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The impact of service quality and passenger satisfaction on passenger loyalty of Petra shuttle bus

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Abstract. To provide alternatives for students that usually using a private vehicle for traveling to campus and to optimize current parking supply, Petra Christian University has prepared Petra Shuttle Bus (PSB) that has started its service since April 2022. This study examines the most sensitive attribute that affects the car/motorcycle users to shift to PSB and the impact of service quality and passenger satisfaction on passenger loyalty of the PSB. Data were collected from a random sample of 126 students who have been using PSB and was analysed using PLS structural equation modeling. Based on the mode choice model, the parking fee is the most sensitive attribute that influences students to shift from private vehicle to PSB, compared with both time to find an empty parking space and time to walk from the parking lot or pick up location to campus buildings. Results show that service quality has significant positive effects on passenger satisfaction, and passenger satisfaction also has significant positive effects on passenger loyalty. But the service quality has insignificant negative effects on passenger loyalty. The results as well indicate that service quality explains up to 64.3% variance of passenger satisfaction, while service quality and passenger satisfaction explain up to 45.2% variance of passenger loyalty.

1 Introduction

Universities are recognized as unique sources of travel demand because the bulk of their residents have more flexible schedules than other types of population. Very few studies have been done on these colleges' travel habits, even though they have a distinctive and frequently significant impact on urban transport demand.

It is urgent to have a shuttle service on the university campus because most student residences are off-campus, students need the shuttle service as an alternative transportation to travel between their residences and the university.

For short-haul feeders, a shuttle bus is an alternate mode of transportation to a private vehicle or public transit. Providing shuttle bus services can help to reduce car trips [1-2] and may increase access to transit for people who don't want to drive [3].

Petra Christian University (PCU) has a Petra Shuttle Bus (PSB) service, as shown in Fig. 1, which started operating in April 2022, to provide transportation choices for students who frequently arrive on campus by private vehicle and to maximize the use of available parking.

Two units of shuttle serving 3 trips per day with route from Pakuwon Mall (PM) Surabaya to PCU as shown on Fig. 2.

The objectives of the current study are to identify the most sensitive attribute that influencing users of cars and motorcycles to switch to PSB as well as the influence of

service quality and passenger satisfaction on passenger loyalty of the PSB.



Fig. 1. Petra shuttle bus.

In this paper, a discrete choice modeling approach is used to build a transportation choice model. Choice models are used to study students' behavior and how they interact with available forms of transportation based on their choices and the parameters of the journey [4].

The attribute of the mode choice model used in this study is parking search time, walking time between the parking space and the destination, and parking fee [5-7]

A major determinant of whether or not people will opt to use public transportation instead of driving their own cars is the service quality of the transportation system [8-9]. Overall satisfaction of passenger depending on perceived quality of service [9-10], and passenger loyalty

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is typically impacted by passenger satisfaction as the primary reason [11]. More precisely, as passenger satisfaction rises, so does passenger loyalty, which means that happy passengers are more likely to keep using and recommending a service [12, 13].

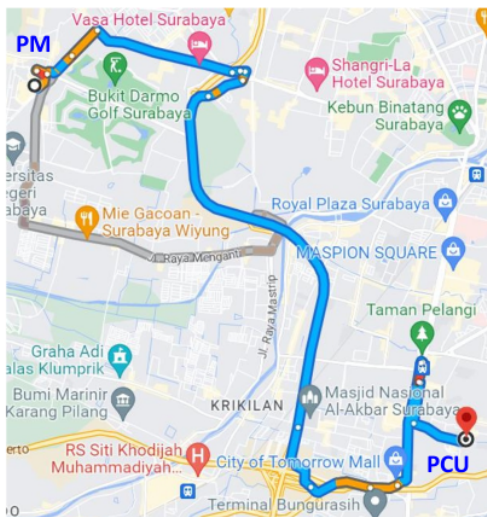


Fig. 2. Petra shuttle bus route.

The conceptual model of this study can be seen in Fig. 3. The conceptual model proposes that passenger loyalty is directly affected by two variables: service quality and passenger satisfaction.

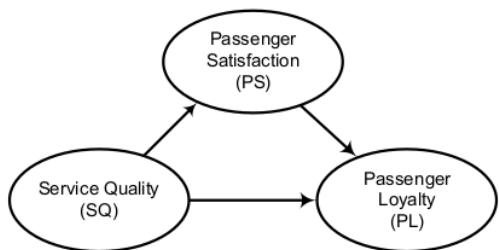


Fig. 3. Theoretical model framework.

2 Research Methods

Petra Shuttle Bus (PSB) passengers were asked to participate in the survey and provided with self-report information on the service quality, satisfaction, and loyalty of the PSB service. For the analysis, a total of 126 questionnaires were provided. Table 1-4 provides a summary of the key traits of the PSB riders.

Students consider that free fare and on time service are the top advantages of using PSB, while PSB capacity and inflexible PSB schedule are the top disadvantages of using PSB, as presented in Table 4.

Students prefer using PSB (73%) than car (20.6%) and motorcycle (6.3%) for traveling to campus. The comparison score, Likert scale 1 to 5, for several factors between mode is presented in Table 5.

Table 1. Respondent characteristics (n=126).

Gender (%)	
Male	33.3
Female	66.7
Students level (%)	
Freshmen	33.3
Sophomores	16.7
Juniors	24.6
Seniors	25.4
Distance between home to campus (%)	
< 5 km	3.2
5 - 10 km	8.7
10 - 15 km	40.5
15 - 20 km	31.0
20 - 25 km	11.9
> 25 km	4.8
Monthly income/pocket money (%)	
< IDR 1 million	64.3
IDR 1 - 2 million	29.4
> IDR 2 million	6.3
Monthly transportation expenses (%)	
< IDR 0.5 million	26.2
IDR 0.5 - 1 million	55.6
> IDR 1 million	18.3
Transportation to travel to and from campus (%)	
Car*	54.8
Motorcycle**	21.4
PSB	11.9
Others	11.9

Table 2. Car users' (n=69).

Car driver or passenger (%)	
Drive yourself	46.4
Driven by someone you know	53.6
Car accessibility (%)	
Always	24.6
Frequent	30.4
Occasionally	31.9
Rarely	13.0
Car availability (%)	
1	76.8
2	20.3
> 2	2.9
Car occupancy (%)	
Drive alone	50.7
Two person per car	40.6
More than two person per car	8.7

Table 3. Motorcycle users' (n=27).

Motorcycle driver or passenger (%)	
Ride yourself	51.9
Ride by someone you know	48.1
Motorcycle accessibility (%)	
Always	22.2
Frequent	22.2
Occasionally	40.7
Rarely	14.8
Motorcycle availability (%)	
1	88.9
2	11.1

The logistics model estimation used in this study is a modeling methodology of dichotomous variables (binary choice) and is based on logistics distribution [14]. Based on regression analysis as shown in Fig. 4, the utility function for car/motorcycle and PSB as shown in Equation 1.

$$Y = -0.9555 - 0.0537X_1 - 0.0532X_2 - 0.0002X_3 \quad (1)$$

where Y is utility car/motorcycle – PSB, X_1 is a difference of time to find an empty parking space (minute), X_2 is a difference of time to walk to a destination (minute), and X_3 is a difference of parking fee (IDR)

Based on the mode choice model, the utility of car/motorcycle users for each attribute of the mode choice model, which are:

- 1) Time to find an empty parking space,
- 2) Time to walk from the parking lot or pick up location of campus buildings, and
- 3) Parking fee is shown in Fig. 5-7.

The most sensitive attribute that affects the utility of car/motorcycle users is the parking fee, compared with time to search parking space and walking time to destination. It is expected that increasing parking fee will reduce the utility of car/motorcycle users, by contrast, will increase the utility of PSB users.

13 measuring items from earlier relevant studies were altered and included in the questionnaires created for the investigation. There were six PSB service quality measurement items, three passenger satisfaction measurement items, and four passenger loyalty measurement items. On a five-point Likert scale (from 1 for strongly disagreeing to 5 for strongly agreeing), the respondents were asked to indicate their agreement or disagreement with several statements. Partial Least Squares Structural Equation Modeling (PLS-SEM) was used to analyze the conceptual model for this investigation.

Table 4. Petra shuttle bus service (n=126).

Expected pick-up point (%)	
Galaxy Mall	23.8
Grand City Mall	2.4
Lenmarc Mall	59.5
Pakuwon City Mall	11.9
Plaza Surabaya	2.4
Know about Petra Shuttle Bus service (%)	
PSB route	99.2
PSB apps	97.6
PSB schedule	96.0
Free fare	96.0
Number of buses	91.3
Information about PSB (%)	
Email	17.5
Instagram	46.9
Others	28.0
Petra mobile apps	7.7
Frequency of using PSB (%)	
Monday to Friday	42.9
Two times per week	19.8
Once per month	7.9
Once per week	7.9
Once	6.3
Occasionally	6.3
Three times per week	5.6
Rarely	2.4
Four times per week	0.8
Reason for using PSB (%)	
Attending class	88.9
Others	9.5
Cost-effective	1.6
Advantage for using PSB (%)	
Free fare	95.2
On-time service	73.8
Comfort while traveling	66.7
Air conditioning	61.9
Friendly driver	55.6
Pick-up point location	53.2
Ease reservation/cancelation	32.5
Disadvantage for using PSB (%)	
Bus capacity	92.9
Schedule does not match	76.2
Apps malfunction	68.3
Difficulty while scan QR code	19.0
Pick-up point location	7.9

Table 5. Mode choice comparison.

	PSB	Car	Motorcycle
Travel time	4.50	4.08	4.50
Walking time to destination	3.74	3.38	4.13
Flexible schedule to travel	4.09	4.19	4.63
Travel expenses	4.53	4.04	4.50
Comfort while traveling	4.47	4.38	3.63

Model Summary

R	R Square	Adjusted R Square
.329 ^a	0.108	0.106

a. Predictors: (Constant), Fee, Walk, Park

ANOVA^a

	Sum of Squares	df	Mean Square	F	Sig.
Regression	227.526	3	75.842	45.596	.000 ^b
Residual	1879.572	1130	1.663		
Total	2107.097	1133			

a. Dependent Variable: Numerik

b. Predictors: (Constant), Fee, Walk, Park

Coefficients^a

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error			
(Constant)	-0.9555	0.053		-17.892	0.000
Park	-0.0537	0.008	-0.208	-7.009	0.000
Walk	-0.0532	0.008	-0.184	-6.548	0.000
Fee	-0.0002	0.000	-0.254	-8.565	0.000

a. Dependent Variable: Numerik

Fig. 4. Screenshot of regression statistics results.

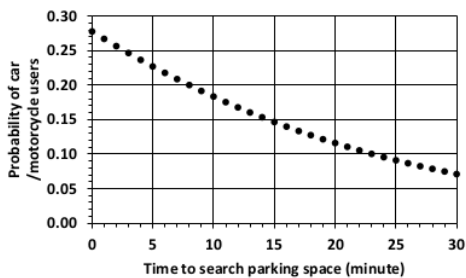


Fig. 5. Utility of car/motorcycle users base on time to search parking space.

3 Results and discussion

According to Table 6, all the individual item reliability is greater than 0.7. The internal consistency reliability, Cronbach's α and Construct Reliability (CR) of all constructs loaded from 0.783 to 0.880 and from 0.874 to 0.909. Thus, all constructs have met and exceeded the acceptable threshold of reliability (0.7). The internal consistency of items, therefore, was confirmed. The convergent validity (Average Variance Extracted/AVE) off all constructs loaded from 0.625 to 0.698. As a result,

the AVE test has performed better than the recommended cut-off value of 0.5, demonstrating satisfactory convergent validity.

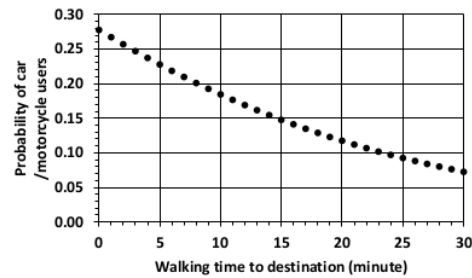


Fig. 6. Utility of car/motorcycle users base on walking time to destination.

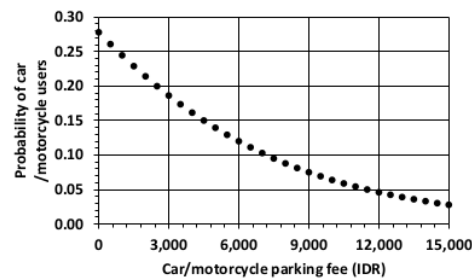


Fig. 7. Utility of car/motorcycle users' base on parking fee.

Table 6. Results of tests of reliability and validity.

Cons.	It.	LF	Ca	CR	AVE
SQ	SQ1	0.763	0.880	0.909	0.625
	SQ2	0.811			
	SQ3	0.777			
	SQ4	0.765			
	SQ5	0.787			
	SQ6	0.840			
PS	PS1	0.861	0.783	0.874	0.698
	PS2	0.838			
	PS3	0.807			
PL	PL1	0.851	0.833	0.888	0.664
	PL2	0.850			
	PL3	0.747			
	PL4	0.808			

where Cons. = Constructs, It. = Items, CR = Construct Reliability, AVE = Average variance extracted, LF = Loading factor, α = Cronbach's α , SQ = PSB service quality, PS = Passenger satisfaction, and PL = Passenger loyalty.

The Fornell and Larcker's criterion, the cross-loading criterion, and the Heterotrait-Monotrait Ratio (HTMT) criterion are all used to determine whether a construct is distinct from another. As seen in Table 7, the square root of AVE has a stronger square correlation than other constructs, ranging from 0.804 to 0.835. The outcomes suggested that the model's discriminant validity had been validated.

Table 8 demonstrates that all measuring element loadings are larger than all other cross-loadings, demonstrating that the model's discriminating validity has been attained. To attain discriminant validity, the HTMT

threshold value as an estimate of the real correlation between two constructs must be less than 0.85.

Table 7. Discriminant validity (fomell-larcker criterion).

Items	SQ	PS	PL
SQ	0.804		
PS	0.791	0.835	
PL	0.510	0.676	0.815

Table 8. Discriminant validity (cross-loading criterion).

	PL	PS	SQ
PL1	0.851	0.647	0.542
PL2	0.850	0.587	0.422
PL3	0.747	0.462	0.322
PL4	0.808	0.479	0.341
PS1	0.712	0.861	0.643
PS2	0.513	0.838	0.614
PS3	0.452	0.807	0.756
SQ1	0.378	0.672	0.763
SQ2	0.463	0.696	0.811
SQ3	0.399	0.622	0.777
SQ4	0.267	0.551	0.765
SQ5	0.391	0.634	0.787
SQ6	0.490	0.620	0.840

Table 9 shows that all values are less than the acceptable level. As a result, all constructs' discriminant validity has been established. This study's overall measurement model results show that all trajectory model measurements fulfilled conventional standards for reliability and validity. Fig. 8 showed the results of the structural model.

Table 9. Discriminant validity (HTMT criterion).

	CL	CS
CL		
CS	0.816	
SQ	0.574	0.693

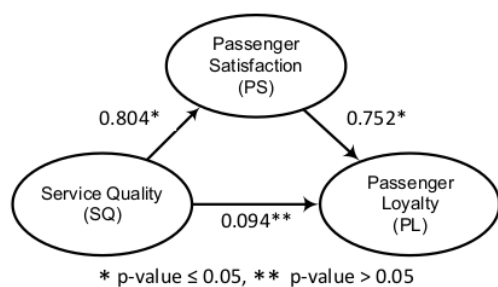


Fig. 8. Structural model of service quality and passenger satisfaction on passenger loyalty.

The coefficient of determination (R²) of PS (0.643) and PL (0.452) are considered moderate and acceptable. This means that PSB service quality (SQ) explained 64.3% of the variation in passenger satisfaction (PS),

while both SQ and PS explained 45.2% of the variation in passenger loyalty (PL). The expected relevance (Q²) and Goodness of Fit (GoF) of the structural model were between 0.804 and 0.602 using R² (0.643 and 0.452) and the AVE (0.625, 0.698, and 0.664). As a result, the model is predictively relevant and acceptable.

4 Conclusions

Findings from this study are: Firstly, students tend to shift to the Petra Shuttle Bus for travel to campus if parking fee, time to find an empty parking space, and time to walk from the parking lot to campus buildings is increasing, secondly, PSB service quality has significant positive effects on passenger satisfaction, which in turn has a significant positive impact on passenger loyalty. However, the service quality has a negligible negative impact on passenger loyalty. Passenger satisfaction fully mediates the influence of PSB service quality on passenger loyalty. The model can explain approximately 64.3% of the variation in passenger satisfaction and 45.2% of the variation in passenger loyalty, respectively. When dealing with human behavior, there will always be some inexplicable variation owing to randomness.

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