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PERFORMANCE ANALYSIS OF PUBLIC TRANSPORT IN GIANYAR REGENCY (Case Study: Batubulan Terminal Route - Ubud)

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Abstract. The performance of urban public transport plays an important role in accommodating population mobility and realizing sustainable transportation. Public transport performance can be influenced by several factors, including the quality of public transport services and the accessibility of the roads they pass. Service quality concerns arrival frequency, waiting time, travel time, etc. Road accessibility is influenced by the presence of side barriers, such as parking vehicles on the road, cars in and out, slow vehicles, and so on. This study analyzes the exogenous latent variables of service quality and road accessibility that affect the endogenous variables of public transportation performance in the Gianyar Regency, especially on the Batubulan-Ubud Terminal Route. Perception data was collected by distributing 250 questionnaires to people living along the Batubulan-Ubud highway corridor. The data analysis was performed by Statistical Equation Modeling (SEM) AMOS. Validity and reliability tests were carried out using the confirmatory factor analysis (CFA) method. After going through the index modification process, all goodness of fit parameters were fulfilled very well, it was found that the quality of public transportation services had a significant positive effect, with p-value = 0.000 < 0.05, path coefficient 0.498. Road accessibility also has a significant positive effect, with p-value = 0.000 < 0.05, path coefficient 0.308. The quality of public transport services is indicated by the frequency of arrivals, waiting times, and travel times. Road accessibility is indicated by on-street parking and the number of intersections. The number of passengers, driver salaries, and operating duration indicates public transport performance.

Keywords : Public Transport Performance, Service Quality, Road Accessibility

1. INTRODUCTION

Public transportation is one of the main actors in sustainable transportation. Increasing the use of public transport systems and reducing the use of private cars is one of the main goals of decision-makers in many countries. The use of the public transport system is closely related to the quality of service. Service quality includes parameters such as convenience, frequency, information systems, and so on. [1]. Other factors that have been identified as attributes of the quality of public transport services are waiting time, travel time, vehicle cleanliness, ease of route, being equipped with driver assistants, and security [2]. The quality of urban public transport services can be measured by several indicators, namely: headway, waiting time, travel time, and speed [3].

Service quality is the biggest subject for both planners and transport operators. The performance of public transport has an important role in accommodating the mobility of the population. In general, service quality is measured by asking about users' perceptions and expectations about several aspects of service quality. Taking into account the level of importance and satisfaction expressed by users [4]. Encouraging people to use public transportation is not an easy task for the government, because public transportation is often considered a bad alternative to car use [5].

To measure and ensure the continuous improvement of the quality of public transport, performance criteria are an important tool for transport operators and focus on their strategic objectives. So far, in developing countries, public transport services have provided substandard quality and limited capacity. Lack of awareness of perceived quality and missing quality management systems are the main causes of poor quality of public transport services. respond to the demand-side needs for accessible, affordable, fast and reliable modes [6].

Road accessibility has always been a major problem in public transportation services and can reduce public interest in using public transportation [7]. One measure of road segment accessibility is providing access to various activity centers [8]. Accessibility refers to the ability of the community to reach goods, services and activities, which are the ultimate goal of most transportation activities. Many factors affect accessibility, including mobility (physical movement), quality and affordability of transport options, connectivity of transport systems, mobility substitutes, and land use patterns [9].

Service quality and road accessibility are two factors that affect the performance of public transport. Performance is the ability or potential of public transportation to serve the needs of movement in an area, both in the form of transportation of goods and transportation of people. Performance is also the level of achievement or results of the company's work from targets to be achieved or tasks to be carried out within a certain period [10]. Operational indicators of public transport performance include the number of passengers, distance traveled, fuel consumption, and load factor [3].

This research takes the location of the Batubulan-Ubud Terminal route, Gianyar Regency, which is served by microbus vehicles, with a capacity of eight passengers. The routes are: Batubulan-Celuk-Sukawati-Batuan-Sakah-Peliatan-Mas-Ubud Terminal. From the observations, it can be seen that the public transportation fleet serving this route is very small and only operates in the morning. Meanwhile, this route passes through a road corridor with a relatively dense population, there are side obstacles in the form of parking on the road, vehicles are going in and out, traditional market activities, and vehicles slowing down. People are more likely to use private transportation to fulfill their mobility so transportation becomes worse.

This study aims to determine the performance of public transportation on the Batubulan-Ubud Terminal route by analyzing the effect of exogenous variables on service quality and accessibility of the road routes served on the endogenous variable, namely the performance of public transportation. respondent's perception data were analyzed by statistical equation modeling (SEM) AMOS.

2. METHODS

Statistical Equation Modeling (SEM) is a strong analytical technique because it considers interaction modeling, nonlinearity, correlated independent variables, measurement errors, correlated error terms, and multiple latent independents where each is measured using many indicators, and one or two latent dependent variables are also each measured by several indicators. SEM is stronger than using multiple regression, path analysis, factor analysis, time series analysis, and analysis of covariance [11]. Table 1 shows the goodness of fit parameters in SEM.

Table 1. Parameter *Goodness of Fit* [12] [13]

No	The goodness of Fit Index	Cut-off Value	Note
1	*Chi-square* (x^2)	Expected small	Testing the level of fit between the sample variance matrix and the model covariance matrix
2	*Significance of Probability*	≥ 0,05	When using a 95% confidence level. This indicates that the hypothesis is accepted and the predicted input matrix is not statistically different.
3	CMIN/DF *(The Minimum Sample Discrepancy Function*)	≤ 2,00	The fit between the two models.
4	GFI (*Goodness of Fit Index*)	≥ 0,90	Nothing but Chi-square divided by DF
5	AGFI (*Adjusted Goodness of Fit Index*)	≥ 0,90	Measuring the relative amount of variance and covariance
6	TLI (Tucker Lewis Index)	≥ 0,95	Its function is the same as the GFI, the difference lies in the adjustment of the DF value to the specified model.
7	CFI (*Comparative Fit Index*)	≥ 0,95	Comparison between the tested model and the baseline model
8	RMSEA (*The Root Mean Square Error of Approximation*)	≤ 0,08	Test the feasibility of a model that is not sensitive to the sample size and complexity of the model

This research is an observational study with a survey method, taking a sample of 250 respondents, and using a questionnaire as an instrument for collecting data from the population in Gianyar Regency. The measurement is in the form of public perception of the quality of public transportation services, road accessibility, and public transportation performance.

Data analysis used the Amos Structural Equation Modeling (SEM) method, with software ver.22. The measurement scale used is a Likert scale with a score of 1-5, namely: strongly disagree (STS) score 1, disagree (TS) score 2, Slightly agree (US) score 3, Agree (S) score 4, and Strongly Agree (SS) score 5

3. RESULTS AND DISCUSSION

3.1 Validity and Reliability Test

Validity and reliability tests were carried out using the confirmation factor analysis (CFA) method. Tables 2 – 4 show the results of the validity and reliability tests of each latent variable indicator. The value of construct reliability (CR) is obtained from Equation $CR = \frac{(\Sigma\lambda)^2}{(\Sigma\lambda)^2+\Sigma(1-\lambda^2)}$ -- (1)

Where:

CR : construct reliability
λ : loading factor

Table 2. The results of the validity and reliability test of the quality of public transportation services (X1)

Indicator Service Quality (X1)	Notation	p	Load (λ)	CR
Arrival frequency is rare	X1.1	0.000	0.812	0,906
Not equipped driver assistant	X1.2	0.000	0.670	
Long waiting time	X1.3	0.000	0.728	
The vehicle is not clean	X1.4	0.000	0.765	
The room is not air-conditioned	X1.5	0.000	0.657	
Small fleet size	X1.6	0.000	0.805	
Long travel time	X1.7	0.000	0.753	
Less comfort	X1.8	0.000	0.723	

Source: Analysis Results (2021)

Table 3 Test results of the validity and reliability of Road Accessibility (X2)

Indicator Road Accessibility (X2)	Notation	p	Load (λ)	CR
Lots of vehicle on-street parking	X2.1	0.000	0.626	0,845
Many vehicles in and out	X2.2	0.000	0.604	
There are many intersections	X2.3	0.000	0.511	
Many vehicles slow down	X2.4	0.000	0.754	
Frequent switching of currents	X2.5	0.000	0.686	
Uneven pavement	X2.6	0.000	0.631	
There are frequent road repairs	X2.7	0.000	0.639	
There is morning market activity	X2.8	0.000	0.630	

Source: Analysis Results (2021)

Table 4. The results of the validity and reliability test of Public Transport Performance (Y1)

Indicator Public Transport Performance (Y1)	Notation	p	Load (λ)	CR
Few passengers	Y1.1	0.000	0.702	0,852
Driver's salary below standard	Y1.2	0.000	0.605	
Short travel distance	Y1.3	0.000	0.628	
High operating costs	Y1.4	0.000	0.604	
Exhaust gas/big emissions	Y1.5	0.000	0.712	
Minor passenger change	Y1.6	0.000	0.694	
Less fuel consumption	Y1.7	0.000	0.628	
Short drive operation time	Y1.8	0.000	0.603	

Source: Analysis Results (2021)

The construct reliability (CR) cut-off value is 0.7, loading factor is 0.50 [14]. From the results of the validity and reliability test using the CFA method, it was found that all indicators had a value of $p = 000 < 0.05$, loading factor $(\lambda) > 0.50$, then all indicators were declared valid. If the value of construct reliability $(CR) > 0.7$, then all indicators can be declared reliable.

3.2 Public Transport Performance Model

After fulfilling the validity and reliability tests, it is continued to test the model with the goodness of fit, using the maximum likelihood method. Modifications are made so that the model meets several parameters in the goodness of fit. By the table on the modification indices, a reduction or correlation of several indicators is carried out for each latent variable. So that the model is obtained as shown in Figure 1.

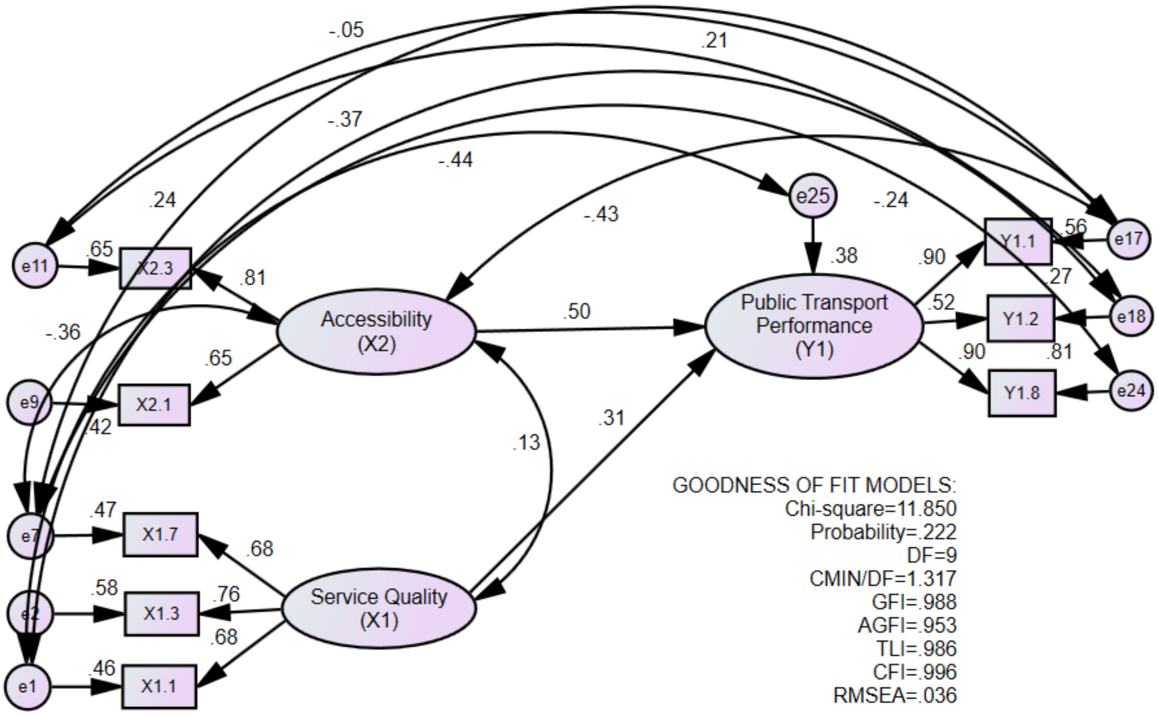

Figure 1.Diagram of Public Transport Performance Model
Source: Analysis Results (2021)

After modifying the model, there are only three indicators that can measure the latent variable of service quality (X1), namely: arrival frequency is rare (X1.1); long waiting time (X1.3); and long travel time (X1.7). Two indicators can measure the road accessibility variable (X2), namely: lots of vehicle on-street parking (X2.1) and there are many intersections (X2.3). Three indicators can measure the public transport performance (Y1) variable, namely: Few passengers (Y1.1); driver's salary below standard (Y1.2); standard drive operation time (Y1.8).

Table 5 shows that the service quality variable (X1) has a significant effect on public transport performance, with a value of $p = 0.000$, which is smaller than $\alpha = 0.05$. Likewise, road accessibility has a significant effect with the value of $p = 0.000$ which is smaller than $\alpha = 0.05$.

Table 5 Regression Weights

Latent Variables			P
Public_transport_performance_Y1	<---	Road Accessibility_X2	.000
Public_transport_performance_Y1	<---	Service_quality_X1	.000

Source: Analysis Results (2021)

Table 6 shows the path coefficient value for the latent variable of service quality (X1), which is 0.498, and the coefficient value. Pathway road accessibility latent variable path (X2) is 0.308.

From Table 6, it can be obtained the following public transport performance model:

$$Y1 = 0.498\ X1 + 0.308\ X2 \qquad (2)$$

Where:

X1 : Service quality

X2 : Road accessibility

Table 6 Standardized Regression Weights

Latent Variables			Estimate
Public_transport_performance_Y1	<---	Road_Accessibility_X2	.498
Public_transport_performance_Y1	<---	Service_quality_X1	.308
Arrival_frequency_is_rare_X1.1	<---	Service_quality_X1	.681
Long_waiting_time_X1.3	<---	Service_quality_X1	.762
Long_travel_time_X1.7	<---	Service_quality_X1	.683
Lots_vehicle_on-street_parking_X2.1	<---	Road_Accessibility_X2	.650
There_many_intersection_X2.3	<---	Road_Accessibility_X2	.807
Few_passengers_Y1.1	<---	Public_transport_performance_Y1	.903
Driver's_salary_below_standar_Y1.2	<---	Public_transport_performance_Y1	.516
Short_drive_operation_time_Y1.8	<---	Public_transport_performance_Y1	.902

Source: Analysis Results (2021)

Parameters of Goodness of Fit Models

In this study, eight goodness of fit parameters were tested. The Chi-Square test is useful for testing the relationship or effect of two nominal variables and measuring the strength of the relationship between one variable and another nominal variable. The Chi-square value is very sensitive to the number of samples. The bigger the sample, the bigger the value. Where, with a value of the degree of freedom (DF) = 7 and a significance level of 0.05, the Chi-square table is 16.919 > Chi-square count is 11,850, meaning the model meets.

The probability value in this study reached 0.222 > 0.05. Models meet. The significance value is required to increase beyond 0.05 to reduce the calculated Chi-square value so that it does not exceed the Chi-square table.

The value of CMIN/DF obtained is 1.317 < 2.00, which fulfills. CMIN/DF is one of the indicators to measure the fitness level of a model. CMIN/DF is nothing but the Chi-square value divided by the DF value. A CMIN/DF value less than 2.00 is an indication of an acceptable fit between the model and the data [12].

The GFI value in this study was 0.988 > 0.900 (very good). GFI is a non-statistical measure that has a range of values between 0 (poor fit) to 1.0 (perfect fit). A high value in the index indicates a better fit and a model is said to be very good if the GFI value is more than or equal to 0.90.

The AGFI value in this study was obtained at 0.953 > 0.900, a good overall model fit. AGFI is a criterion that takes into account the weighted proportion of variance in a sample covariance matrix. The recommended acceptance rate is when AGFI has a value equal to or greater than 0.90. A value of 0.95 can be interpreted as a good level-good overall model fit (good) while a value between 0.90 - 0.95 indicates a sufficient-adequate fit level.

The TLI value in this study was 0.986 > 0.950. TLI is an alternative incremental fit index that compares a tested model against a baseline model. A value that is very close to 1 or more than 0.95 indicates a very good.

The CFI value in this study was 0.996 > 0.950. The magnitude of this index is in the range of values 0 (poor fit) to 1.0 (perfect fit). Values greater than or equal to 0.95 identify the highest level of fit, a very good fit.

The RMSEA value in this study was 0.036 < 0.08. RMSEA is another test tool showing the goodness-of-fit that can be expected when the model is estimated in the population [14]. The RMSEA value which is less than or equal to 0.08 is an index for the acceptance of the model which shows a close fit of the model based on the degrees of freedom. Furthermore, the parameters of the goodness of fit Models can be seen in Table 7.

Table 7 Results of calculation of goodness of fit parameter.

No	Goodness of Fit Index	The calculation results	*Cut off Value*	Information
1	Chi-square (x^2)	11.850	≤ x^2 table (=16.919)	Very good
2	Probability	0,222	≥ 0,05	Very good
3	CMIN/DF	1,317	≤ 2,00	Very good
4	GFI	0,988	≥ 0,90	Very good
5	AGFI	0,953	≥ 0,90	Very good
6	TLI	0,986	≥ 0,95	Very good
7	CFI	0,996	≥ 0,95	Very good
8	RMSEA	0.036	≤ 0,08	Very good

Source: Analysis Results (2021)

4. CONCLUSION

The results show that all the goodness of fit parameters is fulfilled very well. The exogenous variable of service quality (X1) has a significant positive effect on public transport performance (Y1), with a value of $p = 0.000 < 0.05$, meaning that the higher the service, the higher the performance of public transportation, and vice versa. Service quality is indicated by: arrival frequency (loading factor = 0.681), waiting time (0.762), and travel time (0.683). The exogenous variable of road accessibility (X2) has a significant positive effect on the performance of public transportation, with a value of $p = 0.000 < 0.05$, meaning that the higher the road accessibility, the higher the performance of public transportation, and vice versa. Road accessibility is indicated by: on-street parking (0.650), and intersection (0.807)

Public transport performance (Y1) as an endogenous variable is indicated by: the number of passengers (0.903), Driver's salary (0.516), and operating duration (0.902). The performance of public transportation on the Batubulan-Ubud Terminal route is very poor, which is caused by poor service quality and poor road accessibility. The low quality of service is evidenced by the small arrival frequency, long waiting time, and long travel time. Poor road accessibility is evidenced by the number of vehicles parked on the road, and there are many intersections along the route.

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