Comparison User’s Time Value Of Money On Operation Of Public Transportation System in Jakarta

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Abstract: At the recent time, there is happened move of usage from transit (public transportation) usage to private usage especially motorcycle usage. We have known that level of user satisfaction is relatively depend on the whole situation of trip service variables in the city. The two main attributes that be user’s consideration as the measurement of transit service is travel time and waiting time of transit user. Those time are influenced by the characteristic of the user and the purpose of the user trip. So that is very important to know the time value of both travel time and waiting time of transit user. The time value must depend on various of trip purpose and user characteristic. The stated pereference survey method is applied on the questionaire to get the data of user preference. Those time value will be differentiate by the trip purpose and the kind of transit (public transportation) service like Bus, Metromini/ Kopaja (Medium Bus) and Mikrolet (Micro Bus).

Key Words: Waiting time, travel time, fare, time value

1. BACKGROUND

Public transportation or Transit in Jakarta reached 140,000 vehicles and serving 53 routes, which inappropriate vehicle condition or vehicle’s ages is more than 12 years. Their operation overlook is lack of the passenger safety. The other problem of the transit operation in Jakarta is they often stop on any road side, just not on the shelter and stop for along time or they expense the time for wait the sufficient number of passenger or we call in Bahasa is "ngetem”. Since of “ngetem” the travel time of the transit could be longer or the transit’s delay will take very long time. So “ngetem” make the discourse of transit operation in Jakarta. The demand of transit is become decrease day to day and the transit service would be not interesting for trip user especially commuter user in Jakarta.

The impact of the discourse of those transit operation is the split move of trip user from transit’s user to private’s user especially motor cycle’s user. Indeed of those movement use of public transport to private motor vehicles, cause the problem that increasing number of vehicles movement in Jakarta. This situation make traffic congestion on the almost road way in Jakarta become harmful especially on the peak hour. So level of service of almost road way in Jakarta become decrease and approach the fatigue condition. The other Impact is where each vehicle exhaust fumes that may pollute the environment become very high air pollution.
Because those situation is very important to know the reliability of public transportation and one parameter that influence that is transportation cost of user. User’s transportation cost is influenced by user’s time value, so it is very important to know the time of user’s public transportation.

2. RESEARCH OBJECTIVES

The objectives of this research are:
- To find the time value of public transportation user in its various service condition
- To compare time value of user between waiting time and travel time in public transporation services
- To compare time value of user between several kind of public transportation mode that operation in Jakarta

3. PROBLEM IDENTIFICATION

Public transportation often do "ngetem" that can cause of decreasing the reliability of public transportation services. The decreasing public transportation services can cause of decreasing the number of users of public transport, so that many public transport users who moved to use private vehicles. Easy to understand that “ngetem” can increase operational costs of public transportation and user of public transportation especially in time consuming of commuter trip. So that both users and operators of public transport are losses, both in terms of time and cost. This research want to explore how much time value of public transportation user and how it can used as one of some parameters to predict the public transportation reliability.

4. LIMITATION OF PROBLEM

This research was conducted by giving questionaire and interview to:
- All public transportation user who were in the stops are located in areas in Jakarta Indonesia at public transportation shelters or stops, namely the stop are: Palmerah, Slipi Jaya, untar II, Harmony, Sarinah Tamrin, Ratu Plaza, Pondok Indah, Cengkareng and Kedoya.
- Some person that use private vehicle especially motor cycle’s users who work at Tarumanagara university and at the several motor cycle workshop especially at the West Jakarta and its surrounding.

5. RESEARCH BENEFITS

Time value of public transportation user should be the parameter for assessment of public transportation reliability measurement and become the tool for analysis increasing demand of public transportation.
6. LITERATURE REVIEW

Number of vehicles in Jakarta in 2007 reached 5.8 million units with growth rate of 9% per annum in the last five years. Meanwhile, the vehicles coming into Jakarta per day reached 700 thousand units. Unfortunately, it does not offset by the growth of public transportation or road infrastructure that grow very slowly.

The length of roads in Jakarta only ± 7650 km with an area of 40.1 km2 roads or 6.2% of the area of Jakarta but ideally the road ratio is about 10% to 14%. On the other hand, the number of public transportation is only 2% of total vehicle movement everyday in Jakarta, that should be able to serve 56% or 9.6 million trips per day.

Meanwhile, other 44% movement everyday that use 98% private vehicle, of total vehicle movement everyday in Jakarta. The number of vehicles that are in the area Polda Metro Jaya, which registered from 2006 and in 2007 that can see at the Figure 1 as below:

![Figure 1: The Average Growth Rate of Private Vehicle in Jakarta (based on data 2002-2009)](image)

In 2009, the number of vehicles registered reached 9,993,867 vehicles in Jakarta both public and non-vehicle and passenger cars, goods, cars buses, special cars and motorcycles with a total population of Jakarta in March 2009 (www.komisikepolisianindonesia.com)

Jakarta Transportation Agency recorded a growth vehicle to reach 10.79 percent per year. Traffic Directorate Jakarta Police receive new cars registration are 600 units per day. While the motorcycle reached 1000 units (www.vivanews.com).

In those addition of private vehicles number, in fact many point congestion caused by the over capacity presence in almost carriageway in Jakarta. Just as private vehicles are often
accused of indiscriminate parking, bus and public transportation vehicles seem to always stop just outside of the formal bus stop that provided by government (www.ducati.com).

Another cause of congestion is many public transportation stop for “ngetem”. Section Head of Traffic Control and Supervision of Transportation, admitted difficulties in control of “ngetem” of public transportation. The driver of Public Transportation do “ngetem” when they don’t look the officers and when the officer started to leave them (www.beritajakarta.com). So public transportation is also take a part of traffic jams in Jakarta, part because the behavior of drivers who like take “ngetem”.

Level of congestion in Jakarta area resulted loss suffered all citizens capital that reached Rp28 trillion per year. Those losses variable are a result of due to fuel losses, loss of productive time, idle time of public transportation and loss of health cost. Total losses are greatest among the fuel sector, losses that could spend up to Rp10, 7 trillion per year, citizens of productive time loss estimated at Rp 9, 7 trillion per year and losses in the health sector that is as much as Rp 5, 8 trillion per year. While the losses suffered by owners of public transport can reach Rp1, 9 trillion per year due to reduced number of trips that can be taken.

The average of “ngetem” time of Metromini or Kopaja for their distance route more than 15-16 km) is 0,33 minutes, for their distance route more than 16-17 km is 6,67 minutes and for their distance route more than 17-18 km is 4,17 minutes on each bus stops in average (Najid, Albert, 2008).

The average of “ngetem” time of Bus are for for their distance route more than 20-25 km is 7,00 minutes, for for their distance route more than 25-30 km is 4,75 minutes and for for their distance route more than 30-35 km is 7,17 minutes on each bus stop in average (Najid, Albert, 2008).

To minimize the traffic congestion and to give better public transportation service since year 2004 the Government of Jakarta Province introduce the new mass public transportation which namely is Transjakarta. The special purpose of Transjakarta is for switching the motorcycle user to Transjakarta user. Based on research can be identified that mode split between Transjakarta and Motor Cycle is \[ Y = 1.950 - 0.001 \times (\text{difference travel time between Transjakarta and motorcycle}) - 0.031 \times (\text{difference waiting time between Transjakarta and motorcycle}) - 0.052 \times (\text{difference travel cost between Transjakarta and motorcycle}), \] where \( Y \) is proportion of user to choose Transjakarta Busway. The parameter model \( R^2 \) value is 67,60% (Najid, Pongtuluran, 2009).

Those model mean when all the service attributes between Transjakarta and Motorcycle is equal condition, there is about 1950 motor cycle user that will move to Transjakarta user. Those model can give illustration how public transportation very serious needed by travel user in Jakarta especially in peak hour trip either in the morning or in the afternoon.
7. METHODOLOGY

This research is based on public transportation user’s perception and private vehicle user’s perception about their time value when they on the vehicle and at the shelter for wait the transit services. We can see the process of research at figure 2 as below:

![Research Process Diagram](image)

**Figure 2**: Research Process

8. DATA COLLECTION

The number of samples is 50 people. The survey conducted by interviewing method on samples taken as many as 50 people on any large bus, medium bus and minibus or mikrolet. Survey done by a person who has the duty to give the questionnaire to users of public transportation and private vehicle user. Before performing the first survey of the selected any bus stops that would be taking the data, should conducted the pilot survey. Data collection carried out at purposive sampling then set will be the respondents in the research. At the time of going to stop there that go by foot and using public transportation.

The earlier survey conducted on November 25 year 2009 at 06:22 AM until 07:00 AM on
the Palmerah stops, at 07:10 AM until 07:45 AM hours on the Slipi stops, at 08:00 AM until 08:45 AM at Unar II stops, at 09: 30 AM until 10:00 Am at the stops of Harmony, at 11:00 AM until 12:00 AM at the bus stops of Sarinah Tamrin, at 14:00 PM until 15:00 PM on the Ratu Plaza stops, at 16:15 PM until 17:30 PM at Pondok Indah stops. For private vehicle respondents the data collection taking at the motorcycle workshop where exist at the surrounding of bus stops where the several survey of public transportation conducted.

9. DATA ANALYSIS

Before we take data analyze to answer the research question, we start to identifying the Composition of trip purpose on trip survey data as table 1 as below:

Table 1: Responden Trip Purpose Composition

<table>
<thead>
<tr>
<th>Trip Purpose</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work</td>
<td>46</td>
</tr>
<tr>
<td>Study</td>
<td>20.7</td>
</tr>
<tr>
<td>Business</td>
<td>19</td>
</tr>
<tr>
<td>Shopping</td>
<td>14.3</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
</tr>
</tbody>
</table>

From table 1 we can see that the majority respondent’s trip purpose is work and just 14.3% respondents do the trip for shopping. Those trip purpose condition show more than 85% samples of respondents do the commuting trip.

To know how is the certain services of public transportation, we need to calculate the average travel time when the respondents do their trip. Then further analysis we try to compare those analysis with the trip do by private vehicle especially motorcycle that we assume as the competitive mode of transit.

1. Analysis for PUBLIC TRANSPORTATION travel time:
   - The average travel time of Work trip purpose: \( (42.86 \times 23 + 38.1 \times 38 + 19.05 \times 53) / 100 = 34.43 \) minutes
   - The average travel time Business trip purpose: \( (25 \times 23 + 37.5 \times 38 + 12.5 \times 53) / 100 = 26.62 \) minutes
   - The average travel time shopping trip purpose: \( (66.7 \times 23 + 0 \times 38 + 33.33 \times 53) / 100 = 33.01 \) minutes
   - The average travel time study trip purpose: \( (33.33 \times 23 + 33.33 \times 38 + 33.34 \times 53) / 100 = 38.00 \) minutes

2. Analysis for MOTOR CYCLE travel time:
   - The average travel time Work trip purpose: \( (47.62 \times 13 + 52.38 \times 18) / 100 = 15.62 \) minutes
   - The average travel time Business trip purpose: \( (16.67 \times 5 + 33.33 \times 13 + 50 \times 18) / 100 = 14.16 \) minutes
• The average travel time shopping trip purpose : \((66.67 \times 5 +33.33 \times 35) / 100 = 14.99\) minutes.
• The average travel time study trip purpose : \((50 \times 13 +33.33 \times 18 +16.67 \times 23) / 100 = 16.33\) minutes.

We can see for all trip purpose travel time by motor cycle is taking about 50% from travel time by public transport. Those condition shows the attractiveness of motorcycle services than transit (public transportation) services. The data of waiting time, travel time and time value of public transportation and motor cycle we can see at table 2 as below:

Table 2: Data Compilation of Waiting Time, Travel Time and Time Value

<table>
<thead>
<tr>
<th>Trip Purpose</th>
<th>Average Waiting and Travel Time (minutes)</th>
<th>Average User’s Time Value (minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Willingness Waiting Time</td>
<td>Transit Waiting Time</td>
</tr>
<tr>
<td>Work</td>
<td>9.17</td>
<td>11.91</td>
</tr>
<tr>
<td>Study</td>
<td>10.71</td>
<td>12.5</td>
</tr>
<tr>
<td>Shopping</td>
<td>9</td>
<td>10</td>
</tr>
</tbody>
</table>

The Transit (public transportation) waiting and travel time are the average of waiting and travel time Bus, Kopaja/ Metromini and Mikrolet. From table 2 we can see that the average difference of willingness waiting time and actual waiting time for all user is about 14.43%. We can see the completely analysis at the table 3 as below:

Table 3: Difference Percentage of Willingness and Actual Waiting Time

<table>
<thead>
<tr>
<th>Trip Purpose</th>
<th>Willingness Waiting Time (minutes)</th>
<th>Transit Waiting Time (minutes)</th>
<th>Difference Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work</td>
<td>9.17</td>
<td>11.91</td>
<td>29.88</td>
</tr>
<tr>
<td>Study</td>
<td>10.71</td>
<td>12.5</td>
<td>16.71</td>
</tr>
<tr>
<td>Business</td>
<td>9.17</td>
<td>9.17</td>
<td>-</td>
</tr>
<tr>
<td>Shopping</td>
<td>9</td>
<td>10</td>
<td>11.11</td>
</tr>
<tr>
<td>Average all trip purpose</td>
<td></td>
<td></td>
<td>14.43</td>
</tr>
</tbody>
</table>
Work trip purpose has the biggest percentage difference of waiting time, that shows how time is very important variable in work trip as we know the work trip almost take at peak hour period. Otherwise with shopping trip that generally take at off peak hour period.

Analysis of user’s time value of money is for describing how transit mode and trip purpose influence those time value. We can see completely analysis at table 4 as below:

Table 4: Comparisson User’s Time Value

<table>
<thead>
<tr>
<th>Trip Purpose</th>
<th>Bus (IDR)</th>
<th>Metromini/ Kopaja (IDR)</th>
<th>Mikrolet (IDR)</th>
<th>Average (IDR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work</td>
<td>200,30</td>
<td>156,50</td>
<td>151,99</td>
<td>169.60</td>
</tr>
<tr>
<td>Study</td>
<td>24,58</td>
<td>75,33</td>
<td>76</td>
<td>58.64</td>
</tr>
<tr>
<td>Business</td>
<td>152,17</td>
<td>142,33</td>
<td>150,80</td>
<td>148.43</td>
</tr>
<tr>
<td>Shopping</td>
<td>124,67</td>
<td>110,25</td>
<td>120,25</td>
<td>118.39</td>
</tr>
<tr>
<td>Average</td>
<td>125.43</td>
<td>121.1025</td>
<td>124.76</td>
<td>123.76</td>
</tr>
</tbody>
</table>

From table 4 we can see the average time value of money between transit (public transportation) mode almost the same but very difference between trip purpose. For category trip purpose the biggest time value of money is work trip purpose and the smallest one is study trip purpose. User’s time value of money for work trip purpose is almost three time of user’s time value for study trip purpose.

We have to consider the feeder service in transit (public transportation) system operation and service on user’s daily trip of their daily activity example for going to work or back to home. We can see the completely data compilation at table 5 as below:

Tabel 5: Average Travel Cost/ Trip Include Feeder System Services

<table>
<thead>
<tr>
<th>Trip Purpose</th>
<th>Cost/ day</th>
<th>Cost of Feder System Service / door to door service (IDR)</th>
<th>Transit Total Fare (IDR)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Motor Cycle Cost (IDR)</td>
<td>Average Transit Fare (IDR)</td>
<td></td>
</tr>
<tr>
<td>Work</td>
<td>4150</td>
<td>3070</td>
<td>3400</td>
</tr>
<tr>
<td>Study</td>
<td>3950</td>
<td>3510</td>
<td>2700</td>
</tr>
<tr>
<td>Business</td>
<td>4250</td>
<td>4060</td>
<td>3100</td>
</tr>
<tr>
<td>Shopping</td>
<td>5850</td>
<td>5030</td>
<td>2500</td>
</tr>
</tbody>
</table>
The cost analysis between total motorcycle cost and Transit (public transportation) cost is shown at table 6 as below:

<table>
<thead>
<tr>
<th>Trip Purpose</th>
<th>Travel cost/ one trip (IDR)</th>
<th>Relative Cost (IDR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transit</td>
<td>Motor Cycle</td>
<td>Difference</td>
</tr>
<tr>
<td>Work</td>
<td>6470</td>
<td>4150</td>
</tr>
<tr>
<td>Study</td>
<td>6210</td>
<td>3950</td>
</tr>
<tr>
<td>Business</td>
<td>7160</td>
<td>4250</td>
</tr>
<tr>
<td>Shopping</td>
<td>7530</td>
<td>5850</td>
</tr>
</tbody>
</table>

The average cost of transit (public transportation) is more than 1.5 than cost of motorcycle, and of course we can get more relative cost if we added time value of money in waiting and travel time of public transportation operation.

We can explain the table 4 by calculation example for Trip Purpose Work:

11.538% employee pay public transportation fare is Rp. 2000.-
23.077% employee pay public transportation fare is Rp. 2500.-
26.923% employee pay public transportation fare is Rp. 3000.-
26.923% employee pay public transportation fare is Rp. 3500.-
7.923% employee pay public transportation fare is Rp. 4000.-
3.846% employee pay public transportation fare is Rp. 5000.-

Average employee pay rates of public transportation is Rp.3070
Average cost before and after the public transport = Rp.3400, -
Total Cost of Use of Public Transportation for the purpose of travel Work = Rp. 6470, -.

Cost of use of motorcycles is a cumulative cost of fuel cost, maintenance cost and parking (based on questionnaire data).
10. SOME FACTORS AFFECTING THE RELIABILITY OF PUBLIC TRANSPORTATION SERVICES

By using data from an attachment, obtained a number of factors which, according to respondents can affect the reliability of public transport to be grouped according to type of work, namely:

• Some of the factors that make respondents do not use public transport, the type of work employees:
  26.923% of employees think in terms of longer time
  7.692% employees assume more expensive in terms of cost
  34.615% employees consider the public transport service is less
  30.769% take public transportation employees often "ngetem"

• Some of the factors that make respondents do not use public transport, the type of work a student / i:
  11.111% learner / student / i consider more expensive in terms of cost
  22.222% learner / student / i think the public transport service is less
  66.667% learner / student / i think public transport is often "ngetem"

• Some of the factors that make respondents do not use public transport, the type of work merchant:
  11.111% traders think in terms of longer time
  22.222% traders consider more expensive in terms of cost
  11.111% traders consider the public transport service is less
  55.555% traders think public transport is often "ngetem"

• Some of the factors that make respondents do not use public transport, the type of job shopping:
  16.667% consider shopping more expensive in terms of cost
  50% spending less regard public transport services
  33.333% expenditure of public transport are often considered "ngetem"

Of the several factors that most influence the reliability of public transportation is transportation that is often "ngetem". So "ngetem" can influence the timing and reliability of public transport. By using data from the appendix, shows that "ngetem" is one of the causes of travel time becomes longer.

11. CONCLUSION :

- Waiting Time of all trip purpose is not quite different each other
- Travel Time for study purpose quite more than others caused by estimation of travel time of trip to campus do during peak period.
- Time Value of work trip purpose quite more than other trip purpose.
- Fare of transit (public transportation) still more expensive than motorcycle cost but the margin of the cost can identified as convenience, safe and accident cost.
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