

ANALYSIS OF MODAL CHOICE PREFERENCE BETWEEN BUS AND TRAIN IN POST COVID-19 PANDEMICS: A CASE OF TASIKMALAYA-JAKARTA ROUTE

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ABSTRACT

The COVID-19 pandemic has had an impact on transportation. The impact is still felt when COVID-19 subsidies and community activities have begun to return to normal. Public transportation modes Trains had not operated optimally before the pandemic, resulting in most people choosing bus transportation modes. The purpose of this study is to determine the community's behavior in choosing the mode of transportation between trains and buses on the Tasikmalaya - Jakarta travel route. The method used in this study used the state preference method with attributes of travel time, travel costs, and waiting time. Data analysis was carried out from questionnaire data shared with 100 respondents. The survey results were collected, and linear regression analysis and modeling were conducted using a binomial logit model. Linear regression analysis using the SPSS program obtained the results of the transportation mode selection model, namely $(KA-BUS) = -0.293 - 0.389 (X1) - 1.944 \times 10^{-5}(X2) - 0.060 (X3)$ where $X1$ Travel time variable, $X2$ travel cost variable and $X3$ waiting time variable. It can be concluded that the bus mode of transportation, with a proportion of mode selection of 57.12 %, has a greater chance of being chosen by travelers than the mode of rail transportation, which has a proportion of mode selection of 42,875%.

INTRODUCTION

The outbreak of the new Coronavirus disease (COVID-19) with the Severe Acute Respiratory Syndrome virus strain Coronavirus 2 (SARS-CoV-2) hit the global population with the initiation of its center in Wuhan, China, in December 2019 (Huang, Wang, & Li, 2020). COVID-19 was declared a global pandemic by the World Health Organization on March 11, 2020. After the declaration of the COVID-19 pandemic, countries worldwide began to take unprecedented measures to contain the virus. The government has restricted many activities and also implemented Lockdowns, travel restrictions, and restrictions on business activities to contain the spread of the virus. Such restrictions include the cancellation of public events, a ban on indoor gatherings, the closure of many commercial facilities, restrictions on business activities, the obligation to stay at home, and orders to wear masks (Ipek & Bagdatli, 2022). As a result, COVID-19 has changed economic activities and travel behavior, especially in the use of public transport (Hsieh & Hsia, 2022).

Indonesia is one of the countries affected by the policies imposed during COVID-19. This is a very noticeable difference, including in transportation modes. The mode of transportation

Analysis of Modal Choice Preference Between Bus and Train in Post COVID-19 Pandemics: A Case of Tasikmalaya-Jakarta Route

usually used for daily activities and traveling between regions has become minimal users because most of the activities during the pandemic are centered from home. This great pandemic has disrupted all balances and led to a new behavior order. Thus, understanding the preferences of transportation modes after COVID-19 arouses curiosity in determining effective transportation policies. Therefore, it is essential to discuss this issue from different perspectives (Ipek & Bagdatli, 2022). Transportation is defined as the effort to move, move, transport, or divert an object from one place to another so that in another location, the object becomes more useful or can be helpful for a certain purpose. Land transportation is highly dominant in Indonesia compared to other modes of transportation, such as air and sea transportation. The 2001 National Origin Destination data illustrates that $\pm 95\%$ of passenger and freight trips use land transportation modes (Miro, 2005); (Amir & Rahman, 2020)

One of the modes of land transportation used by the Indonesian people, especially the Tasikmalaya-Jakarta regional route as public transportation, is trains and buses. On January 2, 2019, PT Kereta Api Indonesia opened a new route to the southern part of West Java, Banjar-Bandung-Jakarta. The opening of this line is because West Java's mascara needs for mass transportation modes continue to increase. The railway line's opening is an effort to help existing modes of transportation. This train also encourages tourism potential in East Priangan, especially the Pangandaran Regency area, which is famous for having a lot of tourism potential, such as beaches. However, it lasted only a short time; the first case of COVID-19 in Indonesia was announced in early March 2020. Policymakers and several ministers have made various proposals and regulatory proposals to combat the pandemic (ministry of transportation Province of west java, 2019) (Susanna, 2020). The Tasikmalaya City government decided to impose a regional quarantine in Tasikmalaya City starting March 31, 2020, to anticipate the spread of Covid-19 in Tasikmalaya City. Thus causing KAI DAOP 2 to cancel several train trips to prevent the spread of the COVID-19 pandemic. There were nine train trips canceled from Sunday to March 31, 2020. Finally, the Pangandaran Train Stopped Operating due to the Covid-19 pandemic, followed by a regional quarantine policy. During the COVID-19 pandemic, public transport in many cities experienced a drastic drop in passenger demand. Various precautions, such as social distancing and vehicle disinfection, have been implemented to reduce the potential risk associated with infection. However, the effectiveness of promoting the use of public transport remains to be determined. This is, in some cases, accompanied by a reduced supply of services and is compounded by the perception that public transport is riskier than personal transport due to closer contact with others that may be unavoidable in vehicles and public transport (Berita Satu, 2020) (Chen, Feng, Gu, & Yao, 2022); (Tirachini & Cats, 2020)

The decrease in Covid-19 cases and the removal of restrictions on community activities and people's mobility are increasing the need for transportation modes. For now, the options for transportation modes available for the Tasikmalaya – Jakarta travel route are minimal. Tasikmalaya is one of the essential destinations served by the Pangandaran train.

Therefore, to determine the public's interest in choosing a mode of transportation, it is necessary to conduct a study to identify the characteristics of travelers and the characteristics of people's travel from Tasikmalaya to Jakarta. In addition, to find out the model of choosing a mode of transportation based on the response of travelers. So it is hoped that it can be used as a consideration for the government (regulator) in terms of the continuation of the operation of the Pangandaran train to serve the Banjar - Gambir trip. In addition, it is also expected to be input in terms of efforts to improve and improve the service system, both for rail and bus modes.

Analysis of Modal Choice Preference Between Bus and Train in Post COVID-19 Pandemics: A Case of Tasikmalaya-Jakarta Route

LITERATURE REVIEW

Transportation Mode Choice Preference

The choice of mode is defined as the decision to use a particular means of transport to complete a journey (R'erat, 2021). However, mode selection is complicated to model even if it involves only two types of modes. This is due to many factors that are difficult to measure, for example, comfort, safety, reliability, and availability of the vehicle in times of need. Factors that can influence the use of modes can be grouped based on road user characteristics, movement features, mode facility features, and city or zone features. The selection of a suitable mode should take into account all the factors present in these characteristics. In addition to the influence of these factors, the selection is also determined to be influenced by other factors, namely travel time, transportation costs, space availability and the number of parking fees, comfort, and safety, so the choice of transportation mode is very important in transportation planning (Nasution & Erwin, 2019).

The availability of transportation modes also influences the choice of mode of transportation. The availability of public transportation modes has decreased due to COVID-19. The limitations of the public transportation mode will result in people preferring to use road-based public transportation so that the choice of bus transportation modes is increasing and the use of private vehicles is increasing, causing congestion. The effects of congestion result in a decrease in speed and an increase in travel time. Time losses due to congestion cause direct economic losses to road users. However, congestion also causes several indirect effects, including adverse effects on the environment, quality of life, and safety, increasing driver and passenger stress, and also affecting non-motorized roads (Gierszewski & Koźlak, 2019).

Bus and Train

Public transport is any motor vehicle used by the public and charges a specific tariff, either directly or indirectly (Ayuningtyas, Frazila, & Wibowo, 2019). As a link for access between cities, public transportation is significant. The development and improvement of public transport have a positive impact on the economy of the city and the country. For example, travel time/costs, access, and expenses positively affect income. Public transportation is often used from Tasikmalaya to Jakarta and other buses and trains (Alkharabsheh, Moslem, & Oubahman, 2021).



Figure 1. Buses serving the Tasikmalaya-Jakarta route

Bus transportation mode is the most widely used means of transportation for cross-province travel. Buses are an easily accessible means of transportation with a relatively large number of fleets and are economical. However, the bus mode of transportation has disadvantages in traveling

Analysis of Modal Choice Preference Between Bus and Train in Post COVID-19 Pandemics: A Case of Tasikmalaya-Jakarta Route

time. Highway-based modes of public transport are only sometimes the most desirable option in developing countries due to poor pavement conditions and severe traffic congestion (Farazi, Murshed, & Hadiuzzaman, 2022).

A train is an option for transportation that is used by the public for the Tasikmalaya trip to Jakarta. Intercity Railway service has long been considered the most reliable, economical, and safe mode of transport for long-distance travel in almost all parts of the world, especially developing countries. However, the limited schedule of train departures chooses trains as an option for transportation modes less competitive with buses. (Farazi, Murshed, & Hadiuzzaman, 2022)



Figure 2. The Train of Tasikmalaya-Jakarta route

Impact of COVID-19 on Transportation

Since December 2019, the virus (SARS-CoV-2) has spread worldwide from Wuhan, China. On January 30, 2020, WHO declared a public health emergency, and the epidemic developed into a pandemic in March 2020. The COVID-19 pandemic has had a far-reaching impact on aspects of human life. The COVID-19 pandemic has prompted governments and authorities around the world to impose restrictions on transportation and mobility on a scale and scale. This has also happened in Indonesia, which imposes restrictions on community activities to prevent and combat the spread of COVID-19. One of the steps taken in implementing these restrictions is the cancellation of some departures of public transport between cities and a decrease in the frequency of public transport departures between cities. (Macera, Angelis, & Sagnell, 2020); (Jenelius & Cebecauer, 2020).

Due to the high risk of transmission of covid, public transport is implementing preventive measures, such as reducing the frequency of public transportation modes and passenger capacity. Passenger passengers must wear masks, reduce the number of touch points, provide personal protective equipment (PPE) to staff, spreading passengers in cars. Regular deep cleaning and disinfection of public transport vehicles, workplaces, stations, and objects in contact with users, including ticketing devices, poles, and seats, installing disinfectant dispensers, to actively respond to the COVID-19 pandemic. The reduction of intercity public transport services to control the pandemic outbreak has significantly reduced confirmed cases (Naveen & Gurtoo, 2022) (Huang, Wang, & Li, 2022)

Although the spread of COVID-19 is decreasing, the effects of the COVID-19 pandemic. The effect of COVID-19 on mode shift preferences can be assessed based on dynamic changes in transportation demand, commuter preferences in using specific modes, and perceived health risks associated with public transportation (Das, Boruah, & Banerjee, 2021).

Analysis of Modal Choice Preference Between Bus and Train in Post COVID-19 Pandemics: A Case of Tasikmalaya-Jakarta Route

METHOD

Systematic scientific research must identify the right problem (Rifai A. I., Hadiwardoyo, Correia, Pereira, & Cortez, 2015). The study was conducted in November 2022. This study aimed to analyze the selection of transportation modes between buses and trains with the Tasikmalaya – Jakarta travel route. The study locations are Tasikmalaya Station and Primajasa Tasikmalaya Point. Research respondents are train and bus transportation travelers who will travel from Tasikmalaya to Jakarta, with a total of 70 respondents for bus and 30 people for train travelers.

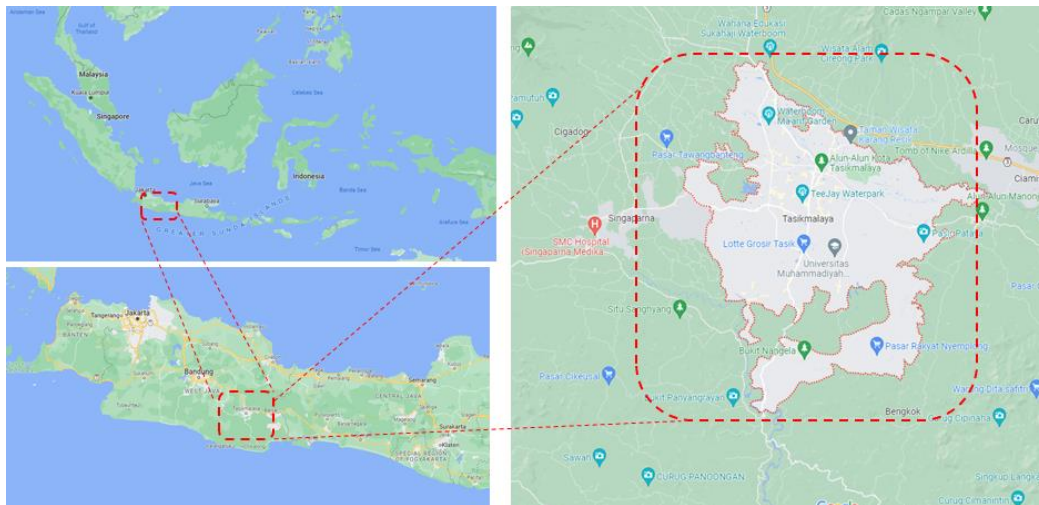


Figure 3. Research Location

This research uses quantitative research methods using stated reference research methods. The Stated Preference technique is characterized by using experimental designs to construct alternative hypotheses to the situation (hypothetical situation), which are then presented to the respondent. Respondents were then asked what choices they wanted to make or how they ranked or chose in one or more of the estimated situations. Using this Stated preference technique, researchers can also fully control the factors present in the hypothesized situation (Rifai, Putra, & Isradi, 2022)

Respondents will later be asked about several scenarios with multiple travel attribute change variation options. Variations in attribute changes are performed by combining several possibilities that can or may occur.

Table 1. Public transport Selection Parameters

Attribute	Reference		
	(Das, Boruah, & Banerjee, 2021)	(Nasution & Erwin, 2019)	(Rifai, Putra, & Isradi, 2022)
Travel Cost		√	√
Travel Time	√		√
Headway		√	√

From the scenario that has been designed, later respondents are asked to respond by providing an assessment using a Likert scale which is described in 5 levels with the following assessment:

Analysis of Modal Choice Preference Between Bus and Train in Post COVID-19 Pandemics: A Case of Tasikmalaya-Jakarta Route

Table 2. Numerical Scale Values Based on Respondents' Choice

Number	Rating Points	Probability	Numeric scale
1	Definitely choose train	0.9	R1 = 2.1972
2	Maybe choose train	0.7	R2 = 0.8473
3	Balance choise	0.5	R3 = 0
4	Maybe choose bus	0.3	R4 = -0.8473
5	Definitely choose bus	0.1	R5 = -2.1972

Data is one of the leading forces in compiling scientific research and modeling. Therefore, the regression method will analyze the data obtained through the questionnaire. From the results of the analysis, it can be seen the proportion of the selection of transportation modes used between buses and trains (Rifai A. I., Hadiwardoyo, Correia, Pereira, & Cortez, 2015).

RESULT AND DISCUSSION

The distribution of questionnaires was carried out digitally to respondents who had and often used train and bus transportation with the Tasikmalaya – Jakarta travel route. The questionnaire results obtained data on the characteristics of respondents and travel characteristics using public transportation users of modes who have used both modes of transportation. As many as 42 % only use buses, 42 % and only use trains, 16 %, as shown in Figure 2 below.

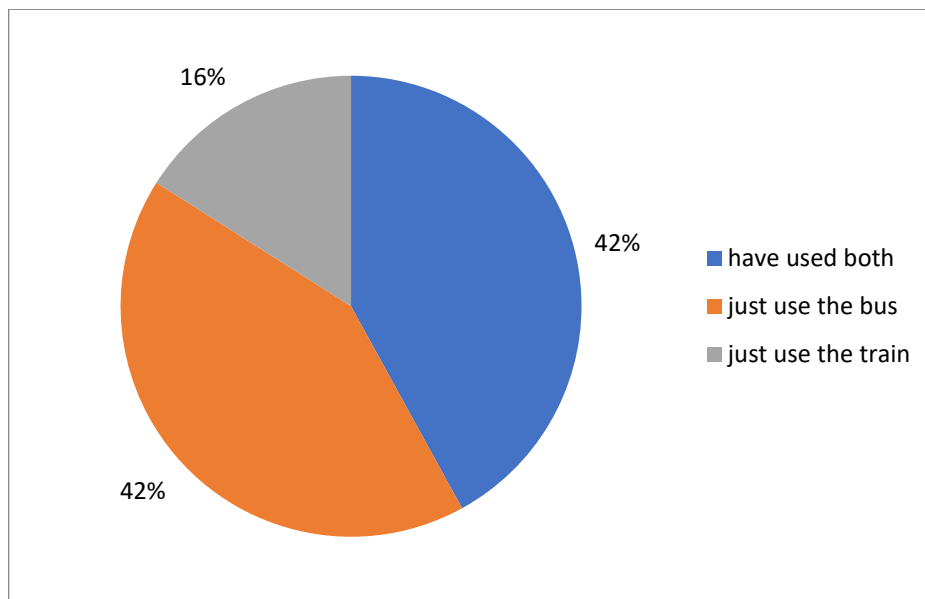


Figure 4. Use of Modes Transportation

Characteristic of respondents

Each respondent has different characteristics, so it can be an underlying thing for the respondent to determine the mode of transportation. The characteristics of public transportation users are divided into seven groups, namely gender, age, last education, type of work, monthly income, travel intent, mode of transportation used, and background in choosing the mode of transportation.

Analysis of Modal Choice Preference Between Bus and Train in Post COVID-19 Pandemics: A Case of Tasikmalaya-Jakarta Route

Table 3. Respondent Characteristic

Variable	Category	Frequency	Relative Frequency
Gender	Male	58	58 %
	Female	42	42 %
Age	Under 20 years old	11	11 %
	21-30 years old	60	60 %
	31-40 years old	17	17 %
	41-50 years old	8	8 %
	Above 51 year old	4	4 %
Occupation	Government Sector	10	10 %
	Private Sector	42	42 %
	Entrepreneur	14	14 %
	Student	19	19 %
	Housewife	5	5 %
	Other	10	10 %
Income/month	< Rp.1.000.000	17	17 %
	IDR 1,000,001 - IDR 2,000,000	17	17 %
	IDR 2,000,001 - IDR 3,000,000	14	14 %
	IDR 3,000,001 - IDR 4,000,000	12	12 %
	IDR 4,000,001 - IDR 5,000,000	20	20 %
	> IDR 5,000,001	19	19 %
Trip purpose	Works	30	30 %
	School/University	12	12 %
	Recreation	51	51 %
	Other	7	7 %
Selected mode of transportation	Bus	69	69 %
	Train	31	31 %
Background of use moda choice	Travel time and punctuality	25	25 %
	Safety and Security	12	12 %
	convenience	23	23 %
	satisfaction	24	24 %
	Travel costs	16	16 %

Attributes of each Mode of Transportation

The field data obtained in the field from the mode of bus and train transportation for the Tasikmalaya - Jakarta travel route are as follows:

Analysis of Modal Choice Preference Between Bus and Train in Post COVID-19 Pandemics: A Case of Tasikmalaya-Jakarta Route

Table 4. The actual attributes of each mode and service.

Number	Travel attributes	Bus	Train
1	Travel Time	7 hours	7 hours
2	Travel Expanse	75.000,-	65.000,-
3	Headway	Every 1 hour	Every 9 hour

Mode choice characteristic

The results that have been processed with the help of SPSS statistical data processing software are obtained from multiple linear regression equations with three free variables that reflect the service attributes of both alternative modes of transportation.

Table 5. SPSS Output of Multiple regression analysis

Coefficients						
	Type	Unstandardized	Standardized	t	Sig.	
		Coefficients	Coefficients			
		B	Std. Error	Beta		
1	(Constant)	-0.293	0.048		-6.143	0.000
	Travel time (X1)	-0.389	0.040	-0.227	-9.619	0.000
	Travel Expenses (X2)	-1,944E-05	0.000	-0.350	-15.654	0.000
	Headway (X3)	-0.060	0.011	-0.135	-5.701	0.000

From the multiple linear equations obtained with the SPSS statistical data processing software, utility value is obtained from each mode of transportation of trains and buses with the Tasikmalaya - Jakarta travel route as follows:

$$\begin{aligned}
 U_{\text{bus}} &= -0.293 - 0.389 (X1) - 1.944 \times 10^{-5} (X2) - 0.060 (X3) \\
 &= -0.293 - 0.389 (7) - 1.944 \times 10^{-5} (75000) - 0.060 (1) \\
 &= -4,536
 \end{aligned}$$

$$\begin{aligned}
 U_{\text{Train}} &= -0.293 - 0.389 (X1) - 1.944 \times 10^{-5} (X2) - 0.060 (X3) \\
 &= -0.293 - 0.389 (7) - 1.944 \times 10^{-5} (65000) - 0.060 (9) \\
 &= -4.823
 \end{aligned}$$

The utility value of each mode of transportation that has been obtained then entered into the binary logit option model to determine the opportunities for transportation modes that will be owned by transportation service users who will travel on the Tasikmalaya Jakarta route as follows:

$$\begin{aligned}
 P_{\text{Bus}} &= \frac{e^{U_{\text{bus}}}}{e^{U_{\text{bus}}} + e^{U_{\text{Train}}}} = \frac{e^{-4.536}}{e^{-4.536} + e^{-4.823}} = \frac{0.010716}{0.018866} = 0.57125 \text{ (57.125 \%)} \\
 P_{\text{Train}} &= \frac{e^{U_{\text{Train}}}}{e^{U_{\text{bus}}} + e^{U_{\text{Train}}}} = \frac{e^{-4.823}}{e^{-4.536} + e^{-4.823}} = \frac{0.0080426}{0.018866} = 0.42875 \text{ (42.875 \%)}
 \end{aligned}$$

Based on the calculation results, the proportion of the selection of rail vehicle transportation modes was 42.875%, and the selection of Bus transportation modes was 57.125%. By observing the results of multiple linear regression calculations using SPSS, it can be seen that

Analysis of Modal Choice Preference Between Bus and Train in Post COVID-19 Pandemics: A Case of Tasikmalaya-Jakarta Route

the attributes of travel time, travel costs, and length of headway time affect the utility value of each mode of transportation. The traveler's response reflects that the most influential factor of the utility value is the travel time factor (X1), with a regression coefficient value of -0.389. For the influence factor of the headway (X3), the regression coefficient value -0.060 is obtained. While the variable travel cost (X2) has a minimal regression coefficient value of $1,944 \times 10^{-5}$. This condition shows that the punctuality factor is the main factor related to the service of transportation modes between buses and trains, followed by the duration of waiting time. As for the travel cost factor, it has a minimal influence on the service factor of the two modes of transportation.

CONCLUSION

From this study, it can be concluded that the Bus mode of transportation, with a proportion of mode selection of 57.12 %, has a greater chance of being chosen by travelers on the Tasikmalaya-Jakarta travel route compared to the train transportation mode which has a proportion of mode selection of 42,875%. The most influencing parameters of the transportation mode choice are travel time, with a regression coefficient value of -0.389, and the waiting or headway time of both modes of transportation, with a regression coefficient value of -0.060. Suppose the bus mode of transportation cannot maintain the punctuality of travel time and the railway transportation mode can shorten the headway. In that case, the train will likely have an excellent opportunity to be chosen by most travelers.

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