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Perceptions of Ride-Hailing for First Mile and Last Mile Trips in Yogyakarta Urban Area

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ABSTRACT

The high population density and mobility in the Yogyakarta Urban Area necessitate the improvement of transportation services. The current population density in Yogyakarta is approximately 13,007 people per square kilometer, and the city experiences significant daily commuter traffic. Problems occur because the available modes of transportation have several limitations. While the existence of stations/airports/terminals requires connectivity from other modes of transportation. Ride-hailing services have emerged as a convenient and practical solution for users. However, the integration of ride-hailing services with multimodal systems, particularly for first mile and last mile trips, is still considered inadequate, and there is limited empirical evidence on this matter. Therefore, conducting an in-depth study is crucial to comprehend users' perceptions of ride-hailing for first mile and last mile trips. Primary data collection was conducted by face-to-face and online using Google Form on 416 respondents. The primary data collection technique was carried out using the convenience sampling method. The data collected consists of socio-demographic data, travel characteristics and variables that influence respondents to use ride-hailing for first mile and last mile trips. This research uses descriptive analysis, and exploratory factor analysis, by employing exploratory factor analysis, the results reveal that there are 2 factors that influence respondents to choose to use ride-hailing, namely convenience and practicality and service performance. Convenience and practicality refer to the ease of service, including payment and ordering, and the ability for ride-hailing services to pick up or drop off users at home. Service performance includes short waiting times, certain travel times, comfort, and safety. Improving these aspects could enhance the integration of ride-hailing services with existing transportation systems, addressing current inadequacies.

1. Introduction

Yogyakarta has experienced significant urban transformation and rapid development over the past few decades. According to data from BPS, the city's population increased by approximately 30% between 2000 and 2020. The current population density in Yogyakarta is around 13,007 people per square kilometer. With a total population of 2,460,131 people encompassing Yogyakarta City, Sleman Regency, and Bantul Regency, Yogyakarta is categorized as a metropolitan area. The presence of several large universities has contributed to the increase in population, which has driven the development of the Yogyakarta urban agglomeration area, commonly known as the Yogyakarta Urban Area (YUA). In addition to being a city of education, Yogyakarta is also a prominent tourism destination and cultural center, boasting significant potential for attracting local, national, and international tourists.

The increasing density and mobility demands in YUA require better transportation services. Integration is needed to enhance the ease of mobility for public transportation users [1]. Stations, airports, and terminals are essential components of the transportation system that should be well-connected to other modes of transportation. A lack of connectivity within the transportation system can lead to increased use of private vehicles and a decline in the use of public transportation. The concepts of "First Mile" and "Last Mile" are crucial in addressing how to facilitate human mobility from the beginning to the end of a journey using various types of transportation.

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The choice of various modes of transportation in YUA provides people with several alternative travel options. The types of travel modes that can be used as options include pedicabs, motorized rickshaws, horse-drawn carriages, motorcycle taxis, regular taxis, and public transportation such as TransJogja and Damri. In addition, people can also use their personal vehicles, whether motorcycles or cars, to drive themselves or to be dropped off. Not infrequently, they also choose to walk or bike.

However, limited coverage makes some modes of transportation unsuitable for first and last mile travel options. The unpredictability of motorcycle taxi and regular taxi availability in every corner of the location poses an obstacle. On the other hand, using private vehicles is not a viable alternative for long periods if driven alone, as it will result in high parking costs at stations, airports, or terminal areas during trips outside the city. Therefore, finding a balance between convenience, cost, and coverage is essential when choosing the most suitable mode of transportation in YUA.

Previous research [2] showed that the high cost of parking significantly affects the decision to choose the last mile mode. The most appropriate alternative mode for first mile and last mile trips is a combination of walking and public transportation. In reality, the condition of pedestrian facilities in YUA does not encourage people to walk. The risk of hazards such as traffic accidents and robbery is a frightening threat to pedestrians. In addition, many street vendors occupy the sidewalks, leaving little space for pedestrians. Similar conditions apply to public transportation in YUA [3], through research on the level of accessibility of public transportation in the sub-urban area of Yogyakarta, suggested that Depok District is an area that is served with the highest category, while Bantul Regency is an area that is served with low and very low categories. Another study [4] showed a gap between the northern and southern regions in terms of Trans Jogja service equity. Meanwhile, [5] there are around 52% of areas with activity systems that have been fully served by TransJogja services. Meanwhile, 48% of areas in YUA are still areas whose activity systems have not been fully served by TransJogja services.

In this era of globalization, the development of ICT (Information and Communication Technology) has changed people’s lifestyles. Many businesses began to emerge by utilizing the development of communication technology, one of which was the emergence of application-based transportation services as a reaction to the weaknesses in the provision of public transportation services. The presence of ride-hailing that offer attributes such as convenience and practicality for their users is considered a solution. However, the role of ride-hailing in multimodal integration, especially for first mile and last mile trips, is still considered weak, and empirical evidence is still limited. Therefore, an in-depth study needs to be conducted to understand the perceptions of ride-hailing users on first and last mile trips. This study was conducted in YUA, where density also correlates with a higher frequency of ride-hailing use [6][7][8].

2. Method

To achieve the research objectives, it is necessary to prepare a research procedure consisting of a series of activities carried out systematically and continuously. This research procedure can be seen in Figure 1. With the existence of well-structured research procedures, it is hoped that research can be carried out more effectively and efficiently to produce accurate and relevant data. Based on Figure 1, the research procedure can be described as follows:

a. In the problem identification stage, the researcher searches for and understands the problem to be studied and formulates the problem formulation, research objectives, and research limitations. This allows researchers to conduct research that is more focused and effective, with maximum results.
b. The literature study stage was carried out to find references and theoretical foundations needed for the research. Information and sources were obtained from various sources, such as books, journals, articles, and other documents. This stage helps enrich the researcher's understanding and insight into the research topic and determine the appropriate theories and methods to answer research problems.
c. The data collection consists of two parts, namely primary data and secondary data. Primary data is obtained from direct and online surveys of ride-hailing users to determine daily travel characteristics, socio-demographics, and variables that influence respondents to use ride-hailing for first mile and last mile trips. Secondary data is obtained from searching open data from agencies/companies on websites consisting of SETDA DIY or provincial secretariat of DIY for population data, Ministries for policy data, and ride-hailing companies to find out the services provided to users.
d. The data processing stage is carried out to process survey results from ride-hailing users. The data processing stage uses two analysis methods: Descriptive Analysis and Exploratory Factor Analysis.

e. A descriptive analysis is carried out to determine the travel characteristics and socio-demographics of ride-hailing users and to see the tendency of ride-hailing users' perceptions for first mile and last mile trips. With this analysis, the data will be simpler and easier to understand.
f. Exploratory Factor Analysis is conducted to determine the grouping of latent variables; in other words, factor analysis is intended to generate a new theory by examining or exploring variations and relationships of factors hidden from existing variables.
g. The discussion stage is carried out to discuss the results of data processing and explain travel characteristics of ride-hailing users
h. The conclusion and suggestion stage is the final stage of this research, which contains conclusions from the discussion stage and suggestions for further research.

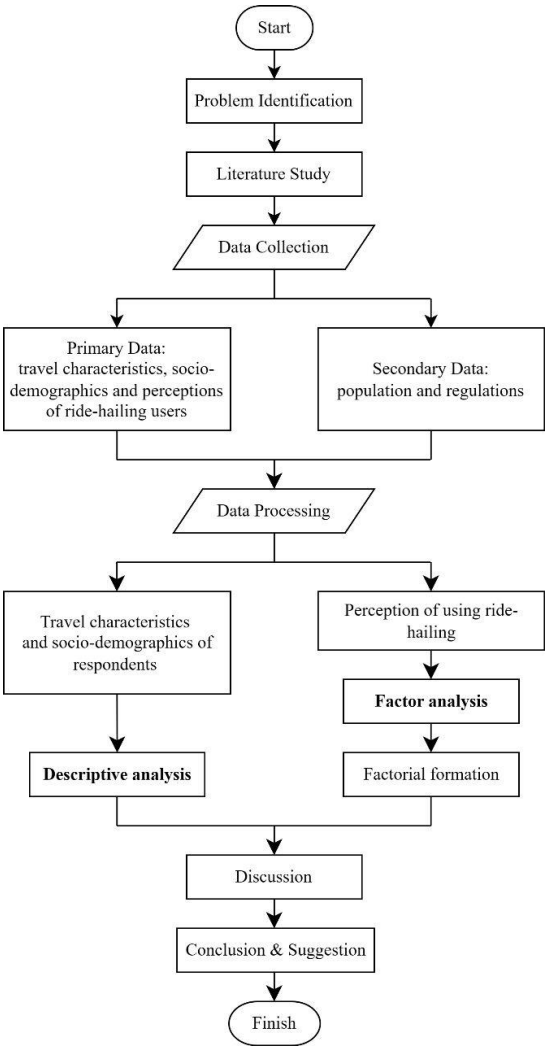

Figure 1. Research Flowchart

2.1 Location and Sampling

The research location is in the Yogyakarta Urban Area (YUA), which consists of Yogyakarta City, parts of Bantul Regency, and parts of Sleman Regency. Bantul Regency includes Sewon Sub-district, Banguntapan Sub-district, and Kasihan Sub-district. Meanwhile, Sleman Regency includes Gamping Sub-district, Depok Sub-district, and Mlati Sub-district. The area is a National Activity Center that has been determined through Yogyakarta Special Region Regional Regulation Number 5 of 2019 concerning the Spatial Plan for the Special Region of Yogyakarta Year 2019 - 2039, which can be seen in Figure 2.

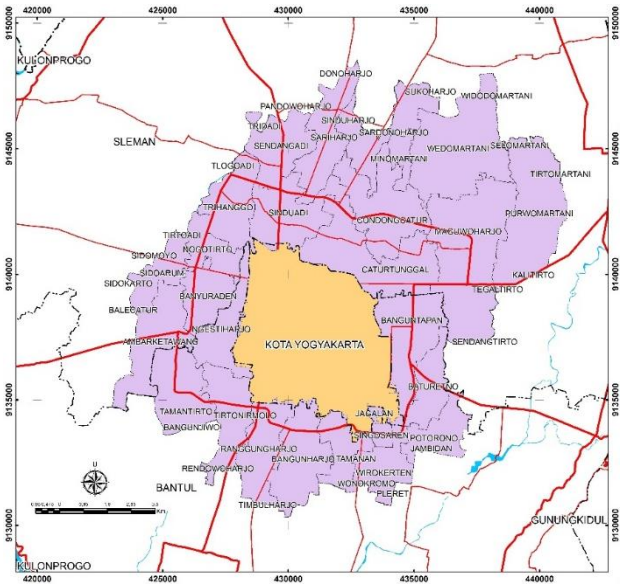

Figure 2. Yogyakarta Urban Area Map

2.2 Data Availability

In this study, some data is needed to analyze, the data used is categorized into 2 types such as primary data and secondary data.

The primary data collection technique was carried out using the convenience sampling method. With the classification of respondents aged at least 15 years, the maximum vulnerable time using ride-hailing in the last 6 months, and domiciled in YUA consist of Yogyakarta City, Gamping District, Depok District, Mlati District, Sewon District, Kasihan District, and Banguntapan District, Primary data collected in this study are data on daily travel characteristics, socio-demographics, and perceptions of ride-hailing users for trips to or from the station, airport, or terminal (first mile, last mile) in the Yogyakarta Urban Area. The survey was conducted face-to-face and online using Google Forms.

The number of respondents needed for this study using the Slovin formula with a confidence level of 95% with the total population of YUA 1,147,255 people (Setda DIY, 2021), then the minimum number of respondents that must

be achieved in order to represent the population based on formula (1) is 399.86 ≈ 400 respondents.

$$n = \frac{N}{1 + Ne^2} \quad (1)$$

$$n = \frac{1.147.255}{1 + 1.147.255 \times 0{,}05^2}$$

$$n = 399.86 \approx 400$$

where *n* is number of samples, *N* is total population and *e* is 100% - confidence level.

The secondary data collected in this study include: (1) Population data, this data is used to determine the number of populations that are taken into account as research samples, (2) Associated regulations and policies.

2.3 Research Instruments

The research instruments needed in this study are as follows:

a. Laptop, used to compile reports, process data, and search for reference sources.
b. Google Forms were used to compile the online questionnaire and as a means for respondents to provide ratings.
c. Microsoft Word software was used to draft the research paper.
d. Microsoft Excel software was used to recap survey data, calculate probabilities, and create graphs; SPSS was used for validity tests, reliability tests, and factor analysis.
e. Printer, used to print the research paper, reference sources, survey forms, and survey results.
f. Stationery is used to record any findings or information needed in the research.

2.4 Research Variables

a. Questionnaire Design

The primary data in this study was obtained from a survey with a questionnaire conducted face-to-face and online. In the questionnaire, there are three parts of information collected, namely related to daily travel characteristics, socio-demographics, and perceptions of ride-hailing users on first mile and last mile trips.

Based on the literature study that has been conducted, this study tries to measure the relationship between variables and the frequency of use of ride-hailing. The results of [9] research suggest that convenience, speed, affordable, and safety are determining factors when choosing to use ride-hailing, and [10] state that the driving factor for using a motorcycle is its fast, reliable, and flexible performance (which can be used in traffic jams). While the performance of motorcycle based ride-hailing is considered to have advantages in short waiting times, no need to walk, and easy use. These factors become indicators used to measure the performance of ride-hailing services in YUA. Where the factors mentioned earlier can affect the frequency of use of ride-hailing. As well as the sources of several studies, this study also uses socio-demographic variables such as gender, age, income, and education level as basic considerations in the use of ride-hailing [8][11] .The use of variables in this study does not consider external factors such as weather conditions or urban public transportation conditions.

To ensure that respondents fill out the questionnaire properly, in this study, control questions are given in each section by ordering respondents to fill in certain answers, This is done to determine the seriousness of filling out this research questionnaire. The list of questions in the planned questionnaire form is listed in Table 1, Table 2, and Table 3.

2.5 Data Analysis

After all the data were collected, a series of analyses were carried out. Prior to analysis, the collected data were tested for normality, validity, and reliability using IBM® SPSS® Statistics 24 software. A validity test is a way of showing the extent to which a measuring instrument is able to measure what you want to measure. Meanwhile, reliability is the extent to which the measurement of a test remains consistent after being carried out repeatedly on the subject and under the same conditions. In general, there are three methods of analysis carried out: descriptive analysis (to facilitate providing an explanatory picture related to the characteristics of respondents), exploratory factor analysis (to help generate a new theory by examining or exploring variations and relationships of factors hidden from existing variables).

In the descriptive analysis, the software used was Microsoft Excel. It has a number of features and functions that are useful for performing descriptive analysis, which is a basic statistical technique used to provide an overview of the characteristics of a data set. With Excel, we can use various formulas and functions to perform descriptive analysis, such as calculating the mean, median, mode, and standard deviation. In addition, Excel also provides features for creating graphs and charts, which can be helpful in visualizing data distribution and emerging patterns.

Meanwhile, exploratory factor analysis used IBM® SPSS® Amos 24 software. It is software that can help support research and theory by extending standard multivariate analysis methods, including regression, factor analysis, correlation, and analysis of variance. In factor analysis, the results can be used to facilitate the understanding and interpretation of data as well as to develop more accurate statistical models.

3. Results and Disscussion

3.1 Sample Characteristic Analysis

Survey data was obtained directly face-to-face and online with 480 respondents from December 4, 2022, to January 15, 2023. Respondents are ride-hailing users who live in the Yogyakarta Urban Area (YUA), including Yogyakarta City, Sleman Regency, and Bantul Regency. The data collection technique is carried out using the convenience sampling method, so that every ride-hailing user who meets the requirements can be used as a respondent.

Table 1. Socio-demographic variables.

Category	Item
Gender	Male
	Female
Age	
Status	Married
	Not Married
Address (domicile) of residence/dorm/rent house	Yogyakarta City
	Sleman Regency
	Bantul Regency
Income	Less than Rp1.975.000,00
	Rp1.975.000,00 – Rp3.950.000,00
	Rp3.950.001,00 – Rp5.925.000,00
	Rp5.925.001,00 – Rp7.900.000,00
	Higher than Rp7.900.000,00
Last education level	Elementary/Secondary/High school
	Bachelor/Diploma or higher
	Currently attending college
Type of employment	Civil Servant (BUMN)
	National Government (PNS)
	Private/entrepreneur
Vehicle ownership	Do not have a vehicle
	Own a motorcycle only
	Own a car only
	Own a motorcycle and a car
Living with family	Yes
	No

Table 2. Trip characteristic variables.

Category	Item
Frequency of using motorcycle based ride-hailing	Almost every day
	Several times a week
	At least once a week
	Several times a month
	At least once a month
	Several times a year
Frequency of using taxi based ride-hailing	Almost every day
	Several times a week
	At least once a week
	Several times a month
	At least once a month
	Several times a year

Table 3. Variables that influence the use of ride-hailing for first mile and last mile trips.

Indicator	Variables	Assessments
I use ride-hailing to travel to or from the station, airport, or terminal because:	1) No one to drop off or pick up	Strongly disagree
	2) Low cost	Disagree
	3) Short waiting time	Agree
	4) Definite travel time (no fear of being late)	Strongly agree
	5) Can be picked up or delivered to the house	Neutral
	6) Can get off inside the station, airport, or terminal	
	7) Convenient	
	8) Safety	
	9) Can do other things while in the vehicle	
	10) Easy/cashless payment	
	11) Easy to order	

The screening of survey results is seen in the control questions in the questionnaire. Control questions serve to measure the accuracy and seriousness of the respondents answers to each question. There are 3 control questions in this study, with the type of question "Please choose the usual option having as many as 2 items and the question "which one is not included in the animal group?" having as many as 1 item. If the respondent does not choose the correct answer, it can be identified that the respondent was not careful in filling out the questionnaire. The questionnaire data used in this study had a maximum of one wrong answer to the control question. After filtering the data, the data that met the standards was obtained, which was 418 respondents.

3.2 Socio-demographic Characteristics of Respondents

Based on data on socio-demographic characteristics in Table 4, the majority of respondents were female at 58.1% and male respondents at 41.9%. Meanwhile, in terms of age, the largest number of respondents in the age range 20-24 years (51.4%), followed by the age range 25-39 years (32.1%), 15-19 years (13.2%), 40-59 years (2.6%), above 59 years (0.7%). The mean age of respondents was 24.7 years with a standard deviation of 6.5. The youngest respondent was 16 years old and the oldest was 66 years old. Overall, the respondents were at productive age, except for 1 respondent who was above productive age. Respondents' domicile addresses were predominantly from Yogyakarta City (34.9%), followed by Depok Sub-district (30.6%), Mlati Sub-district (10.3%), Sewon Sub-district (7.2%), Banguntapan Sub-district (5.5%) and Kasihan Sub-district (5.3%). This condition is possible because Yogyakarta City acts as a business/economic center, while Depok and Mlati Sub-districts are supported by the presence of several large campuses which correspond to the majority of young ride-hailing users. Respondents' income in this research questionnaire is divided into 2, namely, income and pocket money. Income applies to respondents who have worked, while pocket money applies to those who have not worked/students/students. The most income is in the range of Rp1,975,000.00 - Rp3,950,000.00 (48.99%) which is greater than the average minimum wage of DIY (Special Region of Yogyakarta), then by income less than Rp1. 975,000.00 which is below the average DIY MSE (20.71%), followed by Rp3,950,001.00 - Rp5,925,000.00 (11.62%), Rp5,925,001.00 - Rp7,900,000.00 (11.11%) and at least more than Rp7,900,000.00 (7.58%). While the most pocket money is in the range of Rp 500,000.00 – Rp 999,999.00 (31.82%), followed by less than Rp 500,000.00 (22.27%), Rp 1,000,000.00 – Rp 1,499,999.00 (20.45%), Rp 1,500,000.00 – Rp 3,000,000.00 (20%) and at least more than Rp3,000,000.00 (5.45%).

In terms of the latest education, the majority of respondents were Bachelor/Diploma graduates or higher (51.4%), currently attending college (27.5%), high school / equivalent (15.8%), and junior high school / equivalent (5.3%). Meanwhile, the majority of occupations are dominated by students (54.5%), followed by the private sector (24.9%), others (7.4%), civil servants/civil servants (7.2%), entrepreneurs (5%), and state-owned enterprises (1%).

Regarding vehicle ownership and driver's license ownership, the majority of respondents only own a motorcycle (53.1%) and only have a C driver's license (45.5%), respectively. These conditions allow respondents to choose to order ride-hailing in the form of taxis due to luggage / weather conditions / large groups on the trip. Meanwhile, with regard to the percentage of transportation budget allocation from income, most are at 5 - 9% (38.3%), followed by 10 - 19% (28.5%), < 5% (18.7%), 20 - 29% (11.7%), 30 - 39% (2.2%), and 50% or more (0.7%)

3.3 Respondents' Trip Characteristics

The travel characteristics of 418 respondents can be seen in Figure 3 and Figure 4, namely that the frequency of using motorcycle based ride-hailing is mostly in the category of several times a month (30.1%), followed by several times a year (29.2%), several times a week (14.8%), at least once a month (8.9%), at least once a week (8.1%), once a year or less (5%), and the least category is almost every day (3.8%). Meanwhile, the frequency of using taxi based ride-hailing is mostly in the category of several times a year (48.1%), followed by once a year or less (18.9%), several times a month (17.5%), at least once a month (10.3%), several times a week (2.9%), at least once a week (2.2%), and the least frequent category is almost every day (0.2%).

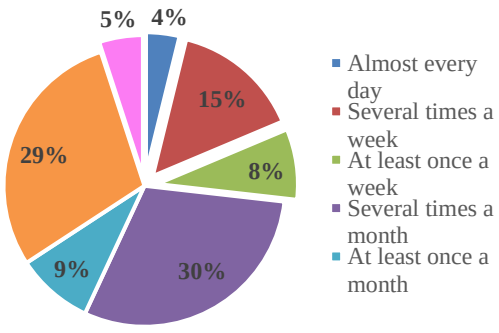

Figure 3. Frequency of using motorcycle based ride-hailing

Table 4. Respondents' Travel Characteristics

Respondents' Travel Characteristics	Survey Result	
	Respondent	**Presentage**
Gender		
Male	175	41.9%
Female	**243**	**58.1%**
Total	418	100%
Age		
15-19 years	55	13.2%
20-24 years	**215**	**51.4%**
25-39 years	134	32.1%
40-59 years	11	2.6%
>59 years	3	0.7%
Total	418	100%
Domicile Address		
Yogyakarta City	**146**	**34.9%**
Depok Sub-district	128	30.6%
Mlati Sub-district	43	10.3%
Gamping Sub-district	26	6.2%
Kasihan Sub-district	22	5.3%
Sewon Sub-district	30	7.2%
Banguntapan Sub-district	23	5.5%
Total	418	100%
Income		
Less than Rp1.975.000,00	41	20.71%
Rp1.975.000,00 – Rp3.950.000,00	**97**	**48.99%**
Rp3.950.001,00 – Rp5.925.000,00	23	11.62%
Rp5.925.001,00 – Rp7.900.000,00	22	11.11%
More than Rp7.900.000,00	15	7.58%
Total	198	100%
Pocket Money		
Less than Rp500.000,00	49	22.27%
Rp500.000,00 – Rp999.999,00	**70**	**31.82%**
Rp1.000.000,00 – Rp1.499.999,00	45	20.45%
Rp1.500.000,00 – Rp3.000.000,00	44	20%
More than Rp3.000.000,00	12	5.45%
Total	220	100%
Last Education Level		
Elementary school/ equivalent	0	0%
Junior High School/ equivalent	22	5.3%
High School/ equivalent	66	15.8%
bachelor/Diploma or Higher	**215**	**51.4%**
In college	115	27.5%
Total	418	100%
Type of Employment		
PNS/ Civil Servant	30	7.2%
Swasta	104	24.9%
POLRI/TNI	0	0%
Entrepreneur	21	5%
BUMN	4	1%
Student	**228**	**54.5%**
Other	31	7.4%
Total	418	100%

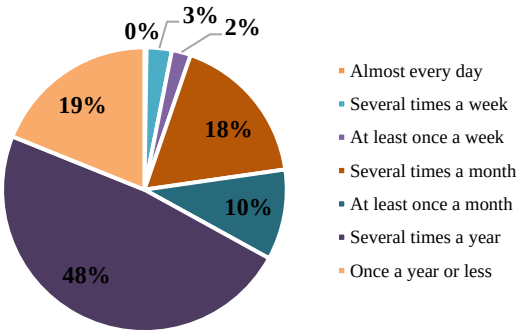

Figure 4. Frequency of using taxi based ride-hailing

3.4 Variables Affecting the Use of Ride-Hailing

The results of the descriptive analysis of variables affecting the use of ride-hailing in Figure 5 show that respondents positively assessed the existence of ride-hailing services at this time. More than 50% of respondents chose the agree and strongly agree options on almost every variable. There are theree variables that have an assessment of agreeing or strongly agreeing more than 90%, namely the variable that can be picked up or delivered to the house, the variable that is easy or cashless to pay, and the variable that is easy to order. The highest choice is in the easy to order variable of 52.6% for the agree category and 41.4% for the strongly agree category, followed by the category of being able to be picked up or delivered to home of 51.7% for the agree category and 41.4% for the strongly agree category, and then the easy/cashless payment category of 50.7% for the agree category and 39.5% for the strongly agree category. This indicates that ride-hailing services offer convenience and practicality for their users.

Furthermore, in other variable categories, the choice of respondents is dominated by the choice of the agree category, such as the comfortable variable, which has an agreed assessment of 59.8%, followed by the safe variable category of 54.1%, the variable category of waiting time is not long at 53.8%, the variable category has no one to drop off or pick up at 48.6%, the variable category can get off inside the station, airport / terminal at 48.1%, the variable category can do other things while in the vehicle at 43.8%, the variable category of low cost at 42.6%, and the variable category of travel time is certain (not afraid of being late) at 39.7%

3.4 Exploratory Factor Analysis

Exploratory factor analysis is carried out to determine the grouping of latent variables; in other words, factor analysis is intended to produce a new theory by examining or exploring variations and relationships of factors hidden from existing variables. In this study, exploratory factor analysis used the help of SPSS version 24 software and went through several stages of analysis with the number of samples obtained as many as 418 samples. Before factor analysis is carried out, it is necessary to test the instrument first, which consists of validity and reliability tests. The number of factor analysis testing variables is 11 in Table 5 where the use of variables is limited to those using a Likert scale.

Tabel 5. Variables of exploratory factor analysis

Variabel	Indikator
X1	No one to drop off or pick up
X2	Low cost
X3	Short waiting time
X4	Definite travel time (no fear of being late)
X5	Can be picked up or delivered to the house
X6	Can get off inside the station/airport/terminal
X7	Convenient
X8	Safety
X9	Can do other things while in the vehicle
X10	Easy/cashless payment
X11	Easy to order

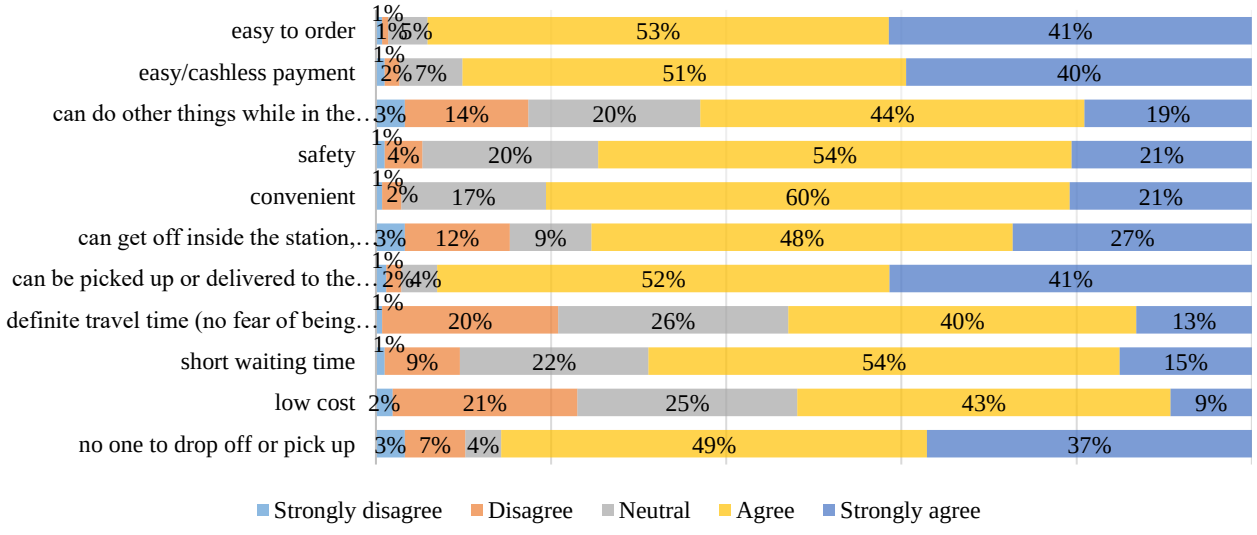

Figure 5. Variables Affecting the Use of Ride-hailing

a. Validity and Reliability Tests

Validity and reliability tests were carried out based on the results of distributing initial questionnaires to 418 respondents who used ride-hailing services within the last six months, so that the r table value for N = 418 and df = 416 with a significance level of 0.05 was 0.096. If you get r count> r table, it is concluded that the variable item is valid.

Based on Table 6, it is found that all variables have a value of r count> 0.096, which means that all indicator items are valid and can be used in further calculations. The indicator used in measuring instrument reliability is the Cronbach's Alpha value; if an instrument has a Cronbach's Alpha> 0.6, then the instrument can be said to have consistency or reliability.

Based on Table 7, it is found that the questionnaire variables have a Cronbach's Alpha value> 0.60, so all questionnaire variables are reliable and can be continued with exploratory factor analysis.

Table 6. The results of testing the validity of the questionnaire.

Variable	R count	R table	Description
X1	0.197	0.096	Valid
X2	0.659	0.096	Valid
X3	0.614	0.096	Valid
X4	0.588	0.096	Valid
X5	0.597	0.096	Valid
X6	0.598	0.096	Valid
X7	0.678	0.096	Valid
X8	0.642	0.096	Valid
X9	0.516	0.096	Valid
X10	0.604	0.096	Valid
X11	0.581	0.096	Valid

Table 7. The results of testing the reability of the questionnaire.

Cronbach's Alpha		**Description**
Result	**Value Requirement**	
0,804	0.600	Reliable

b. Determination of Variables

1) First Analysis

The test results of the Determinant of Correlation Matrix is 0.030, so it can be ascertained that the value obtained is close to zero and the correlation matrix between variables is bound together, based on Kaiser Meyer Olkin Measure of Sampling (KMO) and Barlett Test of Sphercity the result are KMO is 0,793, and Barlett is 0,000 so that the questionnaire data is suitable for further analysis. Based on Table 8 the result of Measure of Sampling Adequacy (MSA) for each variable has met the criteria, but there are several variables that do not meet the criteria for communality> 0.5, namely in variables X6 and X9. So that these variables cannot be used and the analysis must be repeated from the beginning without involving the variables that have been removed.

Table 8. First Analysis MSA and Communality.

Variable	**MSA**	**Communality**
X1	0,823	0,526
X2	0,848	0,544
X3	0,828	0,660
X4	0,829	0,587
X5	0,869	0,610
X6	0,868	**0,403**
X7	0,796	0,701
X8	0,790	0,628
X9	0,917	**0,431**
X10	0,774	0,714
X11	0,794	0,665

2) Second Analysis

The test results of the Determinant of Correlation Matrix is 0.048, so it can be ascertained that the value obtained is close to zero and the correlation matrix between variables is bound together, based on Kaiser Meyer Olkin Measure of Sampling (KMO) and Barlett Test of Sphercity the result are KMO is 0,793, and Barlett is 0,000 so that the questionnaire data is suitable for further analysis. Based on Table 9 the result of Measure of Sampling Adequacy (MSA) for each variable has met the criteria, but there are several variables that do not meet the criteria for communality> 0.5, namely in variables X1 and X2. So that these variables cannot be used and the analysis must be repeated from the beginning without involving the variables that have been removed.

Table 9. Second Analysis MSA and Communality

Variable	**MSA**	**Communality**
X1	0.828	**0.258**
X2	0.840	**0.473**
X3	0.812	0.571
X4	0.824	0.568
X5	0.886	0.582
X7	0.770	0.583
X8	0.754	0.505
X10	0.751	0.740
X11	0.772	0.699

3) Third Analysis

The test results of the Determinant of Correlation Matrix is 0.069, so it can be ascertained that the value obtained is close to zero and the correlation matrix between variables is bound together, based on Kaiser Meyer Olkin Measure of Sampling (KMO) and Barlett Test of Sphercity the result are KMO is 0,773, and Barlett is 0,000 so that the questionnaire data is suitable for further analysis. Based on Table 10 the result of Measure of Sampling Adequacy (MSA) for each variable has met the criteria and suitable for further analysis.

Table 10. Third Analysis MSA and Communality

Variable	MSA	Communality
X3	0.793	0.587
X4	0.809	0.573
X5	0.885	0.579
X7	0.751	0.637
X8	0.739	0.572
X10	0.736	0.813
X11	0.761	0.763

Table 11. Component matrix analysis

Variable	Indicator	Component	
		1	2
X3	Short waiting time	0.587	
X4	Definite travel time (no fear of being late)	0.570	
X5	Can be picked up or delivered to the house	0.697	
X7	Convenient	0.768	
X8	Safety	0.714	
X10	Easy/cashless payment	0.752	
X11	Easy to order	0.754	

Table 12. Rotated component matrix analysis

Variable	Indicator	Component	
		1	2
X3	Short waiting time		0.760
X4	Definite travel time (no fear of being late)		0.752
X5	Can be picked up or delivered to the house	0.719	
X7	Convenient		0.680
X8	Safety		0.667
X10	Easy/cashless payment	0.890	
X11	Easy to order	0.853	

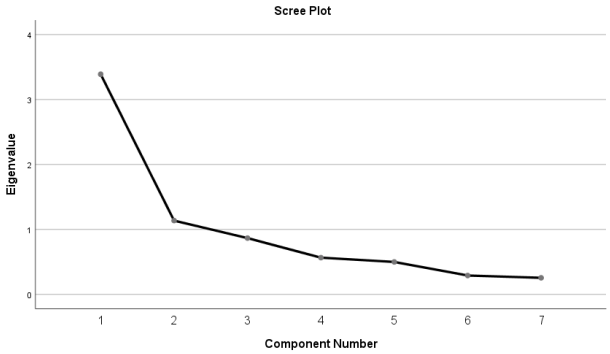

Figure 6. *Scree plot diagram* analysis.

c. Factor Formation

Factor formation is based on eigenvalue and percentage of variance. The results of factor formation show that the number of factors formed is 2 factors and can explain 64.635% of the information. Another criterion for factor formation is based on the scree plot diagram. The diagram is formed between the component number on the horizontal axis and the eigenvalue on the vertical axis. From the formation of this factor, it can be seen the out of points based on the sharpness of the curve, namely when the curve begins to resemble a horizontal line and eigenvalue < 1 as in Figure 6, so it is concluded that the right factor extraction is 2 factors.

The distribution of 7 variables on 2 factors can be seen in Table 11, where the values listed in the table indicate the magnitude of the correlation between a variable and the factor formed (factor loading); the greater the number listed, the closer the variable relationship to the factor formed. The factor loading value <0.5 is considered insignificant for a sample size of 418 respondents with a level of significance (α) of 5%, so researchers set the settings on the SPSS 24 software not to display variables that have factor loading <0.5 to facilitate interpretation of the analysis results.

The rotation of factors that have been formed in the component matrix aims to create simplicity and clarity of factor loading so as to improve the ability and ease of interpreting factors because the rotation of factors (rotated component matrix) can show a clearer distribution of factors than the component matrix. In the factor analysis process, each variable must have only one factor loading, and no cross-loading is allowed. If there are one or more variables that have cross-loading, one of the variables with the lowest factor loading is removed from the next analysis process. Table 12 shows the results of the rotated component matrix that has been carried out in the analysis with a rotation process of three iterations. Based on the results of the rotated component matrix in Table 12, each variable only has one factor loading, so there are no variables with cross-loading. Therefore, the analysis process can proceed to the next stage to interpret the results of factor analysis.

d. Interpretation of Results

Based on the results of the rotated component matrix, 7 variables are grouped into first factor (X1, X10, X11) and second factor (X3, X4, X7, X8), from here we can interpret the characteristics and naming of each factor are identified as in Table 13.

Table 13. Naming factors

Factor	Name	Variable	
1	Convenience and Practicality of Services	X5	Can be picked up or delivered to the house
		X10	Easy/cashless payment
		X11	Easy to order
2	Service Performance	X3	Short waiting time
		X4	Definite travel time (no fear of being late
		X7	Convenient
		X8	Safety

The first factor consists of three variables and is named Convenience and Practicality of Service. The naming of this factor refers to variable statements that explain the ease of service, such as ease of payment and ease of ordering. Meanwhile, the indicator naming Practicality comes from a variable that explains that ride-hailing services can be picked up or delivered to the house. Factor loading on this first factor is in the range between 0.719 and 0.890, and the first factor is able to explain the variance of 48.413%.

The second factor of factor analysis consists of four variables named Service Performance. The naming of this factor refers to variable statements that explain service performance, such as that waiting time is not long and travel time is certain, comfortable, and safe. Factor loading on this second factor is in the range between 0.667 and 0.760, and the first factor is able to explain 16.221% of the variance.

4. Conclusions

Based on the research above, the social demographic characteristics of ride-hailing service users reveal several key insights. The frequency of using motorcycle-based ride-hailing services is reported at 30.1% for several times a month, while 48% of taxi-based ride-hailing users use the service several times a year. The age group most frequently using these services is dominated by individuals aged 20–24, primarily students. Comfort and security are significant attributes for these services, making women the main users. Many users are from Sleman Regency, an area with numerous universities. In terms of education, the majority of users hold a bachelor's degree or diploma, indicating a positive reception among the highly educated community. The majority of users have an income or pocket money ranging from Rp1,975,000.00 to Rp3,950,000.00, showing that the service is affordable and accessible to various social levels. Regarding vehicle ownership, most users own a motorcycle, except in the first-mile taxi-based ride-hailing category, where users tend to own both a motorcycle and a car.

The variables influencing the use of ride-hailing services for trips to or from stations, airports, or terminals are grouped into two main factors: convenience and practicality, and service performance. Convenience and practicality refer to aspects such as ease of payment, ease of ordering, and the ability to be picked up or dropped off at home. Meanwhile, service performance includes variables such as short waiting times, certain travel times, comfort, and safety. These factors significantly influence respondents' choices in using ride-hailing services, highlighting the importance of these attributes in the overall user experience.

To enrich future research, the existing research variables can be combined with the Theory of Planned Behavior (TPB). Additionally, this study has not considered the impact of weather conditions on the frequency of ride-hailing usage. Therefore, future research should include weather variables, especially considering Indonesia's tropical climate with its two distinct seasons, which can influence an individual's decision to use ride-hailing services.

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