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Identification of Surabaya Community Behavior Towards the Use of Wira Wiri Suroboyo as a Mode of Public Transportation

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ABSTRACT

Wira Wiri Suroboyo is a public transportation system operated by the Surabaya city government since 2023, aimed at reducing traffic congestion and environmental pollution caused by private vehicle usage. Despite its introduction, this mode of transportation has not yet achieved a significant shift among residents toward adopting Wira Wiri Suroboyo. To address this, the government must understand the behavior of Surabaya's residents regarding public transportation usage. Behavioral insights can serve as critical input for designing effective strategies to encourage people to transition to Wira Wiri Suroboyo. This research focuses on identifying the behavioral patterns of Surabaya residents who choose Wira Wiri Suroboyo as their public transport option, utilizing the Theory of Planned Behavior (TPB) framework. TPB provides an analytical model to evaluate behavior based on an individual's perceived control over their actions. Data for the study was collected through questionnaires distributed to Surabaya residents who use Wira Wiri Suroboyo. The findings reveal that attitude, perceived behavioral control, and behavioral intentions significantly influence user behavior. However, the subjective norm variable does not substantially impact the behavioral intentions of the Surabaya community in this context.

INTRODUCTION

The population of Surabaya city reached 3,009,286 as of mid-March 2024 and is expected to continue growing annually [1]. This has impacted road usage, leading to city traffic congestion. Other factors exacerbating congestion in Surabaya include the accumulation of activities at certain hours, such as simultaneous departure and return times during work hours, weather conditions, and the large number of traffic lights on every road in Surabaya [2]. Moreover, most Surabaya residents are accustomed to using private vehicles rather than public transportation for their daily activities. On the other hand, online transit has become one of the factors influencing people's behavior in choosing alternative transportation to replace private vehicles [3].

The presence of public transportation in major cities, such as Surabaya, can be one solution to the city's traffic congestion. After the success of the Suroboyo Bus and Trans Semanggi, the Surabaya City Department of Transportation is becoming more optimistic about developing public transportation. The Surabaya City Department of Transportation has developed city public transportation with the "Feeder" concept or small passenger transport vehicles, namely Wira Wiri Suroboyo [4]. Wira Wiri

Suroboyo differs from other public transit because Suroboyo Bus and Trans Semanggi can only operate on major roads. At the same time, Wira Wiri Suroboyo can reach small village roads and residential areas [5]. Wira Wiri Suroboyo offers good facilities in terms of passenger safety, comfort, and accessibility for people with disabilities [6].

Since its inception, Wira Wiri Suroboyo has operated a fleet of 52 vehicles across five distinct travel routes. The service operates from an initial departure time of 05:30 WIB to the final departure at 21:00 WIB. Regarding fares, passengers are charged a flat rate of IDR 5,000, applicable for the first two hours of travel. Additionally, passengers are allowed to transfer to the Suroboyo Bus at no extra cost. To enhance passenger safety and comfort, the government has also provided various supporting facilities for users of the Wira Wiri Suroboyo transportation system. the number of passengers utilizing Wira Wiri Suroboyo has increased significantly since July 2023, with recorded users reaching 64,054. This figure continued to rise, reaching 121,250 passengers by June 2024 [7].

The Government's effort to provide public transportation, especially Wira Wiri Suroboyo, is a commendable initiative that needs support. Some Surabaya residents have utilized this transport mode, but many have yet to use it. An individual's habit of using a product, including Wira Wiri Suroboyo, is influenced by various reasons such as norms, intentions, and behavior. Several theories are used to measure an individual's behavior, including the Theory of Planned Behavior (TPB), Innovation Diffusion Theory, Psychoanalytic Approach, Social Cognitive Theory, Model of PC Utilization (MPCU), Theory of Reasoned Action (TRA), and many more [8][9].

TPB is a model used to assess, model, and investigate people's behavior related to specific activities, products, or services [10]. TPB explains individual behavior in particular scenarios, exploring why someone behaves in a certain way [11][12]. The TPB method has been widely applied in various research topics, including the behavior of purchasing eco-friendly cosmetic products [13], the intention to consume poultry amidst H7N9 risk in China after the bird flu outbreak [14], exploration of tourist behavior while visiting Tibet [15], and many others. TPB has also been frequently used to analyze transportation-related issues, such as predicting the intention of Qatar residents to use public transportation systems in the future [16], examining the determinants influencing the purpose and behavior of using dockless bike-sharing [17], travel behavior related to the policy of converting mini-buses into city buses [18], and the behavior of public transportation use in Japan [19], among others. From these studies, TPB can be used to provide estimates of individual or group behavior and to identify the variables that influence or do not influence behavioral intention.

Applying the TPB method, three internal factors influence individual behavioral intention: attitude toward behavior, subjective norms, and perceived behavioral control. Attitude toward behavior is a self-response regarding positive or negative outcomes. Subjective norms refer to a person's perception of support or pressure from others in realizing or not realizing specific behavior. Perceived behavioral control is a self-perception of the behavior that will be performed. Behavior indicates how much influence each factor will have in the form of action [20][11]. This research aims to find out what factors encourage someone to behave using Wira Wiri Suraboyo. This study contributes to understanding the behavioral factors influencing Surabaya residents' use of Wira Wiri Suroboyo through the lens of the Theory of Planned Behavior (TPB). The contents of the statement for each variable are adjusted to the conditions of Surabaya residents. By identifying key determinants such as attitudes toward public transportation, subjective norms, and perceived behavioral control, the research

provides valuable insights into the motivations and barriers faced by users. The findings aim to assist policymakers in designing targeted interventions to encourage public transportation use, addressing issues like convenience, accessibility, and social influence. Additionally, this study highlights the need to improve public awareness and foster a positive perception of Wira Wiri Suroboyo, ultimately promoting sustainable urban mobility in Surabaya.

MATERIALS AND METHODS

This research was conducted to identify the behavior of Surabaya residents in using Wira Wiri Suroboyo as public transportation. Additionally, it examines the influence of the relationships between each variable in individual behavior. These variables form the main structure of the questionnaire. The variables used follow the five variables in the TPB model: attitude, subjective norm, perceived behavioral control, behavioral intention, and behavior. Each variable is represented by several indicators, with 18 statements used as indicators. All the indicators for each variable are listed in Table 1.

Table 1. Indicators for each variable in the questionnaire

No	Variable	Manifest variable
1	Attitude (X1)	X1.1: Using Wira Wiri Suroboyo can reduce traffic congestion in Surabaya city. X1.2: Using Wira Wiri Suroboyo can shorten travel time. X1.3: Using Wira Wiri Suroboyo feels like contributing to reducing air pollution. X1.4: Using Wira Wiri Suroboyo allows for a more enjoyable journey.
2	Subjective Norm (X2)	X2.1: Family sometimes/often uses Wira Wiri Suroboyo in daily activities. X2.2: People around me support using Wira Wiri Suroboyo as public transportation. X2.3: Information received about Wira Wiri Suroboyo makes me interested in trying it.
3	Perceived Behavioral Control (X3)	X3.1: Affordable pricing can be accepted by all groups. X3.2: Adequate vehicles that can pass through various routes, especially in village areas. X3.3: Clear departure time information is available for every schedule.
4	Behavioral Intention (Z)	Z1: Using Wira Wiri Suroboyo can have a long-term positive impact on public transportation in Surabaya. Z2: Wira Wiri Suroboyo can become a daily transportation alternative to private vehicles. Z3: Cashless payment methods and app-based bookings make it convenient for users. Z4: Discounts for students, free rides for senior citizens, and comfort for people with disabilities.
5	Behavior (Y)	Y1: Choosing Wira Wiri Suroboyo because I know the quality it offers. Y2: Choose Wira Wiri Suroboyo because of its affordable price and accessibility to all groups.

	Y3: Choosing Wira Wiri Suroboyo because it facilitates daily activities. Y4: I chose Wira Wiri Suroboyo because it supports public transportation development and Government programs.

The questionnaire was distributed online through Google Forms. Each indicator was assessed using a Likert scale ranging from 1 to 5. A score of 1 indicates a response of "strongly disagree," while a score of 5 indicates "strongly agree." The data from the questionnaire was then processed using SmartPLS.

One hundred respondents were sampled, which meets the minimum sample size based on the Slovin formula with a margin of error of 0.1. The Slovin method is highly suitable for determining sample size when dealing with large populations, such as Surabaya, which had a population of 3,009,286 in 2024. The criteria for respondents to fill out the questionnaire were that they must be residents of Surabaya and have used the Wira Wiri Suroboyo public transportation.

The hypothesis framework proposed in this study is as follows:

a. H1. Attitude influences behavioral intention when choosing Wira Wiri Suroboyo transportation.
b. H2. Subjective norm influences behavioral intention when choosing Wira Wiri Suroboyo transportation.
c. H3. Perceived behavioral control influences behavioral intention when choosing Wira Wiri Suroboyo transportation.
d. H4. Behavioral intention influences behavior when choosing Wira Wiri Suroboyo transportation.
e. H5. Perceived behavioral control influences behavior when choosing Wira Wiri Suroboyo transportation.
f. H6. The community exhibits a positive attitude when choosing Wira Wiri Suroboyo transportation.

RESULTS AND DISCUSSIONS

Respondent Description

In this study, data collection was conducted using a questionnaire distributed via Google Forms to 100 respondents. Descriptive data gathered from the respondents included gender, age, educational background, employment status, and experience using Wira Wiri Suroboyo. The results of the respondent description test showed that most respondents were female, totaling 61 people, while the remaining 39 were male. Most respondents had a high school education, with the most extensive age range being 21-30. However, based on data collection regarding experience, most respondents were first-time users of Wira Wiri Suroboyo.

Hypothesis Testing

The technique used for processing the primary data was Partial Least Square analysis with SmartPLS 4.0, consisting of the outer and inner models. The outer model measures data, while the inner model is used for structural data. The outer model analysis was conducted using convergent validity, discriminant validity, and composite reliability. Convergent validity tests whether a new measurement tool measures the same concept as an existing tool. Discriminant validity ensures that different ideas in the research are genuinely distinct. Composite reliability is used to assess internal consistency and the reliability of the measurement tool. All processed data showed valid

results based on the convergent validity test results, as the data value was >0.7. The results of the concurrent validity test are presented in Table 2.

Table 2. Convergent validity

Variable	Manifest variable	Loading factor	Significant (>0,7)
Attitude (X1)	X1.1	0.874	Valid
	X1.2	0.729	Valid
	X1.3	0.835	Valid
	X1.4	0.823	Valid
Subjective Norm (X2)	X2.1	0.786	Valid
	X2.2	0.864	Valid
	X2.3	0.858	Valid
Perceived Behavioral Control (X3)	X3.1	0.842	Valid
	X3.2	0.830	Valid
	X3.3	0.774	Valid
Behavioral Intention (Z)	Z.1	0.863	Valid
	Z.2	0.787	Valid
	Z.3	0.777	Valid
	Z.4	0.786	Valid
Behavior (Y)	Y.1	0.886	Valid
	Y.2	0.876	Valid
	Y.3	0.882	Valid
	Y.4	0.889	Valid

Based on convergent validity, the data processing results indicate that the requirements have been met (valid). However, if the Average Variance Extracted (AVE) result does not meet the requirement and is below 0.5, it shows that the indicators have a high average error rate and cannot proceed to the next stage. Based on the AVE results, the average error rate was low, with each variable having an AVE value >0.5. The results of the AVE test are presented in Table 3.

Table 3. AVE test

Variable	AVE
X1	0.667
X2	0.700
X3	0.666
Z	0.647
Y	0.780

Discriminant validity testing was conducted to determine the correlation between each variable or indicator with the highest loading value. The results of the discriminant validity test consist of cross-loading and the Fornell-Larcker criterion. Based on the cross-loading calculation, the results show an appropriate correlation between each variable and its indicator. This can be seen based on each variable's high latent variable value, allowing the process to proceed to the next stage. The cross-loading values are presented in Table 4.

Table 4. Cross loading

	X1	X2	X3	Y	Z
X1.1	0.874	0.735	0.603	0.580	0.640
X1.2	0.729	0.499	0.487	0.483	0.396

	X1	X2	X3	Y	Z
X1.3	0.835	0.605	0.638	0.650	0.739
X1.4	0.823	0.608	0.457	0.517	0.576
X2.1	0.494	0.786	0.627	0.456	0.556
X2.2	0.681	0.864	0.678	0.582	0.572
X2.3	0.718	0.858	0.624	0.540	0.560
X3.1	0.602	0.626	0.842	0.719	0.670
X3.2	0.487	0.619	0.830	0.590	0.498
X3.3	0.564	0.648	0.774	0.515	0.464
Y.1	0.552	0.520	0.663	0.886	0.576
Y.2	0.641	0.552	0.716	0.876	0.677
Y.3	0.589	0.543	0.658	0.882	0.629
Y.4	0.652	0.605	0.638	0.889	0.746
Z.1	0.690	0.593	0.617	0.675	0.863
Z.2	0.602	0.471	0.484	0.597	0.787
Z.3	0.597	0.499	0.502	0.626	0.777
Z.4	0.487	0.607	0.585	0.486	0.786

The measurement data criteria with the Fornell-Larcker criterion were fulfilled, allowing the process to continue. The Fornell-Larcker criterion results are shown in Table 5.

Table 5. Fornell-larcker criterion

	X1	X2	X3	Y	Z
X1	0.817				
X2	0.756	0.837			
X3	0.678	0.769	0.816		
Y	0.691	0.630	0.758	0.883	
Z	0.745	0.673	0.680	0.747	0.804

All variable data were sufficiently reliable, as the composite reliability value was >0.6. The composite reliability values are presented in Table 6.

Table 6. Composite reliability

Variable	Composite reliability
X1	0.865
X2	0.785
X3	0.774
Y	0.908
Z	0.826

The data measurement model stage has shown reliable results, allowing the process to proceed to the structural data model stage (inner model).

Structural Data Model (Inner Model)

The inner model analysis stage was conducted to ensure the structural data processing model is sufficiently robust and accurate. This allows for the next stage, which involves R-Square and Q-Square tests.

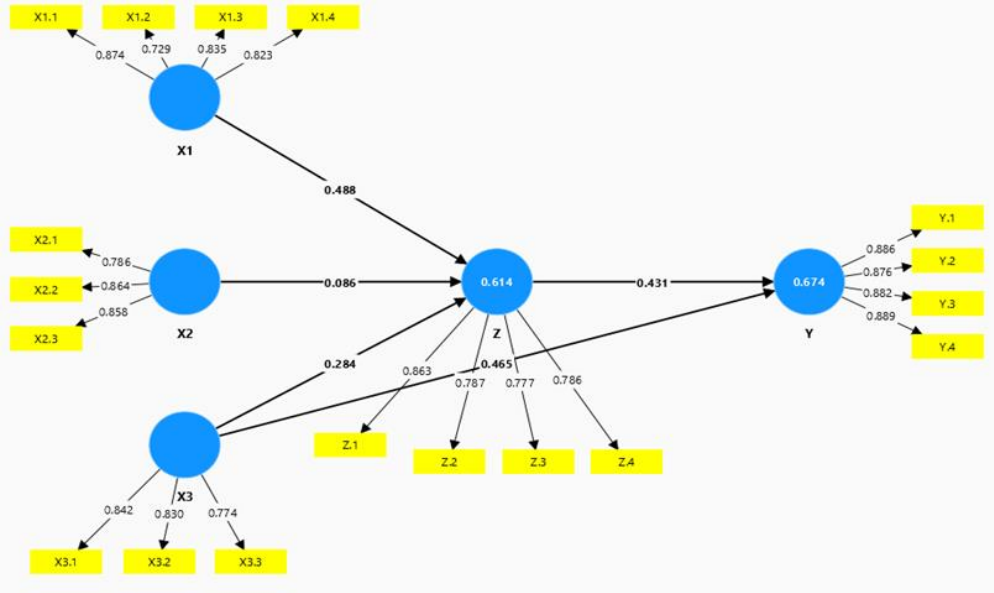

Figure 1. Data processing results

Variable Z acts as the intermediary between variables X and Y. In conclusion, variable Z, "Behavioral Intention," is influenced by 61% from variables X1, X2, and X3. Since the adjusted R-Square is 60%, the influence of the exogenous variables X and Y is considered moderate. The result for variable Y, or "Behavior," from this research shows that 67% is influenced by variables X1, X2, X3, and Z. Since the adjusted R-Square is 66%, the exogenous variables X and Z influence is also considered moderate.

Table 7. R-square results

	R-Square	Adjusted R-square
Z	0.614	0.602
Y	0.674	0.667

The Q-square test is a predictive relevance test that shows how well the observed values are generated. The Q-square value can be calculated with the following formula:

$$Q\text{-}square = 1 - (1\text{-}R1^2)(1\text{-}R2^2)$$

Therefore, the Q-square value is:

$$Q\text{-}square = 1 - (1\text{-}0{,}614^2)(1\text{-}0{,}674^2) = 0{,}660$$

If the observation value is above 0 (>0), the study's observation value is already 60% or good.

Hypothesis Testing

The hypothesis testing used two-tailed processing by comparing the t-statistic and t-table values. The confidence level was 95%, meaning the t-table value should be >1.96. The hypothesis is accepted if the t-statistic value is higher than the t-table value. Based on Table 8, one variable (X2) does not meet the requirements or does not significantly influence variable Y, meaning the hypothesis for X2 is rejected.

The next step is calculating the Path Coefficient value, which aims to indicate the direction of the relationship between each variable. If the value is greater than 0, it means a positive influence from the variable, and vice versa. Based on Table 8, variables X1, X2, X3, and Z positively influence variable Y.

Table 8. Hypothesis testing results

Influence	Path coefficient	t-Statistic	Result
X1>Z	0.488	4.626	Supported
X2>Z	0.086	0.633	Not Supported

X3>Z	0.284	4.932	Supported
X3>Y	0.465	2.292	Supported
Z>Y	0.431	4.398	Supported

The hypothesis testing results show that the decision of Surabaya residents to choose Wira Wiri Suroboyo transportation is influenced by the variables of attitude, perceived behavioral control, behavioral intention, and behavior. The indicators for the attitude variable include using Wira Wiri Suroboyo to reduce traffic congestion, speed up travel time, reduce air pollution, and make the journey more enjoyable. The indicators for the perceived behavioral control variable include using Wira Wiri Suroboyo because of its affordability, ability to pass through village roads, and certainty of departure times. The indicators for the behavioral intention variable include using Wira Wiri Suroboyo for its long-term positive impact, its ability to replace private vehicles, its user-friendly app-based system, and the comfort it provides for students and people with disabilities. The indicators for the behavior variable include using Wira Wiri Suroboyo because of knowing the quality of service, its affordable price, its convenience for daily activities, and its support for Government programs.

Meanwhile, the subjective norm variable does not significantly influence people's behavior when choosing Wira Wiri Suroboyo. This contrasts with previous research by Kalwar, which found that all variables affect people's behavioral intention to use the Karachi Circular Railway [21]. Factors influencing transportation use differ by country, including economic factors, cultural differences in public transportation use, city infrastructure, population density, and the quality of public transportation services [22].

When compared to the characteristics of Surabaya city residents, several key factors differentiate this research hypothesis from previous studies. These include the preference of most Surabaya residents for private vehicles, which are perceived as more efficient and flexible; the unequal distribution of public transportation services in certain areas of the city; the high population density of Surabaya; the unfamiliarity of many residents, especially the elderly, with technology-based public transportation systems; and the lack of strict enforcement of regulations regarding public transportation usage by the city government. Furthermore, the limited dissemination of information to the public exacerbates these issues [23].

CONCLUSION

Overall, the objectives of this research can be concluded as follows: the behavior of Surabaya residents in choosing Wira Wiri Suroboyo public transportation is influenced by attitude, perceived behavioral control, behavioral intention, and behavior itself. However, this research could not prove that subjective norms influence the choice of Wira Wiri Suroboyothis case; many other indicators may influence the subjective norms of Surabaya residents. A suggestion for future researchers is to include different models related to driving safety.

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