Corresponding Author: Sutan P. Silitonga, Departement of Civil Engineering, Faculty of Engineering, Brawijaya University, Indonesia. 
E-mail: sutan_psm@yahoo.co.id

ABSTRACT

This paper studied the behavior model of modal selection base on utility level of public and private transports modal. The discrete model that would be use was Multinomial Logit by developing a kind of laten variable lifestyle as a new one in concerning the behaviour of modal choice in Indonesia. The increasing of using private transport mainly motor cycle influenced the use of public transport. The purpose of this study was to describe the alternative of solution for this problem. Case study selected in three cities of Indonesia such as Palangka Raya, Malang and Surabaya that figured different city sized characteristic.

Key words: behaviour model, utility, public transport

Introduction

To date, many cities have attempted to restrict the use of private cars in favour of public transport. Such politics exist in France, Germany, Britain, Netherlands, Romania, Australia, Asian country and Canada (Kamba, A.D., R. Atiq, Ismail, 2007).

In the last three decades, motorization and urbanization had been the trend in many metropolitan areas in the developing countries. In line with the population and economic growth, the number of motor vehicles also showed in rapid growth. For examples, the motor vehicle per thousand people in Surabaya, one of the main cities in Indonesia, has increased 455% from 70 in 1976 to 310 in 1998 (Susilo, Y., T. Joewono, 2007). In another country, Taiwan in 1961, number of population was 11.5 million, the total of motorcycles was 32,000 and the number of car was 8,968. By being in contrast, in 2004 the population became 22.6 million and the total number of cars increased significantly to 5.39 million while the motorcycles expanded even more sharply to 12.8 million, it was about 390 times of that in 1961 (Lai Wen Tai, Lu Jin-Long, 2007).

Specifically in In Indonesia nowadays, the system of modal selection in society was competitively. One of transportation utilities such as public transportation had left. Since 2005, the policy by increasing of gasoline value caused higher value of public transport rate. There were bad services and not too good in operational management of public transport. The policy of transportation, which was not available, would cause the user of public transportation in decreasing.

This condition is going worse by predicting that lifestyle due to private attracted for using a specific of kind private mode transport start influence mode choice behaviour.

In the other hand, the function of public transport utility, which was smaller than private transport, was increasing the users of private motor cycle and private car. It showed that public transport out of function as public transport, which was dominant in all of the cities in Indonesia. And if it is not anticipated soon, it will be happen like a new asians country impact such increased traffic congestion, accidents, inadequate parking space and air pollution among other evil (Kamba, A.D., R. Atiq, Ismail, 2007).

Public transport reform was, therefore, very important to increase the use of public transport mode and to maintain the sustainable. Design of transportation recommended based on analyses of transportation modeling. There was needed the accurate and reliable of data collecting (Munawar, A., 2007). This study was intended to develop the discrete selected model so that was produced the valid and reliable behavior model of selected modal. For reaching this purpose, it was carried out to design the new system of public transport

Materials and Method

Discrete Choice:

Disrete choice model was chosen for this study becouse it have played an important role in transportation modeling for the last 25 years. They are used to provide a detail representation of the complex aspect of the transportation demand, based on strong theoretical justification. A discrete choice model predict a dicision made
by an individual as a function of any number of variables, including factors that describe policy change. The model can be used to estimate the total number of people who change their behaviour in response to an action (Nurdden, A., R. Atik, A. Ismail, 2007).

Utility Theory:

Virtually all operational models for predicting individual’s Choice are based on behavioral can be stated called “utility maximization”. According to the utility maximization principle, there is a mathematical function, called a utility function, whose mathematical value depends on attributes of the available options and the individual. The utility function has a property that its value for one option exceeds its value for another if and only if the individual prefers the first option to second. (Kamba, A.D., R. Atiq, Ismail, 2007).

Development of Late Factor Lifestyle:

In the empirical literature on travel mode choice, most choice models use time, cost and modal attributes to explain the choice process. However, researches conducted in the area of attitudes and behavior have shown that there are many considerable personality traits in everyday life that may be explored to aid better understanding of the driving forces behind individual’s mode choice. Alternatively, it is needed to study an additional dimension by incorporating latent factors. In Kuala Lumpur Malaysia, Ghani and Ahmad (2007), using data collected through a questionnaire instrument field in the middle of 2005, able to confirm two of latent factors (safety, comfort, convenience and flexibility) are important determinants of mode choice in their study.

In this Study, the latent factor that will develop is the influence of lifestyle toward interesting usage the specific kind of private vehicles. Suspected that the influence of lifestyle in Indonesia was more evident, therefore, if we have not studied the impact of fear of upsetting prediction models built.

By providing better explanation to mode choice behaviour, the enriched discrete choice model could prove useful to policy makers in managing transportation infrastructure and services to maximize welfare (Ghani Nor, M.Z. Ahmad, 2007).

The Mindset Concept:

The mindset of the establishment of the mode choice model developed in this study can be seen in Figure 1.

![Modal Choice Frame of Mind Concept](image-url)
In concept, there are several things can do to increase the use of public transport, in particular:

1. Improve the operational performance of existing public transport, so the quality and reliability can increase the utility of public transport accessibility, particularly in terms of distance, time and cost.
2. Encourage the use of changes in private mode to public transport, with public transport fare policy stimulus is lower than the cost of travel by private vehicle.
3. Prevent the use of private mode, with a policy of raising parking fees, vehicle taxes, license fees and restrictions on private vehicle ownership (motorcycle / car) and others.

**Fig. 2:** Increased the usage of Public Transport Concept.

Location of this study was in three cities of Indonesia such as Palangka Raya, Malang and Surabaya, which described as below:
- Palangka Raya has 2,678.51 km² area and 191,104 populations with density of population was 71.3/km²
- Surabaya has 574.36 km² area and 2,941,820 populations with density of population was 7,858/km²
- Malang has 110.06 km² area and 816,444 populations with density of population was 7,418/km²

Response criteria was developed through a joint survey revealed preferences and stated preferences, the process can be seen with the scheme as in figure 3 below.

**Fig. 3:** Single Choice Response Schema.
Results and Discussion

Generally, condition of public transport in 3 samples of cities was described as in Table 1 below.

Table 1: Result of average Load Factor and Headway public Transport.

<table>
<thead>
<tr>
<th>City</th>
<th>Load factor (%)</th>
<th>headway (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palangka Raya</td>
<td>20.05</td>
<td>1.38</td>
</tr>
<tr>
<td>Malang</td>
<td>26.7</td>
<td>4.3</td>
</tr>
<tr>
<td>Surabaya</td>
<td>37.7</td>
<td>1.82</td>
</tr>
<tr>
<td>Mean</td>
<td>28.15</td>
<td>2.5</td>
</tr>
</tbody>
</table>

The result showed that there was no problem related to load factor and headway of public transport in some cities of Indonesia, which would influence the decreasing of using public transport. The users of public transport generally were daughter in the age under 20 years for educational purposes as described as in Figure 4 below.

![Fig. 4: Characteristic Of Public Transport User.](image)

Based on R-square (Cox and Snell, Nagelkerke, McFadden), it showed that the ability of fact description was about ± 73% and the model was expressed as a good one. Table 2 was described prediction level of model due to SPSS and all of the prediction level of model was 81.9%. It showed that the accuracy of model prediction was higher in prediction of public transport selection (mikrolet/bus 90.1%). It showed that combined model was easier to describe the characteristic of public transport selection than private transport.

Table 2: Modal Choice Model Predicted Result.

<table>
<thead>
<tr>
<th>Observation</th>
<th>Model Predict</th>
<th>Correct</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mikrolet/Bus</td>
<td>Private car</td>
</tr>
<tr>
<td>Mikrolet/Bus</td>
<td>282</td>
<td>11</td>
</tr>
<tr>
<td>Private car</td>
<td>15</td>
<td>270</td>
</tr>
<tr>
<td>Motorcycle</td>
<td>33</td>
<td>56</td>
</tr>
<tr>
<td>Total percentage</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The probability public transport generally, could be selected for individual due to the characteristic as follows:
1. Female
2. Job of a student
3. Family structure as a child
4. Level of private transport belonging was so small
5. The age of transport doing was so young
6. Family with big number
7. The selection of genuine moda due to the demand consideration and it did not based on personal interest.

R-square (Cox and Snell, Nagelkerke, McFadden) showed that by the ability of fact description at about ± 60%, the model could express as a good one. Based on validity test of SPSS as described (in Table 3), the whole prediction level was 79.2%. Accurate model prediction was so higher in prediction public transport (mikrolet/bus 91.4%). It showed that selection of public transport was easier to describe than private transport.
Based on the curve of data simulation, which described level difference of 5 main dominant variables due to the change of moda selection such as motor cycle, car and public transport it was carried out for some of certain groups as follow:

For individual group, which had probability of motor cycle choice > 75%, some results could be carried out to increase the use of public transport as follow:

Probability of moda choice would be predicted to increase from 0% to 42.8% while the public transport fee was at the lowest level (<Rp 2500), private car fee was > Rp 7500 and time of private car journey was >45 minutes.

By considering to apply special policy, probability of public transport moda choice would predict to increase to 50.2%. It was due to the increasing 25% of private vehicle tax and the restriction of motor cycle or car belonging.

For individual group, which had probability of private car choice > 75 percentage, it was predicted that the probability of using public transport could not be optimal increased. For this group, the use of private car was as permanent choice; however, the five transportation policies applied.

Simulation model for group 1 and 2 was described as in Figure 5 below.

For individual group, which had probability of motor cycle choice between 50- 75%, some simulation result which could be carried out to increase the use of public transport was as follow:

The probability of moda choice would predict to increase from 1.4% to 40.4% if it simulated to public transport and motor cycle fee was in the range of Rp 2500-Rp 5000.

By considering applying special policy, probability of public transport moda choice would predict to increase to 51.8%. It was due to the increasing 25% of private vehicle tax and the restriction of motor cycle or car belonging and the increasing of driving licence fee of 50%

For individual group, which had probability of private transport choice > 50-75 percentage, simulation effort of characteristic transport moda did not increase significantly the probability of using public transport. Figure 6 showed that the effort of increasing journey time of private car more than 45 minutes and it was impact the motor cycle choice. The probability of public transport would be less increase as 4.2 %, if the journey fee of motor cycle and private car was > Rp. 7.500.-. Journey time of motor cycle and private car was > 45 minutes and journey fee of public transport at the lowest level (<Rp 2500). The effort of applying the five transport
policies described as in Figure 6. It increased the probability of using public transport to 9.5% with special condition, which selected moda due to demand and pair journey type. Model of simulation group 3 and 4 could be seen as the output program as in Figure 6.

![Figure 6: Output Simulation Model with own vehicle choice probability 50-75%](image)

**Conclusion:**

Based on the result of simulation, it was concluded that private car user to date was as individuated, which was more difficult to be changed in moda selection. It was different with the user of motor cycle, which had significant prediction at moda transition to the user of public transport if there was any change in certain condition.

**References**


