USER ACCEPTANCE OF PUBLIC TRANSPORT SYSTEMS BASED ON A PERCEPTION MODEL

LAMBANG BASRI SAID & ILHAM SYAFEY
Faculty of Engineering, Universitas Muslim Indonesia, Indonesia

ABSTRACT

The purpose of this study was to evaluate the need for mass transportation in Makassar City, Indonesia and to analyze public perceptions of the relationships among transport management, service qualities, user capacity and acceptance through user satisfaction. This research was conducted in two stages. The first was a survey of public transport users and an estimate of the number of the bus fleet requirements. This was conducted by estimating the number of users, mapping the main public transportation routes and measuring the period based on the departure schedule and the headway. In the second stage, a survey of public perceptions of bus transportation, which covered transport management, service qualities, user capacity, user satisfaction and user acceptance, was conducted. A self-administrated questionnaire had been developed and distributed in 10 residential points representing a certain area in Makassar city, Indonesia. At each point, 40 questionnaires were distributed to respondents by non-probability samplings. The respondents were selected by certain criteria consisting of age, transport need and experience in receiving bus services. Out of 400 questionnaires that have been distributed, 315 were returned (78.0%). Of the 315, there were 15 regarded as invalid and 300 were considered valid responses. Therefore, further analyses were done by extracting those 300 valid responses. The results indicated that user acceptance was directly or indirectly influenced by transport management, service qualities, user capacity and user satisfaction. User satisfaction is an intervening variable between service qualities and user acceptance. Meanwhile, user capacity positively and directly affects user acceptance, but indirectly it has a negative relationship with user satisfaction. Therefore, the quality of the bus services in terms of security, comfort and orderliness significantly affects user satisfaction, which impacts acceptance.
Keywords: service qualities, transport management, user capacity, user acceptance.

1 INTRODUCTION

Transportation is a major component of the social system, which affects socio-economic conditions such as urban growth. It plays a pivotal role in promoting economic growth, especially in urban areas. Conversely, the socio-demographic conditions of an area may affect its transportation performance [1]. Population density has a significant influence on the ability of transportation to meet community needs. The complexity of public transportation is evident in big cities, which involves a combination of variables, such as population growth, the increase in the number of vehicles exceeding road capacity and user behavior related to ignoring traffic regulations on the highway [2,3].

Makassar, the largest city in eastern Indonesia, is located in South Sulawesi. This city serves as a service center for the educational and health sectors, industrial and government activities, and a node for the transportation of goods and passengers by land, sea, and air. The city has an area of 175.77 km^2 and a population density of 8,701 people/km^2. One of the chronic problems faced by residents is the severe level of traffic congestion caused by several factors, such as an increase in the number of private vehicles, insufficient public transportation, violation of parking orders, narrowing of roads in transitional sections, median openings by undisciplined road users, limited traffic signs and weak traffic law enforcement [4].

Insufficient public transportation occurs because the quantity and quality of mass transportation fall below the required standard. In Makassar city, the number of main bus lanes has reduced from five to one during the past 10 years. This situation prompted the government

ISSN: 2058-8305 (paper format), ISSN: 2058-8313 (online), http://www.witpress.com/journals
DOI: 10.2495/TDI-V6-N4-399-414

to restructure the public transportation system and improve the public transportation system. In 2020, the Indonesian Directorate General of Land Transportation launched a restructuring program based on the service purchase concept. This initiative has been implemented in nine cities: Medan, Palembang, Solo, Yogyakarta, Surabaya, Denpasar, Bandung, Makassar and Banjarmasin. The service purchase program is the program to purchase of public transportation services by the government to the private sector and public transport operators. Through this program, the government pays operators based on the value of the freight cost which is calculated per kilometer. As a result, the government subsidizes 100% of vehicle operating costs to transportation operators. With this program, the Ministry intends to eliminate the culture of reckless public transport traffic, unhealthy competition, erratic driving schedules and travel times. Therefore, a strategy that involves the public's perception is needed. Over the past ten years, buses have been distributed in this region. However, they lack adequate public transportation services because there is no pattern of guidance and supervision mandated in national regulations.

The strategy employed to improve the public transportation system must consider community needs, including the stipulated number of vehicles and the quality of services rendered. Several studies have indicated that safety, security, comfort and environmental friendliness are important factors [4–6]. Convenience and accessibility are the main factors impacting overall user satisfaction; these are followed by adequate facilities, namely, bus stops and public transportation services within the city [7]. However, the extent to which user perceptions of the relationships among service management, service qualities, user capacity and user acceptance affect user satisfaction has never been studied. Therefore, it is important to conduct a study to measure the level of community need for the number of vehicles and the perception of user acceptance of public transportation. This study aimed to analyze the need for mass transportation in Makassar City and evaluate public perceptions of the relationships among service management, service qualities, user capacity and user acceptance through user satisfaction. The hypotheses in this study are formulated as follows, (a) Transport management, service quality and user capacity have a significant effect on user satisfaction, (b) Transport management, service quality and user capacity have a direct significant effect on User Acceptance and (c) User satisfaction has a significant effect on user Acceptance.

2 MATERIALS AND METHODS

This research was conducted in two stages. First, a survey of public transport users and the estimated number of bus fleets. This stage is carried out by mapping the main bus routes. Estimated the number of bus fleets was conducted on four reopening routes. These routes consisted of the Route A (Terminal Mallengkeri – UNHAS, Via Metro Tanjung Bunga), the Route B (Mall Panakkukang – Bandara Internasional Sultan Hasanuddin), the Route C (Kampus 2 Politeknik Negeri Ujung Pandang – Kampus 2 Politeknik Ilmu Pelayaran) and the Route D (Pelabuhan Sukarno Hatta – UIN Alauddin Samata). Those routes previously existed, and this study project to reopen the services. The measurement of the number of fleets is determined based on the number of passengers, the number of circulation, change frequency and bus capacity.

Second, user perceptions of public transportation, covering transport management, service qualities, user capacity, user satisfaction and user acceptance were surveyed by distributing questionnaires. The total number of participants was determined based on Slovin's formula.

A self-administrated questionnaire had been developed and distributed in 10 residential points representing a certain area in Makassar city, Indonesia. At each point, 40 questionnaires were distributed to respondents by non-probability samplings. The respondents were selected by certain criteria consisting of age, transport need and experience in receiving bus services. Out of 400 questionnaires that have been distributed, 315 were returned (78.0%). Of the 315, there were 15 regarded as invalid and 300 were considered valid responses. Therefore, further analyses were done by extracting those 300 valid responses.

2.1 Estimated number of users

The number of users is estimated from the total number of captive groups and 30% of choice groups [8].

$$N = Ca + 30\%\ Ch \tag{1}$$

where
N = number of users
Ca = captive group
Ch = choice group

2.2. Estimated number of passengers in studied routes

The estimated number of passengers in studied routes was calculated by dividing the certain route length by the total length of routes, then multiply by the total number of users [9].

$$\sum P = \frac{LoR}{\sum LoR} \times \sum U \tag{2}$$

where
P = estimated number of passengers in the studied route
LoR = Length of route
ΣLoR = Total length of all routes
Σ U = Total number of users

2.3. Circulation time (CT)

Circulation time was determined by summing up the time spent by the bus fleet from A terminal to B terminal and return to A terminal [9].

$$CT_{ABA} = (T_{AB} + T_{BA}) + (\sigma_{AB} + \sigma_{BA}) + (T_{TA} + T_{TB}) \tag{3}$$

where
CT_{ABA} = circulation time from A to B and back A
T_{AB} = average travel time from A to B
T_{BA} = average travel time from A to B
σ_{AB} = deviation time from A to B
σ_{BA} = deviation time from A to B
T_{TA} = bus fleet downtime in A
T_{TB} = bus fleet downtime in B

2.4 Estimated number of circulation at a route (Ci)

The estimated number of circulation in a certain route was determined by maximum daily service time divided by circulation time per hour [9].

$$\mathrm{Ci} = \frac{\mathrm{t\ max}}{\mathrm{CTABA} - 0.5} \times 60 \text{ minutes} \tag{4}$$

where
Ci = estimated number of circulation
t max = maximum daily service time (16 hours)
CT_{ABA} = circulation time from A to B and back A

2.5. Change frequency

Change frequency is the frequency of passenger change within a certain route. Change frequency is formulated based on the number of bus stops within a certain route divided by the average number of bus stops traveled [9]. The average number of bus stops traveled was determined by a survey of passengers.

$$\mathrm{CF} = \frac{\mathrm{BS}}{\mathrm{BST}} \tag{5}$$

where
CF = Change frequency
BS = bus stop
BST = average number of bus stop traveled

2.6. Estimated number of the bus fleet

The estimated number of bus fleet was calculated based on the number of passengers served, divided by the number of circulation, change frequency and bus capacity [9].

$$\mathrm{F} = \frac{\mathrm{P}}{\mathrm{Ci} \times \mathrm{CF} \times \mathrm{C}}$$

where
F = estimated number of the bus fleet
P = Number of passengers served
Ci = number of circulation
CF = Change frequency
C = bus capacity

2.4. Users' acceptance of public transportation

The conceptual framework of this research is constructed based on the theoretical foundation of various concepts and the results of previous studies as follows. First, transport management can increase user acceptance [10,11]. Second, service quality, customer satisfaction, and behavioral intentions in public transit transport management can increase customer satisfaction [13]. Third, personal outcome expectations and the perceived effectiveness of expenses (i.e. fares) is the pivotal factor in improving user acceptance [13]. Fourth, availability, safety and security positively influence to user satisfaction [14]. In general, previous studies did not distinguish between transport management and service quality by the provider. In this study, these two variables were separated because transport management is generally determined by the government, while service quality is provided by the operator.

User acceptance of public transportation was determined by constructing the behavioral model, which involved measuring some latent variables and indicator items. Subsequently, the data was obtained from the respondents' perceptions, while their responses to each question were subjected to five options as follows, 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree. The questions on the latent variables and indicator items are shown in Table 1. The qualification level was determined by the following ranges: Very low = 1.00 to 1.80, Low = 1.81 to 2.60, Moderate = 2.61 to 3.40, High = 3.41 to 4.20, Very high = 4.21 to 5.00.

This study applied Structural Equation Modeling analysis tools to analyze the correlation among the latent variables and indicators. Those analyses were done using the partial least square (PLS) method and processed with SmartPLS 3.0 software. Structural model analyses in PLS consisted of four stages as follows, formulating the structural model concept, analyzing the outer model validity and reliability, analyzing the inner model validity and testing the hypothesis. The conceptual model for the proposed framework was constructed based on the relevant theory and previous studies. Furthermore, the structural model was created based on conceptual relationships among the variables. The outer model test aims to evaluate the validity and reliability of a model. The result of the analysis was determined by Loading Factor value, Average variance extracted (AVE) and composite reliability. Loading factor analysis is the initial stage in testing the convergent validity of a model, with a cut-off value of 0.7. Furthermore, to find out the discriminant validity of the outer model of this study can be seen in the AVE value, with a cut-off value of 0.5. Discriminant validity was established to ensure the specificity of the constructs in the study. The correlation between the indicator and its latent variable must be greater than the correlation between the indicator and other latent variables (outside the block). Composite Reliability measures the true reliability value of a variable while Cronbach's Alpha measures the lowest value (lower bound) reliability. The value of composite reliability is analyzed to ensure real reliability measurement. The last step in evaluating the outer model is to test the unidimensionality of the model. This test was carried out using composite reliability and Cronbach's alpha. For both indicators, the cut-off value is 0.6.

The inner model test aims to ensure the accuracy of the structural model. The accuracy of the inner model was evaluated by several indicators, namely the value of RMSEA, chi-square, significance, d_ULS, d_G, normed fit index (NFI), standardized root means residual (SRMR) and adjusted goodness of fit index (AGFI). In the last step, testing the hypothesis is determined by the value of probability and t-statistics. The criteria for acceptance of the alternative hypothesis was decided when $p < 0.05$.

2.5. Recommendation for transportation development plan

Based on the results of the previous stage analysis, a recommendation for a transportation development plan was formulated. The phase was done through focused group discussions involving local government offices (including the Department of City Transportation) to compile a problem-solving scenario. This discussion focuses on strategy outlines and detailed scenarios to improve user acceptance. The scenario was selected based on the level of service.

3 RESULT

3.1 Estimated number of users

Based on the Statistics Central Bureau, the population of Makassar City is 1,423,877 individuals. The total of users aged between 17 and 60 years was 942,248 persons. [16] (Statistics Central Bureau, 2021). There are 1078 registered minibusses operated by private companies and 22 buses operated by the government company (Makassar City Transportation Department). Based on the calculation, the result showed that the captive group consisted of 122.492 individuals, the choice group consisted of 819,756 persons, and the total of users was estimated as 368,419 individuals. Of the total users, 129,360 persons are served by existing secondary transportation (as feeders), while the remaining 239.059 individuals would be distributed into five routes. There is an existing bus route serving approximately one-fifth of the remaining users (47,812 persons), while this study estimated the rest of the four routes users (191,247 persons). A total of 191,247 individuals were distributed proportionally into four routes based on the length of the route (Table 1). The result showed that the number of passengers ranged from 42.258 to 53,963 persons (Table 1).

Table 1: Estimated number of passengers (persons) in each route.

Route	Length of circulated route (km)	Estimated number of the user (persons)
Route A	53.25	53,963
Route B	42.65	43,221
Route C	51.12	51,805
Route D	41.70	42,258
	188.72	191,247

3.2. Estimated number of the fleet (circulation/day), number of bus stop, the average number of bus stop traveled and change frequency

Results demonstrated that total traveling time ranged from 166.8 minutes to 213 minutes when the average bus speed was 15 km/hour. The number of circulation ranged from 4 to 5 circulations/day. The number of bus stops ranged from 35 to 55. The number of change frequencies ranged from 13 to 16.3 (Table 2).

Based on the data presented in Table 2, the estimated number of the bus was calculated based on three scenarios. First, all buses have a capacity of 40 persons. Second, all buses have a capacity of 20 people. Third, combined passenger capacity of both 40 and 20 persons (big and medium bus). The first scenario demonstrated that the number of the bus was 16 or 21 units per route and headway ranged from 10 to 11 minutes (Table 3). The second scenario demonstrated that the number of the bus was 33 or 41 units per route and headway was 5 minutes (Table 4). The third scenario demonstrated that the number of the bus was 25 or 30 units per route and headway was 7 minutes (Table 5).

Table 2: Estimated number of the fleet (circulation/day), number of the bus stop, the average number of bus stops traveled and change frequency.

Route	Length of circulated route (km)	Bus speed (km/hour)	Traveling time (minutes)	Maximum number of circulation per day	Number of bus stops	The average number of bus stop traveled	Passenger change frequency
Route A	53.25	15	213	4.2	44	2.7	16.3
Route B	42.65	15	170.6	5.3	35	2.7	13.0
Route C	51.12	15	204.48	4.4	43	2.7	15.9
Route D	41.7	15	166.8	5.4	35	2.7	13

Table 3: Estimate the number of the bus (units) and headway (minutes) when applying the passenger capacity of 40 persons (big bus).

Route	User (persons)	Fleet (number/day)	Passenger change frequency	Bus capacity	Number of the bus (units)	Headway (minutes)
Route A	53,963	4	16	40	21	10
Route B	43,221	5	13	40	16	11
Route C	51,805	4	16	40	21	10
Route D	42,258	5	13	40	16	11

Table 4: Estimate the number of buses (units) and headway (minutes) when applying the passenger capacity of 20 persons (medium bus).

Route	User (persons)	Fleet (number/day)	Change /circulation	Bus capacity	Number of the bus (units)	Headway (minutes)
Route A	53,963	4	16	20	41	5
Route B	43,221	5	13	20	33	5
Route C	51,805	4	16	20	41	5
Route D	42,258	5	13	20	33	5

3.3 User acceptance of the public transportation

3.3.1 Description of Respondents' Answers

The responses for each indicator or item on the questionnaire were analyzed descriptively. An overview of the respondent's answers indicated good results represented by its high category, except travel intensity. The travel intensity falls in the moderate category (Table 6).

Table 5: Estimate the number of the bus (units) and headway (minutes) when applying a combined passenger capacity of both 40 and 20 persons (big and medium buses).

Route	User (persons)	Fleet (number/day)	Change/ circulation	Number of combined buses (capacity)	Headway (minutes)
Route A	53,963	4	16	B (40) = 11 and M (20) = 19	7
Route B	43,221	5	13	B (40) = 8 and M (20) = 17	7
Route C	51,805	4	16	B (40) = 11 and M (20) = 19	7
Route D	42,258	5	13	B (40) = 8 and M (20) = 17	7

Table 6: Description of Respondents' perceptions toward the variables and indicators.

Variables	Indicators	Respondent score	Categories
Transport management	X1.1. accessibility	4.17	High
	X1.2. connectivity	3.93	High
	X1.3. fare/ticket price	3.78	High
Service quality	X2.1. security	4.02	High
	X2.2. comfortability	4.17	High
	X2.3. orderliness	3.95	High
User capacity	X3.1. the family income per month	3.49	High
	X3.2. allocation of transportation costs	3.49	High
	X3.3. travel intensity	3.36	Moderate
	X3.4. number of family members	3.44	High
User satisfaction	Z1. service suitability	4.04	High
	Z2. Ticket price	4.03	High
	Z3. Accuracy	4.05	High
	Z4. Willingness to recommend.	4.09	High
User acceptance	Y1. Productivity	4.07	High
	Y2. utility	4.00	High
	Y3. acceptability.	3.92	High

The results of the convergent validity analysis for each variable in this study are presented in Tables 7 to 11, while the discriminant validity analysis, Composite Reliability and Cronbach's Alpha measures are shown in Table 12. It showed that transport management (X1) was developed by the following indicators, namely accessibility (X1.1), connectivity (X1.2) and fare rate (X1.3). Moreover, all the outer loading values were greater than 0.70, indicating that the research instrument met the requirements of convergent validity. The other number displayed shows the extent to which the indicator reflects each latent variable. Therefore, the instrument consisting of indicator items was valid for analyzing transport management. All transport management indicators showed significant results of $p < 0.001$, indicating this variable was formed by the causative factor, accessibility, connectivity and fare rate (Table 7).

Security (X2.1), comfortability (X2.2) and orderliness (X2.3) developed sustainable service qualities (X2). The outer loading value of all indicators was greater than 0.70, depicting that the research instrument met the convergent validity requirements. Therefore, the instrument consisting of indicator items is reliable for analyzing service qualities. Furthermore, all service quality indicators showed a *p*-value less than 0.001, implying that the service qualities were formed by security, comfortability and orderliness, as shown in Table 8.

The sustainable user capacity (X3) was developed by indicators such as family income per month (X3.1), transportation costs allocation (X3.2), travel intensity (X3.3) and the number of family members (X3.4). The outer loading values of all indicators were greater than 0.50, depicting that the research instrument met the convergent validity requirements. The number displayed outside the loading value shows the extent to which the indicator reflects each latent variable. Therefore, the instrument consisting of indicator items is reliable for analyzing user capacity. Furthermore, the *p*-value is less than 0.001, indicating that the user capacity was shaped by family income per month, transportation costs allocation, travel intensity and the number of family members (Table 9).

According to the result, user satisfaction (Z) was developed by service suitability (Z1), fare compliance (Z2), accuracy (Z3) and willingness to recommend (Z4). The outer loading value of all indicators was greater than 0.50, depicting that the research instrument met the

Table 7: Value of convergent validity (outer loading) transport management.

Indicator	Outer loading	Standard deviation (STDEV)	T Statistics (|O/STDEV|)	*p*-value
X1.1	0.816	0.034	23.67	0.000
X1.2	0.905	0.014	64.76	0.000
X1.3	0.803	0.031	25.86	0.000

Table 8: Value of convergent validity (outer loading) of service qualities indicators.

Indicator	Outer loading	Standard deviation (STDEV)	T Statistics (|O/STDEV|)	*p*-value
X2.1	0.803	0.0305	26.278	0.000
X2.2	0.856	0.023	37.584	0.000
X2.3	0.777	0.042	18.408	0.000

Table 9: Value of convergent validity (outer loading) of user capacity indicators.

Indicator	Outer loading	Standard deviation (STDEV)	T Statistics (|O/STDEV|)	*p*-value
X3.1	0.896	0.020	45.86	0.000
X3.2	0.927	0.011	81.92	0.000
X3.3	0.907	0.017	52.8	0.000
X3.4	0.843	0.027	31.8	0.000

convergent validity requirements. The number displayed outside the loading value shows the extent to which the indicator reflects each latent variable. Therefore, the instrument consisting of indicator items is reliable for analyzing the users' satisfaction. Furthermore, all indicators of user satisfaction demonstrated a *p*-value of less than 0.001, illustrating that the user satisfaction variable reflected service suitability, fare compliance, accuracy and willingness to recommend (Table 10).

User acceptance (Y) reflected the user perception of productivity (Y1), utility (Y2) and acceptability (Y3). The outer loading value of all indicators was greater than 0.70, indicating that the research instrument met the convergent validity requirements. The number displayed outside the loading value shows the extent to which the indicator reflects each latent variable. Therefore, the instrument consisting of indicator items is reliable for analyzing the users' acceptance. Furthermore, the *p*-value is less than 0.001, indicating that the user acceptance supported the user perception of productivity, utility and acceptability (Table 6).

The result of the outer model analysis indicated that all latent variables have AVE scores of more than 0.5. Both Composite Reliability and Cronbach's Alpha values were also more than 0.6, indicating that all variables were valid and reliable (Table 12).

The modeling results indicated that transport management had a positive correlation with user satisfaction ($p < 0.01$) and user acceptance ($p < 0.001$). Service qualities had a significant

Table 10: Value of convergent validity (outer loading) of the user satisfaction indicators.

Indicator	Outer loading	Standard deviation (STDEV)	T Statistics (|O/STDEV|)	*p*-value
Z1	0.860	0.02	44.07	0.000
Z2	0.685	0.047	14.46	0.000
Z3	0.813	0.029	28.48	0.000
Z4	0.891	0.013	69.82	0.000

Table 11: Value of convergent validity (outer loading) of the user acceptance indicators.

Indicator	Outer loading	Standard deviation (STDEV)	T Statistics (|O/STDEV|)	*p*-value
Y1	0.857	0.023	37.055	0.000
Y2	0.873	0.019	46.119	0.000
Y3	0.807	0.034	23.897	0.000

Table 12: Result of outer model analysis of all variables.

Latent variables	Average variance extracted (AVE)	Composite reliability	Cronbach's alpha
Transport management	0.710	0.880	0.795
Service quality	0.660	0.853	0.743
User capacity	0.799	0.941	0.916
User satisfaction	0.666	0.888	0.829
User acceptance	0.716	0.883	0.801

and positive relationship to user satisfaction ($p < 0.001$) but it had a negative correlation to user acceptance ($p > 0.05$). Meanwhile, user capacity had a significant and negative relationship with user satisfaction ($p < 0.001$). This variable also had a significant and positive correlation with user acceptance ($p = 0.001$). User satisfaction had a significant and positive correlation with user acceptance ($p <0.001$) (Table 13 and Fig. 1).

Based on indirect testing, Transport management had a positive relationship with user acceptance through user satisfaction. Service qualities had a positive relationship with user acceptance through user satisfaction ($p < 0.001$). User capacity had a negative relationship with user acceptance through user satisfaction ($p < 0.05$) (Table 14).

Table 13: Total direct effect among variables.

Variables	Loading factor	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	*p*-values
Transport management → user satisfaction	0.213	0.075	2.844	0.005
Transport management → user acceptance	0.387	0.069	5.574	0.000
Service qualities → user satisfaction	0.535	0.082	6.540	0.000
Service qualities → user acceptance	–0.011	0.089	0.124	0.902
User capacity → user satisfaction	–0.174	0.039	4.475	0.000
User capacity → user acceptance	0.119	0.047	2.499	0.001
User satisfaction → user acceptance	0.282	0.07	4.056	0.000

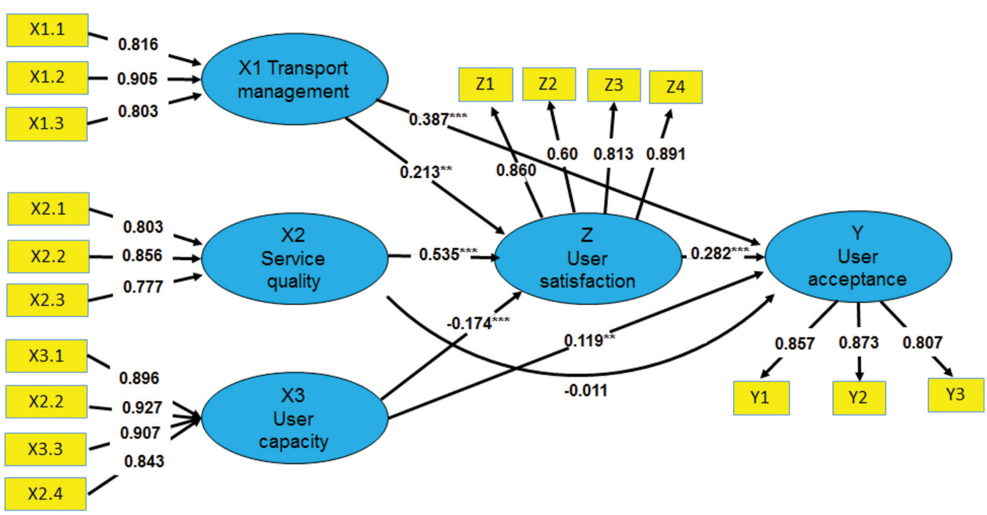

Figure 1: Structural model of user perception on the effect of transport management, service qualities and user capacity on user satisfaction with public transportation. Note: asterisk symbols represent significant correlation at ** ($p < 0.01$), *** ($p < 0.001$).

The validity of the formative indicator model was determined using the significance criteria of each external weight indicator. This criterion was accomplished when the test statistic value-t is $t < 1.96$ or $t > 1.96$. In addition, the path diagram was used to classify all latent variables as formative, implying that significant and valid criteria were adopted. The Fit Model Test results according to several criteria indicated that the overall framework was fit and acceptable. The AGFI had an output of 0.909, demonstrating that it had a better fit because its value was greater than 0.90 (Hair et al., 2010). The SRMR value of 0.011 also demonstrated an acceptable fit model because it has a lesser value, indicating a better match. The NFI had an output value of 0.910, demonstrating this model had a better fit because it is approximately 1, as shown in Table 15.

3.3.2 Recommendation for transportation development plan

The results of the focus group discussions indicate the need for a short, medium and long-term solution. These short-term recommendations for transport management include setting a particular type of vehicle on the route and monitoring its intensity or schedule. It includes safety and comfort improvements for better service quality. Meanwhile, medium and long-term solutions comprise integrated connectivity between primary and secondary transport (feeder) systems, repair of bus stops and stations, handling roadblocks, improvement of service qualities and facilities, increased number of buses, and its ratio to minibusses (Table 16).

4 DISCUSSION

This study revealed that user acceptance is directly and indirectly influenced by transport management, service qualities, user capacity and user satisfaction. Users tend to be more concerned about transport management and service quality. Interestingly, user capacity has

Table 14: Total indirect effect among variables.

Variables	Loading factor	Standard deviation (STDEV)	T Statistics (|O/STDEV|)	*p*-values
Transport management → user acceptance	0.06	0.027	2.187	0.029
User capacity → user acceptance	–0.049	0.015	3.217	0.001
Service qualities → user acceptance	0.151	0.042	3.552	0.000

Table 15: Indicators of the goodness of fit of the model.

Indicators	*p*-value	Cut off-value	Acceptable fit
AGFI	0.909	≥0.90	Acceptable fit
SRMR	0.044	≤0.08	Acceptable fit
NFI	0.910	≥0.90	Acceptable fit
RMSEA	0.015	≤0.08	Acceptable fit
Chi-Square	6.515 ($p > 0.05$)	≤32.67	Acceptable fit
Significance	$p > 0.05$	$p \geq 0.05$	Acceptable fit

Table 16: Short, medium and long terms solutions.

Variables	Solution		
	Short-term	Mid-term	Long-term
Transport management	Manage the type of vehicle in one route Manage vehicle intensity/schedule settings	Integrate/ connectivity between primary transport and secondary transport (feeder) Integrate/ connectivity between primary transport and secondary transport (feeder)	Bus stop and station repairs Handling roadblocks Bus stop and station developments Reducing congestion
Service qualities	Improve safety and comfort	Improve service qualities and facilities Increased the number of buses	Improve bus ratio; minibus

a positive direct effect on user acceptance, although indirectly, it has a negative relationship with user satisfaction. This implies that the higher the user's ability to pay, the more difficult it is to feel satisfied with the service management and service qualities. Additionally, user satisfaction is an intervening variable between both transport management and service qualities with user acceptance. Those indirect effects are positive for user acceptance. In contrast, the effect of user satisfaction as an intervening variable between user capacity to user acceptance is negative. The higher the user's ability to pay, the higher their demands on service management and service quality. Therefore, it is necessary to improve transportation management and service quality in terms of accessibility, connectivity, acceptability of fares/ticket prices, security, comfortability and orderliness which greatly affect user satisfaction.

Several studies have shown that public transportation services in Indonesia are very poor [7, 17, 18]. This situation led the users to switch to private vehicles. With a high number of private cars and motorcycles, congestion has gradually worsened the environment [19]. To retract people to use bus service substitutes for personal vehicles, the service providers must struggle to improve quality to increase passenger satisfaction. Various studies have shown that quality of service has a positive impact on user satisfaction and consequently leads to customer loyalty [13,17,20]. Therefore, improving the overall service quality would be the best strategy to increase bus ridership [12, 21]. A study in Yogyakarta showed that several indicators were related to transportation services as follows: availability, timeliness, security, and comfort both at the bus stop and on the bus [7,18]. Meanwhile, customer satisfaction with the Transjakarta Public Bus in Jakarta was influenced by service quality, price and brand image [22]. Therefore, it is necessary to pay attention to improving the quality of the bus transportation system in several cities in Indonesia, including Makassar city.

A previous study evaluated the perceptions of users of paratransit services in Thailand. The results indicated that reliability, in-vehicle environment, comfort, convenience and environmental impact were useful indicators for customers [23]. In another study, it was reported that service quality, perceived value, engagement and satisfaction positively affected the behavioral intentions of public transport passengers in Kuala Lumpur. It has also been reported that a direct negative relationship exists between perceived value and passenger satisfaction, which determines behavioral intentions. Additionally, this variable, however, depends on improving the service quality provided by the public transport system, which, in turn, affects passengers' perception. Service attributes, namely, vehicle safety, cleanliness and complaint management, have a major influence on the perceptions of public transport passengers [24]. Based on these analyses, ticket prices significantly affected consumer satisfaction. This was perceived as an intervening variable between service quality and consumer loyalty [25]. Other studies reported that passengers expect higher levels of safety and environmental friendliness from minibuses [5,17]. In the future, users will expect more qualified and automated public transportation. This is because the results reveal a high level of familiarity with the topic and an overall intention to use fully automated public transport in the future [26,27].

The results of this study can be used to recommend short-, medium- and long-term strategies. The short-term strategy focuses on managing the type and schedule of vehicles. Meanwhile, medium- and long-term strategies focus on improving facilities and increasing transit connectivity between primary and secondary transportation systems. A study in Taiwan demonstrated the importance of the perceptions of urban travelers of the interactions among availability, mobility and seamed connectivity of the public transportation system [28]. Therefore, a strategy to increase user satisfaction can be implemented by improving user-friendly public transportation services in terms of availability, accessibility, comfortability, mobility and connectivity of the bus transportation system.

CONCLUSION

This study estimates that efforts to reopen four bus lines with a total length of 188.72 km, can serve a total of 191,247 users. To meet the needs of those people, this study offers three scenarios. First, all buses have a capacity of 40 persons. Second, all buses have a capacity of 20 people. Third, combined passenger capacity of both 40 and 20 persons (big and medium bus). The first scenario demonstrated that the number of buses ranged from 16 to 21 units per route, while the headway ranged from 10 to 11 minutes. The second scenario demonstrated that the number of buses ranged from 33 to 41 units per route, while the headway was 5 minutes. The third scenario demonstrated that the number of buses ranged from 25 to 30 units per route, while the headway was 7 minutes.

The structural model of passenger perception demonstrated that user acceptance is directly and indirectly influenced by transport management, service qualities, user capacity and user satisfaction. Both transport management and service quality have a positive correlation to user satisfaction. User capacity has a negative effect on user satisfaction. User satisfaction is an intervening variable between both transport management and service qualities with user acceptance. Those indirect effects are positive for user acceptance. In contrast, the effect of user satisfaction as an intervening variable between user capacity to user acceptance is negative. This implies that the higher the user's ability to pay, the more burdensome it is to feel satisfied with the service management and service qualities. Therefore, the service qualities in terms of security, comfort and orderliness greatly affect user satisfaction. The results of this study can be used to recommend short-, medium- and long-term strategies. The short-term strategy focuses on managing the type and schedule of vehicles. Meanwhile, medium- and long-term strategies focus on improving facilities and increasing transit connectivity between primary and secondary transportation systems.

ACKNOWLEDGEMENTS

We thank our field sampling assistants for their contributions.

REFERENCES

[1] Mantoro, B., The Importance of Transportation in Knitting Indonesia's Diverse Communities Together. *KnE Social Sciences*, pp. 340-352, 2021.

[2] Susantoro, B. & Parikesit, D., 1-2-3 Steps: Small Steps We Take Towards Sustainable Transport. *Majalah Transportasi Indonesia*, **1**(1), pp. 1–9, 2004 (in Indonesian).

[3] Tian, Z., Zhang, Z., Wang, H., & Ma, L. Complexity analysis on public transport networks of 97 large-and medium-sized cities in China. *International Journal of Modern Physics B*, **32**(09), 1850108, 2018.

[4] Said, L.B. & Syafey, I. The scenario of reducing congestion and resolving parking issues in Makassar City, Indonesia. *Case Studies on Transport Policy*, **9**(4), pp. 1849–1859, 2021. https://doi.org/10.1016/j.cstp.2021.10.004

[5] Nwachukwu, A.A., Assessment of passenger satisfaction with intra-City public bus transport services in Abuja, Nigeria. *Journal of Public Transportation*, **17**(1), pp. 99–119, 2014. https://doi.org/10.5038/2375-0901.17.1.5

[6] Bernhard, C., Oberfeld, D., Hoffmann, C., Weismüller, D. & Hecht, H., User acceptance of automated public transport: Valence of an autonomous minibus experience. *Transportation Research Part F: Traffic Psychology and Behaviour*, **70**, pp. 109–123, 2020. https://doi.org/10.1016/j.trf.2020.02.008

[7] Idris, Z. Performance level analysis of public transport user in Jogjakarta. *Dinamika Teknik Sipil*, **9**(2), 189–196, 2009 (in Indonesian).

[8] Miro, F., Perencanaan Transportasi untuk Mahasiwa, Perencana dan Praktisi, Erlangga, Jakarta, 2005. (in Indonesian)

[9] Directorate General of Land Transportation of Indonesia. Keputusan Direktorat Jenderal Perhubungan Darat Nomor SK.687/AJ.206/DRJD/2002, Tentang Pedoman Teknis Penyelenggaraan Angkutan Penumpang Umum di Wilayah Perkotaan Dalam Trayek Tetap dan Teratur. Jakarta, 2002. (in Indonesian)

[10] Leontiadis, I., Marfia, G., Mack, D., Pau, G., Mascolo, C. & Gerla, M., (). On the effectiveness of an opportunistic traffic management system for vehicular networks. *IEEE Transactions on Intelligent Transportation Systems*, **12**(4), 1537-1548, 2011.

[11] Hadiuzzman, M., Das, T., Hasnat, M.M., Hossain, S. & Rafee Musabbir, S., (). Structural equation modeling of user satisfaction of bus transit service quality based on stated preferences and latent variables. *Transportation Planning and Technology*, **40**(3), 257-277, 2017.

[12] Van Lierop, D., & El-Geneidy, A., Enjoying loyalty: The relationship between service quality, customer satisfaction, and behavioral intentions in public transit. *Research in Transportation Economics*, **59**, pp. 50-59, 2016.

[13] Schade, J. & Schlag, B., Acceptability of urban transport pricing strategies. *Transportation Research Part F: Traffic Psychology and Behaviour*, **6**(1), 45-61, 2003.

[14] Chan, W.C., Ibrahim, W. H.W., Lo, M.C., Suaidi, M.K. & Ha, S.T., (). Determinants of Customer Satisfaction and Loyalty in Public Transport: A PLS-SEM Approach. *Studies of Applied Economics*, **39**(8), 2021

[15] Ringle, C.M., Wende, S. & Becker, J.M., *SmartPLS 3. SmartPLS GmbH, Boenningstedt*, 2015. Http://www.Smartpls.Com. Accessed on: 4 Jun. 2021.

[16] 15 Statistic Central Bureau. Total Population by District and Gender in Makassar City (individuals), 2019-2021, [24] Statistic Central Bureau of Makassar City 2022. https://makassarkota.bps.go.id/indicator/12/72/1/jumlah-penduduk-menurut-kecamatan-dan-jenis-kelamin-di-kota-makassar.html Accessed on: 4 Jun. 2021.

[17] Djatnika, T., Suhartanto, D. & Leo, G., Penerapan model loyalitas pelanggan sebagai strategi untuk membangun daya saing jasa angkutan kota di Jawa Barat. *Prosiding Industrial Research Workshop and National Seminar*, **4**, pp. 110-115, 2013 (in Indonesian).

[18] Hidayat, N., Performance level analyses of public transportation using importance-performance analysis method. In *MATEC Web of Conferences,* **147**, 02001, 2018.

[19] Farda, M. & Balijepalli, C., Exploring the effectiveness of demand management policy in reducing traffic congestion and environmental pollution: Car-free day and odd-even plate measures for Bandung city in Indonesia. *Case Studies on Transport Policy*, **6**(4), pp. 577-590, 2018.

[20] Fan, W. & Chang, J., Assessment on Public Satisfaction of Public Housing Condition in Beijing. *IOP Conference Series: Earth and Environmental Science*, **153**(6), 62020, 2018.

[21] Nguyen, X.P., The bus transportation issue and people satisfaction with public transport in Ho Chi Minh city. *Journal of Mechanical Engineering Research and Development*, **42**, pp. 10-16, 2019.

[22] Sriyanto, A. & Ditto, D., Analysis of Customer Satisfaction Factors for Users of Transjakarta Bus Public Transportation Corridor 13 (Ciledug – Blok M). *Jurnal Ekonomika Dan Manajemen*, **7**(1), pp. 15–27, 2018 (in Indonesian).

[23] Amrapala, C. & Choocharukul, K., Perceived service quality and commuter segmentation of informal public transport service in Bangkok, Thailand. *Engineering Journal*, **23**(6), 1-18, 2019.

[24] Irtem, H.I.M., Ismail, A., Borhan, M.N., Das, A.M. & Alshetwi, A.B.Z. Case study of the behavioural intentions of public transportation passengers in Kuala Lumpur. *Case Studies on Transport Policy*, **6**(4), pp. 462–474, 2018.

[25] Saribanon, E., Sitanggang, R. & Amrizal, A. Transportation service user satisfaction to increase loyalty (in Indonesian). *Jurnal ManajemenTransportasi & Logistik*, **3**(3), pp. 317–326, 2016. https://doi.org/10.25292/j.mtl.v3i3.81

[26] Pakusch, C. & Bossauer, P. User Acceptance of Fully Autonomous Public Transport. *In Proceedings of the 14th International Joint Conference on E-Business and Telecommunications - ICE-B*, pp. 52–60, 2017. https://doi.org/10.5220/0006472900520060.

[27] Nordhoff, S., de Winter, J., Madigan, R., Merat, N., van Arem, B. & Happee, R., User acceptance of automated shuttles in Berlin-Schöneberg: A questionnaire study. *Transportation Research Part F Traffic Psychology and Behaviour*, **58**, pp. 843–854, 2018. https://doi.org/10.1016/j.trf.2018.06.024

[28] Cheng, Y.H. & Chen, S.Y., Perceived accessibility, mobility, and connectivity of public transportation systems. *Transportation Research Part A: Policy and Practice*, **77**, pp. 386-403, 2015.