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Original Article

Trans Jogja Bus adaptation in the efforts of improving services during pandemic

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Abstract

During the pandemic the government has issued some policies, one of which is mobility restriction for people. This restriction affected the public transportation sector, including Trans Jogja Bus for which passengers decreased by 69%. A study was conducted to find reasonable solutions for the emerging problem by using passengers' safety approach and taking health protocols into consideration in both Trans Jogja Bus stop and in the vehicle. Data collection was done online by distributing questionnaire link through social media and targeting 100 respondents. Structural Equation Model (SEM) was used in the data analysis. The analysis results show that latent variables 'health protocol implementation by the bus operator' and 'health protocol implementation in the bus stop' significantly affected the passengers' decision to travel by using Trans Jogja Bus during the pandemic. In contrast, the latent variable 'health protocol implementation by the passengers' had little significance to the passengers' decision to travel by using Trans Jogja Bus.

Keywords: adaptation, Covid–19, pandemic, SEM, Trans Jogja Bus

1. Introduction

Since the first case was found in the early of March 2020, the number of coronavirus disease (COVID–19) infections grew rapidly in Indonesia. The outbreak caused public sector to suffer imminent blows. The impact of the pandemic can be witnessed not only in health and economic sectors, but also in public transportation sector. Several circular letters have been issued by the Indonesian Government to oversee public activities in order to suppress the virus from spreading, requiring working from home, studying from home, as well as praying from home. The Ministry of Transportation and The Ministry of Health have also issued some regulations related to health protocol implementation in all running public transportation, for example Circular Letter of Ministry of Transportation Republic of Indonesia No. SE 93 Year 2021 regarding the regulation of domestic mobility for people by using land transportation during COVID 19 pandemic. The policy of mobility restriction for people greatly affected the ease of travel, both in duration and in distance, during the pandemic (Hensher, Wei, Beck, & Balbontin, 2021; Kartal, Depren, & Depren, 2021; Katrakazas, Michelaraki, Sekadakis, & Yannis, 2020; Parker *et al*., 2021).

The mobility restriction for people has resulted in a decreased number of passengers on public transportation (Cződörová *et al*., 2021; Hensher *et al*., 2021; Jenelius & Cebecauer, 2020; Kartal *et al*., 2021; Katrakazas *et al*., 2021; Kementerian Transportasi Indonesia, 2020; Lau *et al*., 2020; Sun, Wandelt, & Zhang, 2021), and there is a tendency for people to use private vehicles (Das *et al*., 2021; Schaefer, Tuitjer, & Levin–Keitel, 2021). Mode choice during travel may affect the number of fatal accidents (Moeinaddini, Asadi–Shekari, Sultan, & Shah, 2014). Government

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regulations on public transportation operation during the pandemic included the limitation on seating provided, i.e. maximally 50% of total seats available in the public vehicle, and the curb of operating hours (Peraturan Menteri Perhubungan No. 18/2020). These regulations caused public transportation to become unable to perform its full function in services (Hasselwander *et al*., 2021). In addition, people became reluctant to use public transportation due to the assumption that it is one of the media that transmit the coronavirus (Dong, Jia, & Tian, 2021; Rasca, Markvica, & Ivanschitz, 2021; Sogbe, 2021).

There is a relation between the impact of pandemic and the decrease in number of passengers on public transportation (Lau *et al*., 2020). Data shows that since 1st of April 2020 the number of passengers of Trans Jogja had started to decrease severely, from 20,000 passengers before the pandemic to 7,000 passengers during the pandemic. The significant loss of passengers highly impacted the management, and 72 employees were laid off during the pandemic. The operating hours of Trans Jogja Bus were also adjusted from 05.00 AM – 09.00 PM before the pandemic to 06.00 AM – 06.00 PM during the pandemic. As a result, the number of buses operated was decreased by up to 30%. Trans Jogja Bus also halted its operation temporary due to the enforcement of activity restrictions for people (PPKM) caused by the massive outbreak of COVID–19 in several areas of Indonesia, including Yogyakarta.

The purpose of this study was to explore the impacts of the pandemic on the Trans Jogja Bus operation and its countermeasures, so that Trans Jogja Bus may perform its services well. The novelty of this study lies in the public transportation planning, which concerns not only technical, economic, environmental, and social aspects, but also the wellbeing aspect by the implementation of health protocols. This study illustrates the the policymakers the attempts and efforts in how public transportation, especially the Trans Jogja Bus, can deal with the passenger safety in a period of pandemic.

2. Materials and Methods

The study location was in Yogyakarta, Indonesia. The data collection was performed online by distributing link to a research questionnaire through social media. The target audience was those who frequently travel by Trans Jogja and whose travel routine was affected by the decreased frequency of Trans Jogja services. 100 samples were chosen out of the 137 respondents. The desired sample size was calculated by using the formula in Figure 1.

$$n = \frac{N}{1 + Ne^2}$$

$$\frac{7.000}{1 + 7.000(0.1)^2} = 98.59 \text{ responden}$$

Figure 1. Slovin's formula

In it:

n = number of research samples
N = number of population (7,000)
e = margin error (0.1)

To analyze the data, Structural Equation Modelling (SEM), a combination of factor analysis and regression analysis, was used. SEM consists of latent variables and indicator variables, where the latent variables consist of two or more indicator variables, as shown in Figure 2. Latent variables are variables that could not be measured directly but are constructed using one or more indicator variables.

2.1 Measurement model

The measurement model explains the connection between latent variables and indicator variables, as shown in Figure 2.

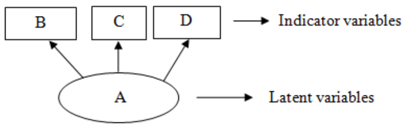

Figure 2. The connection between latent variable and indicators

2.2 Structural model

The structural model explains the connection between latent variables, as shown in Figure 3.

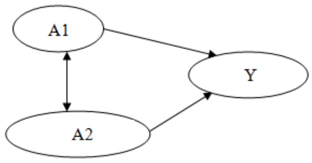

Figure 3. The structural model in SEM

The latent variables of this study were: health protocols implementation by Trans Jogja Bus operators (X1); health protocols implementation by Trans Jogja Bus passengers (X2); health protocols implementation at Trans Jogja Bus Stop (X3); and passengers' decision in choosing Trans Jogja Bus during pandemic (mode choice) (Y). The indicator variables for the latent variable X1 were X1.1 to X1.10; the indicator variables for the latent variable X2 were X2.1 to X2.5; the indicator variables for the latent variable X3 were X3.1 to X3.7; and, the indicator variables for the latent variable Y were Y1 to Y5, as shown in Table 1.

Further, SEM analysis was carried out by creating the path diagram shown in Figure 4. Each indicator was reflective. There were two tests on SEM analysis, i.e. evaluation of measurement model and structural model assessment. The evaluation of measurement model consisted of 4 assessments, i.e. convergent validity test, validity test by using average variance extracted (AVE) value, and reliability test by using composite reliability value and Cronbach alpha value. Convergent validity test was performed by examining the correlation between reflexive indicator score and latent variable. The indicator was reliable if the correlation was above 0.7, although in scale development research a correlation of 0.5 – 0.6 could still be accepted. Meanwhile, for the validity test, AVE value of latent variable needed to be above 0.5. In addition, the composite reliability and Cronbach alpha for reliability must be above 0.7. Structural model assessment was done by examining R^2 of the model. Then,

Table 1. Latent and manifest variables

	Variable	Symbol	Remark
A	Health protocols implementation by Trans Jogja Bus operators	X1	L
	The availability of hand sanitizer and mask inside the bus	X1.1	I
	Periodic health checkup for bus staff	X1.2	I
	The availability of health protocol information inside the bus	X1.3	I
	The availability of protective barrier between bus driver and passengers	X1.4	I
	The promptness of bus arrival to reduce contact period among passengers and between bus staff and passengers	X1.5	I
	The implementation of physical distancing inside the bus	X1.6	I
	Periodic disinfectant spraying inside the bus	X1.7	I
	The implementation of different bus fare during peak hours	X1.8	I
	Special attention on bus cleanliness by both staff and passengers	X1.9	I
	Digital ticket checking	X1.10	I
B	Health protocols implementation by Trans Jogja Bus passengers	X2	L
	Passengers are required to wear mask	X2.1	I
	Passengers are required to bring hand sanitizer	X2.2	I
	Cashless bus ticket payment	X2.3	I
	Passengers are required to show proof of vaccination	X2.4	I
	Passengers are required to show proof of vaccination	X2.5	I
C	Health protocols implementation at Trans Jogja Bus stop	X3	L
	The availability of hand sanitizer and mask at the bus stop	X3.1	I
	Periodic health checkup for staff	X3.2	I
	The availability of health protocol information at the bus stop	X3.3	I
	The implementation of physical distancing at the Bus Stop	X3.4	I
	Periodic disinfectant spraying at the bus stop	X3.5	I
	Special attention on the bus stop cleanliness by both staff and passengers	X3.6	I
	Consideration for bus arrival punctuality	X3.7	I
D	Passengers decision in choosing Trans Jogja Bus during pandemic (Mode Choice)	Y	L
	Security assurance at the bus stop and inside the bus signifies passengers to decidedly travel by using Trans Jogja Bus during pandemic	Y1	I
	Safety assurance at the bus stop and inside the bus signifies passengers to decidedly travel by using Trans Jogja Bus during pandemic	Y2	I
	Comfort assurance at the bus stop and inside the bus signifies passengers to decidedly travel by using Trans Jogja Bus during pandemic	Y3	I
	Inexpensive ticket fare signifies passengers to decidedly travel by using Trans Jogja Bus during pandemic	Y4	I
	Punctuality assurance signifies passengers to decidedly travel by using Trans Jogja Bus during pandemic	Y5	I

Description L = latent variable, I = indicator variable

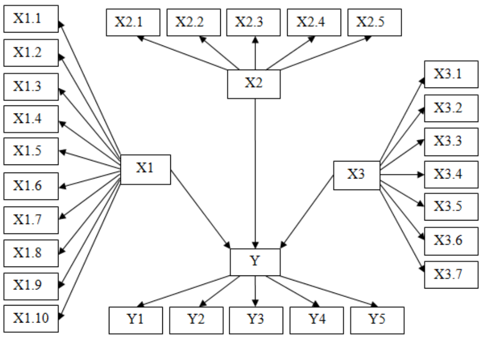

Figure 4. Trans Jogja Bus SEM model

significance test was performed by using parameter coefficient value and t statistical significance.

3. Results and Discussion

3.1 Evaluation of the measurement model

The structural equation modeling analysis showed that several indicators possessed correlations above 0.7, and several others possessed correlations below 0.7, as shown in Table 2. To find the accuracy of the model, this study reserved correlations above 0.7. Several indicators of which correlations were below 0.7 were excluded from the model, i.e. X1.1, X1.2, X1.3, X1.8, X2.4, and X3.7. Further, it was necessary to re–estimate the model by removing the excluded indicators.

After the excluded indicators were removed from the model as shown in Figure 5, re–estimation was carried out. The results of the re–estimated model showed that all indicators of each latent variable had correlations above 0.7 in accordance with statistical requirements as shown in Table 3. This meant that each latent variable (X1, X2, X3 and Y) could be measured by using the respective individual indicators. The latent variable X1 could be measured by indicators X1.4, X1.5, X1.6, X1.7, X1.9, and X1.10. The latent variable X2 could be measured by indicators X2.1, X2.2, X2.3, and X2.5. The latent variable X3 could be measured by indicators X3.1, X3.2, X3.3, X3.4, and X3.6. The latent variable Y could be measured by indicators Y1, Y2, Y3, Y4, and Y5.

Next, validity test was performed by examining the AVE of latent variables X1, X2, X3 and Y. The AVE of each latent variable was above 0.5 as shown in Table 4. This indicated that this model was satisfactory. Reliability test was carried out by examining the composite reliability and the Cronbach alpha of each latent variable, which were above the required 0.7 as shown in Table 4. This meant that the latent variables (X1, X2, X3, and Y) were reliable.

Table 2. Correlations of individual indicators

No	Latent variable	Symbol	P–value
1	X1	X1.1	0.592
		X1.2	0.676
		X1.3	0.663
		X1.4	0.805
		X1.5	0.754
		X1.6	0.752
		X1.7	0.810
		X1.8	0.470
		X1.9	0.728
		X1.10	0.762
2	X2	X2.1	0.802
		X2.2	0.701
		X2.3	0.828
		X2.4	0.525
		X2.5	0.779
3	X3	X3.1	0.723
		X3.2	0.875
		X3.3	0.861
		X3.4	0.846
		X3.5	0.789
		X3.6	0.871
		X3.7	0.690
4	Y	Y1	0.902
		Y2	0.900
		Y3	0.920
		Y4	0.821
		Y5	0.837

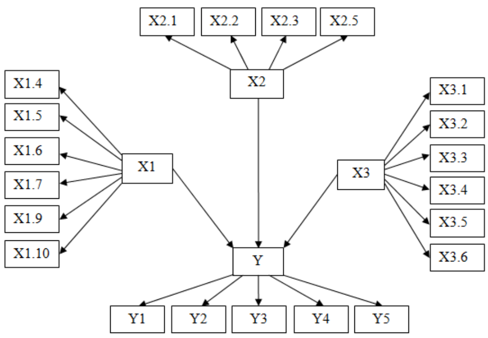

Figure 5. Trans Jogja Bus SEM corrected model

3.2 Structural model assessment

The structural model assessment by examining the t–statistical value and P–value is summarized in Table 5. T–statistical value was used to determine the level of significance and P–value was the probability value. Latent variable X1 (health protocol implementation by bus operator) and X3 (health protocol implementation at bus stop) significantly affected the passengers' decision to travel by Trans Jogja Bus. Meanwhile, latent variable X2 (health protocol implementation by passengers) insignificantly affected the passengers' decision to travel by Trans Jogja Bus.

Because the latent variable X2 did not significantly affect passengers' decision to travel by using Trans Jogja Bus during the pandemic, latent variable X2 was excluded from the model, as shown in Figure 5. Re–estimation was performed to calculate the t statistical value and the P–value, and these results now met the statistical requirements as shown in Table 5. Meanwhile, the R^2 of the model was 0.699. This meant that latent variables X1 (health protocol implementation by bus operator) and X3 (health protocol implementation at bus stop) could explain passengers' decision in choosing Trans Jogja Bus during pandemic (Y) by 69.9%, while the remaining 30.1% is explained by other variables.

Table 3. Correlations of individual indicators after re–estimation

No	Latent variable	Symbol	P–value
1	X1	X1.4	0.819
		X1.5	0.757
		X1.6	0.786
		X1.7	0.822
		X1.9	0.761
		X1.10	0.773
2	X2	X2.1	0.818
		X2.2	0.702
		X2.3	0.847
		X2.5	0.764
3	X3	X3.1	0.723
		X3.2	0.875
		X3.3	0.861
		X3.4	0.846
		X3.5	0.789
		X3.6	0.871
4	Y	Y1	0.902
		Y2	0.900
		Y3	0.919
		Y4	0.821
		Y5	0.837

Table 4. AVE, composite reliability and Cronbach alpha for the latent variables

Latent variable	AVE	Composite reliability	Cronbach alpha
X1	0.619	0.907	0.877
X2	0.616	0.864	0.795
X3	0.701	0.933	0.914
Y	0.769	0.943	0.924

Table 5. Path coefficients

Latent variable	Original sample	Sample mean	Standard deviation	t–statistic	P–value
Bus stop – Trans Jogja Bus option	0.423	0.421	0.133	3.180	0.002
Operator – Trans Jogja Bus option	0.423	0.426	0.147	2.888	0.004
Passengers –Trans Jogja Bus option	0.031	0.034	0.120	0.258	0.796
Bus Stop – The choice of Trans Jogja Bus	0.434	0.425	0.130	3.336	0.001
Operator – The choice of Trans Jogja Bus	0.439	0.450	0.128	3.435	0.001

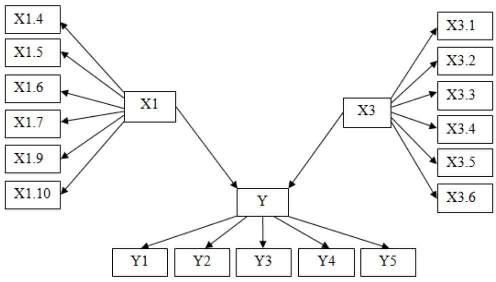

Figure 6. Final Trans Jogja Bus SEM model

4. Conclusions

The analysis results from structural equation modeling (SEM) showed that the latent variable X1 can be measured from indicators X1.4, X1.5, X1.6, X1.7, X1.9, and X1.10; the latent variable X2 can be measured from indicators X2.1, X2.2, X2.3, and X2.5; the latent variable X3 can be measured from indicators X3.1, X3.2, X3.3, X3.4, and X3.6, and, the latent variable Y can be measured from indicators Y1, Y2, Y3, Y4, Y5. The validity test of all latent variables resulted in AVE above 0.5, indicating that the obtained model was satisfactory. The reliability test gave composite reliability and Cronbach alpha above 0.7, meaning that the latent variable was reliable. From the structural model assessment, health protocol implementation by bus operator and at bus stop presented significant influences in passengers' choice of travel mode, supported by the R^2 of 69.9%. Meanwhile, the health protocol implemented by the passengers themselves presented little significance to the travel mode choice.

Based on this study, the significant variables which affected the passengers' choice in using Trans Jogja were the health protocol implementation inside the bus and at the bus stop. This can imply that the passengers prefer a transportation mode in which the services accommodate their needs in health and safety during the travel (inside the bus) from the origin to the destination (at bus stops). Therefore, it is recommended that policy makers and bus operators give more concern to health protocol implementations at both bus stop and in the bus vehicle, in order to improve the services during a pandemic.

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