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# The Innovation Breakthrough in Digital and Disruptive Era

# Study of Transportasi Mode Selection to Khairun University Campus with Binary Logit Method

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**Abstract.** Land transportation mode is the main means of transportation to reach campus II Unkhair Gambesi which can be accessed using motorbikes and public transportation. Ternate City is one of the cities in North Maluku Province which has many important activities in the fields of education, politics, and economy. In addition, the center of government of North Maluku province is also still in the Ternate City area, so it also has an impact on the development of the lives of the people of Ternate City. This study aims to determine the effect of cost and travel time on the selection of transportation modes between private vehicles (motorcycles) and public transportation using the state preference method. This study uses the Stated preference method used for an approach by using respondents' opinions on various alternative options on the attributes of travel costs and travel time to transportation modes Private Vehicles (Motorcycles) and Public Transportation Case Study: Central Ternate – Campus II Unkhair Gambesi. The results of this study used linear regression analysis and the binary logit method. And it can be concluded that the chance of choosing a Private Vehicle (Motorcycle) is 74% while the chance of choosing public transportation is 26%.

**Keywords.** Mode choice, public transportation, travel time

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## 1 Introduction

Land use functions in the form of parchment, business centers, housing and education areas have an impact on different traffic movements [1], [2]. Khairun University is an area with diverse forms of activity, the large number of students causes high travel, transportation is very important to support the movement of students to and from campus [3]. High movement has an impact on the high volume of traffic during peak hours [4], the provision of reliable public transportation is a separate problem that must be solved by policy makers [5], [6].

## 2 Research Purposes

This study aims to determine the effect of cost and travel time on the selection of transportation modes between private vehicles (motorcycles) and public transportation using the state preference method.

## 3 Literature Review

Nowadays competition between modes in supporting the movement of travelers is very tight [7]. Age, gender, occupation and income factors affect a person's decision in determining the type of mode to be used [8], [9]. Mode choice can also be influenced by income, travel time and costs [10],[11]. In some cases such as campus areas that influence students in choosing modes are vehicle ownership, and comfort [12], while in the selection of online and conventional taxi public transportation that affects the accessibility and availability of modes [13].

## 4 Research Methods

### 4.1 Types of research

The type of research conducted is a field survey and literature study related to the selection of public transportation modes and private vehicles (motorcycles).

### 4.2 Time and location of research

The study on the selection of transportation modes between private vehicles (motorcycles) and public transportation was carried out from May to June 2023

### 4.3 Sample

The total number of Khairun University students in 2021/2022 reached 9262 people, with the desired accuracy level of 90% then an error tolerance of € 10%. Then the number of samples to be studied is:

$$n = \frac{N}{1+N.e^2} \quad n = \frac{9.262}{1+9.262.0,1^2} \quad n = 99 = 100 \text{ sample}$$

**Table 1.** Cost and travel time

Mode of transport	Travel expenses	Travel time
City Transport	Rp. 35.000/week	30 minute
Private vehicles (motorcycles)	Rp. 50.000/week	20 minute

### 4.4 State Preference Method

Equation analysis is used to obtain the equation of the utility, cost, and time difference function. The analysis used in this study is regression analysis. Analysis with a regression approach was carried out for stated preference data where the choice used rating options presented on a semantic scale, namely;

- a) 1 = Choose a private vehicle (motorcycle)
- b) 2 = Maybe choose a private vehicle (motorcycle)
- c) 3 = Balanced Choice
- d) 4 = choose public transport
- e) 5 = Maybe choose public transport

This semantic scale is then transformed into a numerical scale (a value that expresses an individual's response to a choice statement) using ordinal logistic regression transformations, on the probability for each rating point. The numeric scale value is a non-free variable in regression analysis and as an independent variable is the difference in value between the cost and time attributes. The process of transformation from the semantic scale into the numerical scale is as follows:

- a. The choice probability scale value represented by the point rating values of 1, 2, 3, 4, and 5 is the standard scale value of 0.9; 0.7; 0.5; 0.3; and 0.1.
- b. Using linear transformations of the binary logit model can be known numerical scale values for each probability of the option.

Where:

- For point rating 1 with a probability value of 0.9, then the numerical scale value is  $\text{Ln} [0.9/(1-0.9)] = 2.1972$
- For point rating 2 with a probability value of 0.7, the numerical scale value is  $\text{Ln} [0.7/(1-0.7)] = 0.8473$
- For point rating 3 with a probability value of 0.5, the numerical scale value is  $\text{Ln} [0.5/(1-0.5)] = 0$
- For point rating 4 with a probability value of 0.3, the numerical scale value is  $\text{Ln} [0.3/(1-0.3)] = -0.8473$
- For point rating 5 with a probability value of 0.1, the numerical scale value is  $\text{Ln} [0.1/(1-0.1)] = -2.1972$

## 5 Results and Discussion

### 5.1 Characteristics of Respondents

The characteristics of respondents who use private vehicle transportation modes (motor bicycles and public transportation Route: Central Ternate – campus II khairun university can be seen based on the following data:

**Table 2.** Characteristics of Respondents

No	Description of individual characteristics	Percentage (%)
1	Gender	
	Man	119
	Woman	81
	Sum	200
2	Age	
	17-20 years	87
	21-23 years	68
	24-25 years	45
	Sum	200
3	Faculty	
	engineering	46
	Humanities	27
	Economics and Business	24
	Fisheries and Marine Sciences	20
	Medicine	16
	Agriculture	36
	Law	31
	Sum	200
4	Motor Ownership	
	Has a Motor	120
	Does not have a Motor	80
	Sum	200
5	SIM ownership	
	Have SIM C	84
	Don't have SIM C	116
	Sum	200

### 5.2 Binary Logit Model Analysis

**Table 3.** Multiple Linear Regression Test

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	
	B	Std. Error	Beta			
1	(Constant)	-1,384	0,062		22,438	0,000
	X1 cost	0,00083	0,000	-0,453	27,811	0,000
	X2 time	0,120	0,004	0,510	31,256	,000

Based on the table above, it is known that the constant value is -1.384, the value of the cost variable is -0.000084, and the value of the time variable is 0.120, so the multiple regression equation is as follows:

$$(USM - U_{au}) = -1.384 - 0.000083 \cdot (C) + 0.120 \cdot (T)$$

Based on the table of linear regression test results in Table 4.6, it can be concluded that travel time and cost affect the choice of transportation, so from the regression equation above it can be concluded as follows:

1. A constant value of -1.384 means that if there is no difference in cost and travel time, then the difference in utility is -1.384
2. The value of the cost variable regression coefficient of -0.000083 means that if other variables have fixed values and costs increase by 1 (rupiah units), then the transportation selection will decrease by -0.000083.
3. The value of the regression coefficient of the time variable of 0.120 means that if the other variables have a fixed value and time increases by 1 (unit of minutes), then the transportation selection will increase by 0.120.

Utility of respondents in the selection of land transportation from central Ternate – campus II khairun university gambesi

$$U_{sm} - U_{au} = 1.384 - 0.000083 \cdot (C) + 0.120 \cdot (T)$$

so that it becomes:

$$U_{sm} - U_{au} = 1.384 - 0.000083 \cdot (-15000) + 0.120 \cdot (10) = 1.069$$

Transport probabilities can be selected:

1. Probability of a personal vehicle (motorcycle)

$$P_{sm} = \frac{\exp^{U_{au} - U_{sm}}}{1 + \exp^{U_{au} - U_{sm}}} = \frac{\exp^{1.069}}{1 + \exp^{1.069}} = 0.74 = 74\%$$

So the probability of choosing a motorcycle is 0.74 if it is multiplied by 74% and the probability of choosing public transportation is:

2. Probability of public transport

$$P_{au} = 1 - P_{sm}$$

$$P_{au} = 1 - 0.74 = 0.26 = 26\%$$

So the effect of cost and time attributes on the probability of public transportation and personal vehicles (motorcycles) routes: Central Ternate – campus II khairun university is the chance of choosing a private vehicle (motorcycle) is 74% while the chance of public transportation is 26%.

## 6 Conclusion

From the results of this study, it was concluded that respondents prefer private vehicle modes (motorcycles) to travel rather than public transportation, obtained the probability of choosing private vehicle modes (motorcycles) which is 74% of private vehicles (motorcycles) and the probability of public transportation is 26% with attributes of travel costs and travel time.

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