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"The Effect of Public Minibus Service Quality on User Satisfaction of Public Minibus Using SEM (Structural Equation Modeling) Method"

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Abstract
Economic and educational growth in Palu city has led to the increasement in the number of vehicles. However, this growth was not accompanied by adequate public transportation, particularly Public Minibus (angkot). As a result, students are relying on personal vehicles, contributing to the increased number of vehicles on the road, which potentially leads to traffic congestion and accidents. The aim of this study is to examine the characteristics of Public Minibus users in Palu City and to analyze the relationship between the quality of Public Minibus services and user satisfaction using the SEM (Structural Equation Modeling) method. The analysis reveals that the most significant factor influencing user satisfaction with Public Minibus services is the responsiveness factor, specifically the Public Minibus fare. The second factor is empathy, which includes variables such as waiting time and travel time, while the final factor is assurance, particularly concerning traffic safety. The satisfaction dimension, based on the coefficient of determination (R^2) in the structural model of service quality and satisfaction, is 0.64, indicating that service quality strongly influences user satisfaction, explaining 64% of the variation in satisfaction.
Keywords: *satisfaction, transportation, user, quality, service*

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I. INTRODUCTION

Transportation plays a crucial role in economic development, as it is related to the distribution of goods, services, and labor, and is central to economic movement within a city. The primary function of transportation is to move goods (commodities) and passengers from one location (origin or port of call) to another (destination). As the human population continues to grow rapidly, the demand for transportation facilities inevitably increases. However, at times, the government does not give adequate attention to the need for public transportation in Palu City, leading to a significant decline in public interest in using Public Minibus services (angkot). Structural Equation Modeling (SEM) has become a preferred methodology in this context. SEM, as a multivariate analysis method, is essentially a hybrid technique that incorporates confirmatory factor analysis, path analysis, and regression, which can be considered as a special case within SEM.

This study addresses several research questions related to the study area, including the characteristics of Public Minibus users in Palu City and an analysis of the quality of Public Minibus services in relation to user satisfaction using the SEM method

1.1 Literatur Review

This study analyzes the relationship between the quality of Public Minibus services and user satisfaction using the Structural Equation Modeling (SEM) method, with the Lisrel 9.3 software.

1.1.1 SEM Definition

Structural Equation Modeling (SEM) is a technique that can solve a set of relationships consisting of more than one relationship within a conceptual framework, which is analyzed simultaneously. SEM is a

multivariate statistical technique that combines factor analysis, path analysis, and regression analysis, aimed at testing causal relationships between variables in a model, both between attributes (indicators) and construct variables (latent) [16], as well as between latent construct variables. The SEM approach can analyze a large number of variables, including both endogenous and exogenous variables, as well as latent variables (unobserved), which are linear combinations of the observed variables[4]. The principle of SEM integrates regression analysis, simultaneous equations, factor analysis, and path analysis[4].

1.1.2 SEM Analysis Procedure

In general, the SEM procedure [2] consists of the following stages such as:

i. Model specification

This stage involves the formulation of the initial structural equation model. The initial model is based on theory or prior research.

ii. Identification

This stage concerns the assessment of whether unique values can be obtained for each parameter in the model and whether the simultaneous equations have a solution.

iii. Estimation

At this stage, the model is estimated to produce parameter values using one of the available estimation methods. The choice of estimation method is often determined by the characteristics of the variables being analyzed.

iv. Testing fit

TestingThis stage involves testing the fit of the model to the data. Several fit indices or Goodness of Fit (GOF) criteria can be used for this step.

v. Respecification

This stage, also known as model modification, involves respecifying the model based on the results of the fit testing from the previous stage.

1.2 Study Location and Research Method

The study was conducted in Palu City. Data collection was carried out through questionnaires and interviews with Public Minibus users in Palu City. User data were gathered through questionnaires and direct interviews with passengers inside the Public Minibus (angkot)

1.2.1 Survey Preparations

The following preparations are necessary before conducting the survey:

i. Data Identification – Primary and secondary data

ii. Preparation of Tools and Questionnaire

1.2.2 Preliminary Survey

Based on the identification from the preliminary survey, Public Minibus exhibits the following operational and service characteristics:

i. Infrastructure: Has terminals and operates at specific hours.

ii. Service Characteristics: pick up/drop off passengers along its route, has a fixed schedule, and fares are distance-based.

1.2.3 Data Compilation

The compilation or gathering of data obtained from the survey questionnaire is then organized and input into the chosen analytical method. This study uses the Structural Equation Modeling (SEM) method, utilizing Lisrel
9.3 software.

1.2.4 Data Analysis

i. Descriptive Analysis

Descriptive analysis is a research method used to analyze data by describing or depicting the data as it is without intending to make general conclusions or generalizations. Descriptive research is conducted to determine the values of independent variables, whether one or more, without making comparisons or linking one variable to another[21].

A Likert scale is used to measure attitudes, opinions, and perceptions of individuals or groups about social phenomena. Responses to each item on the Likert scale range from very positive to very negative. There

are five categories of value weights when using the Likert scale, as follows:

Table 1.1 Likert scale

Alternatives Answer	Value
Strongly Agree (SA)	5
Agree (A)	4
Disagree (D)	3
Strongly Disagree (SD)	2
Very Strongly Disagree (VSD)	1

ii. Structural Equation Modeling Analysis

Data analysis was conducted using the SEM method. Therefore, the primary requirement for using SEM is to construct a hypothesis model that includes both a structural model and a measurement model in a path analysis, based on theoretical justification. The hypothesis to be tested is that service quality has a positive and significant effect on user satisfaction. Satisfaction analysis aims to determine the level of satisfaction among Public Minibus users. User satisfaction is directly influenced by service quality. Service quality consists of several dimensions: comfort, availability/accessibility, safety/security, punctuality, and fare. Each dimension or factor is reflected by several indicators. The influence of these factors is analyzed simultaneously.

II. RESULT AND DISCUSSION

2.1 Questionnaire Results

The respondents involved in the data collection were all urban transport users in Palu City, specifically focusing on the quality of service aspects: Comfort, Accessibility, Safety/Security, Punctuality, and Fare. This study aims to examine the impact of urban transport service quality on user satisfaction using the Structural Equation Modeling (SEM) method, with Lisrel 9.30 software.

2.2 Respondent Characteristics

i. Gender

The research results indicate that the respondents' gender consists of 29.17% males and 70.83% females. It can be concluded that the majority of respondents are female, with a total of 85 respondents.

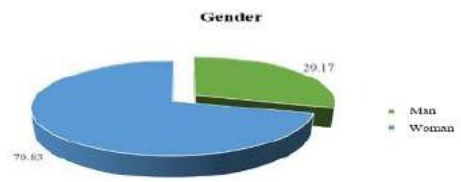

Figure 2.1 Gender Percentage Diagram of Respondent

ii. Marital Status

The study results show that 74.17% of respondents are married, while 25.83% are unmarried. Thus, it can be concluded that the majority of respondents are married, with a total of 89 respondents.

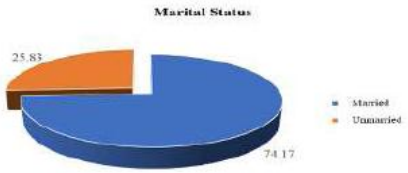

Figure 2.2 Marital Status Percentage Diagram of Respondent

iii. Educational Level

The study results show that 27.50% of respondents' highest education level is elementary school, 27.50% have completed junior high school, 40.00% have completed high school, 2.50% have a diploma (D3), and 2.50% have a bachelor's degree (S1). No respondents reported having a master's (S2) or doctoral degree (S3).

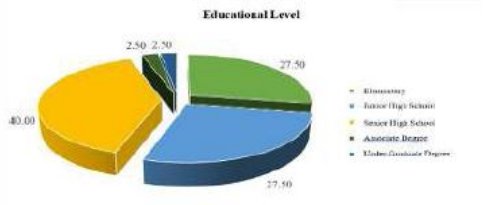

Figure 2.3 Educational Level Percentage Diagram of Respondent

iv. Occupation

The study results indicate that 15.00% of respondents are laborers, 30.00% are housewives, 6.67% are private employees, 19.17% are students, and 29.17% are entrepreneurs. Therefore, the majority of respondents are housewives, with a total of 35 respondents.

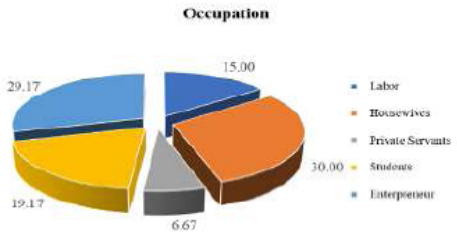

Figure 2.4 Occupation Percentage Diagram of Respondent

v. Travel Destination

The study results show that the purpose of travel for 38.33% of respondents is for work, 25.00% travel to their home, 11.67% travel to school, 10.00% for social activities or worship, and 15.00% for shopping. Therefore, the most common travel purpose is work, with a total of 46 respondents.

Figure 2.5 Travel Destination Percentage Diagram of Responden

2.3 Description of Respondents Answer Regarding Service Quality Criteria and User Satisfaction of Public Minibus

i. Service Quality Description on Comfort

The service quality criteria for comfort consist of two indicators, X1 and X2. The questionnaire responses were processed using frequency analysis in SPSS software to determine the frequency of each answer. The results can be seen in Tables 2.1 and 2.2.

Table 2.1 Frequency Analysis of Comfort Criteria Indicator X1

X1 (Comfort)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	15	12.5	12.5	12.5
	2.00	15	12.5	12.5	25.0
	4.00	8	6.7	6.7	31.7
	5.00	82	68.3	68.3	100.0
	Total	120	100.0	100.0	

Tabel 2.2 Frequency Analysis of Comfort Criteria Indicator X2

X2 (Comfort)

Frequency			Percent	Valid Percent	Cumulative Percent
Valid	1.00	10	8.3	8.3	8.3
	2.00	10	8.3	8.3	16.7
	4.00	12	10.0	10.0	26.7
	5.00	88	73.3	73.3	100.0
	Total	120	100.0	100.0	

The most frequent value for the Comfort criteria is Value 5, appearing 82 times for X1, accounting for 68.3%, and 88 times for X2, accounting for 73.3%.

i. Service Quality Description on Accessibility

The service quality criteria for accessibility consist of two indicators: X3 and X4. The questionnaire responses were processed using frequency analysis in SPSS software to determine the frequency of each answer. The results can be seen in Tables 2.3 and 2.4.

Table 2.3 Frequency Analysis of Accessibility Criteria Indicator X3

X3 (Accessibility)

Frequency			Percent	Valid Percent	Cumulative Percent
Valid	1.00	62	51.7	51.7	51.7
	2.00	32	26.7	26.7	78.3

	3.00	10	8.3	8.3	86.7
	4.00	11	9.2	9.2	95.8
	5.00	5	4.2	4.2	100.0
	Total	120	100.0	100.0	

Table 2.4 Frequency Analysis of Accessibility Criteria Indicator X4

X4 (Accessibility)

Frequency			Percent	Valid Percent	Cumulative Percent
Valid	1.00	6	5.0	5.0	5.0
	2.00	3	2.5	2.5	7.5
	3.00	21	17.5	17.5	25.0
	4.00	19	15.8	15.8	40.8
	5.00	71	59.2	59.2	100.0
	Total	120	100.0	100.0	

The most frequent values for the Comfort Criteria are Value 1, which appears 62 times at X3 with a frequency of 51.7%, and Value 5, which appears 71 times at X4 with a frequency of 59.2%.

ii. Description of Service Quality Regarding Safety

The Safety Service criteria consist of two indicators: X5 and X6. The questionnaire responses were processed using Frequency Analysis with SPSS software to determine the frequency of response occurrences. The results will be shown in Tables 2.5 and 2.6.

Table 2.5 Frequency Analysis of Safety Criteria for Indicator X5

X5 (Safety)

Frequency			Percent	Valid Percent	Cumulative Percent
Valid	1.00	12	10.0	10.0	10.0
	3.00	12	10.0	10.0	20.0
	4.00	1	0.8	0.8	20.8
	5.00	95	79.2	79.2	100.0
	Total	120	100.0	100.0	

Table 2.6 Frequency Analysis of Safety Criteria for Indicator X6

X6 (Safety)

Frequency			Percent	Valid Percent	Cumulative Percent
Valid	1.00	24	20.0	20.0	20.0
	3.00	24	20.0	20.0	40.0
	4.00	1	.8	.8	40.8
	5.00	71	59.2	59.2	100.0
	Total	120	100.0	100.0	

The most frequent value for the Safety Criteria is Value 5, which appears 95 times at X5 with a frequency of 79.2%, and 71 times at X6 with a frequency of 59.2%.

iii. Description of Service Quality Regarding Timeliness

The Timeliness Service criteria consist of two indicators: X7 and X8. The questionnaire responses were processed using Frequency Analysis with SPSS software to determine the frequency of response occurrences. The results can be seen in Tables 2.7 and 2.8.

Table 2.7 Frequency Analysis of Timeliness Criteria for Indicator X7

X7 (Time)

Frequency			Percent	Valid Percent	Cumulative Percent
Valid	1.00	14	11.7	11.7	11.7
	2.00	29	24.2	24.2	35.8
	3.00	9	7.5	7.5	43.3

	4.00	35	29.2	29.2	72.5
	5.00	33	27.5	27.5	100.0
	Total	120	100.0	100.0	

Table 2.8 Frequency Analysis of Timeliness Criteria for Indicator X8

X8 (Time)

Frequency			Percent	Valid Percent	Cumulative Percent
Valid	1.00	10	8.3	8.3	8.3
	2.00	6	5.0	5.0	13.3
	3.00	4	3.3	3.3	16.7
	4.00	36	30.0	30.0	46.7
	5.00	64	53.3	53.3	100.0
	Total	120	100.0	100.0	

The most frequent value for the Timeliness Criteria is Value 4, which appears 35 times at X7 with a frequency of 29.2%, and Value 5, which appears 64 times at X8 with a frequency of 53.3%.

iv. Description of Service Quality Related to Fare

The most frequent value for the Timeliness Criteria is Value 4, which appears 35 times at X7 with a frequency of 29.2%, and Value 5, which appears 64 times at X8 with a frequency of 53.3%.

Table 2.9 Frequency Analysis of Fare Criteria for Indicator X9

X9 (Charge)

Frequency			Percent	Valid Percent	Cumulative Percent
Valid	1.00	7	5.8	5.8	5.8
	2.00	4	3.3	3.3	9.2
	3.00	21	17.5	17.5	26.7
	4.00	23	19.2	19.2	45.8
	5.00	65	54.2	54.2	100.0
	Total	120	100.0	100.0	

Table 2.10 Frequency Analysis of Fare Criteria for Indicator X10

X10 (Fare)

Frequency			Percent	Valid Percent		Cumulative Percent
Valid	1.00	16	13.3	13.3		13.3
	2.00	16	13.3	13.3		26.7
	3.00	23	19.2	19.2		45.8
	4.00	14	11.7	11.7		57.5
	5.00	51	42.5	42.5		100.0
	Total	120	100.0	100.0		

The most frequent value for the Charge Criteria is Value 5, which appears 65 times at X9 with a frequency of 54.2%, and Value 5, which appears 51 times at X10 with a frequency of 42.5%.

2.4 Concept of the Relationship between Transportation Service Quality Variables and User Satisfaction: The service quality indicators, which consist of 5 criteria—Comfort, Accessibility, Safety/Security,

Timeliness, and Charge—are represented by 10 indicators with operational variables X1 to X10, as outlined in the table below.

Table 2.11 Indicators of Service Quality Criteria

No.	Quality Components	Criteria	Indicator	Latent Variable
1.	*Tangible*	Comfort	X_1 X_2	Satisfaction
2.	*Reability*	Accessibility	X_3 X_4	
3.	*Assurance*	Safety	X_5 X_6	
4.	*Empathy*	Time	X_7 X_8	
5.	*Responsiveness*	Charge	X_9 X_{10}	

i. **Satisfaction Indicator** : Y1 with the Satisfaction Criteria.

The structural model specification defines the relations between one latent variable and another latent variable. Meanwhile, the Path Diagram is a combination of the measurement model and the structural model. Figure 2.6 shown the initial research model for the factors influencing User Satisfaction in Public Minibus.

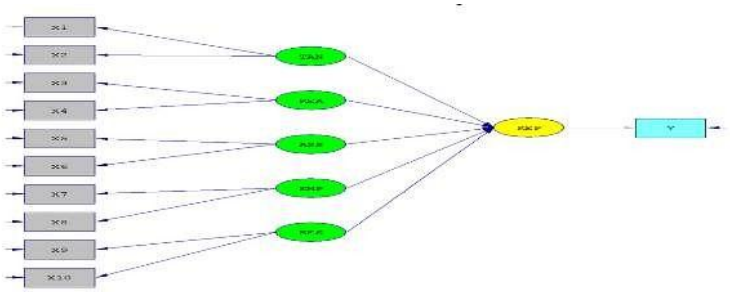

Figure 2.6 Conceptual Diagram of the Influence Relationship between Transportation Service Quality and User Satisfaction in Public Minibus

2.5 Variable Measurement Model Testing

i. Validity Test

The SEM measurement using 10 indicators is tested for validity by examining the relationship with the level of User Satisfaction in Public Minibus.

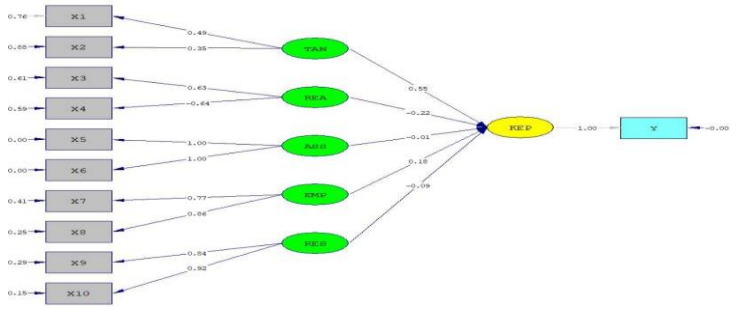

Figure 2.7 Conceptual Diagram of the Influence Relationship between Transportation Service Quality and User Satisfaction in Public Minibus

Tabel 2.12 Hasil *Confirmatory Factor Analysis* (CFA)

No		Indicator	*Standard Solution*	Dimension Relationship	Conclusion
1	X_1	Disruption to other passengers	0,49	0,55	Not Valid
2	X_2	Availability of seats	0,35		Not Valid
3	X_3	Moda change	0,63	-0,22	Valid
4	X_4	Travel route	-0,64		Not Valid
5	X_5	Safety during travel	1,00	0,18	Valid
6	X_6	Safety while waiting for the moda	1,00		Valid
7	X_7	Waiting time	0,77	-0,09	Valid
8	X_8	Travel time	0,86		Valid
9	X_9	Urban transportation fare	0,84	-0,09	Valid
10	X_{10}	Payment system	0,92		Valid

Based on Figure 2.7 and Table 2.12, it can be concluded that almost all questionnaire items are valid through testing using Lisrel software version 9.30, as indicated by all indicators having a Standardized Solution value greater than 0.50, except for the factors of Disruption to Other Passengers (X1), Availability of Seats (X2), and Travel Route (X4).

ii. Reliability Test

Table 2.13 Reliability Test

Variable	*Composite Reliability (CR)*		*Average Variance Extracted (AVE)*		Description
	Result	Standard	Result	Standard	
Tangible	0.389	> 0.70	0.246	> 0.50	Unreliable
Reability	0.000	> 0.70	0.402	> 0.50	Unreliable
Assurance	1.000	> 0.70	1.000	> 0.50	Reliable
Empathy	0.801	> 0.70	0.669	> 0.50	Reliable
Responsiveness	0.876	> 0.70	0.779	> 0.50	Reliable

Based on the calculations, the Composite Reliability (CR) values for the Tangible and Reliability variables are 0.389 and 0.000, respectively, while the Average Variance Extracted (AVE) values are 0.246 and 0.402, indicating that the indicators for the Learning Organization variable have poor construct reliability, as both CR <
0.7 and AVE < 0.5. However, for the Assurance, Empathy, and Responsiveness variables, the Composite Reliability (CR) values are > 0.7, and the Average Variance Extracted (AVE) values are > 0.50, which means these variables are valid and reliable.

iii. Normality Test

In the normality test, data is considered to follow a normal distribution if the P-Value for Skewness and Kurtosis is > 0.05. Univariate normality testing shows the results for each variable. Based on the output, the variables that meet normality are X5, X6, X7, X8, X9, and X10, as their P-Value for Skewness and Kurtosis is >
0.05. However, the variables that have issues with normality are X1, X2, X3, and X4.

2.6 Goodness Of Fit Model Analysis

This goodness-of-fit test is intended to evaluate the overall fit or Goodness of Fit (GOF) between the data and the model. From the structural model, we can determine how the latent variables interact, specifically how the dimensions of service quality affect customer satisfaction and how customer satisfaction influences customer loyalty using the Structural Equation Modeling (SEM) method.

Tabel 2.14 Goodness of Fit Index

No.	*Goodness of Fit Index*	*Cut-Off Value* (Threshold Value)	Result	Criteria
1.	*Chi Square*	Diharapkan Kecil (P > 0.05)	18.169 (P=0.9408)	*Good Fit*
2.	*Goodness of Fit Index (GFI)*	> 0.90	0.975	*Good Fit*
3.	*Root Mean Square Residual (RMR)*	≤ 0.05	0.00611	*Good Fit*
4.	*Root Mean Square Error Approximation (RMSEA)*	≤ 0.08	0.000	*Good Fit*
5.	*Adjusted Goodness of Fit Index (AGFI)*	≥ 0.90	0.942	*Good Fit*
6.	*Non-Normed Fit Index (NNFI)*	≥ 0.90	1.021	*Good Fit*
7.	*Normed Fit Index (NFI)*	≥ 0.90	0.982	*Good Fit*
8.	*Incremental Fit Index (IFI)*	≥ 0.90	1.011	*Good Fit*
9.	*Comparative Fit Index (CFI)*	≥ 0.90	1.000	*Good Fit*
10.	*Parsimony Normed Fit Index (PNFI)*	0 - 1	0.518	*Good Fit*
11.	*Parsimony Goodness of Fit Index (PGFI)*	0 - 1	0.428	*Good Fit*

The table 2.14 shown the results of the Goodness of Fit (GOF) testing. The chi-square test yielded a p-value of 0.948 > 0.05, which means that the model is a Goodness of Fit, indicating that the data fits well with the model overall.

2.7 Relation between Service Quality and Satisfaction

Table 2.15 Hypothesis Testing Results

No.	Dimension	Standarized Loading Factor / R^2	T-*Value*	Conclusion
1.	X1 *Tangible* → Satisfaction	0.999	15.51	Significant
2.	X2 *Tangible* → Satisfaction	0.999	15.52	Significant
3.	X3 *Reability*→ Satisfaction	0.587	6.95	Significant
4.	X4 *Reability* → Satisfaction	0.746	7.41	Significant
5.	X5 *Assurance* → Satisfaction	0.999	15.51	Significant
6.	X6 *Assurance* → Satisfaction	0.999	15.52	Significant
7.	X7 *Empathy*→ Satisfaction	0.587	6.95	Significant
8.	X8 *Empathy*→ Satisfaction	0.746	7.41	Significant
9.	X9 *Responsiveness*→ Satisfaction	0.711	8.91	Significant
10.	X10 *Responsiveness*→ Satisfaction	0.849	9.58	Significant

There is a direct influence from the **Tangible** indicator, which consists of factors X1 (Disruption to other passengers) and X2 (Availability of seats), on the **User Satisfaction in Public Minibus (Y)** variable, as it has a value of 0.554. The **Reliability** indicator, consisting of factors X3 (Mode change) and X4 (Travel route), also affects the **User Satisfaction in Public Minibus (Y)** variable, with a value of -0.218. The **Assurance** indicator, consisting of factors X5 (Safety during travel) and X6 (Safety while waiting for the mode), shows a value of - 0.0105, indicating a very small negative effect on satisfaction. There is a direct influence from the **Empathy** indicator, which consists of factors X7 (Waiting time) and X8 (Travel time), on the **User Satisfaction in Public Minibus (Y)** variable, with a value of 0.180. Finally, there is a direct influence from the **Responsiveness** indicator, which consists of factors X9 (City transportation fare) and X10 (Payment system), on the **User Satisfaction in Public Minibus (Y)** variable, with a value of -0.0806.

III. CONCLUSION

According to the analysis results, this study concludes, among other things: The characteristics of public transportation users in Palu city in 2024 include 70.83% female users, 74.17% married users, 40.0% with a high school education (SMA), and 30.0% housewives (IRT). This is due to the fact that most public transportation users are traveling for work purposes, which accounts for 38.33%. The satisfaction dimension, based on the coefficient of determination (R^2) of the structural model of the service quality–satisfaction relationship, is 0.64, indicating that service quality strongly influences satisfaction, and service quality can explain 64% of the satisfaction. The quality of public transportation service has the most significant impact on user satisfaction, with the most influential variable being the Public Minibus fare. The second most significant variables are waiting time and travel time, while the last variable is traffic safety.

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