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Initial Study on the Daily Activity, Trip Arrangement, the Use of ICT and Social-economic Characteristic in Malang City

Achmad Wicaksono, Department of Civil Engineering, Brawijaya University, Indonesia.
(e-mail:wicaksono68@ub.ac.id)

Meriana Wahyu Nugroho, Department of Civil Engineering, Brawijaya University, Indonesia & Faculty of Engineering, Hasyim Asy'ari University, Indonesia.
(e-mail:rian.sipilunhasy@gmail.com)

Dimas B.E. Dharmowijoyo, Department of Civil and Environmental Engineering, Teknologi PETRONAS University, Malaysia&School of Planning and Policy Development, Institut Teknologi Bandung, Indonesia.
(e-mail:dimas.bayu@utp.edu.my)

M. Zainul Arifin, Department of Civil Engineering, Brawijaya University, Indonesia.
(e-mail: mzaub@ub.ac.id)

Abstract---Undertaking healthy activities and trips is manifested from a set of daily activities and travels. The consequences of undertaking healthy activities and trips also includes reducing the time of some unhealthy activities. At present, ICT (Information, Communication and Technologies) activities are replacing some daily physical activities into non-physical daily activities in the digital age. The penetration of ICT might also determine the trip arrangement either number of trips and trip chains of the travelers that will also influence the traffic volume, especially on urban streets. Travelers try to improve their travel efficiency through a variety of ways, but now people have more varied activities, so that their travel behavior has changed, as well as their travel patterns. The purpose of this study is to analyze the characteristics of household socio-economic on different trip arrangement with the influence of ICT penetration. The ones who use ICT more often might have different choice on transport modes from someone who undertakes no online activities. Data collection is done using an activity diary. The survey location was focused on Malang City of Indonesia, and the nearest city boundary, the sample used was 200 household samples in this study. The analysis technique in this study uses Logistic Regression with the Purposive Sampling method by constructing a number of models based on individual daily physical activity travel data records, the data obtained are expected to be able to describe travel patterns and mode choice use on a household scale based.

Key words---Activity Diary, Travel Patterns, Socio-economic, Trip Arrangement, Malang City

I. INTRODUCTION

Travel is one of individuals' activities conducted in order to fulfil their needs and desires in multiple locations. For that reasons, travel parameter is also influenced by the type of people's daily activities (Hägerstrand, 1970; Jones et al, 1983, Neutens et al.2011, Dharmowijoyo et al., 2015, 2017; Liu et al., 2018). However, how we set the built environment conditions have also affected people's travel behavior. Residing in high populated area with more compact land use and closer to various public amenities will create different activity-travel patterns than residing in low populated area with less compact land use and farther to various public amenities (Ewing and Cervero, 2010; Sundquist et al., 2011; Dharmowijoyo et al., 2016). Moreover, time-space prism also revealed the influence of household resources such as the household income level and the access to motorized mode. Better correlation has been seen for the social relations or capital on the behavior of individual travel-activities (Putnam 2001; Zhang, 2013; Dharmowijoyoet al2015).

At present, the penetration of ICT (Information and Communication Technology) has replaced some daily physical activities into digital or online daily activities. The ICT has created the new shopping online platform, and also the new transport service platform. People start doing intensive online activities according to their daily needs. At present, it is usual to see someone who start starts from morning activities to send the children to school by using the motorcycle taxi online application.

Information and communication technology (ICT) has the potential to increase the number of closest opportunities and thus increase access and reduce social exclusion. Accessibility as classified by (Geurs and van Wee, 2004), has four primary components; (a) land use, (b) transportation, (c) temporal, (d) individuals, certainly ICTs have the potential to influence them all. This paper tries to investigate the effects of several socioeconomic characteristics, travel characteristics and ICT utilization in explaining public transport mode choice. The approach model used in this study is logistic regression analysis, using data collected from household travel surveys, this study will examine daily activity variables in the Malang city area.

There are many studies on public transport and private car modal choice. Previously the characteristics of grabcar users, service performance and modal choices models between conventional taxis and grabcar in Malang with the Importance Performance Analysis Method. The results show that on-line taxi user is more dependent only on on-line fares (Setiawan et al 2019). Now, there is a need to study how the user characteristics (social economic, travel and ICT characteristics) affect the use of public transport, and what specific factors that affecting the selection of public transport in Malang City.

II. LITERATURE REVIEW

Working and studying are activities that carried out by most of daily individuals, while household task are activities that carried out to support household needs, such as shopping for household needs, and activities other than household task are activities carried out for social life or recreations (Anggraini, 2009). In terms of daily activity, people's travel activity behavior may differs from day to day, and it is difficult to avoid the variability of individual activity travel behavior on a daily basis. Exclusion of daily variations can reduce the complexity of travel behavioral models, and it can provide a wrong figure of the needs and desires of individuals in terms of travel. In addition, variability analysis also predicts how individuals plan and optimize various patterns of travel activities in changing needs situation and construct environmental situations (Kang and Scott, 2010; Susilo and Axhausen, 2014; Moiseeva et al., 2014; Dharmowijoyo et al., 2016, 2017, 2018, 2019).

Travel activities in transportation modes in the digital era have an impact associated with certain social (Afrida, 2003). From the travel patterns of the community activities, it can be seen how the rules of public either written or unwritten regulates their daily activities (Hägerstrand, 1970; Neutens et al., 2011; Dharmowijoyo et al., 2015, 2017). . Household income is income from all family members that is used to meet shared or individual needs in a household (Afrida, 2003).

The level of income in a household can be seen based on the type of work or profession of a person and the number of family members who have worked. Health indicators will reveal other dimensions of individual ability factors which in some cases cannot only be explained by conventional time and space variables such as socio-demographic, socio-economic, and time use and a series of activities.

III. METHODS

Data collection methods used in this paper are observation and questionnaire with offline interview techniques to collect information on household travel activities. In obtaining the data of this study, there are 200 respondents asked to fill out survey forms, recording their daily activities. The contents of activity record survey form includes: location activities (home, school/office and outside home or work/school), activities in the neighborhood, travel activities using modes other than private vehicle, and walking activities.

First, there is a need to overview the social economic, travel and ICT characteristics of respondents, and then we use it to develop mode choice model, between private and public transport. Logistic Regression with the Purposive Sampling method has been utilized to build the models, and it is expected to be able to describe the existing travel patterns of respondent living in Malang City.

IV. RESULTS

First, descriptive analysis has been done by analyzing each variable, namely the group of social economic factors, ICT and travel characteristics of respondents. Further, the respondent characteristics can be observed in Table 1. For the purpose of modeling, then we made classifying and coding, as can be seen also on that Table 1.

Table 1. Profile of samples in this study (N = 200 individuals from 52 households)

Variable	Percentage/Mean	Coding
Socio-DemographicCharacteristics		
Type of residence building (X_1)		
Permanent house	90.5 %	1
Non-permanent house	9.5 %	0
Status of residence ownership (X_2)		
Private house	75.5 %	1
Rental house	14.5 %	0
Gender (X_3)		
Male	53.5 %	1
Female	46.5 %	0
Education level (X_4)		
Elementary and high school	33.5 %	0
Diploma and above	66.5 %	1
Age (X_5)		
$\geq$ 17 years old	72 %	1
< 17 years old	28 %	0
Occupation (X_6)		
No Works (including housewife and student)	48.5 %	0
Workers	51.5 %	1
Household income (X_7)		
< 3 million/month	91.5 %	0
$\geq$ 3 million/month	8.5 %	1
Travel Characteristics		
Average length of work/school activies (X_8)		
< 8 hours a day	33 %	0
$\geq$ 8 hours a day	63 %	1
Daily number of trips (X_9)		
Daily trips< 2	24.5 %	0
Daily trips $\geq$ 2	75.5 %	1
Percentage of monthly transport cost (X_{10})		
< 20% of household expenditure	89 %	0
$\geq$ 20% of household expenditure	11 %	1
Number of private vehicles (X_{11})		
< 2 vehicles	12.5 %	0
$\geq$ 2 vehicles	87.5 %	1
Type of private vehicle (X_{12})		

Motorcycle	37 %	0
Motorcycle and car	63 %	1
Weekly intensity usage of vehicle (X_{13})		
Daily usage	58 %	1
Few days a week	42 %	0
Types of vehicle usage (X_{14})		
Partial usage or no usage of Private vehicles	38.5 %	0
Full usage of private vehicles	61.5 %	1
Internet activity (ICT) (X_{15})		
No Internet activities (ICT)	8.5 %	0
Internet activities (ICT) including smart phone	91.5 %	1
Passive/active transport modes (X_{16})		
Passive Transport	89.5 %	0
Active Transport	10.5 %	1
Major daily mode choice (Y)		
Private vehicle	71 %	0
Public Transport	29 %	1

The profile of respondent in Malang City shown that the dominant respondents are: live in permanent house (90.5%); stay in their owned house (75.5%); male (53.5%); education level of diploma and above (66.5%); age 17 years and above (72%); worker (51.5%); monthly household income less than 3 million rupiah (91.5%); daily spent 8 hours or more for work/school (63%); twice or more daily trips (75.5%); proportion of transportation cost is less than 20% of household expenditure (89%); has owned 2 or more of private vehicle (87.5%); has motorcycle and car (63%); daily usage of private vehicles (58%); daily full usage of private vehicles (61.5%); have an access to internet/ITC (91.5%); daily passive transport (89.5%) and the dominant daily use of private modes (71%).

It is interesting to mention that monthly household income is less than 3 million rupiah, as the minimum wage payment in this city is about 2.5 million rupiah. It seems that majority of the respondent has the income about this minimum wages for the city. However, their living standar is relatively middle to high level. The number of people who have motorcycle and cars is 63%, and this might happened since the credit to have motorcycle, car and even house is available on monthly payment which is affordable, but with long term of payment (5-15 years). This situation reflect that, for the future, with the rise of household income, the motorcycle and car ownership would be much higher.

MulticolinearityTest

First, before doing model, multicolinearity test has to be applied for selecting which variable that have highly correlated, so that it will not be put on the model together. This test check the correlation between independent variables, if the correlation value is low, then there is no colinearity. Based on the correlation value resulted from this test, it is known that all of the correlation value among the independent variables is below 0.5, so it can be concluded that all the independent variables are not correlated. Since the dependent variable is a variable with a categorical data type (the use of private vehicles or public transport), therefore the regression analysis used in this research is logistic regression.The result has been shown in Table 2.

Table 2. The Mode Choice Model

	B	S.E.	Wald	df	Sig.	Exp(B)
Percentage monthly transport cost (X_{10})	-1.45	.652	2.573	1	.109	.352
Weekly intensity usage of vehicle (X_{13})	.730	.338	4.653	1	.031	2.075
Internet activity/ICT (X_{15})	-.942	.527	3.193	1	.074	.390
Constant	-.403	.521	.600	1	.439	.668

It is common also to apply model fit test in logistic regression. By applying Hosmer and LemeshowTest which popular as a feasibility test for logistic regression models, and the resultan is shown Table 3.

Tabel 3.Hosmer And Lemeshow Test Score

Step	Chi-square	df	Sig.
1	0.603	3	0.896

Based on the results of the fit model test above, it is concluded that the logistic regression model is accepted, and the model is feasible (fit).

By applying the logistic regression, the Log Likelihood Ratio is also has to be checked, and it is found that the highest Log Likelihood Ratio when there are 3 variables (Table 2). The Log Likelihood Ratio of the model can be seen in Table 4.

Tabel 4. Log Likelihood Ratio result

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	230.306[a]	0.051	0.073

After several test has been applied, then it can be concluded that the fit mode choice model in this paper is:

$Y = - 4.03 - 1.45 X_{10} + 0.73 X_{13} - 0.942 X_{15}$

Where: Y = choice of public transport or private vehicle

X_{10} =Percentage monthly transport cost

X_{13} = Weekly intensity usage of vehicle

X_{15} = Internet activity/ICT

The interpretation of this model will be explained. The percentage monthly transport cost is influencing the choice of public transport, where the lower percentage monthly income people will prefer public transport, comparing with higher percentage. It is clear that private vehicles need additional cost, not only vehicle operating cost, but also maintenance. Therefore, many low income people will be more likely to use public transport. The weekly intensity usage of vehicle seems it support public transport, although they use intensively to use private vehicles, but some of them park their vehicles and go to some places using public transport. It is also common that some people would like to go together using public transport for saving their money for routine trips. In term of internet access, it is clear that those who are less access to internet, then they tend to use public transport, since their income is also less, therefore they prefer to use public transport.

V. CONCLUSIONS

Based on the data analysis, the following conclusions can be drawn:

1. The profile of respondent in Malang City shown that the dominant respondents are: live in permanent house (90.5%); male (53.5%); education level of diploma and above (66.5%); age 17 years and above (72%); worker

(51.5%); monthly household income less than 3 million rupiah (91.5%); proportion of transportation cost is less than 20% of household expenditure (89%); have an access to internet/ITC (91.5%); daily passive transport (89.5%) and the dominant daily use of private modes (71%)..

2. The choice of public transport or private vehicle in the study area is affected by three factors, these are percentage monthly transport cost, weekly intensity usage of vehicle, and internet activity/ICT.

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