



Comparative Analysis of Transportation Mode Choice Between Trans Banyumas BRT and AKDP Bus on the Banyumas Sub-District – Bulupitu Terminal Corridor

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ABSTRACT

This study analyzes the transportation mode choice behavior between Trans Banyumas Bus Rapid Transit (BRT) and Intra-Provincial Intercity Bus (AKDP) on the Banyumas Sub-District – Bulupitu Terminal corridor, Banyumas Regency, Central Java. Both modes serve the same route but differ in operational characteristics, including fares, comfort, and accessibility. A total of 100 respondents were selected through accidental sampling at Trans Banyumas stops and Bulupitu Terminal. Two analytical methods were applied: Importance Performance Analysis (IPA) to evaluate service quality, and binary logistic regression to identify factors influencing mode choice probability. IPA results indicate that Trans Banyumas achieves an exceptionally high level of conformance between service performance and passenger expectations (93%–99%), with safety, fare, and comfort attributes positioned in the 'maintain performance' quadrant. Binary logistic regression results reveal that travel cost (Wald = 21.973; $p = 0.000$) and travel time (Wald = 5.477; $p = 0.019$) are the only statistically significant predictors, with the model achieving 94.0% prediction accuracy (Nagelkerke $R^2 = 0.855$). Under existing conditions — average fare of IDR 4,100 and travel time of 39.6 minutes — the probability of choosing Trans Banyumas reaches 78.8%. Sensitivity analysis identifies a critical fare threshold at IDR 4,537 and a travel time indifference point at 44–45 minutes, beyond which passenger preference shifts decisively toward AKDP. These findings provide actionable policy recommendations for Trans Banyumas operators to sustain their competitive advantage through fare stabilization and travel time optimization.



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INTRODUCTION

Transportation plays a strategic role in supporting societal activities, particularly the movement of people and goods between regions. An efficient transportation system is not solely determined by infrastructure availability, but also by its capacity to fulfill mobility needs in an affordable and comfortable manner (Tamin, 2000). In Banyumas Regency, two public transport modes serve the Banyumas Sub-District – Purwokerto corridor: Trans Banyumas, a Bus Rapid Transit (BRT) service, and the Intra-Provincial Intercity Bus (Angkutan Kota Dalam Provinsi/AKDP), both converging at Bulupitu Terminal. Although they share the same route, these modes differ markedly in fare structure, travel time, waiting time, and comfort level.

Operational data from 2025 recorded 1.99 million Trans Banyumas passengers, indicating strong public acceptance. Nevertheless, AKDP buses on the Banyumas–Purwokerto route continue to sustain their market presence, largely due to flexible access passengers may board and alight at any point without needing to reach a designated stop. This phenomenon suggests that mode choice decisions are not solely driven by mode availability, but are also influenced by service attributes including cost, travel time, waiting time, and perceived service quality (Ortúzar & Willumsen, 2011).

Mode choice behavior constitutes a discrete decision that can be investigated quantitatively to measure user preferences (Ben-Akiva & Lerman, 1985). Prior studies have applied the binary logit model to public transport mode choice. Gu et al. (2025) demonstrated that travel cost and time were primary determinants on the Malang–Blitar train–bus corridor. Jumaily (2024) confirmed cost dominance on the Payakumbuh–Padang AKDP route. Nurlaily and Santosa (2023) applied the model to tourism corridors and found cost as the most influential factor, with accessibility as a secondary determinant. However, empirical studies combining IPA and binary logit analysis for BRT–AKDP corridors at the regency level in Central Java remain scarce, constituting the research gap addressed by this study.

Accordingly, this study focuses on three primary aspects: (1) user mobility behavior and travel characteristics, (2) service quality evaluation using IPA based on passenger perception, and (3) identification of significant factors influencing mode choice probability through binary logistic regression. The findings are expected to provide a comprehensive picture of user preferences while offering evidence-based policy recommendations for improving public transportation in Banyumas Regency.

RESEARCH METHOD

This study employs a quantitative approach with primary data obtained through a Revealed Preference (RP) questionnaire survey administered to Trans Banyumas and AKDP bus users on the Banyumas Sub-District – Bulupitu Terminal corridor, Banyumas Regency, Central Java, Indonesia.

Population and Sampling Technique

The study population comprised all public transport users on the Banyumas–Purwokerto corridor, estimated at 1,480 passengers within a given period. The minimum sample size was determined using the Slovin formula with a 10% margin of error: $n = N / [1 + N(e)^2] = 1,480 / [1 + 1,480(0.1)^2] = 93.67 \approx 100$ respondents.

Sampling was conducted using accidental sampling, selecting respondents encountered at research locations who met the eligibility criterion of being public transport users. Data collection points included Trans Banyumas stops, the area around Bulupitu Terminal, and boarding/alighting points along the corridor.

Research Variables

The dependent variable (Y) represents mode choice, coded as a binary dummy: Y = 1 (Trans Banyumas) and Y = 0 (AKDP bus). Independent variables include travel cost (X1, IDR), travel time (X2, minutes), waiting time (X3, minutes), stop accessibility (X4, ordinal scale), comfort (X5, Likert 1–5), punctuality (X6, Likert 1–5), safety (X7, Likert 1–5), and perceived fare value (X8, Likert 1–5).

Table 1 Research Variables and Operational Definitions

No	Variable	Code	Operational Definition	Unit / Scale
1	Mode Choice	Y	Binary decision: Trans BMS or AKDP	0 = AKDP; 1 = Trans BMS
2	Travel Cost	X1	Out-of-pocket cost per trip	IDR (Rupiah)
3	Travel Time	X2	Door-to-door journey duration	Minutes
4	Waiting Time	X3	Time spent waiting for the mode	Minutes
5	Stop Accessibility	X4	Ease of reaching the stop/terminal	Ordinal scale
6	Comfort	X5	Perceived in-vehicle comfort level	Likert 1–5
7	Punctuality	X6	Perceived schedule reliability	Likert 1–5
8	Safety	X7	Perceived personal safety during travel	Likert 1–5
9	Perceived Fare Value	X8	Perceived fare affordability	Likert 1–5

Analytical Methods

Two complementary analytical methods were employed. First, Importance Performance Analysis (IPA), introduced by Martilla and James (1977), compares actual performance scores (X) against importance/expectation scores (Y) for each service attribute. The conformance level is calculated as: $Tki = (X/Y) \times 100\%$. Results are plotted on a Cartesian diagram divided into four quadrants: Quadrant I (concentrate here), Quadrant II (keep up the good work), Quadrant III (low priority), and Quadrant IV (possible overkill).

Second, binary logistic regression was used to estimate mode choice probability based on utility functions (Ben-Akiva & Lerman, 1985). Parameters were estimated using Maximum Likelihood Estimation (MLE) in SPSS 25. Model validity was assessed through: Omnibus Test (simultaneous significance), Hosmer–Lemeshow Test (goodness-of-fit), Nagelkerke R^2 (explanatory power), and the Classification Table (predictive accuracy). The mode choice probability is expressed as:

$$P(\text{Trans BMS}) = 1 / [1 + e^{(-U)}]$$

where the utility function is: $U = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \dots + \beta_n X_n$, with X_1 = travel cost, X_2 = travel time, X_3 = waiting time, and β representing estimated parameters.

Sensitivity analysis was subsequently conducted to identify the critical tipping point for cost and travel time variables — the threshold at which both modes reach an equilibrium probability (indifference point, $P = 50\%$).

RESULTS AND DISCUSSION

User Characteristics and Travel Patterns

The survey covered 100 respondents: 42 AKDP bus users and 58 Trans Banyumas users. Regarding gender, AKDP users were predominantly male (57%), while Trans Banyumas users were predominantly female (69%). This difference suggests that the comfort and safety associated with Trans Banyumas' air-conditioned cabins are more appealing to female passengers.

Both modes were dominated by young passengers under 20 years of age (40%), reflecting the prevalence of the student segment. This aligns with occupational characteristics: AKDP users were predominantly students (60%), followed by civil servants (24%) and private employees (16%), while Trans Banyumas users consisted of students (46%), civil servants (34%), private employees (19%), and military/police personnel (1%). Students' high price sensitivity helps explain why travel cost emerged as the dominant factor in the model.

Regarding travel patterns, the primary trip purpose among AKDP users was commuting to work (54%), while Trans Banyumas users predominantly traveled for school or study (44%). AKDP fares ranged from IDR 5,000 to IDR 6,000 per trip, whereas Trans Banyumas fares were IDR 3,900 (64% of respondents) or IDR 2,000 (36%, likely subsidized or student fares). Waiting times were similar across both modes, concentrated within the 5–10 minute range. The primary stated reason for choosing Trans Banyumas was fare affordability (48%) and comfort (24%), while AKDP users prioritized short waiting times (37%) and flexible boarding/alighting access (30%).

Importance Performance Analysis Results

IPA was conducted across five service attributes: comfort, punctuality, safety, stop/terminal accessibility, and fare. Comparative results for each mode are presented in Tables 2 and 3.

Table 2 IPA Results – AKDP Bus Service

No	Service Attribute	Performance (X)	Importance (Y)	Conformance (%)	Quadrant
1	Comfort	3.79	4.86	78%	I (Concentrate Here)
2	Punctuality	4.07	4.79	85%	IV (Possible Overkill)
3	Safety	4.10	4.81	85%	II (Keep Up)

No	Service Attribute	Performance (X)	Importance (Y)	Conformance (%)	Quadrant
4	Stop/Terminal Access	4.26	4.67	91%	IV (Possible Overkill)
5	Fare	4.02	4.83	83%	I (Concentrate Here)

Source: Primary data analysis, 2026

Table 3 IPA Results – Trans Banyumas BRT Service

No	Service Attribute	Performance (X)	Importance (Y)	Conformance (%)	Quadrant
1	Comfort	4.72	4.86	97%	II (Keep Up)
2	Punctuality	4.64	4.79	97%	III (Low Priority)
3	Safety	4.79	4.84	99%	II (Keep Up)
4	Stop/Terminal Access	4.45	4.78	93%	III (Low Priority)
5	Fare	4.78	4.93	97%	II (Keep Up)

Source: Primary data analysis, 2026

The IPA results for AKDP bus indicate that comfort (78%) and fare (83%) fall in Quadrant I, meaning these attributes are highly important to users yet their current performance falls below expectations. This is consistent with the operational reality that most AKDP buses operate without air-conditioning and apply variable, negotiation-based fares. By contrast, safety achieved Quadrant II status, indicating adequate performance relative to expectations.

Trans Banyumas presents a starkly different profile. All five attributes achieve conformance levels above 93%, substantially higher than AKDP across the board. Safety (99%), fare (97%), and comfort (97%) are positioned in Quadrant II, constituting the primary competitive advantages of Trans Banyumas. The most pronounced difference concerns comfort: Trans Banyumas achieved a performance score of 4.72 compared to AKDP's 3.79, confirming that air-conditioned facilities and standardized cabin conditions represent the principal service differentiator of BRT operations.

Binary Logistic Regression Results

Prior to logistic regression, Pearson correlation analysis revealed that travel cost exhibited the strongest negative correlation with mode choice ($r = -0.759$; $p = 0.000$). Waiting time ($r = 0.358$) and stop accessibility ($r = 0.264$) showed significant positive correlations, while travel time was not significant at the bivariate level ($r = -0.220$; $p = 0.028$). No evidence of multicollinearity was detected among independent variables (highest inter-variable correlation = -0.245).

The Omnibus Test yielded a Chi-square value of 96.138 ($p = 0.000$), confirming that the four independent variables jointly exert a statistically significant influence on mode choice. The Hosmer–Lemeshow Test produced a significance value of 0.276 (> 0.05), indicating satisfactory model fit. A Nagelkerke R^2 of 0.855 demonstrates that 85.5% of the variation in mode choice is explained by the model. Overall predictive accuracy reached 94.0%, a substantial improvement over the 66.0% baseline of the null model.

Based on regression coefficients, the full binary logit model equation is:

$$U = 25.807 + (-0.003)(Cost) + (-0.308)(Travel\ Time) + (0.300)(Waiting\ Time) + (0.475)(Stop\ Access)$$

Table 4 Binary Logistic Regression Coefficients

Variable	B	Wald	p-value	Exp(B)	Remark
Travel Cost (X1)	−0.003	21.973	0.000***	0.997	Significant, dominant
Travel Time (X2)	−0.308	5.477	0.019*	0.735	Significant
Waiting Time (X3)	+0.300	1.473	0.225	1.349	Not significant
Stop Accessibility (X4)	+0.475	0.471	0.492	1.608	Not significant
Constant	25.807	-	0.000	-	-

Note: *** $p < 0.001$; * $p < 0.05$. Source: SPSS 25 output, 2026

Travel cost is the most dominant predictor (Wald = 21.973; $p = 0.000$). An Exp(B) of 0.997 indicates that each IDR 1 increase in travel cost reduces the odds of choosing Trans Banyumas by 0.3%. Travel time also exerted a significant negative effect ($p = 0.019$), with Exp(B) = 0.735 implying that each additional minute of travel time reduces the odds of choosing Trans Banyumas by 26.5%. Waiting time and stop accessibility were not significant as partial predictors, likely because their effects were absorbed by the dominant travel cost variable.

These findings are consistent with Gu et al. (2025), who identified cost as the primary determinant in train–bus mode choice, and with Jumaily (2024), who confirmed cost dominance on AKDP corridors. However, unlike Nurlaily and Santosa (2023), who found accessibility as the second most significant factor, this study identifies travel time as the second significant predictor. This divergence may be attributed to the relatively short and urban character of the study corridor, where temporal efficiency carries greater weight for daily commuters.

Mode Choice Probability and Sensitivity Analysis

Using aggregate variable values (average cost = IDR 4,100; average travel time = 39.6 minutes), the utility value for Trans Banyumas is computed as:

$$U = 25.807 + (-0.003)(4,100) + (-0.308)(39.6) = 25.807 - 12.300 - 12.197 = 1.310$$

A positive utility value ($U = +1.310$) indicates that Trans Banyumas offers greater attractiveness under current conditions. The resulting mode choice probabilities are: $P(\text{Trans BMS}) = 1/[1 + e^{(-1.310)}] = 78.8\%$, and $P(\text{AKDP}) = 21.2\%$, confirming Trans Banyumas dominance at the current service level.

Travel cost sensitivity analysis demonstrates that when fares remain at IDR 1,000–3,000, the probability of choosing Trans Banyumas is virtually absolute (99–100%). The critical fare threshold occurs at approximately IDR 4,537 — only IDR 437 above the current fare of IDR 4,100. At IDR 5,000, the probability reverses: AKDP becomes dominant at 80.1%. Table 5 presents the complete cost sensitivity scenarios.

Table 5 Travel Cost Sensitivity Scenarios

Scenario	Fare (IDR)	Utility (U)	P(AKDP) %	P(Trans BMS) %
1	1,000	+10.610	0%	100%
2	2,000	+7.610	0.1%	99.9%
3	3,000	+4.610	1%	99%
4 (Existing)	4,100	+1.310	21.2%	78.8%
5	5,000	−1.390	80.1%	19.9%

Scenario	Fare (IDR)	Utility (U)	P(AKDP) %	P(Trans BMS) %
6	6,000	-4.390	98.8%	1.2%
7	7,000	-7.390	99.9%	0.1%

Source: Binary logit model computation, 2026

Travel time sensitivity analysis yields parallel findings. When travel time is below 30 minutes, Trans Banyumas dominates with probabilities exceeding 98%. The indifference point — where both modes share an equal 50% probability — is found at approximately 44–45 minutes, only 4–5 minutes beyond the existing average of 39.6 minutes. When travel time reaches 50 minutes, the probability of choosing Trans Banyumas collapses to 13.1%, while AKDP surges to 86.9%. The steep gradient of the sensitivity curve between 40 and 50 minutes reveals extreme consumer sensitivity to travel time increments within this critical zone.

These findings carry clear strategic implications. Current Trans Banyumas operations exist in a highly vulnerable position in terms of both cost (critical margin of only IDR 437) and travel time (critical margin of only 4–5 minutes). Any fare increase policy or operational degradation that extends travel time risks triggering a mass ridership shift toward AKDP.

CONCLUSION

This study yields three principal conclusions. First, Trans Banyumas users skew female, younger, and travel predominantly for educational purposes, while AKDP users are more commonly male with work-related trip purposes. Fare affordability is the primary stated reason for choosing Trans Banyumas (48%), while AKDP's strengths lie in shorter waiting times and flexible boarding/alighting access.

Second, IPA results confirm that Trans Banyumas substantially outperforms AKDP across all service attributes, achieving conformance rates of 93%–99%. Safety, fare, and comfort all occupy the 'keep up the good work' quadrant, while AKDP requires significant improvement in comfort and fare competitiveness, both of which remain in the 'concentrate here' quadrant.

Third, the binary logit model — with 94.0% predictive accuracy (Nagelkerke $R^2 = 0.855$) — identifies travel cost (Wald = 21.973; $p = 0.000$) and travel time (Wald = 5.477; $p = 0.019$) as the only statistically significant mode choice determinants. Under existing conditions, Trans Banyumas achieves a 78.8% selection probability. Sensitivity analysis identifies a critical fare threshold at IDR 4,537 and a travel time indifference point at 44–45 minutes, establishing fare stabilization and travel time optimization as the foremost operational priorities for Trans Banyumas management. Future research is recommended to incorporate stated preference (SP) experiments and to extend the analysis to multiple BRT corridors in Banyumas Regency for a more generalizable understanding of urban mode choice behavior.

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