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Research Article

Analysis of Mode Choice Between Damri Bus and Taxi Services as an Effort to Improve Passenger Transportation Services (Case Study: Gemeh–Melonguane)

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Abstract: The Gemeh–Melonguane route experiences a high volume of passenger trips, with noticeable competition between Damri buses and taxis as the primary transportation modes. Passengers' mode selection is influenced by various individual considerations and situational factors. This study aims to examine the characteristics and key factors affecting passenger decisions in choosing between Damri buses and taxis on this route. A descriptive quantitative method is applied, combining descriptive analysis to explain user characteristics with multiple linear regression to identify significant influencing factors. The regression results are then processed using a binomial logit model to estimate the probability of mode choice. The utility function derived from the regression analysis is Yubd = -3.027 + 2.417X10 + 3.85X23 + 4.052X24 + 4.659X31 + 4.289X32 + 3.388X33 + 2.352X34 - 3.653X61 - 4.377X62 - 2.629X72 + 1.325X82. Six variables were found to significantly influence mode selection: gender (X1), age (X2), occupation (X3), luggage weight (X6), reason for choosing the mode (X7), and service perception (X8). The coefficients of these variables were input into the binomial logit model to determine the likelihood of choosing each transport mode. The findings reveal that the probability of selecting Damri buses is 82%, while the likelihood of choosing taxis is 18%. These results indicate that Damri buses are more likely to be chosen due to factors such as affordability, convenience, and passenger demographics.

Keywords: Mode Selection; Transportation Choice; Binomial Logit; Damri Bus; Taxi Service.

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1. Introduction

Mode choice is a fundamental step in transportation modeling and plays a crucial role in shaping transportation policy, particularly in determining the appropriate type of transportation mode and infrastructure [1], [2]. As human activities grow, the need for mobility also increases, leading to the emergence of various transport mode preferences [3]. One of the fastest-developing urban centers in the Talaud Islands Regency is Melonguane, which functions as a hub for trade, seaport, airport, and other essential services. Gemeh village is among several areas connected to Melonguane in the distribution of goods, services, and passenger movement.

In inter-village travel, mode selection is influenced by various factors, including whether travelers choose public transport or private vehicles [4], [5]. Travel decisions are closely related to individual characteristics, trip purposes, and modal attributes. Basic mode choices typically begin with walking or using a vehicle, whether privately owned (motorcycles or cars) or public transport options such as Damri buses or taxis [6], [7]. Individuals who travel without a personal vehicle are reliant on public transport. Public passenger transport services aim to offer safe, efficient, affordable, and comfortable service. Travelers are often categorized as captive users (who have no alternative but public transport) and choice users (who voluntarily

choose public transport) [8], [9]. With policies favoring mass transportation systems, the number of captive users is expected to grow, leading to reduced congestion through optimal road space utilization. To encourage a shift from private to public transport, improvements in public transport quality are essential [10], [11].

On the Gemeh–Melonguane route, both buses and taxis operate as competing transport modes. Passengers' mode selection is shaped by various factors, including service attributes and personal preferences [12], [13]. Understanding travel behavior is essential in designing effective strategies to improve public transport service quality. Notably, passengers using Damri buses must first take bentor (a local motorcycle rickshaw) to access the terminal, highlighting the importance of connectivity in mode choice [14]. Based on this situation, this study seeks to identify the factors that influence mode selection behavior, analyze utility functions associated with each mode, and estimate the probability of passengers choosing between Damri buses and taxis [9], [15].

The research problem is formulated as follows: (1) What are the characteristics of passengers using Damri buses and taxis? (2) What is the probability of choosing Damri buses or taxis? and (3) What are effective strategies to improve the quality of Damri bus and taxi services? This study is limited to the Damri bus and taxi modes operating on the Gemeh–Melonguane route, with analysis conducted from the user perspective using a binomial mode choice model based on field surveys [16]. The objectives of the study are: (1) to analyze passenger characteristics influencing mode choice; (2) to model the factors affecting the selection between Damri buses and taxis; and (3) to evaluate the results to propose improvements in service quality. The benefits of this study include: providing insights for the author regarding mode choice behavior; offering useful information on factors influencing travel decisions to stakeholders aiming to enhance service quality; and serving as a reference for transportation policymakers in formulating strategies such as fare adjustments, service integration, or other regulatory interventions to improve coordination between taxis and Damri buses and facilitate smoother user transitions, ultimately supporting a more efficient transport system.

2. Theoretical Studies

2.1. Transportation Planning and Mode Choice Theory

Transportation planning is a critical aspect of infrastructure development and urban mobility. According to Tamin, transportation systems consist of three interrelated components: trip generation, trip distribution, and mode choice [1]. Mode choice refers to the process by which individuals decide on the most appropriate mode of transport, based on various socioeconomic and trip-related factors.

Theoretically, mode choice is often modeled using utility-based frameworks. McFadden introduced the Random Utility Theory, which postulates that individuals will choose the alternative that provides the greatest perceived utility [5]. This theory serves as the foundation for discrete choice models, such as the binomial logit model, which is suitable for evaluating decisions involving two alternatives (e.g., DAMRI buses vs. taxis).

2.2. Empirical Studies on Mode Choice

Several empirical studies have explored factors affecting transport mode choice. Lefrandt and Kumaat analyzed the characteristics of mode choice in the maritime city of Manado and found that service quality and accessibility were among the most influential factors [10]. Rompis used a multinomial logit model to investigate mode choice determinants in Manado, identifying variables such as income, age, and travel purpose as significant predictors [17].

Similarly, Prasetyo conducted a binary logit model study on student mode choices at Diponegoro University, highlighting the role of fare and travel time [12]. Wibowo and Yuliastuti also supported these findings in the context of student transportation decisions [18].

However, most prior research either focuses on urban settings or educational commuting patterns, with limited emphasis on inter-village travel routes such as Gemeh–Melonguane. Additionally, existing studies rarely consider logit regression integration with descriptive statistics for comprehensive mode choice modeling in rural or semi-urban contexts.

2.3. Factors Influencing Mode Choice

According to Tamin, mode choice is influenced by three major dimensions:

- User characteristics (e.g., income, age, gender, vehicle ownership),
- Trip characteristics (e.g., distance, purpose, time),
- Transportation system attributes (e.g., cost, safety, comfort, frequency) [1].

The study by Khosravi et al. reinforces this by confirming that passengers tend to select transport options that optimize both time and cost, consistent with the utility maximization framework. Meanwhile, Lefrandt & Rumayar emphasize that passenger satisfaction is a critical metric driven by service quality, fare affordability, comfort, and accessibility [10].

Furthermore, Gonzaga and Viloria identified socio-economic structure—including family income, trip length, and number of workers—as dominant variables influencing intra-city travel behavior [6].

2.4. Theoretical Framework and Research Gap

While previous works have laid a strong foundation for understanding mode choice, there is a notable gap in analyzing rural inter-village mobility using integrated binomial logit models combined with socioeconomic profiling. This study contributes by:

- Exploring non-urban passenger preferences between public transport alternatives (DAMRI bus and taxi),
- Applying a binary logistic regression model integrated with multiple linear regression to predict utility scores,
- Investigating how luggage weight, satisfaction levels, and gender correlate with mode choice in a semi-rural Indonesian context.

Thus, this study expands on prior works by not only replicating established theories but also tailoring the analysis to a unique, under-researched region (Gemeh–Melonguane), offering valuable insights for transportation planning and policy in Indonesia's outer islands.

3. Research Method

This study adopts a quantitative research approach, which was selected due to its ability to systematically collect and analyze numerical data in order to test hypotheses and explain the interactions between variables [19]. The quantitative approach, which generally follows a post-positivist paradigm, emphasizes measurement and theory testing. It often employs strategies such as experiments and surveys, requiring statistical data. In this study, data were gathered from respondents through interviews, with each respondent being measured only once to determine their behavior and preferences regarding transportation modes. This method allows the research not only to describe the features and distribution of transport mode preferences but also to identify the factors influencing people's decisions to choose between Damri buses and taxis. This aligns with the goal of quantitative research: to objectively and measurably test and explain the relationships between variables.

The research was conducted in several sequential stages. It began by identifying the bus and taxi routes to be studied—namely the Damri bus and taxi services operating between Gemeh and Melonguane. A literature review was then conducted, along with initial data collection to determine appropriate data processing techniques. A preliminary survey was carried out through questionnaires and direct interviews to refine the survey design. The final questionnaire consisted of two parts: one focusing on the general characteristics of transport users (including socioeconomic background and travel patterns), and the other on their transport mode preferences. Variables included in the analysis were travel cost (in Indonesian Rupiah per person), travel time (from origin to destination), frequency of departures (number of trips per day), and the amount of luggage allowed per mode.

After data collection, the data analysis process followed the steps outlined by Arikunto, consisting of three stages: data preparation (filtering out irrelevant data), tabulation (assigning codes and scores to facilitate analysis), and application (analyzing the data using appropriate statistical methods) [20]. A binary logistic regression model was employed, with the binary-scaled transport mode choice as the dependent variable and mode attributes (of Damri bus and taxi) as the independent variables. The significance of the model was tested using the Likelihood Ratio Test to evaluate the combined effect of independent variables. Partial significance tests were conducted to identify which variables had significant individual effects. Since logistic regression coefficients cannot be interpreted directly like in linear regression, odds ratios (Exp(β)) were used to measure the relative likelihood of choosing one mode over another.

Data collection methods included questionnaires and unstructured interviews. Questionnaires consisted of written questions distributed to respondents, while unstructured interviews involved flexible, open-ended conversations to gain deeper insight. In determining the population and sample, this study referred to Supangat, who defines a population as a group with similar characteristics being studied, while a sample is a representative subset used for analysis [2]. Based on Slovin's formula and a population of 350 users on the Gemeh–Melonguane route, with a 10% margin of error, the sample size was calculated as 78 respondents.

The research was conducted in the Talaud Islands Regency (Kabupaten Kepulauan Talaud), where data collection involved distributing questionnaires and conducting in-person interviews. The routes studied included both Damri bus and taxi services operating between Gemeh and Melonguane, as illustrated in the route map provided in Figure 1.

Figure 1. Gemeh – Melonguane Travel Route

4. Result and Discussion

4.1 . Characteristics

Passenger characteristics were analyzed to understand their influence on transport mode preferences between Damri buses and taxis on the Gemeh–Melonguane route. Gender distribution revealed that male respondents (55.2%) preferred Damri buses (68%), while female respondents (44.8%) tended to choose taxis (67%). Age-wise, the dominant group was 36–45 years old (38.8%), followed by 26–35 years (33.6%), both favoring Damri due to its affordability and capacity. Occupation played a significant role, with traders and farmers favoring Damri for its cost-effectiveness in transporting goods, while civil servants and other professionals preferred taxis, which offer greater convenience and comfort. Students also predominantly used Damri, while informal workers leaned toward taxis.

Income levels also influenced mode choice. Respondents earning below IDR 1 million per month (56% of total) mostly chose Damri (99 out of 140), indicating its accessibility to low-income groups. In contrast, middle- and high-income groups leaned toward taxis, prioritizing comfort and speed. Travel purposes varied: Damri was preferred for agricultural delivery and shopping, while taxis were dominant for work-related travel. Regarding luggage, Damri accommodated heavier loads, with 19 out of 21 passengers carrying more than 15 kg

choosing this mode. As for decision criteria, safety and comfort (42.4%) were the top reasons, followed by affordability (37.6%) and travel time (20%). Satisfaction levels indicated that 68.8% of users were "satisfied," while 27.2% were "very satisfied," with taxis receiving higher ratings in the latter. Safety perceptions also favored both modes, with 61.2% of respondents feeling "very safe," slightly more in favor of taxis. These characteristics provide essential context for understanding mode choice behavior on the route.

4.2 . Binomial Regression Analysis

To determine the suitability and accuracy of the logistic regression model used to analyze transport mode preference, both model feasibility and goodness-of-fit tests were conducted.

4.2.1. Model Feasibility Test

The model feasibility (model fitting) was evaluated using the -2 Log Likelihood statistic. A comparison between the null model (only intercept) and the final model (with predictors) is shown in the table below:

Table 1. Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	320.279	–	–	–
Final	152.413	167.866	23	0.000

The Chi-square value of 167.866 with 23 degrees of freedom and a significance level of 0.000 indicates that the inclusion of predictor variables significantly improves the model. This confirms that the model is feasible and appropriate for identifying factors influencing transport mode selection.

4.2.2. Goodness-of-Fit Test (Hosmer and Lemeshow)

To evaluate how well the model fits the actual data, the Hosmer and Lemeshow Test was used. A p-value > 0.05 indicates that the model's estimates are not significantly different from the observed outcomes, suggesting a good fit.

Table 2. Hosmer and Lemeshow Test

Step	Chi-Square	df	Sig.
1	14.895	8	0.061

The test result shows a Chi-Square value of 14.895 with 8 degrees of freedom and a significance level of 0.061. Since the p-value exceeds 0.05, the model is considered to have a good fit with the data. This means the predicted probabilities closely match the actual outcomes.

These two tables validate that the logistic regression model used in this study is both statistically significant and suitably accurate for explaining the observed transport mode choices between Damri buses and taxis.

4.2.3. Statistical Test

A statistical significance test was conducted to evaluate whether each independent variable had a significant influence on the choice of transport mode. The test results are presented in the table below:

Table 3. Significance Levels of Independent Variables

No	Variable	α	Sig. Value	Significance
1	Gender	0.05	0.000	Significant
2	Age	0.05	0.010	Significant
3	Occupation	0.05	0.000	Significant
4	Income	0.05	0.265	Not Significant
5	Travel Purpose	0.05	0.095	Not Significant
6	Luggage Weight	0.05	0.008	Significant
7	Reason for Choosing Mode	0.05	0.001	Significant
8	Satisfaction Level	0.05	0.022	Significant

9	Perceived Safety	0.05	0.211	Not Significant

From the table, six variables were found to have a statistically significant effect (Sig. < 0.05): gender, age, occupation, luggage weight, reason for choosing mode, and satisfaction level.

4.2.4. Partial Test

The partial significance test identified the influence of each variable individually. The binary logistic regression produced one logit function using the taxi mode as the reference category. The estimated parameters for significant predictors are shown below:

Table 4. Parameter Estimates for Significant Variables

Variable	B	Std. Error	Wald	df	Sig.	Exp(B)
X1 = 0 (Male)	2.417	1.800	15.456	1	0.000	11.216
X2 = 3 (Age 36–45)	3.850	1.522	6.399	1	0.011	46.989
X2 = 4 (Age 46–55)	4.052	1.578	6.596	1	0.010	57.495
X3 = 1 (Student)	4.659	1.088	18.327	1	0.000	105.569
X3 = 2 (Trader)	4.289	1.153	13.835	1	0.000	72.908
X3 = 3 (Farmer)	3.388	0.954	12.603	1	0.000	29.606
X3 = 4 (Others)	2.352	0.903	6.788	1	0.009	10.507
X6 = 1 (6–15kg)	-3.653	1.524	5.746	1	0.017	0.026
X6 = 2 (>15kg)	-4.377	1.647	7.061	1	0.008	0.013
X7 = 2 (Cost-based)	-2.629	0.804	10.629	1	0.001	0.072
X8 = 2 (Very Satisfied)	1.325	0.580	5.212	1	0.022	3.762

4.2.5. Logit Function and Mode Choice Probability

Based on the parameter estimates above, the logit function representing the probability of choosing Damri over a taxi is expressed as:

$$Y = -3{,}027 + 2{,}417X1_0 + 3.85X2_3 + 4{,}052X2_4 + 4{,}659X3_1 + 4{,}289X3_2 + 3{,}388X3_3 + 2{,}352X3_4 + -3{,}653X6_1 + -4{,}377X6_2 + -2{,}629X7_2 + 1{,}325X8_2 \quad (1)$$

To calculate the actual utility value (Y), the average values of each variable in the model were substituted:

$$\text{Yubd} = -3{,}027 + 2{,}417(0{,}68) + 3.85(0{,}38) + 4{,}052(0{,}23) + 4{,}659(0{,}14) + 4{,}289(0{,}21) + 3{,}388(0{,}39) + 2{,}352(0{,}20) + -3{,}653(0{,}45) + -4{,}377\text{X}(0{,}42) + -2{,}629(0{,}15) + 1{,}325(0{,}78) = 1{,}534 \quad (2)$$

Using this utility score in the binomial logit formula:

$$P(\text{i}) = \frac{e^{Yi}}{e^{Yi} + \sum e^{Yjn}} \quad (3)$$

$$\text{P (Bus damri)} = \frac{e^{1{,}534}}{e^{1{,}534} + e} = 0{,}82 = 82\% \quad (4)$$

$$\text{P (Taksi)} = 1 - 0{,}82 = 0{,}18 = 18\% \quad (5)$$

This result indicates that Damri is the preferred mode of transport on the Gemeh–Melonguane route, with a choice probability of 82%, compared to 18% for taxis.

Table 5. Mode Choice Probabilities

No	Transport Mode	Probability
1	Damri Bus	82%
2	Taxi	18%

The logistic regression results clearly show that Damri buses are significantly more preferred, especially by male users, traders, farmers, students, and those carrying heavier luggage.

This highlights the strategic role Damri plays in serving the majority of the population on this route.

4.3 . Service Quality Improvement

Based on the results of the binomial logistic regression analysis, several key variables were identified as significantly influencing the choice between Damri buses and taxis. These findings offer critical insights for improving service quality in public transportation, particularly for the Damri bus service.

First, gender emerged as a significant factor. Male respondents were found to be approximately 11 times more likely to choose Damri buses over taxis. This suggests that service improvements targeting male passengers—such as enhanced logistics support and affordability—could further reinforce this preference.

Second, age also demonstrated a notable impact. Respondents aged 36–45 years and 46–55 years had significantly higher tendencies to choose Damri, with odds ratios of approximately 47 and 57 times greater, respectively, compared to those over 55 years old. This indicates that mid-aged adults represent a core demographic for Damri services and should be prioritized in service planning, particularly in terms of scheduling, accessibility, and reliability.

Third, occupation showed exceptionally strong influence. Students had over 100 times higher likelihood to choose Damri compared to civil servants, military/police personnel, and the general category of "others." Traders and farmers were also significantly inclined toward Damri, with odds ratios of 72.29 and 10, respectively. These findings suggest that nearly all active occupation groups prefer Damri, primarily due to its functional utility for transporting goods and affordability. Hence, service enhancements should include greater luggage capacity, lower fares for frequent users, and possibly student or trade-specific programs.

Fourth, luggage weight had a significant negative effect on the likelihood of choosing taxis. Respondents carrying light (X6 = 1) and medium loads (X6 = 2) had significantly lower odds of choosing Damri—Exp(B) = 0.026 and 0.013, respectively. This clearly indicates that Damri is highly favored by passengers with heavy baggage, likely due to its large storage space and easier access to luggage areas. Therefore, maintaining and promoting Damri's baggage-handling convenience is vital.

Fifth, reason for choosing transport mode was another key factor. Respondents who selected modes for reasons other than travel time efficiency were 92.8% less likely to choose Damri (Exp(B) = 0.072; Sig. = 0.001) compared to those who valued speed. This implies that taxis are preferred when time is critical, reinforcing their role as the faster option. Thus, Damri should avoid directly competing on speed, and instead focus on enhancing its strengths such as affordability and cargo accommodation.

Lastly, passenger satisfaction played a crucial role. Compared to respondents who were dissatisfied, those who expressed satisfaction with Damri service were 3.76 times more likely to choose it again. This confirms that service satisfaction is directly linked to loyalty, underscoring the need for Damri operators to maintain high service standards, including cleanliness, punctuality, staff friendliness, and overall passenger comfort.

In conclusion, improving service quality should not follow a one-size-fits-all approach. Instead, data-driven service differentiation should be adopted, based on demographics, user needs, and journey characteristics. For Damri, investments in capacity, affordability, and user satisfaction will reinforce its market dominance, while taxis can focus on speed, flexibility, and personalized service for specific user groups such as professionals and time-sensitive travelers.

5. Conclusion

This study analyzed passenger mode choice on the Gemeh–Melonguane route by comparing Damri bus and taxi services as efforts to enhance public transportation, using a binary logistic model. The results show that several key characteristics significantly influence passengers' decisions, including gender, age, occupation, income level, trip purpose, and luggage weight. Male respondents (77.5%) tend to choose Damri buses, while females (55.4%) more frequently select taxis, reflecting a gender-based preference. Age also plays a role, with productive age groups (26–55 years) leaning towards Damri buses, whereas younger and older individuals prefer taxis. Occupation differences show that students, traders, and farmers predominantly choose Damri buses (68–92%), while civil servants and other professionals tend to use taxis. Income level is also influential: those earning under IDR 3 million per month

mostly use Damri, while higher-income groups prefer taxis. Additionally, passengers traveling for selling agricultural goods or shopping (with heavier baggage) favor Damri buses for their affordability and direct routes, while those commuting to work prioritize punctuality and thus prefer taxis. The multinomial logistic regression model predicts an 82% probability of Damri bus selection and 18% for taxis.

Based on these findings, several recommendations are proposed: Damri services should improve punctuality and reliability, enhance comfort (especially for elderly and women), provide accessible luggage storage, and maintain affordable fare schemes with special pricing for students and regular users. Introducing express services for workers and limited premium options could also broaden market reach. Collaboration with local government is essential to ensure policy support and sustainable operations. Future studies are encouraged to conduct home-based interviews for richer data collection and include additional behavioral variables to expand the model's applicability. Through these efforts, Damri can become a more competitive, efficient, and inclusive public transportation option in the Talaud Islands Regency.

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Conflict of Interest: The author declares that there is no conflict of interest in the preparation and execution of this research. All analyses and interpretations were carried out objectively without external influence.

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