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The Demand Model of App-Based Transportation Household Scale in Semarang, Indonesia

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ABSTRACT

In the development of transportation systems, Application-Based Transportation is an innovation to adapt to technological advances. It offers users an alternative mode that is cheap, easy, and flexible according to their needs. The Application-based travel demands can be seen from its socio-economic and travel characteristics. In Indonesia, previous studies have concentrated on study areas on a city scale, with diverse land use classifications not only on the residential area which is the most users of app-based transportation. The modelling results in this study were obtained from spatial simulation and partial linear regression analysis with the T-test as the final stage of analysis. As a result, demand for App-Based Transportation is affected by two factors which include age and travel costs. They are inversely proportional to the frequency of travel. In this case, this mode is mostly used by the population with young age and low cost of travel. Also, this mode is only used on short-distance trips and trips during rush hour in the morning. During the afternoon rush hour, the trip is transferred to public transportation, which has a lower cost. Therefore, this study aims to determine the application-based transportation demand model for household units in Tlogosari, Semarang, Indonesia. An additional in-depth study is needed to be carried out on the degree of motorcycle safety to improve services.

Keywords: App-based transportation, demand, household unit

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INTRODUCTION

For convenience and flexibility, the significant growth of the urban population has been accompanied by an increase in the number of private vehicle use. High mobility has led to various environmental problems such as congestion, air pollution, lack of parking space, high accident rates, and excessive energy consumption (Zhao et al., 2018). In developing countries such as Indonesia, public transportation tends to be inefficient in cost and time (Rithoma & Rakhmatulloh, 2013). This condition was also supported by Jaśkiewicz and Besta (2014), who discovered that public transportation is not optimal due to various factors. It includes travel time, inadequate cleanliness, access, travel safety, and less than optimal driver ability. In addition, public transportation is considered difficult to access due to its location, which tends to be far from the user's home (Cheng & Chen, 2015).

As a result of the industrial revolution 4.0 and the development of technology, App-Based Transportation was developed to solve increasingly massive personal use and less optimal quality of service for public transportation modes. The implementation of an app-based transportation model connects motorists and drivers using only the applications on smartphones. Furthermore, the development of App-Based Transportation in the world is often referred to as "ridesharing" or "peer-to-peer mobility" with the concept of sharing rides with the same destination. However, this term is considered inappropriate with the development of technology and science. The driver and passenger do not share the same destination, but the driver provides a service similar to a limousine or taxi (Regina & Clewlow, 2018). In 2013, California Public Utilities officially terminated the service as Transportation Network Companies (TNCs), recently referred to as "ride-hailing." Also, the term ridesourcing is an app-based transportation system that provides transportation services on demand with higher reliability and less waiting time (Rayle et al., 2014). The number of terms that appear implementing application-based transportation modes has led to a misperception of implementing the concept in various countries. Furthermore, the same source stated that it could replace private and complement public transportation in reaching areas it cannot serve. The App-Based Transportation services were also chosen due to the reduced waiting time with a door-to-door system. It is cheaper, faster, and require half the waiting time compared to traditional taxi services (Smart et al., 2015; Hou et al., 2016; Anderson, 2014). Also, this service is trackable; therefore, it is advantageous compared to other modes because it reduces parking demand, improves driver welfare by providing new jobs, and affects user travel patterns and travel destinations (Henao, 2017).

Like other modes of transportation, App-Based Transportation relies heavily on user demand characteristics to provide its services. Furthermore, socio-economic characteristics and user movement patterns influence these requests. Age is one of the socio-economic factors that most influence the travel demand for users of App-Based Transportation modes (Efthymiou et al., 2013). Meanwhile, Rayle et al. (2014) stated that parents tend not to be

adept at using technology. Therefore, the ability to use App-Based Transportation services such as ridesourcing decreases with age. Apart from age, Shaheen et al. (2016) discovered that employment status is the next factor most influences App-Based Transportation modes. Furthermore, work activities and the implications for the income generated will influence a person to use App-Based Transportation modes. According to Lavieri et al. (2018), a person with low income tends not to use App-Based Transportation services due to the consideration of travel costs. On the other hand, a person with high and middle income tends to use these services. Also, it was discovered that most users do not own private vehicles, forcing them to choose App-Based Transportation modes as their daily mobility mode. Meanwhile, Lekshmi et al. (2016) identified the five variables that most significantly influence the choice of these modes. It includes age, income, vehicle ownership, travel time, and travel costs.

In addition to the socio-economic factors, users' travel demand trends can also be seen based on movement patterns such as travel destinations. Users often use it for social/recreational activities, including going to bars, restaurants and concerts, and family and friends gatherings (Rayle et al., 2014). It is also the case in Slovakia, which shows that the average travel time spent on recreational purposes is more significant than travelling for work or other activities (Šimeček, 2019). According to Lavieri et al. (2018), areas with a high density, such as residential areas, are the origin of App-Based Transportation users. Furthermore, land use should be considered as one of the factors that make a person travel. Generally, it can be concluded that age, gender, vehicle ownership, travel time, travel costs, employment status, income, vehicle ownership, and purpose of travel are some of the variables that affect the demand for App-Based Transportation trips (Rayle et al., 2014; Lekshmi et al., 2016; Shaheen et al., 2016; Efthymiou et al., 2013; Lavieri et al., 2018).

Based on Figure 1, the application of App-Based Transportation in the Southeast Asia region commenced in 2010 with the presence of Gojek in Indonesia. Furthermore, this has continued to increase since 2013 in various countries and systems. For example, Grab in Malaysia, the Philippines, Cambodia, Gotaxi in Myanmar, Viviantaxi in Laos, and Comfortdelgro in Vietnam (Phun et al., 2018). For example, in Malaysia, application-based transportation is dominated by cars with a ride-sharing system to alleviate traffic congestion. The availability of transportation rules also has a significant impact. App-Based Transportation in Malaysia only reaches a few cities, such as Johor Bahru, Kuala Lumpur, Kinabalu City, Penang, and Melaka (GrabCarMalaysia, 2018). The study carried out by Sakaran et al. (2018) used socio-economic factors such as gender, age, and monthly income to identify an App-Based Transportation demand model in Kinabalu City, Malaysia. The results showed that the demand for App-Based Transportation in Kinabalu City was dominated by female residents aged 30 years with lower middle income. Meanwhile, the study carried out by Adam et al. (2020) in the City of Penang and Bayan Lepas, Penang

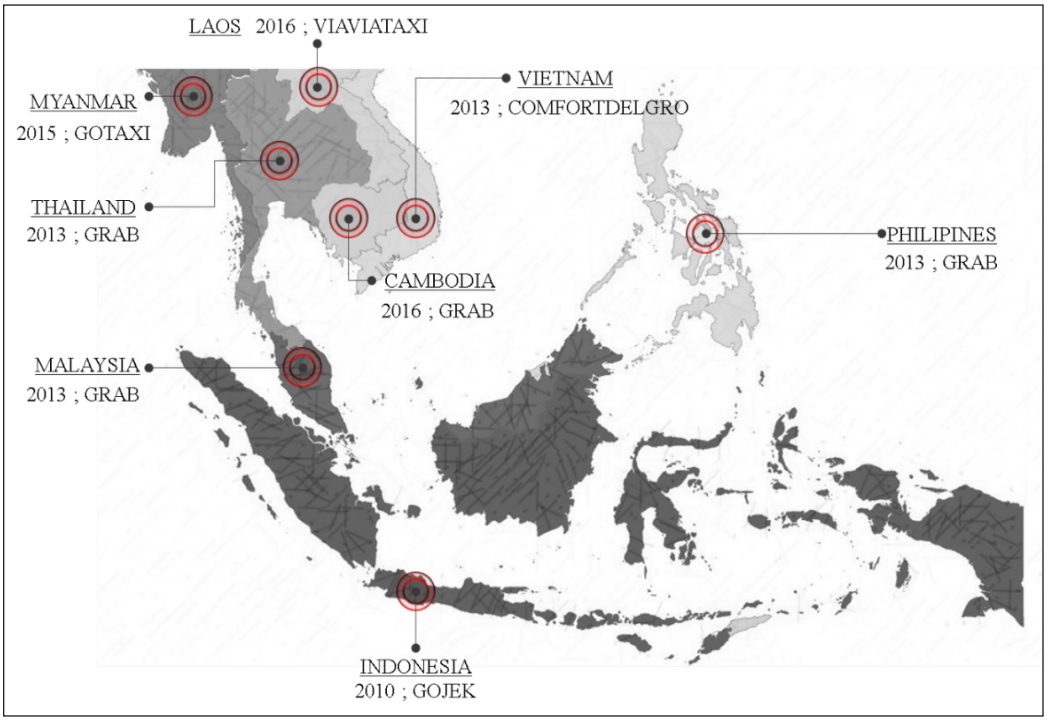

Figure 1. Application of App-Based Transportation in Southeast Asian countries

showed that factors that influence App-Based Transportation demand are user age, gender, and vehicle ownership. With the dominance of 21 to 30 years and women, most are not private vehicles owners.

The embryo for the growth of App-Based Transportation in Indonesia commenced with the existence of Uber Taxi. However, along with technological developments and society's current needs, the existence of Uber Taxi has been displaced by Gojek and Grab platforms (Ristantia & Hayah, 2018). Figure 1 shows that the Gojek application has been operating since 2010. However, the on-demand system commenced operating in 2015. Meanwhile, Grab commenced operating in Indonesia in 2014. These two platforms are growing, wherein in 2018, Gojek and Grab had served 62 districts/cities and approximately 100 districts/cities, respectively. As of December 2017, the Grab and Gojek application services users reached 9.7 million (Bohang, 2017). In Indonesia, Semarang City is one of the cities with the highest internet usage, with an average contribution of 64% of usage per year and 93% of the population using smartphones to access the internet network (Sukma, 2016). That has become one of the factors that have influenced the rapid increase in App-Based transportation modes in the city of Semarang in the last quinquennium. Unlike what happened in Kinabalu City, Malaysia, App-Based Transportation in the city of Semarang mostly uses motorbikes, which often leads to problems such as congestion. Furthermore,

the use of technology in its operation causes the App-Based Transportation mode to depend heavily on user demands related to a person's characteristics and needs.

The concept of App-Based Transportation mode procurement has the advantage of reducing transportation costs, reducing fuel consumption, minimising air pollution, and reducing congestion provided that the user demand is well controlled (Morency, 2007; Caulfield, 2009; Chan & Shaheen, 2012). Furthermore, the household unit is one of the smallest areas that determine the travel demand characteristics of transportation modes users in more detail. However, most study on App-Based Transportation demand characteristics, especially in Indonesia, is still limited to a regional or city scale, leading to more generalised characteristics. Therefore, this study aims to select the analysis area to the household level to obtain a demand model with more specific characteristics towards App-Based Transportation modes, especially in Semarang. Moreover, this study question that needs to be answered in this case is what factors affect the travel demand of users of household-scale application-based transportation modes in the Tlogosari Household Semarang, user characteristics (gender, age, income, vehicle ownership, typo of work) and travel characteristics (purpose of trip, mode choice, travel time, travel distance, cost).

METHODOLOGY

Semarang Study Area

App-Based Transportation usually only focuses on service targets in massive downtown areas in economic activity (Hall & Krueger, 2016). However, the growing demand for community movement has led to this service reaching more suburbs on a smaller scale, such as households. Previous studies have been dominated by observations of App-Based Transportation service demand models on a larger scale including cities to countries. Therefore, it is necessary to obtain a smaller study scope, such as households that need to be carried out to pay attention to the community's need for more detailed transportation. For example, Figure 2 shows that Semarang City is one of the cities in Indonesia that dominates land use in the form of settlements. Therefore, the basis for using this transportation application serves many household units and the surrounding area. Furthermore, Tlogosari Household is a form of household unit in Semarang with a dense activity every day in an area and a high-density level. Therefore, the intensity of the movement is relatively high. It was supported by Lavieri et al. (2018) that areas with a high density, such as residential areas, are the origin of App-Based Transportation services.

Since 1986, this housing has been built by the Government of Indonesia and implemented by Perum Perumnas Regional V. This was a form of providing justice-based housing, especially for the middle to lower class. The housing with 170.74 hectares was included in Muktiharjo Kidul and Tlogosari Kulon Village, Pedurungan District, Semarang City, Central Java, Indonesia, which can be seen in Figure 2. Based on the data obtained

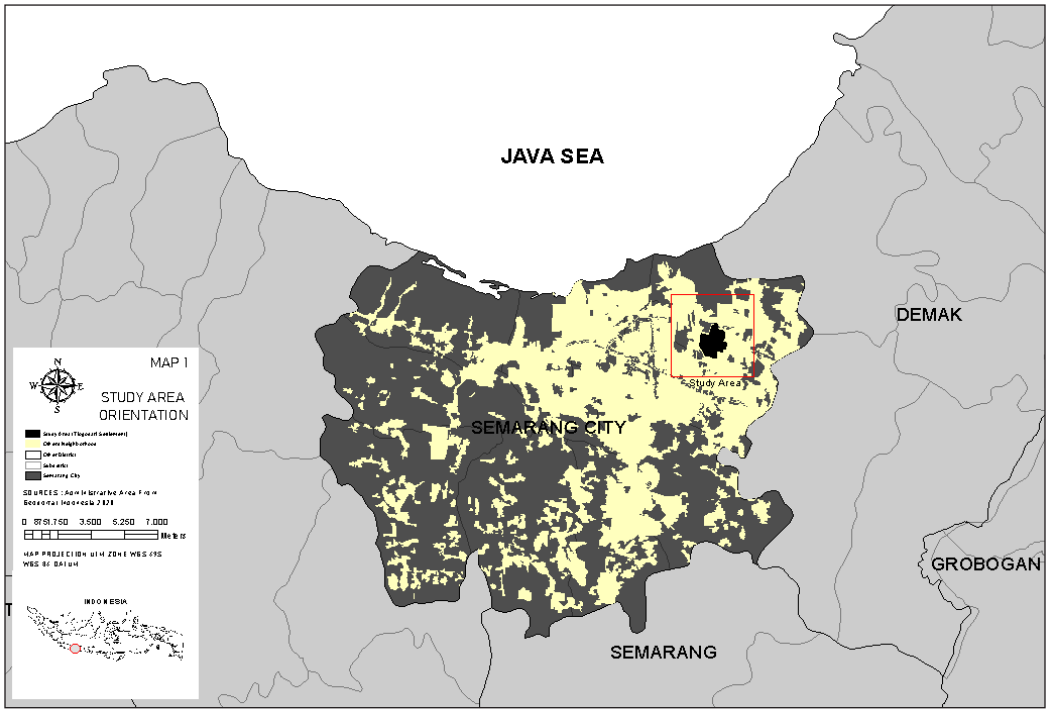

Figure 2. Study area orientation of Tlogosari Household

from the field survey, there are 9,598 and 7,445 Heads of Families in Tlogosari Kulon and Muktiharjo Kidul District, respectively. Furthermore, both districts are dominated by people of productive age (<50 years). The dominant livelihoods in this area are entrepreneurs and service providers, labourers, and traders. A large number of school-age and working (productive) population has led to this area being traversed by commuters. Therefore, the application-based mode of transportation was selected as an alternative for daily transportation to work and school.

Quantitative Analysis

This study implemented quantitative methods with nonprobabilistic sampling techniques. That is, these techniques do not provide equal opportunities for population members. Also, the accidental sampling technique was used in which the sample's determination is carried out by chance. Sampling is based on whom the user meets while carrying out this study (Leedy & Ormrod, 2010). Furthermore, this technique was used because the study population, in this case, the exact number of the App-Based Transportation users at Tlogosari Household, was unknown. The number of samples in this study was 100 respondents, with sampling carried out at community activity centres, including parks, rice fields, and residential areas. Based on Figure 2, it can be seen that main roads, public

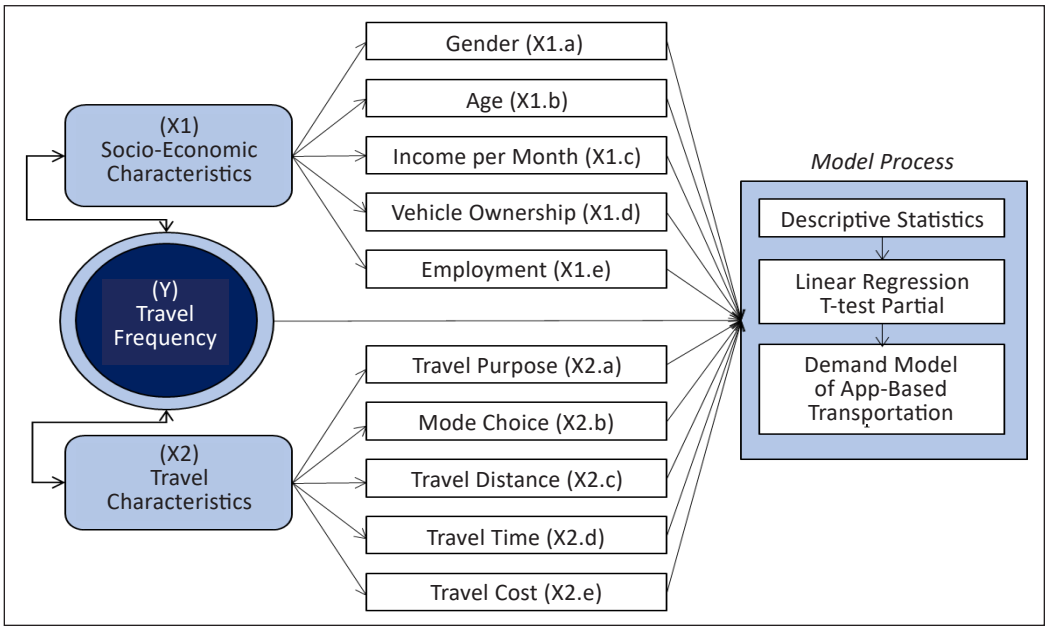

Figure 3. Study variable for app-based transportation

spaces, and trade and service locations are sample points with activities that tend to be massive. Therefore, the App-Based mode of transportation has a higher chance of being in these locations. The variables used in this study were based on previous literature studies' results which can be seen in Figure 3.

Furthermore, the acquisition of study data was processed by quantitative methods, i.e., linear regression utilising mathematical data processing applications. This study was built based on a simple analytical approach using descriptive statistical analysis and linear regression analysis. The depiction of data acquisition results combined the concept of descriptive diagrams and spatial data simulation to clarify the real conditions in the field. Meanwhile, implementing the linear regression analysis method is quite suitable for identifying the factors that influence App-Based Transportation demand. It is because it involves the dependent and independent variables in the process. In data analysis, the linear regression implemented the partial t-test method by looking at the T value and significant results to examine the relationship between variables. These variables are related to the T-Test > T-Table value, and the significance value is greater than 0.05 (> 0.05). Furthermore, the dependent variable used was the frequency of modal usage in a week (Y), and the independent variables are age, gender, type of occupation, income, vehicle ownership, the purpose of travel, travel time, mode choice, and travel costs. The linear regression process results will obtain a model with the equation, as seen in Equation 1.

$$Y = a + bn(Xc.d) + e \quad [1]$$

Where;

Y : the frequency of mode usage within a week

a : constant

bn : coefficient (b1-b10)

Xc.d :number of variables (X1: socio-economic characteristics; X2: travel characteristics)

e : another variable that is not observed/detected by the observer

RESULT AND DISCUSSION

Identification of User Characteristics

The characteristics of App-Based Transportation users can be divided into two types of variables: the users' socio-economic variables and travel characteristics. The socio-economic variables consist of gender, age, income, vehicle ownership, and type of work. Meanwhile, travel characteristics can be divided into destinations, travel times, mode choice, and travel costs. The travel frequency, in this case, is a dependent variable that affects those in the socio-economic and travel characteristics. Based on Figure 4, it shows that from its characteristics, users of the App-Based Transportation in Tlogosari Household are dominated by female residents with ages ranging from 17 to 25 years, have status as students, have an income of between 1 to 3 million rupiah, and own private vehicles, especially motorcycle. Furthermore, the female population tends to use app-based transportation more than the male population. That can be due to the large number of female residents that cannot use private vehicles. This condition is the same as what happened in Kinabalu City, Malaysia. The female population dominates the App-Based Transportation modes because of the ease of access, convenience, and most of them cannot use private vehicles (Adam et al., 2020).

Half of the respondents are in the young age group (17 to 25 years). 51% of respondents, followed by the 26 to 35 years age group (20%), and the age group 12 to 16 years (13%), with the old age group as the smallest. This young age group's dominance is in line with the activities carried out by that age group, which is higher than that of other age groups. With the high activity level, young age groups often use transportation modes (App-Based Transportation) compared to other age groups. Furthermore, based on the study carried out by Rayle et al. (2014), the elderly have limitations in using technology. Therefore, it is challenging to use App-Based Transportation. As one of the cities with the highest level of internet consumption in Indonesia, the Semarang City community's opportunity to use App-Based Transportation is relatively high.

Student residents dominate the young population (17-25 years) in Tlogosari Household, and some of them head to the city centre to access education. Also, the door-to-door system causes parents to feel safer choosing this type of transportation as their child's

main transportation to and from school. Furthermore, the student-age population that does not have an income causes the income of App-Based Transportation users in Tlogosari Household to be from the middle to lower level. Based on the study carried out by Rayle et al. (2014), App-Based Transportation in various countries was mostly used for recreational purposes than for schools. It is due to differences in systems, cultures, and customs between Indonesia and other countries, in which this type of transportation in other countries operates more cars than motorbikes.

Apart from being reviewed based on the user's socio-economic condition, trip characteristics are another variable in identifying App-Based Transportation modes in Tlogosari Household. Generally, Figure 4 shows that App-Based Transportation is widely used in the morning, i.e. during the busy hours of activity from 06.00-09.59 WIB. Furthermore, the population aged 17 to 25 led to app-based transportation to travel to or from school. During peak hours, most of them use this mode of transportation as an alternative to their mobility. Motorcycles are the most popular mode of transportation, which account for 76% of all trips, compared to just 24% for cars. Because the cost system is adjusted to the distance travelled in which the farther the distance, the more expensive the price will be issued, the residents of Tlogosari Household, on average, only use it at a distance of 4 to 8 kilometres. Therefore, the travel costs incurred to use App-Based Transportation in a day average only around 10 to 20 thousand IDR according to the abilities and needs of Tlogosari Household residents.

The Origin-Destination (O-D) analysis aids the examination of movement patterns according to land use in an area. An additional analysis variable that can better understand App-Based Transportation users' travel patterns in Tlogosari Household. This was carried

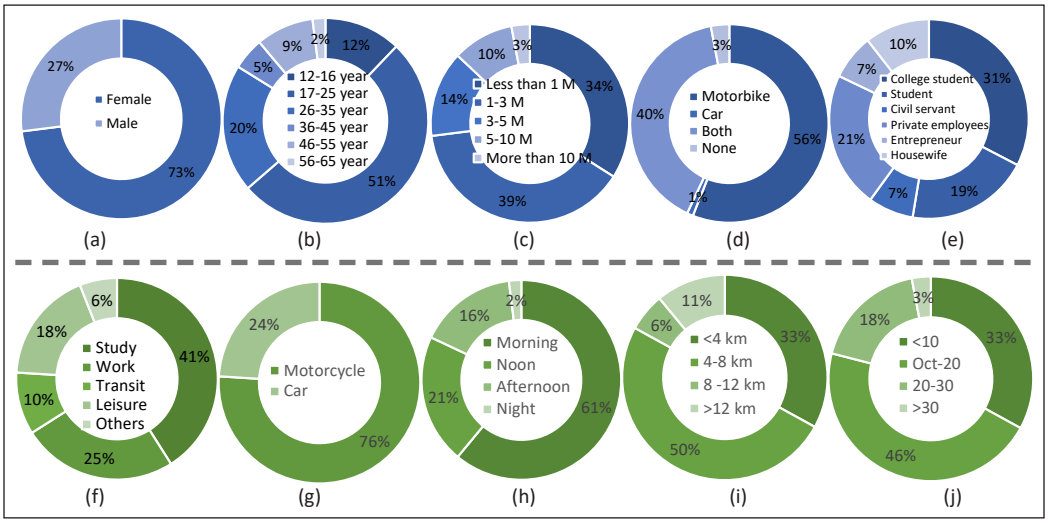

Figure 4. Socio Economic characteristics (blue) and travel characteristics (green); (a) gender, (b) age, (c) income (IDR), (d) vehicle ownership, (e) type of work, (f) purpose of trip, (g) travel frequency for a week, (h) travel time, (i) travel distance, (j) cost (thousand IDR).

out to support the regional development policy for Semarang, which is contained in the Regional Regulation of the City of Semarang Number 14 of 2011 concerning the Spatial Plan for the city from 2011-2031. Generally, the purpose of travel for App-Based Transportation users at Tlogosari Household is to go to areas with land use as trade and services and offices, transportation, education, industry, and surrounding settlements. Furthermore, the trips made were only limited to the closest areas identified in the previous section, which states that the average distance travel. Based on Figure 5 in the symbol D, the most prominent travel attraction for App-Based Transportation users in Tlogosari Household is in the central area of Semarang City with the use of the largest land for offices and trade and services (including education). Also, it can be indicated that there was a rotating demand-pull in the downtown area. This is because of the area of the facilities' completeness, and diversity of land uses that are offered compared to other areas around Tlogosari Household.

The population density in the centre of Semarang City is getting more significant due to travel attractions from its surrounding area of the Tlogosari Household. The areas with high density tend to be locations with much mobility. Therefore, the use of App-Based Transportation modes is potentially higher than in areas with low density (Lavieri et al., 2018). The App-Based Transportation originating from Tlogosari Household is part

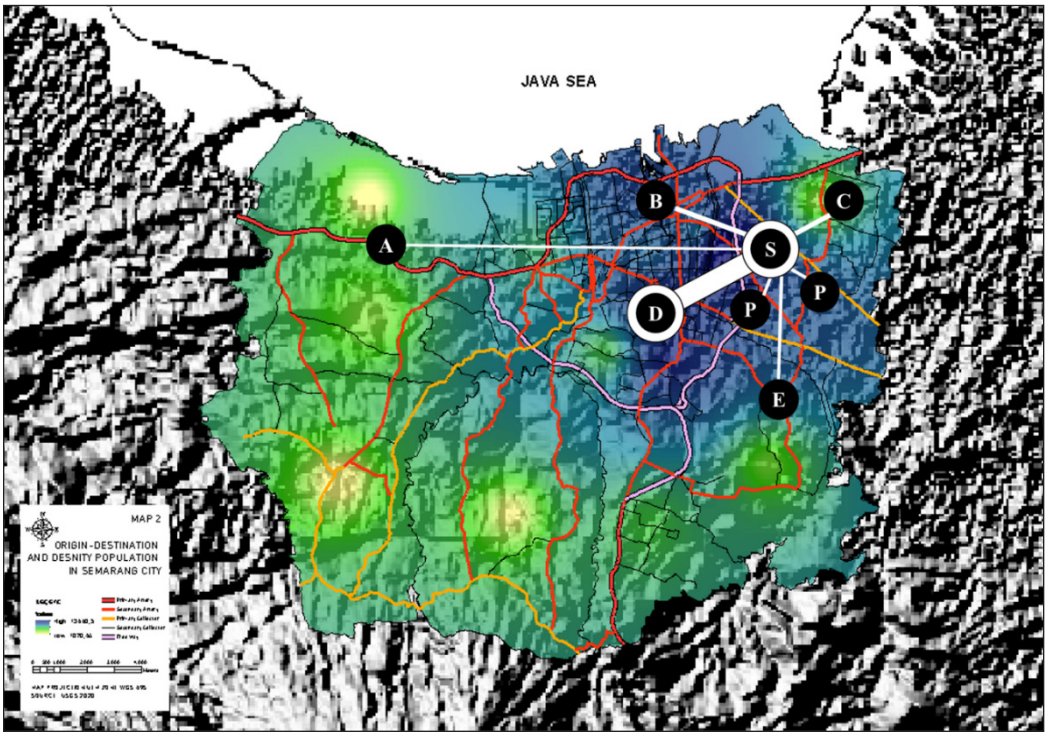

Figure 5. Trip origin-destination (OD) app-based transportation in Semarang City; (S) Tlogosari settlement; (a) industrial area, (b) station; (c) terminal; (d) city centre; (e) educational area; (p) other settlement

of the Transit-Oriented Development (TOD) concept in Semarang City. Furthermore, the Household-scale movements in the area contribute to improving the TOD system by integrating public transportation centres such as stations and terminals for further movement. Based on Figure 5, travel attraction also occurs at locations with industrial land uses. It implies that App-Based Transportation has also become a forum for the labour movement in Semarang. Therefore, land use is an essential factor to be considered in planning an App-Based Transportation system. A person's movement is strongly influenced by the needs of activities for specific land uses.

Travel Demand Model Analysis

The linear regression analysis of the partial T-test was carried out using the frequency of trips by the app-based transportation users per week on eight independent variables. It was in the form of the socio-economic characteristics (gender, age, income, type of work) and travel characteristics (purpose of trip, mode choice, travel distance, cost). Previously, the data normality test was carried out, and two variables with abnormal patterns were discovered, namely vehicle ownership and travel time. However, they were not included in the regression process. After testing the eight dependent variables with good normality, two variables that directly affected the increase in user travel requests in age and travel costs were obtained (Table 1). From the Collinearity Statistics component in Table 1, all tested variables did not show signs of multicollinearity. It is because the Tolerance and VIF value were >0.10 and <10.00, respectively. It indicated that the independent variables, especially cost and age, did not have a strong correlation.

$$Y = 7.226 - 0.54\ (X1.b) - 0.795\ (X2.e) \qquad [2]$$

Based on the results of the regression equation shown in Equation 2, several findings of the travel demand model are obtained in the form of:

- The constant 7.226 showed that provided the independent variable is considered constant, the average App-Based Transportation demand is 7.226,
- The age regression coefficient (X1.b) of −0.54 indicates that a yearly increase in age will reduce App-Based Transportation demand by 0.54.
- The travel cost regression coefficient (X2.e) of −0.795 indicated that each additional trip cost of 1 IDR reduces fashion demand by 0.795.

In developing countries such as Indonesia, the age and cost of travel are highly considered by App-Based Transportation users. The young population contributes more to increasing users of transportation modes to the household scale in Semarang City. It also proves that Semarang's position as one of the highest contributors to internet users affects the ease of access of its people to App-Based Transportation. Although the equation results showed that the other eight variables were not affected, they indirectly contributed to the

Table 1
Linear regression results

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
Code		B	Std. Error	Beta			Tolerance	VIF
(Constant)		7.226	0.762	-	9.483	0.000	-	-
Socio-Economic Characteristics (X1)								
X1.a	Gender	0.078	0.177	0.046	0.437	0.663	0.893	1.120
X1.b	Age	-0.054	0.023	-0.226	-2.360	0.020	0.913	1.095
X1.c	Income	-0.047	0.077	-0.071	-0.616	0.539	0.757	1.320
X1.e	Work	-0.097	0.057	-0.220	-1.719	0.089	0.610	1.641
Travel Characteristics (X2)								
X2.a	Purpose of Trip	0.026	0.075	0.039	0.350	0.727	0.795	1.258
X2.b	Mode Choice	0.103	0.194	0.058	0.531	0.597	0.823	1.095
X2.c	Distance	0.070	0.074	0.100	0.949	0.345	0.899	1.112
X2.e	Cost	-0.795	0.248	-0.307	-3.202	0.002	0.913	1.095

Note. Dependent variable: frequency, number of T table 1.860

Table 2
Correlation of indicators

Coefficient Correlations[a]									
Model		**Mode Choice**	**Travel_Purpose**	**Cost**	**Gender**	**Travel Distance**	**Income**	**Age**	**Work**
Correlations	Mode Choice	1.000	0.092	0.031	0.125	0.013	-0.152	-0.185	-0.138
	Travel_ Purpose	0.092	1.000	0.049	-0.174	0.113	-0.057	0.102	-0.365
	Cost	0.031	0.049	1.000	-0.121	-0.243	0.010	-0.086	-0.014
	Gender	0.125	-0.174	-0.121	1.000	-0.004	-0.203	0.065	0.110
	Travel_ Distance	0.013	0.113	-0.243	-0.004	1.000	0.022	-0.021	0.089
	Income	-0.152	-0.057	0.010	-0.203	0.022	1.000	-0.234	-0.177
	Age	-0.185	0.102	-0.086	0.065	-0.021	-0.234	1.000	-0.361
	Work	-0.138	-0.365	-0.014	0.110	0.089	-0.177	-0.361	1.000

[a]Dependent variable: frequency

age and travel costs variables' influence. Based on Table 2 shows that others influence the formation of several independent variables in the study. Furthermore, the variables that produced a correlation value of <0.05 are considered to have a close relationship with another one. The variable of travel costs is related to the choice of the transportation mode used, the purpose of the trip, income of service users which is also relevant to the type of work. Meanwhile, the user age variable relates to a person's ability to travel or the distance between locations. It is because older people tend to have limited mobility compared to younger ones.

These results are relevant to the study carried out by Sakaran et al. (2018) in Kinabalu City, Malaysia, which states that the factors that influence travel demand for App-Based Transportation modes are age and income (indirectly related to travel costs). It was also supported by Lavieri et al. (2018) statement, which states that basic income is a factor that influences people in choosing to use transportation. In this case, low-level people tend to choose cheap and affordable transportation due to the low cost of travel. It suggests that the area scale between urban and household has the same result. Although the policies and concepts for providing App-Based Transportation modes that are implemented are also different, Kinabalu City uses more cars. Meanwhile, in Indonesia, especially in Tlogosari Household Semarang, there is more usage of motorbikes.

The number of motorcycles used in app-based transportation is due to the relatively affordable price compared to cars. As a developing country, prices are considered for local people in choosing the mode of transportation. It has led to the procurement of application-based transportation in Indonesia, especially in the Tlogosari Semarang Household, which is very vulnerable to the safety and security of passengers. Furthermore, several platforms, such as Gojek, have provided safety insurance for drivers and passengers in the event of an accident while using the service (Gojek.com, 2019). In addition, vehicle equipment and safety standards have been implemented. It includes mandatory use of national standard helmets, special raincoats, and ensuring motorcycles meet operating requirements or are in good condition. Surprisingly, a feature is provided in the application to report complaints about the condition of the motorbike or service driver if it is not satisfactory for the company to follow up. Certainly, further study is still needed on the safety factor in application-based transportation, especially motorcycle services. It is because there are still many violations of service standards on application-based transportation in Indonesia.

CONCLUSION

The travel demand model derived from the App-Based Transportation in the Tlogosari Household area household unit produces two factors: age and travel costs, which can directly affect user demand. Both socio-economic and travel characteristics influence each other and are formed through the influence of other variables. Furthermore, the frequency

of travel requests is inversely proportional to the variable age and travel costs. Therefore, the older a person is or, the cheaper the transportation costs, the more frequent the use of transportation modes in Tlogosari Household will increase. In detail, it was discovered that students were the population that dominated the usage of application-based transportation from the point of its generation (Tlogosari Household). It often occurs in the morning because of the ease of access to technology and to save travel time. However, application-based transportation to Tlogosari Household decreased in the afternoon because most students return with their working parents or use public transportation such as Bus Rapid Transit.

Furthermore, this study also discovered a strong influence of land use at the point of attraction on the choice of application-based transportation as a mode of the residents' movement in Tlogosari Household and its surroundings. The downtown area that is dominant in land use as trade and services were the strongest attraction as a point of awakening for the movement of application-based transportation users. Apart from trade and services, land use as education also plays an important role in influencing the use of application-based transportation because most users are students. Furthermore, acknowledging the characteristics of the demand for App-Based Transportation modes on the household scale can guide the government and stakeholders to make detailed plans in providing these modes by the characteristics of users in the future. Also, the cost variable is very sensitive and influences the public in choosing motorcycle services in application-based transportation. In consideration, further study is suggested to be carried out on the safety of motorcycles to improve services of the app-based transportation implementation, especially in Indonesia.

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