

Analysis of the Characteristics of Young Ride-sourcing Users based on Previous Modes: Case of Bandung City

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Abstract—People are now starting to switch to using ride-sourcing with all the advantages it provides compared to using other transportation. This study aims to analyze ride-sourcing users based on the mode of origin using the discriminant analysis method. Data collection is obtained using an online questionnaire for ride-sourcing users in Bandung City. The results of the analysis show that ride-sourcing users who have high family income tend to associate with car users compared to previous public transportation users, while ride-sourcing users those who just used ride-sourcing in the 3 to 5 month range tended to be motorbike users before rides-sourcing existed. Transportation online users who choose to use motorbikes instead of ride-sourcing tend to use motorbikes.

Keywords—ride-sourcing, young users, previous mode

I. INTRODUCTION

People are now starting to switch to using online transportation with all the advantages provided over using other transportation. The main reason for using online transportation is because it is cheaper, safer and easily accessible via the application anytime and anywhere [1]–[3]. In addition, online transportation reduces the need for private vehicle users to find and pay for parking if traveling, which is currently relatively difficult and expensive in metropolitan cities due to limited land and private vehicle restriction policies [4].

The existence of online transportation services has affected the urban transportation ecosystem [5]. One of them is because online transportation services resemble taxi services [6] and motorcycle taxis [7]. A study by Irawan et al. [1] says that public transportation users in several cities in Indonesia are starting to switch to online transportation. On the other hand, there are several studies that show that

increasing the use of online transportation has the potential to reduce the use of personal transportation [4].

Based on previous studies, there are variations in the influence of online transportation on public transportation and private transportation. Irawan et al. [5] said that the effects of online transportation can be divided into two, namely substitution and complementary. Substitution is the effect of online transportation to reduce public transportation or private transportation, while complementary is the effect of online transportation that supports public transportation. Previous studies [1], [7], [8] have focused on online transportation users as a whole, while studies that have focused on the young segmentation of online transportation users, namely students and college students, have not been widely conducted. Study of young online transportation users is important to research because the majority of online transportation users in Indonesia are students and university students. This study aims to describe the characteristics of online transportation user respondents, describe the travel characteristics of online transportation users, and analyze the characteristics of young online transportation users based on their mode of origin using IBM SPSS software.

The organization of this paper is as follows. The next section described the literature review about the ride-sourcing. The data collection which and descriptive analysis for the key variables described in third section followed by analysis of travel activity changes during mobility restriction and new normal. The last section summarizes and remark on the future research opportunities.

II. ONLINE TRANSPORTATION OR RIDE-SOURCING

Online transportation is application-based transportation that is connected to the internet or transportation supported by

communication technology via smartphones which is an amalgamation of transportation services and communication technology [6], [9]. Several online transportation service companies such as Uber, Lyft, Cabify, Ola and Didi Chuxing have developed and operated in various cities around the world. In Indonesia, Gojek is the first online transportation service company launched in 2010 and in 2018 it has served more than 4 billion trips in 50 cities in Indonesia with more than one million drivers [10]. After Gojek there are several other applications such as Uber and Grab, but over time in 2018 Grab acquired Uber. Online transportation in Indonesia provides services by cars and motorbikes, the type of service has developed from only transportation services to food delivery services, goods delivery services to house cleaning services.

The presence of online transportation has created a conflict between the two services, namely online transportation and public transportation. Reduced income for public transportation drivers can reach 70% making social conflicts between transportation services unavoidable [11]. The absence of a certification process that requires costs causes online transportation rates to be cheaper than other transportation [5]. This has resulted in the emergence of demonstrations carried out by public transportation. The Ministry of Transportation continues to refine regulations governing online transportation, both online car and motorcycle transportation (Minister of Transportation Regulation No.12/2019).

Rayle et al. [6] said that online transportation can be a substitute for other transportation. Surveys conducted in Chile, Brazil and China found that taxis and public transportation were the most widely substituted modes. Graehler et al. [12] estimate that Uber has reduced the number of bus and train usage by 1.3% -1.7% per year based on data from 22 cities in the United States. On the other hand, several studies show that high demand for online transportation can reduce the number of private vehicle use [4], [8], for example in the United States the reduction in private vehicles is a form of online transportation substitution [13]. Irawan et al. [5] study conducted in DKI Jakarta shows that people with high incomes tend to use online transportation rather than public transportation.

III. METHODOLOGY

A. Data Collection

The effect of online transportation can reduce the use of public transportation or private transportation, but on the other hand, online transportation can also reduce the use of private transportation. The questionnaire design was formulated based on literature studies including Irawan et al. [1], Medeiros et al. [7], Rizki et al. [14]. After that, a questionnaire trial was conducted on 50 respondents to determine the level of understanding of the respondents regarding the questions designed. If there is a questionnaire item that is not understood by the respondent, then it is necessary to improve the questionnaire. The sample size was determined so that the sample taken could represent the characteristics of the population of young online transportation users in Bandung. The Cochran formula is used when the population size and population size are not known with certainty. The confidence level used is 95%

(deviation of 5%) which will result in a z value of 1.96. The value of the error rate used is 10%, so that the minimum sample to be studied is 100 respondents. Then carried out by distributing questionnaires online to young online transportation users in the city of Bandung. The mode of origin in this study is the transportation used before online transportation, including motorbikes, cars, and public transportation.

The questions in the questionnaire consisted of two variables, namely the independent / independent variable (X) and the dependent / dependent variable (Y). User characteristics are the independent variables, while the mode of origin is the dependent variable. Characteristics of respondents include age, gender, educational status, residence, and family income per month, while travel characteristics include frequency of use, distance traveled, travel time, travel costs, online transportation applications, length of time using online transportation, modes before online transportation is available. and alternative modes used.

B. Discriminant Analysis

The data on the characteristics of online transportation users that have been obtained are entered into MS. Excel was then transferred and processed using IBM SPSS Statistics 23 software. Data analysis was carried out, namely describing the characteristics of respondents using online transportation, describing the travel characteristics of online transportation users, and analyzing the characteristics of young online transportation users based on the classification of the mode of origin. Respondent characteristics and travel characteristics of online transportation users were described using descriptive analysis. The characteristics of online transportation users based on the mode of origin were analyzed using discriminant analysis [15] which aims to determine the effect of the characteristics of young online transportation users so that they produce clear differences in variables between groups of origin modes. The discriminant function used is shown in Equation 2 as follows:

$$D = a + W_1X_1 + W_2X_2 + \dots + W_nX_{nk} \dots(1)$$

halmana:

D = Discriminant function

a = Constant

W = Discriminant weight of the variable

X = The independent variable towards the object

C. Respondents Statistics

Based on Table 1, it shows that the distribution of respondents before online transportation was mostly using motorbikes (58.7%), while for car users (11.6%) and public transportation users (29.7%). Online transportation users are dominated by respondents aged 19 to 25 years (90.3%) with current educational status being students (96.7%). As many as (66.5%) of online transportation respondents were women.

The majority of respondents who previously used motorbikes had a family income ranging from 2 to 4 million rupiah per month (23.1%), while respondents who were previously car users had a family income of more than 12 million per month (38.9%). Furthermore, 34.8% of

respondents who previously used public transportation had an income ranging from 4 to 6 million rupiah per month. 43.2% of respondents have used online transportation for more than 2 years. If the respondent does not get online transportation, the alternative mode chosen is the transportation that the respondent uses before online transportation exists.

TABLE I. RESPONDENTS' STATISTICS

Variabel		Previous Mode		
		M=91 58.7%	C=18 11.6%	PT N=46 29.7%
Age	13-15 years	1.1	5.6	4.3
	16-18 years	6.6	5.6	8.7
	19-25 years	92.3	88.9	87
Gender	Men	47.3	16.7	34.8
	Woman	52.7	83.3	65.2
Educational status	Student	1.1	5.6	6.5
	College student	98.9	94.4	93.5
Residence	Bandung	69.2	77.8	80.4
	West Bandung Regency	18.7	16.7	13
	North Bandung	4.4	0	4.3
	Cimahi	7.7	5.6	2.2
	< Rp1.000.000	6.6	0	4.3
Family Income per Month‡	Rp1.000.000 - Rp 2.000.000	4.4	5.6	10.9
	Rp2.000.001 - Rp4.000.000	23.1	22.2	26.1
	Rp4.000.001 - Rp6.000.000	18.7	5.6	34.8
	Rp6.000.001 - Rp8.000.000	14.3	22.2	8.7
	Rp8.000.001 - Rp10.000.000	17.6	5.6	4.3
	Rp10.000.001 - Rp 12.000.000	6.6	0	4.3
	> Rp12.000.000	8.8	38.9	6.5

M = Motorcycle, C=Car, PT= Public Transport; ‡1 USD = 14,500 IDR in May 2020

IV. PREVIOUS MODES CHARACTERISTICS

A. Travel Characteristics

The most widely used online mode of transportation was motorbikes at 88.4%. As many as 59.4% of respondents use online transportation for occasional trips ($\leq 3x$). The majority of respondents' average travel time ranges from 15 to 30 minutes and the average travel time is 2 to 4 km. The average travel costs incurred by the respondents, who previously used motorbikes and public transportation, were in the range of 10 thousand to 20 thousand rupiah. The majority of respondents who used cars before online transportation had an average travel cost of around 20 thousand. 43.2% of respondents have used online transportation for more than 2 years. If the respondent does not get online transportation, the alternative mode chosen is the transportation that the respondent uses before online transportation exists.

TABLE II. TRAVEL CHARACTERISTICS

Variables		Previous Modes		
		M=91 58.7%	C=18 11.6%	PT N=46 29.7%
Moda Transportasi Online	Sepeda Motor	90.1	88.9	84.8
	Mobil	9.9	11.1	15.2
Frekuensi Penggunaan Transportasi Online	Sesekali ($\leq 3x$)	63.7	44.4	56.5
	Beberapa kali (4-6 x)	20.9	22.2	19.6
	Sering (7-14x)	7.7	11.1	15.2
	Sangat sering (15-30x)	5.5	11.1	6.5
	Selalu ($>30x$)	2.2	11.1	2.2
Rata-rata Jarak Tempuh	< 2 km	9.9	11.1	10.9
	2-4 km	30.8	38.9	28.3
	4-6 km	18.7	16.7	28.3
	6-8 km	13.2	5.6	19.6
	8-10 km	8.8	5.6	2.2
	> 10 km	18.7	22.2	10.9
Rata-rata Waktu Tempuh Perjalanan	< 15 menit	17.6	33.3	15.2
	15-30 menit	53.8	44.4	65.2
	30-60 menit	26.4	16.7	15.2
	61-90 menit	2.2	0	2.2
	> 90 menit	0	5.6	2.2
Rata-rata Biaya Perjalanan‡	< Rp10.000	9.9	5.6	15.2
	Rp10.001 – Rp20.000	44	27.8	47.8
	Rp20.001 – Rp30.000	27.5	33.3	13
	Rp30.001 – Rp40.000	9.9	22.2	8.7
	Rp40.001 – Rp50.000	3.3	5.6	6.5
	>Rp50.000	5.5	5.6	8.7
Aplikasi Transportasi Online	Gojek	25.3	16.7	17.4
	Grab	15.4	5.6	28.3
	Gojek dan Grab	58.2	77.8	54.3
	My Blue Bird	1.1	0	0
Lama Menggunakan Transportasi Online	1-2 bulan	3.3	0	2.2
	3-5 bulan	11	0	0
	5 bulan – 1 tahun	14.3	11.1	8.7
	1-2 tahun	34.1	33.3	39.1
	> 2 tahun	37.4	55.6	50
Alternatif Moda	Sepeda Motor	67	16.7	30.4
	Mobil	4.4	50	0
	Transportasi Umum	28.6	33.3	69.6

M = Motorcycle, C=Car, PT= Public Transport;

The most widely used online mode of transportation was motorbikes at 88.4%. As many as 59.4% of respondents use online transportation for occasional trips ($\leq 3x$). The majority of respondents' average travel time ranges from 15 to 30 minutes and the average travel time is 2 to 4 km. The average travel costs incurred by the respondents, who previously used motorbikes and public transportation, were in the range of 10 thousand to 20 thousand rupiah. The majority of respondents who used cars before online transportation had an average travel cost of around 20 thousand. 43.2% of respondents have used online transportation for more than 2 years. If the respondent does not get online transportation, the alternative mode chosen is the transportation that the respondent uses before online transportation exists.

B. Model of Ride-sourcing Previous Modes

Discriminant analysis was carried out with the dependent variable being the previous mode and the independent variable being the characteristics of the respondent and the characteristics of online transportation trips. The results of the discriminant analysis can be seen in Table 6. To determine the feasibility of the discriminant model, it can be

seen from the significance test value between groups in each variable, the closeness test between the discriminant weight and the group, and the classification accuracy test. Based on the canonical correlation value, it is known that 39.2% of the variance of the dependent variable can be explained by the independent variable. The discriminant model estimation is related to the function group centroid (FGC) as in Table 7 and the structure matrix. By evaluating the options with the most positive and most negative values, 2 functions of the 3 previous mode groups are generated. Function 1 separates respondents who previously used a car (2,191) and respondents who previously used public transportation (-0.298). Online transportation users who have an income of more than 12 million are more likely to be associated with car users than previous public transportation users. Based on the structure matrix, the independent variables related to function 1 are alternative cars, family income of more than 12 million rupiah per month, alternative public transportation, 3 to 5 months of using online transportation, and family income of 4 to 6 million rupiah per month. The model shows that online transportation users who have an income of more than 12 million are more likely to be

associated with car users than previous users of public transportation. Online transportation users who have a family income in the range of 4 to 6 million rupiah per month and have only used online transportation for 3 to 5 months tend to previously use public transportation instead of using a car. Online transportation users who prefer to use public transportation as an alternative if they don't get online transportation tend to associate with previous public transportation users. Function 2 separates groups of online transportation users who previously used motorbikes (0.350) from those previously used public transportation (-0.688).

Based on the structure matrix, the significant variable in function 2 is an alternative to motorbikes and the duration of using online transportation for 3 to 5 months. The results of the model show that online transportation users who have just used online transportation in the 3 to 5 month range tend to be motorbike users before online transportation occurs. As for online transportation users who choose to use a motorbike if they don't get online transportation, they tend to previously use a motorbike.

TABLE III. DISCRIMINANT ANALYSIS OF PREVIOUS MODES

Variables	Dependent Variables Group Means			F	Structure Matrix	
	M	C	PT		F1	F2
Karakteristik Responden						
Wanita [D]	0.527	0.833	0.652	3.38	0.812	0.169
Pendapatan keluarga 4-6 juta per bulan [D]	0.187	0.056	0.348	4.036	0.405	0.065
Pendapatan keluarga > 12 juta per bulan [D]	0.088	0.389	0.065	8.091	-0.083	-0.855
Karakteristik Perjalanan Transportasi <i>Online</i>						
Lama menggunakan transportasi <i>online</i> 3-5 bulan [D]	0.11	0	0	3.874	-0.329	0.769
Alternatif motor [D]	0.67	0.167	0.304	15.035	-0.119	0.439
Alternatif mobil [D]	0.044	0.5	0	32.736	-0.185	-0.378
Alternatif transportasi umum [D]	0.286	0.333	0.696	12.381	0.219	-0.251
Function at Group Centroid					F1	F2
Motorcycle					-0.283	0.35
Car					2.191	-0.011
Public Transport					-0.298	-0.688

M = Motorcycle, C=Car, PT= Public Transport;

V. DISCUSSION

This study focuses on the characteristics of young segmentation of online transportation users by looking at the modes of transportation used before online transportation existed. The modes of origin referred to are motorbikes, cars and public transportation. The model estimate states that the use of online transportation has an impact on the use of private transportation as stated by Irawan et al. [5] that there is a mode shift from private transportation to online transportation.

Based on the proportion of respondents, there is a 70.3% substitution effect for motorbikes and cars due to online transportation. This confirms the study of Henao and Marshall [13] that private transportation is a mode that is widely replaced by online transportation. Online transportation users who have high family income tend to use cars compared to public transportation before online transportation existed. This finding confirms the substitution of private transportation associated with respondents who

have high family income [14]. The discriminant model also found that respondents with a fairly low usage experience (3-5 months) tended to use private transportation before online transportation was available. It can be estimated that users who used to use public transportation first used online transportation when online transportation was already providing services. This is possible because public transportation services in the city of Bandung are not good enough, so that online transportation provides an alternative to a new travel mode. Several recommendations in the context of online transportation management can be given from this study. First, with public transportation users who are more prone to switching, there is a need to improve the quality of public transportation in Bandung City to reduce mode shifting from public transportation to online transportation. Intervention can be done with tariff incentives (subsidies) as recommended by Irawan et al. [1].

VI. CONCLUSION

Based on the results of the analysis that has been carried out on the characteristics of young online

transportation users based on the mode of origin in Bandung, it can be concluded that:

1. The characteristics of young online transportation users are dominated by respondents aged 19 to 25 years with current educational status as students. As many as 66.5% of online transportation respondents are women. The majority of respondents who previously used motorbikes tended to have lower family income compared to users of public transportation and cars before online transportation existed.

2. Travel characteristics of young online transportation users, including the most widely used online mode of transportation is motorbikes (88.4%). Respondents used online transportation only for occasional trips ($\leq 3x$) which required a travel time of 15 to 30 minutes with an average distance of 2 to 4 km. Respondents who used cars prior to online transportation had a higher average travel cost than respondents who previously used motorbikes and public transportation. The majority of respondents have used online transportation for more than 2 years and the most commonly used online transportation applications are Gojek and Grab.

3. The results of the discriminant analysis model show that the variables that do not affect the mode grouping from the aspect of respondent characteristics are age, educational status, location of residence, while from the aspect of travel characteristics, namely travel time, distance traveled, applications, and online transportation modes are used. Furthermore, the results of the analysis show that online transportation is mostly used by respondents who have a family income of more than 12 million per month, tend to be car users before the existence of online transportation. In addition, online transportation users who prefer to use public transportation as an alternative if they do not get online transportation and have a family income in the range of 4 to 6 million rupiah per month tend to be users of public transportation prior to online transportation. As for online transportation users who have just used online transportation in the range of 3 to 5 months and choose to use a motorbike if they do not get online transportation, they tend to previously use a motorbike to travel so it can be estimated that users who used to use public transportation first used online transportation when transportation online already provide services.

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