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Research paper

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ABSTRACT

Purpose: This study aims to analyze public transportation preferences in the Special Region of Yogyakarta (DIY). The focus is on comparing Trans Jogja and online transportation based on the criteria of comfort, time efficiency, convenience, safety, and cost. The goal is to determine which mode is most prioritized by residents in this densely populated city.

Methods/Design: The Analytic Hierarchy Process (AHP) method was applied to compare preferences for two transportation modes based on specific criteria. A survey of 100 users of both modes was conducted to collect assessment data for each criterion. The assessment results were then processed using the AHP to generate quantitative preference weights and determine priority mode choices systematically and measurably.

Findings: The results of the study showed that in terms of comfort, Trans Jogja obtained the highest score of 20.23%, slightly higher than online transportation at 19.95%. However, in terms of time efficiency, online transportation excelled with a score of 30.29%, far above Trans Jogja, which only achieved 9.98%. The dominant factors influencing the decision to choose a mode of transportation were convenience (25%), time (22%), comfort (20%), safety (18%), and cost (15%). In terms of accessibility and availability, online transportation also excelled with 69%, compared to Trans Jogja, which only achieved 31%.

Practical implication: The results of this study indicate that online transportation is the primary choice for passengers due to its speed, ease of access, and higher availability. These findings can serve as a basis for Trans Jogja operators to improve service quality, expand fleet coverage, and improve travel times.

INTRODUCTION

Indonesia's population growth has increased significantly over the past two decades. According to data from the Central Statistics Agency (BPS), Indonesia's population is projected to reach 278.696 million by mid-2023, up from 270.203 million in 2020 and 238.518 million in 2010 (Badan Pusat Statistik Indonesia, 2023). This rapid growth is driving increased population mobility, particularly in urban areas. Increased mobility is generally accompanied by a surge in travel demand and the need for faster, more efficient, and more accessible modes of transportation (Tamin, 2005). The phenomenon of urbanization, which has accelerated population concentration in large cities, is further increasing pressure on transportation systems (Habitat, 2020). Globally, increasing population and mobility have also been identified as key drivers of the transformation of urban transportation systems toward more sustainable and integrated solutions (Schafer and Victor, 2000). In Indonesia, the impact of population growth on transportation demand has been empirically demonstrated in research, which shows a positive correlation between population density and travel volume in metropolitan areas (Novita, 2022).

As a city that plays a dual role as an educational center (student city) and a national tourist destination, mobility is a crucial element in supporting the dynamics of urban activity in Yogyakarta. The surge in the transient population (students and tourists) and the growth of private vehicles have put significant pressure on the transportation system, manifested in chronic congestion, limited road space, and declining air quality (Pathan and Landge, 2025). This condition aligns with global findings that reveal uncontrolled private vehicle growth tends to exceed available road capacity, thereby triggering congestion and negative externalities, such as air pollution (Litman, 2013; Rodrigue, 2024). Specifically, research by (Ansusanto *et al.*, 2014) noted that in Yogyakarta, the interaction between educational activities and tourism creates unique and fluctuating travel demand patterns, necessitating a more adaptive and sustainable approach to transportation governance. The implications of these complex mobility patterns are also evident in a study by Prihartono, Falatehan, and Widyastutik (2024), which highlights the need for integrated, sustainable transportation policies to address environmental and social impacts in urban areas.

The digital revolution has given birth to app-based transportation services (ride-hailing) such as Gojek, Grab, and Maxim, which have developed into flexible and responsive mobility alternatives. Their presence has not only shifted urban travel patterns but also created disruption and fierce competition for conventional public transportation, such as Trans Jogja. These services rely on advanced technologies such as the Global Positioning System (GPS) for location tracking and a real-time platform for booking, thus offering a level of convenience, certainty, and efficiency that is difficult to achieve with conventional transportation. This phenomenon is part of the global trend of Mobility as a Service (MaaS), where the integration of digital technology is transforming transportation services to become more personalized and on-demand (Jittrapirom et al., 2017). At the national level, research by Prima (2023) confirms that ease of access, fare transparency, and a better user experience are determining factors for the dominance of online transportation in Indonesian cities.

On the other hand, Trans Jogja, a Bus Rapid Transit (BRT) system launched in March 2008, represents a governmental initiative to offer a safe, affordable, and sustainable mass public transportation alternative in Yogyakarta. As noted by Deng and Nelson (2010), the core promise of any BRT system lies in its ability to combine the efficiency of rail with the flexibility of buses. However, in practice, its operational effectiveness is not guaranteed and is highly contingent on several critical factors. As highlighted in a study on BRT performance in Indonesia, key determinants include fleet availability and punctuality, which ensure service reliability; route network connectivity and coverage, which affect accessibility; and the quality of passenger facilities, such as bus stops, which directly influence user experience and perception (Joewono and Kubota, 2005). These factors collectively determine the system's ability to compete with more personalized transport modes and fulfill its intended role in urban mobility.

People's preferences in choosing transportation modes are the result of complex considerations and are influenced by various factors. In general, travel decisions depend on the purpose of the trip, the distance traveled, and the income level, which can then be summarized into more specific factors, such as travel cost, travel time, and ease of access (Litman, 2013). Among these factors, travel time is often considered the most critical element, especially in densely populated urban areas where time efficiency is a primary consideration (Weng *et al.*, 2018; Ghader, Darzi, and Zhang, 2019). This finding is consistent with the Indonesian context, where research by Yamin *et al.* (2022) shows that when choosing between public transportation and online transportation, travel time and punctuality are the two most valued attributes for users.

Given this phenomenon, a comprehensive analysis is needed to determine which transportation mode, between Trans Jogja and online transportation, provides the best comfort, time efficiency, and accessibility for the public. This study is crucial as a basis for developing transportation policies and improving the quality of public transportation services in Yogyakarta.

METHODS

The research method used is a descriptive quantitative research method with questionnaire data collection and the Analytical Hierarchy Process (AHP) data processing method. This descriptive quantitative research is a research approach used to collect, analyze, and interpret data quantitatively to answer research questions. Descriptive quantitative research methods generally involve data collection through surveys, observations, or case studies, and data analysis is carried out statistically.

The research location used in this study is Yogyakarta City, with research location points at Jombor Terminal and Ambarrukmo Plaza.

Steps to create a hierarchy: Determine the main objective, which in this study is to select the most efficient and comfortable mode of transportation. Next, determine the criteria used, such as travel time, comfort, safety, convenience, availability, cost, and accessibility. Then, determine the alternative modes to be compared, in this study, namely Trans Jogja and Online-Based Transportation (Grab/Gojek/Maxim).

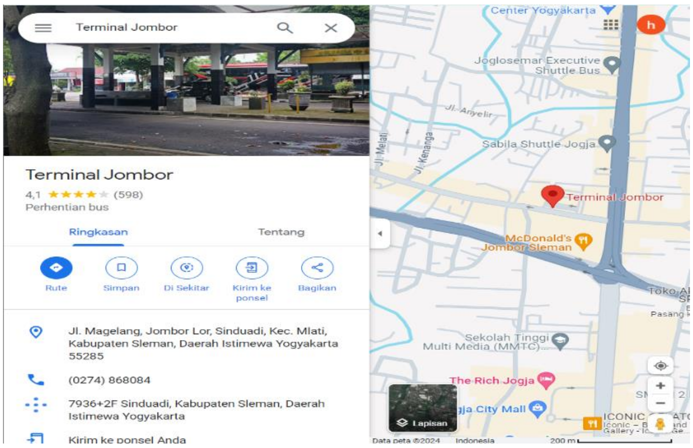

Figure 1. Location of Jombor Terminal: Google Maps, 2024

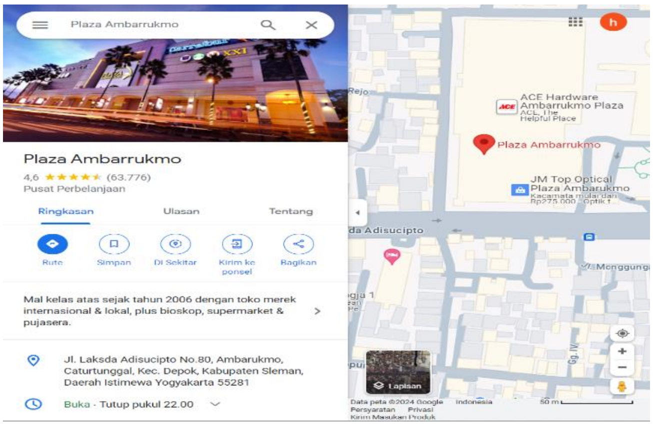

Figure 2. Location of Plaza Ambarrukmo: Google Maps, 2024

The research method used in this study is a descriptive quantitative research method with questionnaire data collection and the Analytical Hierarchy Process (AHP) data processing method. This descriptive quantitative research is a research approach used to collect, analyze, and interpret data quantitatively to answer research questions. Descriptive quantitative research methods generally involve data collection through surveys, observations, or case studies, and data analysis is carried out statistically.

The data processing method uses the Analytic Hierarchy Process (AHP), where, in this study, the use of AHP is related to the preparation of a questionnaire that covers various aspects of transportation mode assessment. Data collection was carried out by distributing questionnaires to respondents who use Trans Jogja and online transportation (Grab/Gojek/Maxim). Primary data collection from respondents regarding travel time, comfort, and the AHP questionnaire.

According to Sugiyono (2021), a sample is a portion of the population's size and characteristics. Therefore, samples taken from the population must be truly representative. The determination of the sample size in this study refers to the Slovin formula, namely:

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

Data analysis is a critical stage in research that not only processes and interprets the results but also identifies various obstacles and limitations that arise during the research process. In this study, data analysis was conducted using the Analytic Hierarchy Process (AHP) method. As explained by Saaty (1990), the hierarchy begins at the objective level (level 1), which is then broken down into factors, criteria, and sub-criteria at the middle level, until it reaches the lowest level in the form of choices. This structuring allows complex problems to be broken down (decomposition), compared (comparison), and synthesized (synthesis) in a more structured, systematic, and measurable manner, resulting in logical priorities (Subramanian and Ramanathan, 2012).

FINDINGS

In this study, the number of respondents was determined using the Slovin formula in equation (1). Overall, sampling was conducted randomly, and the population size in this study was taken from the population of Yogyakarta City in 2023, which was 4,073,907 people.

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

$$= \frac{4.073.907}{1 + 4.073.907x(0,1)^2}$$

$$= 100$$

From the calculation above, the sample size was 100 respondents.

In this study, to perform calculations using the Analytic Hierarchy Process (AHP) method, the following steps must be taken to create a Pairwise Comparison Matrix. This study used five criteria: comfort, time, safety, convenience, and cost. The values in this pairwise comparison matrix were derived from the decision assessments given to random respondents over a specific period. The comparison scale ranges from 1 to 9, as shown in Table 1 below.

Table 1. Paired Comparison Scale

Intensity of Interest	Definition
1	Both elements are equally important to the others.
3	One element is slightly more important than the other element
5	One element is more important than the other
7	One element is more important than the other elements
9	One absolute element is clearly more important than the other elements.
2,4,6,8	Values between two adjacent consideration values (uncertain)

Table 2. Pairwise Comparison Matrix Between Criteria

Criteria	Comfort	Time	Security	Convenience	Cost
Comfort	1	1/4	2	1/2	9
Time	4	1	4	2	9
Security	1/2	1/4	1	1	5
Convenience	2	1/2	1	1	8
Cost	1/9	1/9	1/5	1/8	1
Total	7,61	2,11	8,2	4,62	32

The Pairwise Comparison Matrix between Criteria can be seen in Table 2. Below, calculations are carried out according to the AHP procedure.

Calculating Normalized Eigenvalues

After determining the values in the comparison matrix between criteria, the values in the matrix are normalized by dividing the comfort rows and columns by the total value in the comfort column, namely:

Comfort

$$\frac{1}{7,61} = 0,131$$

Time

$$\frac{4}{7,61} = 0,526$$

Security

$$\frac{0,5}{7,61} = 0,066$$

Convenience

$$\frac{2}{7,61} = 0,263$$

Cost

$$\frac{0,11}{7,61} = 0,014$$

This process continues for all existing rows and columns. Once all values have been normalized, the relative weight of each column will be the same, namely 1 (one).

Table 3. Normalized Pairwise Comparison Matrix Between Criteria

Criteria	Comfort	Time	Security	Convenience	Cost
Comfort	0,131	0,118	0,244	0,108	0,281
Time	0,526	0,474	0,488	0,433	0,281
Security	0,066	0,181	0,122	0,216	0,156
Convenience	0,263	0,237	0,122	0,216	0,250
Cost	0,014	0,052	0,024	0,026	0,031
Total	1	1	1	1	1

Calculating Eigenvalues of Vectors

The eigenvector values are generated by summing the values in row 1 and dividing by the number of criteria. The sum of each row is shown below.

In Table 4 above, respondents' assessment of the importance of the prioritized criteria is the convenience criterion with a weighting of 21.7%.

$$Comfort: \frac{(0{,}131+0{,}118+0{,}244+0{,}108+0{,}281)}{5} = 0{,}176$$

$$\text{Time}: \frac{(0{,}526+0{,}474+0{,}488+0{,}433+0{,}281)}{5} = 0{,}440$$

$$\text{Security}: \frac{(0{,}066+0{,}118+0{,}122+0{,}216+0{,}156)}{5} = 0{,}135$$

$$\text{Convenience}: \frac{(0{,}263+0{,}237+0{,}122+0{,}216+0{,}250)}{5} = 0{,}217$$

$$\text{Cost}: \frac{(0{,}014+0{,}052+0{,}024+0{,}026+0{,}031)}{5} = 0{,}029$$

Table 4. Normalized Eigenvectors

Criteria	Amount	Weight of Value	%
Comfort	0,882	0,176	17,6
Time	2,202	0,440	44
Security	0,678	0,135	13,5
Convenience	1,088	0,217	21,7
Cost	0,147	0,029	2,9
Total	5	1	100

Calculating Maximum Eigenvalue

Calculate the maximum eigenvalue λmax by multiplying the total value of each row in Table 2 by the Normalized Eigenvector of Table 4.

λmax = ((0.176 × 7.61) + (0.440 × 2.11) + (0.135 × 8.2) + (0.217 × 4.62) + (0.029 × 32)) = (1.339 + 0.928 + 1.107 + 1.002 + 0.928)

= 5.304

Consistency Index (CI)

$$\text{CI} = \frac{\lambda max - n}{n-1}$$

$$= \frac{5.304 - 5}{5-1}$$

$$= 0{,}076$$

Consistency Ratio

$$\text{CR} = \frac{CI}{RI}$$

$$= \frac{0{,}076}{1{,}12}$$

$$= 0{,}067$$

Because the CR value is <0.1, the respondents' weighting preferences are consistent.

Calculating Accessibility and Availability Levels

Table 5. Paired Matrix

	Accessibility	Availability
Accessibility	1	3
Availability	1/3	1
Total	1,33	4

Matrix Normalization

To normalize a matrix, each value in the matrix is divided by the number of columns present, as below:

Accessibility: 1,00 / 1,33 = 0,75

Availability: 3,00 / 4,00 = 0,75

Table 6. Normalization Matrix

	Accessibility	Availability
Accessibility	0,75	0,75
Availability	0,25	0,25

Calculating Eigenvectors

The Eigenvalues of the Vector are obtained from the average of each row of the normalized matrix:

Accessibility: (0,75 + 0,75) / 2 = 0,75

Availability: (0,25 + 0,25) / 2 = 0,25

The relative weights are:

Accessibility = 0,75

Availability = 0,25

Matrix Consistency

To check the consistency of the above matrix, the Maximum Eigenvalue, Consistency Index, and Consistency Ratio are calculated.

(1) λ max = ((0,75 × 1,33) + (0,25 × 4))

= 0,997 + 1

= 1,997

(2) Consistency Index (CI)

CI = λmax−n n−1

= 1,997−2 n−1

= −0,003

(3) Consistency Ratio (CR)

CR = CI/RI

= -0,003/0,00

= 0

Since the CR value <0.1, the above value is consistent.

Calculation of Priority Weights Between Alternative Modes (Local Priority)

This analysis aims to determine the criteria or aspects that most influence respondents' travel between Jombor Terminal and Plaza Ambarrukmo. The results are based on the combined weighting of the selected respondents.

Table 7. Priority Weights of Alternative Modes Based on Convenience Criteria

Criteria	Trans Jogja	Grab/Gojek/Maxim	Amount	Priority
Trans Jogja	1	1/9	1,80	0,90
Grab/Gojek/Maxim	9	1	0,20	0,10

From Table 7 above, for the priority weight of alternative modes for the comfort criteria, Trans Jogja has a greater weight with a value of 90%, while Grab/Gojek/Maxim has a value of 10%.

Table 8. Alternative Mode Priority Weights Based on Time Criteria

Criteria	Trans Jogja	Grab/Gojek/Maxim	Amount	Priority
Trans Jogja	1	1/8	0,22	0,11
Grab/Gojek/Maxim	8	1	1,78	0,89

The calculation results in Table 8 reveal a strong dominance of Grab/Gojek/Maxim over Trans Jogja in terms of time. With a priority weight of 89%, online transportation services are considered far superior in terms of time efficiency. In contrast, Trans Jogja's priority weight is only 11%, indicating that this public transportation is perceived as less efficient in meeting travel time considerations.

Table 9. Priority Weights of Alternative Modes Based on Security Criteria

Criteria	Trans Jogja	Grab/Gojek/Maxim	Amount	Priority
Trans Jogja	1	1/7	0,25	0,13
Grab/Gojek/Maxim	7	1	1,75	0,87

Analysis of Table 9 reveals that, in terms of safety criteria, there is a significant disparity in priority weights between the two alternative transportation modes. Grab/Gojek/Maxim is considered significantly superior, with a priority weight of 87%. Conversely, Trans Jogja has a much lower weight, at only 13%. This indicates that, based on this criterion, online transportation services are perceived as significantly safer than mass public transportation.

Table 10. Priority Weights of Alternative Modes Based on Convenience Criteria

Criteria	Trans Jogja	Grab/Gojek/Maxim	Amount	Priority
Trans Jogja	1	1/9	0,20	0,10
Grab/Gojek/Maxim	9	1	1,80	0,90

Based on the alternative priority matrix in Table 10, the evaluation of the convenience criterion yielded highly unequal weightings. Grab/Gojek/Maxim had a priority weighting of 0.90 (90%), while Trans Jogja only had 0.10 (10%). Therefore, it can be concluded that, based on the convenience criterion, online transportation alternatives have a higher absolute preference level. This dominance reflects the superior features offered by ride-hailing services, such as on-demand bookings, cashless payments, and door-to-door service.

Table 11. Alternative Mode Priority Weights Based on Cost Criteria

Criteria	Trans Jogja	Grab/Gojek/Maxim	Amount	Priority
Trans Jogja	1	5	1,67	0,83
Grab/Gojek/Maxim	1/5	1	0,33	0,17

The priority calculation results in Table 11 for the cost criterion reveal that Trans Jogja is the dominant choice. With a priority weighting of 83%, this public transportation is considered far superior in terms of cost (economic) considerations. In contrast, Grab/Gojek/Maxim only received a weighting of 17%, indicating that these online transportation services are perceived as having a lower level of affordability.

Table 12. Priority Weight of Alternative Modes for Accessibility

Criteria	Trans Jogja	Grab/Gojek/Maxim	Amount	Priority
Trans Jogja	1	1/5	0,33	0,17
Grab/Gojek/Maxim	5	1	1,67	0,83

Based on Table 12, the priority weights for accessibility criteria show a striking difference between the two modes of transportation. Grab/Gojek/Maxim dominates with a priority weight of 83%, while Trans Jogja only has a priority weight of 17%.

Table 13. Alternative Mode Priority Weights Against Availability

Criteria	Trans Jogja	Grab/Gojek/Maxim	Amount	Priority
Trans Jogja	1	1/7	0,25	0,13
Grab/Gojek/Maxim	7	1	1,75	0,87

Based on Table 13, the priority weights for the availability criteria show significant differences. Grab/Gojek/Maxim dominate with a weighting of 87%, while Trans Jogja only receives 13%.

Table 14. Priority Weights for Alternatives

Criteria	K1	K2	K3	K4	K5	K6	K7
Trans Jogja	0,9	0,11	0,13	0,10	0,83	0,17	0,13
Grab/Gojek/Maxim	0,1	0,89	0,88	0,90	0,17	0,83	0,88

Information:
K1: Comfort
K2: Time
K3: Security
K4: Convenience
K5: Cost
K6: Accessibility
K7: Availability

Calculating Global Priority Weights Against Criteria

The global priority weight in the Analytic Hierarchy Process (AHP) is the overall weight of each alternative after evaluating various existing criteria. The global priority weight is obtained by multiplying the local priority weight matrix by the priority weights between criteria.

From the calculation above, the global priority weight for the Trans Jogja and Grab/Gojek/Maxim online transportation modes can be seen that the Grab/Gojek/Maxim value is greater, namely 0.72823, compared to the Trans Jogja value of 0.27012.

0,9	0,11	0,13	0,1	0,83
0,1	0,89	0,88	0,9	0,17

x

0,176
0,44
0,135
0,217
0,029

Figure 3. Calculating Global Priority Weights Against Criteria

Global Priorities for Accessibility and Availability

0,17	0,13
0,83	0,88

x

0,75
0,75

Figure 4. Global Priorities for Accessibility and Availability

From the calculation above, the global priority weight for the Trans Jogja transportation mode and Grab/Gojek/Maxim online transportation based on accessibility and availability, the Grab/Gojek/Maxim value is greater, namely 0.842, compared to the Trans Jogja value of 0.160.

Analysis of Priority Weights Between Criteria

The priority weight analysis between criteria was calculated to determine the order of weights of the criteria that most influence the selection of transportation modes. The priority weights in this study were obtained from respondents' answers. Based on the priority weights between criteria in Figure 5, the order of priority weights that most influence the selection of transportation modes can be seen, namely the convenience criterion with a weight of 25%, followed by the time criterion with a weight of 22%, the comfort criterion with a weight of 20%, then the safety factor with a weight of 18% and finally the cost factor with a weight of 15%.

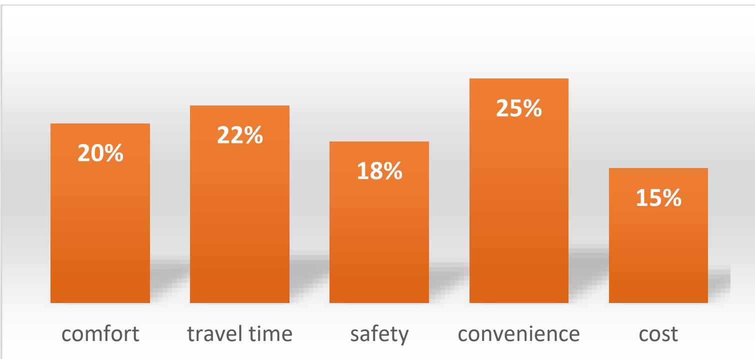

Figure 5. Graph of Percentage Weights Between Criteria: Calculation of Weights Between Criteria, 2024

Analysis of Priority Weights Between Alternatives

The priority weight analysis between alternative modes is obtained from the calculation of all existing variables, and the total value of the overall selection of transportation modes is obtained. The priority weight in this study was obtained from respondents' answers. Based on the priority weight between alternatives in Figure 6, in traveling, respondents tend to choose Trans Jogja transportation with a weight of 61.342% and Grab/Gojek/Maxim with a weight of 38.685%.

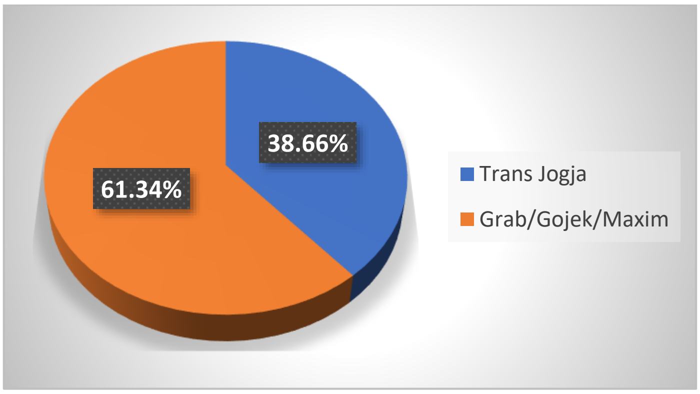

Figure 6. Graph of Priority Weight Percentage Between Alternative Modes: Calculation of Weight Between Alternatives, 2024

Priority Weighting Between Alternative Modes Regarding Accessibility and Availability

The analysis of priority weights between alternative modes of accessibility and availability is obtained from the calculation of all existing variables and results in the total value of the overall selection of transportation modes. The priority weights in this study were obtained from respondents' answers. Based on the priority weights between alternatives in Figure 7, Grab/Gojek/Maxim transportation has a higher score of 69%, and Trans Jogja weights 31%. In this case, it shows that accessibility and availability levels, Online Transportation is prioritized by respondents.

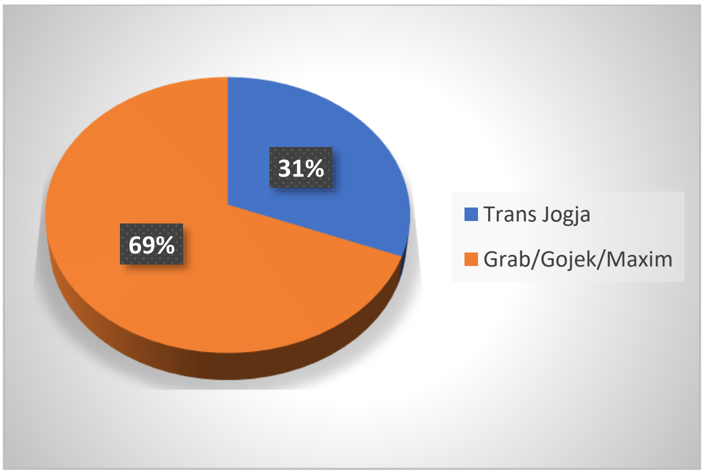

Figure 7. Global Accessibility and Availability Percentage Chart: Calculation of Global Accessibility and Availability Weights, 2024

PRACTICAL IMPLICATION

The results of this study on the preference for choosing transportation modes between Trans Jogja and online transportation provide important implications for various stakeholders, from local governments, service operators, to the public who use transportation services. The finding that online transportation received a higher global priority weight (0.728) than Trans Jogja (0.270), as well as the dominance of scores in the aspects of accessibility (83%), availability (87%), and convenience (90%), indicates a significant change in urban mobility patterns. The practical implications of this study can be directed at efforts to improve service quality, address the imbalance between modes, and develop a more integrated, efficient, and inclusive urban transportation system.

1. **Implications for the Development of Public Transportation Services (Trans Jogja)**

   The dominant user preference for online transportation, particularly in terms of accessibility, travel time, and convenience, underscores the need for operational transformation in Trans Jogja services. The finding that Trans Jogja only excels in cost (83%) suggests that superior fares are not enough to attract the interest of a modern society that demands fast and adaptive service.

   Local governments and operators need to consider the following strategic steps:

   a. Optimizing bus routes and frequencies, especially during peak hours, to reduce waiting times and expand service coverage in residential and tourist areas.
   b. Integrating digital technology, such as real-time bus tracking via apps, cashless payment methods, and providing accurate schedule information.
   c. Improving physical accessibility, including designing disability-friendly bus stops, increasing fleet comfort, and providing additional safety features.
   d. Partnerships with online transportation, for example, by providing first-mile–last-mile services so that users can reach bus stops more easily.

   Implementation of these recommendations has the potential to increase Trans Jogja's score in the categories of time, convenience, and accessibility as assessed by respondents.

2. **Implications for Online Transportation Providers**

   The dominance of online transportation across nearly all criteria demonstrates that operators like Grab, Gojek, and Maxim have successfully met the mobility needs of urban communities. However, the implications of this research extend beyond recognition of success to additional responsibilities:

   a. Strengthen safety and service quality assurance, including through vehicle standards monitoring and driver verification, to address public concerns.
   b. Maintain stable fares, especially during peak hours, to maintain the perception of convenience and comfort as the main attractions of the service.
   c. Contribute to urban planning by sharing user mobility data with the government to support congestion management and better transportation planning.

   Operators can also experiment with additional innovations such as value-for-money travel packages, smart safety features, and eco-friendly vehicle options.

3. **Implications for Local Governments and Policy Makers**

   The results of this study have significant implications for the formulation of urban transportation policy. The government needs to balance the existence of public and online modes of transportation so that both can operate harmoniously for the benefit of the community. Possible policy implications include:

a. Revise transportation policies to recognize the strategic role of online transportation by regulating fares and service quality to prevent exploitation.
b. Provide official pick-up/drop-off points for online transportation in strategic locations (such as city centers and bus stops) to create better connectivity.
c. Provide subsidies and incentives to improve the quality of Trans Jogja services to ensure they remain a primary and competitive choice.

The implications of this policy are expected to create a transportation ecosystem that is sustainable, fair, and able to reduce dependence on private vehicles.

4. **Implications for Urban Society and Mobility**

The public's preference for fast, easy, and flexible transportation reflects changing mobility patterns increasingly influenced by technology. The public needs to understand the consequences of their mode of transportation choices, such as:

a. The high use of online transportation, which can increase two-wheeled vehicle traffic,
b. The increasing need to protect the personal data of app users,
c. The potential for dependence on modes whose fares are not always stable.

Thus, education for the public is needed to choose modes intelligently based on travel context, cost, safety, and environmental conditions.

5. **Implications for Future Research and Experiments**

This research opens opportunities for further experiments to deepen our understanding of transportation mode choice behavior. Some possible experiments are as follows.

a. Analyze preferences based on user segmentation (students, workers, tourists, people with disabilities) and simulate preference dynamics through changes in scenarios such as fares, routes, or online transportation regulations.
b. Evaluate the carbon emission contribution of each transportation mode and integrate the AHP method with other techniques (such as fuzzy AHP) to refine preference weights.
c. Combine preference analysis, policy modeling, and environmental impact analysis to formulate more targeted and sustainable urban transportation policy recommendations.

Thus, the practical implications of this research not only guide for improving current services but also open a wider scientific exploration space to support the development of sustainable transportation in Yogyakarta City.

REFERENCES

Ansusanto, J.D. *et al.* (2014) ‘Karakteristik pola perjalanan di kota yogyakarta’, *Jurnal Transportasi*, 14(1).

Badan Pusat Statistik Indonesia (2023) ‘Statistik Indonesia Dalam Infografis 2023’, *Statistik Indonesia*, 1101001.

Deng, T. and Nelson, J.D. (2010) ‘The impact of bus rapid transit on land development: A case study of Beijing, China’, *World Academy of Science, Engineering and Technology*, 42.

Ghader, S., Darzi, A. and Zhang, L. (2019) 'Modeling effects of travel time reliability on mode choice using cumulative prospect theory', *Transportation Research Part C: Emerging Technologies*, 108. Available at: https://doi.org/10.1016/j.trc.2019.09.014.

Habitat, U.N. (2020) 'World Cities Report 2020: The value of sustainable urbanization', *United Nations Human Settlements Programme* [Preprint].

Jittrapirom, P. *et al.* (2017) 'Mobility as a service: A critical review of definitions, assessments of schemes, and key challenges', *Urban Planning*, 2(2). Available at: https://doi.org/10.17645/up.v2i2.931.

Joewono, T.B. and Kubota, H. (2005) 'The Characteristics of Paratransit and Non-motorized Transport in Bandung', *Eastern Asia Society for Transportation Studies*, 6.

Litman, T.A. (2013) 'Understanding transport demands and elasticities: how prices and other factors affect travel behavior', *Victoria Transport Policy Institute* [Preprint].

Novita, D. (2022) 'Analisis Permasalahan Transportasi Berkelanjutan di Kota Metropolitan Surabaya: Studi Kasus Perkotaan Padat Penduduk', *Jurnal Manajemen Bisnis Transportasi dan Logistik*, 8(1). Available at: https://doi.org/10.54324/j.mbtl.v8i1.1251.

Pathan, N.T. and Landge, V.S. (2025) 'Acceptability of congestion pricing system in developing countries: A case study in India', *Case Studies on Transport Policy*, 20. Available at: https://doi.org/10.1016/j.cstp.2025.101458.

Prihartono, R., Falatehan, A.F. and Widyastutik (2024) 'Strategi Adaptasi dan Mitigasi Penurunan Emisi Gas Rumah Kaca (Grk) Melalui Sektor Transportasi Di Kota Bogor', *RISALAH KEBIJAKAN PERTANIAN DAN LINGKUNGAN Rumusan Kajian Strategis Bidang Pertanian dan Lingkungan*, 11(3). Available at: https://doi.org/10.29244/jkebijakan.v11i3.60430.

Prima, G.R. (2023) 'Analisis Faktor-Faktor Pemilihan Transportasi Online', *Menara: Jurnal Teknik Sipil*, 18(1). Available at: https://doi.org/10.21009/jmenara.v18i1.31045.

Rodrigue, J.P. (2024) *The geography of transport systems*, *The Geography of Transport Systems*. Available at: https://doi.org/10.4324/9781003343196.

Saaty, T.L. (1990) 'How to make a decision: The analytic hierarchy process', *European Journal of Operational Research*, 48(1). Available at: https://doi.org/10.1016/0377-2217(90)90057-I.

Schafer, A. and Victor, D.G. (2000) 'The future mobility of the world population', *Transportation Research Part A: Policy and Practice*, 34(3). Available at: https://doi.org/10.1016/S0965-8564(98)00071-8.

Subramanian, N. and Ramanathan, R. (2012) 'A review of applications of Analytic Hierarchy Process in operations management', *International Journal of Production Economics*. Available at: https://doi.org/10.1016/j.ijpe.2012.03.036.

Sugiyono (2021) *Buku Metode Penelitian Pendidikan (kuantitatif,kualitatif,kombinasi R&D dan Penelitian Pendidikan*, *Penerbit ALFABETA BANDUNG*.

Tamin, O.Z. (2005) *Perencanaan, Pemodelan, dan Rekayasa Transportasi*, *ITB Press*.

Weng, J. *et al*. (2018) 'Modeling Mode Choice Behaviors for Public Transport Commuters in Beijing', *Journal of Urban Planning and Development*, 144(3). Available at: https://doi.org/10.1061/(asce)up.1943-5444.0000459.

Yamin, Y. *et al*. (2022) 'Analisis Preferensi Konsumen Terhadap Penggunaan Transportasi Online', *Jurnal Manajemen Mandiri Saburai (JMMS)*, 6(4). Available at: https://doi.org/10.24967/jmms.v6i4.2020.