking a maximum p value of 0.5, the error rate (e) is a maximum of 10%, and a confidence level of 95% (z = 1.96), then the number of samples needed is:

$$n > \frac{p\,(1-p)}{\left(\frac{e}{z}\right)^2 + 0.5\,\frac{(1-p)}{N}}$$

$$n > \frac{0.5\,(1-0.5)}{\left(\frac{0.1}{1.96}\right)^2 + 0.5\,\frac{(1-0.5)}{107.793}}$$

$$n > 96$$

So the minimum sample size needed in the roadside interview survey according to Ortuzar (1994) in Sri (2004) for a population of 107,793 people is 96 people. In addition, the number of interviews withtechniques *stated preference* according to Barnley (1988) would be more appropriate if 75-100 respondents were taken.

B. Correlation Analysis

Data on passenger characteristics that have been obtained are then analyzed for their correlation with the choice of mode. This correlation value is used to ascertain the presence or absence of the influence of passenger socio-economic factors in determining the mode choice. In this study using the analysis method with the coefficient *Cramer*. The coefficient method *Cramer* is a measure of the degree of association (relationship) or correlation between two groups of variables. correlation test *Cramer* Thisis used because the information is nominal or arranged by category. The calculation results can be seen in the table below.

No.	Variable	*Pearson Chi-Square*	Df	*Cramer's* V	Approx. Sig.	χ^2 table
1	Gender	0.916	1	0.096	0.339	3.841
2	Age	5.516	3	0.235	0.003*	7.8147
3	Recent education	0.812	3	0.90	0.04*	7.8147
4	Job	5.784	5	0.240	0.328	11.070
5	Income	4.260	3	0.206	0002*	7.8147
6	Transport cost	7.715	3	0.278	0.052*	7.8147

Source: Analysis Results, 2020

C. Multiple Linear Regression Analysis

Data obtained from the interview survey can be made a modal choice equation. Equation approach with modal choice probability calibration with modal choice attributes. The mode choice equation is calculated with the probability value of the average service level for each scenario obtained. The data input is in form of regression analysis, namely X_2 is the travel time, X_3 is the cost, X_4 is the waiting time for departure, X_5 is the risk of accident, X_6 is the availability of seats, and X_7 is the comfort which is the independent variable. Furthermore, the choice of mode is determined as the dependent variable. Regression analysis was obtained using a program from *SPSS Statistic 26.0*. The results of the mode selection calibration calculation can be seen in the table below.

Table 4. Mode Selection Equation Calibration

Variable	Coefficient	t count	Significance the
Constant	0.664	3,363	0,000
Travel Time	-0.009	-3,342	0,000
Cost	-0,014	-1,656	0,052
Waiting Time	-0,013	-5,525	0,000
Accident Risk	-0,012	-2,534	0,000
Seat Availability	-0,019	-8,856	0,000
Comfort	-0,003	-1,154	0,074
r^2	0.776		
F count	4.462		
Significance F	0.002		

Source: Analysis Results, 2020

D. Analysis of the Elasticity of Mode Selection

Differences in passenger characteristics between urban transportation lead to differences in responses between the modal choice variables between urban transportation and elegant trains. Therefore an analysis is needed to determine the changes in the characteristics of the modal choice variable.

The elasticity analysis is calculated based on the rating value which is transformed into a logarithmic form so that the function obtained is a logarithmic function. After the transformation is carried out, the data for each variable is in logarithmic form so that regression can be performed.
After obtaining the transformed value from the mean and also the rating value for each variable, then regression analysis is carried out using the logarithmic value obtained. The following is the result of the regression analysis on the logarithmic form obtained. The results of the calculation of the elasticity value of the selected equation test can be seen in the table below.

Table 5. Results of Regression Analysis in Logarithmic form

Variable	Regression Coefficient	T count	Sign.
Konstanta	-0,281	-8,738	0,000
$\log X_2$	0,37	9,002	0,000
$\log X_3$	-0,19	2,118	0,013
$\log X_4$	0,43	3,031	0,000
$\log X_5$	-0,30	7,033	0,000
$\log X_6$	0,04	4,411	0,000
$\log X_7$	0,53	1,265	0,028
r^2	0,819		
Signifikansi F	0,000		
F	6,608		

Source: Analysis Results of the Compilation Team

IV. CONCLUSION

From the results of the analysis previously discussed, it can be concluded that:

1. Based on the survey results withtechniques, it is *stated preference* explained that the variables that influence a person to ride a beautiful train are: travel time, cost, waiting time departure, Accident Risk, Seat Availability, and Comfort. The value of each service level variable is shown in the equation, namely P is the probability, X_2 represents the travel time variable, X_3 represents the cost, X_4 represents the waiting time, X_5 represents the risk of accidents, X_6 represents the availability of seats and X_6 is comfort

$$P = 0.664 - 0.009X_2 - 0.014X_3 - 0.013X_4 - 0.012X_5 - 0.019X_6 - 0.003X_7$$

2. The result of elasticity changes in an increase in the regression coefficient which makes the potential to switch modes to Elegant KA is indicated by increase to 3.7% for travel time with second choice, 1.9% for cost for first choice, 4.3% for waiting time with second choice, 3% for accident risk with first choice, 0.4% for seat with the second option, 5.3% for comfort with an increase in existing facilities in the Elok Train transportation mode

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