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Exploring Ride-Sourcing Usage Among Older Adults: A Case Study of DKI Jakarta

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Abstract. *Mobility is a critical determinant of the quality of life for older adults, particularly in urban areas where limited physical capacity and economic constraints reduce their accessibility to transportation. Ride-sourcing services offer more flexible and independent mobility options; however, their adoption among older adults remains limited due to technological barriers and concerns regarding safety and security aspects. This study explored ride-sourcing usage among older adults in DKI Jakarta and identified the factors influencing their adoption. A quantitative approach was employed using revealed preference survey data collected from 408 older adult respondents. The dataset covered socioeconomic characteristics, health condition, technology response, safety and security perceptions. Descriptive statistics, factor analysis (principal component analysis), and discrete choice modeling (multinomial logit and nested logit) were conducted to analyze user preferences and identify significant factors. The findings indicate that while most older adults have positive perceptions on smartphones, many still require assistance in booking ride-sourcing services, and the majority are classified as inactive users. The nested logit model reveals a potential behavioral transition from assisted booking to independent usage. PCA reduced 28 perception indicators into six factors: driver safety and behavior, trip support, driver characteristics, technological barriers, travel risk, and personal security risk. Discrete choice models identified age, gender, employment status, vehicle ownership, presence of young dependents, physical condition, and user perceptions as significant predictors of ride-sourcing usage.*

Keywords. *Older adults, ride-sourcing, safety and security perception, factor analysis, discrete choice modelling.*

Introduction

The rapid increase in the elderly population presents growing challenges for urban mobility systems, particularly in densely populated metropolitan regions such as Jakarta. Population aging is a global demographic trend, with Southeast Asia projected to experience a significant rise in the elderly population from 9.3% in 2015 to 21.0% in 2050 (UNFPA, 2019). In Indonesia, the increase in life expectancy and improved health conditions has led to a growing elderly population, particularly in urban regions such as DKI Jakarta, where the elderly population has reached 11.3%, entering the aging population (BPS, 2024). On the other hand, older adults in DKI Jakarta face numerous mobility constraints; infrastructure such as pedestrian pathways remains poorly adapted to their needs, and overcrowded public transportation further restricts their accessibility. This demographic shift elevates the importance of inclusive, safe, and accessible transportation systems that accommodate elderly mobility, especially considering their vulnerability in complex urban environments.

Mobility plays a critical role in maintaining the independence, health, and quality of life of older adults (Maulina et al., 2014). However, in Jakarta, elderly individuals face multiple mobility barriers, including inadequate pedestrian infrastructure, limited accessibility to public transportation, and challenges in safely navigating high-density transport environments. Public

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transport systems that are effective for the general population often fail to address the accessibility, safety, and comfort needs of vulnerable groups, particularly older adults, who face higher risks of traffic accidents and mobility exclusion.

Ride-sourcing is an app-based on-demand transport service. It has emerged as a potential solution that offers flexible, door-to-door mobility, reducing the need for transfers, walking, or navigating crowded public facilities. This system may support transportation safety and accessibility for older adults, especially in urban settings with insufficient age-friendly infrastructure (Rayle et al., 2016; Chalermpong et al., 2023). Yet, despite these potential benefits, elderly individuals may face challenges in adopting ride-sourcing due to health limitations, low technology literacy, and perceptions of security and safety. In Indonesia, the digital literacy rate among older adults (aged >56) stands at a mere 5% (Kominfo, 2023). This low digital literacy presents a barrier, hindering the elderly from effectively utilizing ride-sourcing as a viable day-to-day transportation alternative.

Previous studies have shown that older adults exhibit diverse patterns of ride-sourcing adoption across regions, driven by differences in technology responses, mobility needs, and safety concerns. In London, they tend to rely more on taxi services due to their higher accessibility and perceived safety (Schmöcker et al., 2008). In California, ride-sourcing adoption among older adults is relatively high, influenced by technology perception, household structure, and health limitations (Misra et al., 2022). However, in Michigan, many elderly individuals remain reluctant to use ride-sourcing services due to limited digital literacy and low trust in app-based transportation systems (Vivoda et al., 2018). Safety perception plays a key role in shaping elderly users' trust in ride-sourcing, particularly in contexts where motorcycle-based services dominate, such as Indonesia, where motorcycles account for a high proportion of fatal accidents (Savitri, 2012; BPS, 2023). These variations highlight the importance of understanding how elderly individuals perceive safety, security, and risks associated with ride-sourcing services, particularly within urban mobility systems in developing countries (Daud et al., 2023).

Existing studies on ride-sourcing adoption primarily focus on younger users (Belgiawan et al., 2022; Irawan et al., 2021; Nugroho et al., 2020), limited attention given to elderly populations and their unique mobility vulnerabilities. The studies on ride-sourcing adoption among older adults found that sociodemographic, health condition, and technology response factors significantly affect the use of ride-sourcing services (Irawan et al., 2022, Misra et al., 2022; Gomez et al., 2021; Shirgaokar et al., 2021; Sikder, 2019). On the other hand, elderly individuals tend to have distinct mobility needs and risk perceptions, especially toward safety and security of transport services (Daud et al., 2023; Hu & Yang, 2024). These concerns may influence their willingness to adopt ride-sourcing as a mobility alternative.

This study aimed to explore the use of ride-sourcing services among elderly individuals in DKI Jakarta and identify the key factors that influence their adoption. It specifically examined how socio-demographic attributes, health conditions, technology responses, and perceptions on safety and security aspects shape ride-sourcing usage among older adults. A questionnaire-based survey was conducted to a specific target population using a structured sampling framework. The quantitative analysis utilizes factor analysis to reduce the dimension of the variables, followed by discrete choice modeling using multinomial logit (MNL) and nested logit (NL) methods. Guided by the formulated hypotheses, the empirical findings are discussed to draw comprehensive conclusions aligned with the study's primary propositions.

Data sampling

As in the *Undang-undang Nomor 13 Tahun 1998 tentang Kesejahteraan Lanjut Usia* (Law of the Republic of Indonesia Number 13 of 1998 concerning the Welfare of Older Adults), where individuals who have reached the age of 60 or above are legally categorized as older adults, the target population of this study comprised older adults (aged 60 years and above) residing in the urban areas of DKI Jakarta. As the total elderly population in DKI Jakarta is considerably large, this study employed a non-probability sampling approach, combined with stratified sampling, to ensure proportional representation across age groups and residential locations. Stratification was applied to capture variation in age segments (60-64 years old, 65-69 years old, 70-75 years old, 75+ years old) and spatial distribution across urban districts, aligning with the existing demographic structure.

Table 1. Elderly Population by Age and Domicile

City	Age				Total
	60-64	65-69	70-74	75+	
Jakarta Selatan	100,061	69,421	41,752	36,709	24,7943
Jakarta Timur	130,976	93,144	55,257	40,692	320,069
Jakarta Pusat	51,283	36,906	22,990	20,789	131,968
Jakarta Barat	103,077	73,516	44,941	37,399	258,933
Jakarta Utara	72,175	52,782	31,813	25,225	181,995
DKI Jakarta	457,572	325,769	196,753	160,814	1,140,908

BPS, 2024

The minimum required sample size was calculated using the Lemeshow formula (Lwanga & Lemeshow, 1991), with a 95% confidence level (Z = 1.96), a 5% margin of error (d = 0.05), and a population proportion of 0.5. The calculated minimum sample size was 385 respondents, which reached 408 respondents at the end of the data collection phase. In achieving the target sample based on the proportional distribution of the elderly population, the questionnaire responses were sufficiently representative of the overall age distribution. However, respondents aged 75 years and above were relatively difficult to reach, resulting in underrepresentation of this age group and a slight overrepresentation of those in the 60–64 age category.

Survey design

The survey instrument was designed to capture four main dimensions: sociodemographic characteristics, health condition, technology response, and safety-security perception. Sociodemographic variables included gender, age, income level, driver’s license ownership, vehicle ownership, number of household members capable of driving, daily trip frequency, household size, and smartphone usage. These variables served as baseline information and were used as explanatory variables in the modeling stage. Since physical capability may influence the usability of ride-sourcing services among older adults, health-related questions were included, covering mobility limitations (ability to carry heavy items, large items, and walk 500 meters or more) and sensory conditions (vision and hearing). The questionnaire also assessed technology response through three indicators: perceived necessity of smartphones, perceived difficulty of using smartphone, and willingness to use technology-based mobility services. Health condition and technology response variables were observed with Likert-scale questions (1 = strongly disagree to 7 = strongly agree), adopted from a previous study by Irawan et al. (2022).

Table 2. Safety and Security Perception Questionnaire Constructs

Variables	Factors	Indicators (question)
Security	Drivers	I have no concerns regarding the driver's age
		I have no concerns regarding the driver's gender
		I have no concerns regarding the driver's appearance
		I feel more comfortable when the driver does not ask personal questions
		I feel more comfortable when driver informs me before taking an unusual route
	Crime risks	I believe there is nothing to worry about when using ride-sourcing services alone
		I am confident that there is no risk of theft or robbery
		I am confident that there is no risk of harassment or violence
		I feel safer when more people travel with me
		I feel safer when traveling with my caregiver
	Digital protection	I believe there is no risk of personal data misuse by the service platform
		I feel safer when my trip is tracked or monitored
		I feel safer knowing that there is an emergency contact available
		I feel more secure when my smartphone is fully charged and has signal
	Environment	I can use ride-sourcing services without worry, even at night
		I can use ride-sourcing services without worry, even in peripheral areas
		I can use ride-sourcing services without worry, even in suspicious places
Safety	Certification and Assurance	I feel more assured when the driver is certified to operate a vehicle
		I feel more assured knowing that the platform has travel safety insurance
	Driver Behavior	I feel more comfortable when the driver avoids speeding
		I feel more comfortable when the driver is fully focused while driving (not smoking, using a smartphone, or other distracting activities)
		I feel more comfortable when driver uses familiar routes than shortcuts
	Vehicle Environment	I feel more comfortable when the vehicle is in good condition
		I feel assured by the overall road traffic safety when using the services

To assess safety and security perceptions, a series of questions act as perception indicators were developed based on constructs from previous studies (Hu & Yang, 2024). A total of 25 indicators representing safety and security dimensions were included, covering driver profile, driver behavior, trip assistance, platform credibility, smartphone dependency, environmental conditions, travel risks, and personal security. These items were later used in the factor analysis to classify and extract latent perception dimensions. Similar to health condition and technology response variables, safety-security perception was also measured using a Likert-scale (1 = strongly disagree to 7 = strongly agree). Table 1 presents the detailed composition of safety and security perception indicators.

The observation of ride-sourcing usage used the revealed preference (RP) approach, as it captures the respondents' real-life behavioral choices rather, not a hypothetical scenario. Ride-sourcing usage was examined at two levels: service usage and technology usage, developed by Irawan et al. (2022) in a previous study. First, respondents were asked whether they actively use (riders), previously used but no longer use (current non-riders), or have never used ride-sourcing services (non-riders). Second, respondents were asked whether they had ever downloaded a ride-sourcing application on their personal smartphone (app-installed/app-less) and whether they make bookings independently (self-request) or require assistance from others (requested by others).

Methodology

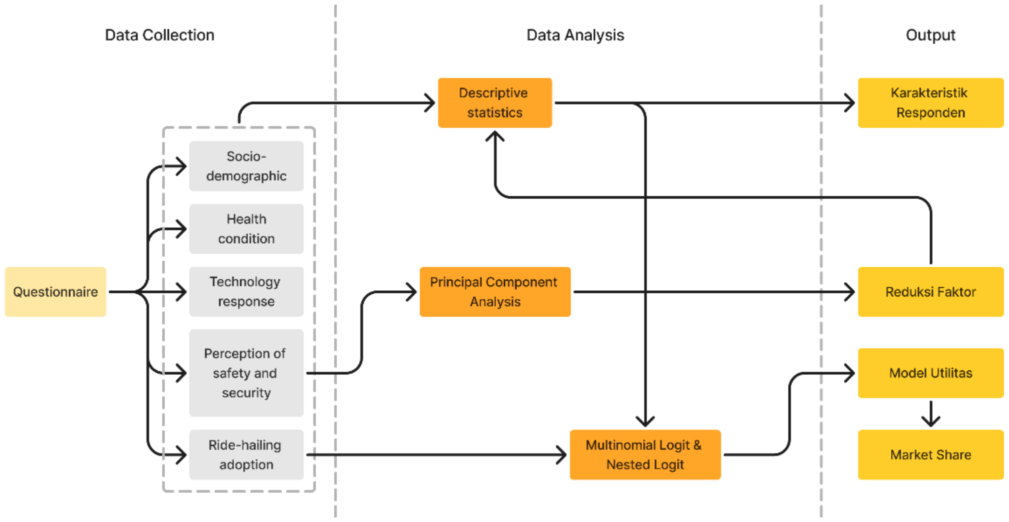

Figure 1. Analysis framework.

The analysis was conducted in several sequential stages. First, factor analysis was performed using Principal Component Analysis (PCA) to reduce the dimension of multiple parameters into a more concise set of latent factors for further analysis. Second, descriptive statistical analysis was carried out to provide a comprehensive overview of the respondents' characteristics, including their perceptions of ride-sourcing services based on the extracted factors. Third, the integrated dataset was utilized for discrete choice modeling, specifically Multinomial Logit (MNL) and Nested Logit (NL) methods. The MNL model was specified to be able to identify the impact of each independent variable on ride-sourcing adoption among older adults, whereas the NL model was estimated to examine potential correlations and shared unobserved attributes among alternative choices. Finally, the model outputs were used to calculate choice probabilities, yielding market share estimates that reflect the extent to which older adults utilize ride-sourcing services.

Factor analysis

Factor analysis was conducted to reduce the dimension of the technology response and safety–security perception variables, which consisted of multiple correlated indicators. Indicator reduction is necessary to address multicollinearity issues and to generate latent factors that are more condensed yet statistically meaningful (Makridakis et al., 2008). Principal Component Analysis (PCA) was selected as the factor anlaysis method due to its ability to transform a large set of interrelated variables into a smaller number of components while retaining most of the original variance. The PCA procedure was performed using IBM SPSS Statistics.

The analysis followed three major stages. First, all perception-related data were standardized, and a correlation matrix was computed to assess the suitability of PCA. Second, eigenvalues and eigenvectors were derived to generate the principal components, which represent linear combinations of the original variables. Components with eigenvalues greater than 1.0 were retained, and factor loadings were examined to determine variable-group associations. Finally, factor scores were computed to represent each respondent's position on the extracted components.

Regarding the factor analysis framework, it was hypothesized that the multidimensional safety, security, and technological perception indicators could be effectively reduced into a concise set of distinct latent factors which collectively explain a substantial portion of the variance in the dataset. Furthermore, these extracted latent factors were hypothesized to exhibit high internal consistency and construct validity, thereby serving as statistically meaningful and non-multicollinear explanatory variables that significantly dictate the utility of different ride-sourcing adoption alternatives among older adults.

Discrete Choice Modelling (DCM)

To examine the usage of ride-sourcing among older adults, this study employed a discrete choice modeling approach. Ride-sourcing usage was categorized following the classification framework developed by Irawan et al. (2022), which identified five user types: (1) app-installed non-riders, (2) app-less non-riders, (3) current non-riders, (4) requested by others riders, and (5) self-request riders. Modeling was conducted by multinomial logit (MNL) and nested logit (NL) method. In nested logit, alternatives were grouped into a two-level nested structure. At the first level, alternatives were categorized based on service usage and at the second level, alternatives were further differentiated based on technology engagement.

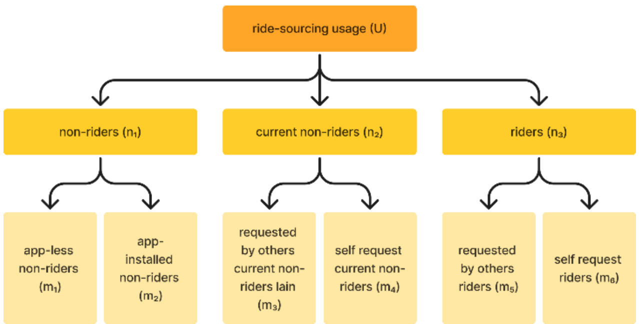

Figure 2. Nested logit model structure.

This nesting structure reflects behavioral differences in adoption, where individuals may choose between using or not using ride-sourcing and then choose the degree of dependence on technology within the adopted group. Given the hierarchical nature of these decisions, the nested logit (NL) model was deemed appropriate, as it relaxes the Independence of Irrelevant Alternatives (IIA) assumption and allows correlation between alternatives within the same nest.

Furthermore, probability estimation was conducted to identify the predominant ride-sourcing usage behavior among older adults. Using PandasBiogeme, choice probabilities were derived for both the MNL and NL models. The estimated probabilities were compared and evaluated based on goodness-of-fit indicators—final log likelihood, rho-square-bar, Akaike Info Crit (AIC), Bayesian Info Crit (BIC)—to determine which model provided the most accurate representation of the observed choices. The resulting probabilities describe the existing distribution of ride-sourcing usage among older adults in Jakarta.

The main content

Factor analysis result

The Kaiser-Meyer-Olkin (KMO) and Bartlett's Test were used to assess the suitability of the dataset for factor analysis. A KMO value greater than 0.50 indicates that the data are adequate for factor analysis. As shown in Table 2, the KMO Measure of Sampling Adequacy (KMO-MSA) is 0.857, exceeds the minimum threshold. Therefore, the dataset was considered appropriate for factor analysis.

Table 3. Safety and Security Perception Questionnaire Constructs

KMO-MSA		0.857
Bartlett's Test of Sphericity	Approx chi-square	6876.149
	df	378
	Sig.	<0.001

The table Total Variance Explained indicates the number of factors that could be retained based on eigenvalues and the proportion of variance accounted for by each factor. In this study, an eigenvalue threshold of 1.0 was used. As shown in Table 3, six factors met this criterion with eigenvalues greater than 1. This is further confirmed by the scree plot in Figure 2, where the eigenvalues drop below 1.0 from the seventh factor onward. After rotation, the six retained factors collectively explained 67.74% of the total variance. This percentage demonstrates satisfactory representation of the underlying constructs, indicating that the factor analysis results were statistically adequate and valid.

Table 4. Total Variance Explained

Components	Rotation Sum of Squared Loadings		
	Total	% Variance	% Cummulative
1	5.04	18.00	18.00
2	3.10	11.07	29.08
3	2.98	10.64	39.72
4	2.80	10.00	49.72
5	2.69	9.26	59.34
6	2.45	8.76	68.10
Total		67.74	

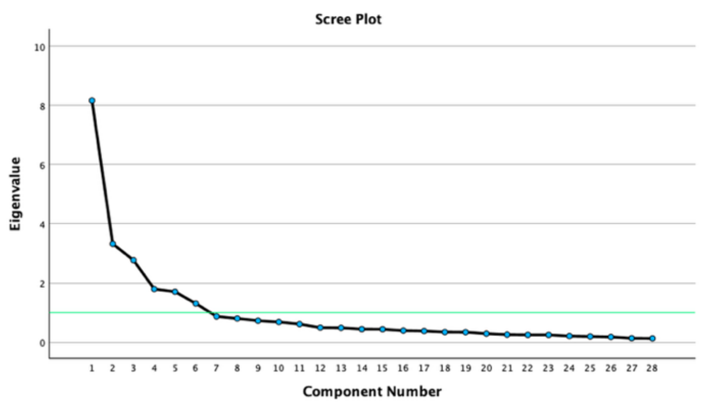

Figure 3. Scree Plot

Factor loadings were obtained and the component matrix was rotated using the varimax method to clarify indicator grouping. The rotation produced six distinct and interpretable perception factors: (1) safety and driver behavior, (2) trip support, (3) driver characteristics and behavior, (4) smartphone technology barriers, (5) travel risk, and (6) personal security risk.

Descriptive statistics

Most respondents were male (53%) and primarily aged 60–64. They tended to live in households with more adults and elderly members, and the majority were unemployed or worked in jobs not requiring frequent travel. Income levels were low, with nearly all earning below IDR 5 million or having no income. Smartphone ownership was high, with most having used one for less than 10 years. Mobility-related characteristics show low car license ownership (9%), moderate motorcycle license ownership (22%), and relatively high motorcycle ownership (1.38 units on average). There were on average 0.36 household members capable of driving a car and 1.79 capable of driving a motorcycle. Most respondents traveled infrequently, dominant frequency once per month (37%).

Health conditions among respondents were generally good. The majority reported being able to carry heavy bags (59%), lift large items (46%), and walk more than 500 meters (73%). Sensory functions were also relatively well maintained, 87% good hearing and 70% adequate vision. Only a minority were assisted by a caregiver (26%). Ride-sourcing usage preferences averaged 2.10, indicating that most were inactive users—either relying on others to book or booking independently—suggesting prior but not current use. The factor values showed a wide distribution (around –5 to 3). Respondents tended to disagree that safety facilities, trip support, and driver characteristics were insignificant, indicating these aspects are important (fac1, fac 2, fac3). They generally had a positive perception of smartphone usability (fac4) and expressed concern about travel risks (fac5). Perceptions of personal security risks were mostly neutral (fac6).

Table 5. Descriptive Statistic Results

Notation	Explanation	Min	Max	Mean	Std.Dev.
gender	Gender (0 = woman, 1 = man)	0	1	0.53	0.5
age_60-64*	Age 60-64 years old (0 = no, 1 = yes)	0	1	0.48	0.5
age_65-69	Age 65-69 years old (0 = no, 1 = yes)	0	1	0.3	0.46
age_70-74	Age 70-74 years old (0 = no, 1 = yes)	0	1	0.15	0.36
age_75	Age 75+ years old (0 = no, 1 = yes)	0	1	0.07	0.25
occ_need_fac	Occupation requires transportation facilities (0 = no, 1 = yes)	0	1	0.15	0.36
occ_no_fac	Occupation does not require transportation (0 = no, 1 = yes)	0	1	0.3	0.46
occ_not_working*	Unemployed (0 = no, 1 = yes)	0	1	0.55	0.5
work_far	Workplace far (0 = no, 1 = yes)	0	1	0.05	0.22
work_close	Workplace nearby (0 = no, 1 = yes)	0	1	0.5	0.5
work_not_working*	Not working (0 = no, 1 = yes)	0	1	0.45	0.5
freq_kerja	Working days per week (days)	0	7	2.73	3.16
income_under5jt	Income <5 mil. IDR (0 = no, 1 = yes)	0	1	0.46	0.5
income_5-15jt	Income 5-15 mil. IDR (0 = no, 1 = yes)	0	1	0.06	0.24
income_over15jt	Income >15 mil. IDR (0 = no, 1 = yes)	0	1	0.01	0.1
no_income*	No income (0 = no, 1 = yes)	0	1	0.47	0.5
sim_mobil	Car driving license (0 = no, 1 = yes)	0	1	0.09	0.29
sim_motor	Motorcycle driving license (0 = no, 1 = yes)	0	1	0.22	0.42

Notation	Explanation	Min	Max	Mean	Std.Dev.
mobil	Number of cars owned (unit)	0	4	0.17	0.5
motor	Number of motorcycles owned (unit)	0	5	1.38	1.05
pengendara_mobil	Car drivers in household	0	7	0.36	0.88
pengendara_motor	Motorcycle drivers in household	0	7	1.79	1.31
smartphone_ under10yr	Smartphone usage less than 10 years (0 = no, 1 = yes)	0	1	0.59	0.49
smartphone_ over10yr	Smartphone usage more than 10 years (0 = no, 1 = yes)	0	1	0.13	0.34
smartphone_no*	No smartphone (0 = no, 1 = yes)	0	1	027	0.45
fac1	Safety and driver behavior perception	-3.32	2.48	0	1
fac2	Travel support perception	-4.18	1.93	0	1
fac3	Driver characteristics perception	-4.88	1.88	0	1
fac4	Smartphone technology barriers	-1.92	2.66	0	1
fac5	Travel-related risks perception	-3.03	2.28	0	1
fac6	Personal security risks perception	-3.11	3.33	0.01	0.99
rp_full	Ride-sourcing usage (0 = app-less non-riders, 1 = app-installed non-riders, 2 = requested by others current non-riders, 3 = self-request current non-riders, 4 = requested by others riders, 5 = self-request riders	0	5	2.1	1.16

* Not estimated (reference category)

Model results

Discrete choice modeling was conducted to identify the factors influencing ride-sourcing usage among older adults, incorporating sociodemographic characteristics, mobility attributes, health conditions, technology responses, and safety–security perceptions. Model estimation was performed using PandasBiogeme (Bierlaire, 2020), beginning with the multinomial logit (MNL) model as the baseline specification. Variables were tested iteratively, retaining only those that were statistically significant and contributed to improving model fit. Model selection relied on standard goodness-of-fit criteria—including final log-likelihood, AIC, BIC, and adjusted rho-squared. The final MNL model retained 34 significant parameters, including alternative-specific constants and 29 significant beta coefficients in Table 5, with the 'app-less non-riders' group used as reference category.

A nested logit (NL) model was subsequently developed to test the assumption of independent alternatives and to account for potential correlation among behaviorally similar choices. Alternatives were grouped into three nests—non-riders, current non-riders, and current riders—reflecting similarities in service usage. Although the NL model improved the interpretation of substitution patterns within nests, especially among current non-riders, fewer variables remained significant in Table 5, and technology-related factors did not exhibit meaningful effects within the NL framework.

Table 5 compares the final MNL and NL models, indicating that the MNL specification provided a superior overall fit, with higher log-likelihood and lower AIC and BIC values. Despite the NL model exhibiting a slightly better adjusted rho-squared, the MNL model demonstrated stronger explanatory power and retained a broader set of significant predictors. Therefore, the final MNL model was selected as the most robust representation of ride-sourcing usage behavior among older adults in Jakarta.

Table 5. Parameter Estimation in Multinomial Logit (MNL) and Nested Logit (NL) Model

Variabels	Affected alternatives	MNL Value	Rob. t-test	NL Value	Rob. t-test
Alternative specific constant	App-installed non-riders	-8.87	-15*	-8.24	-3.37*
Alternative specific constant	Requested by others current non-riders	2.04	8.25*	1.05	4.86*
Alternative specific constant	Self-request current non-riders	-2.13	-3.72*	0.705	2.82*
Alternative specific constant	Requested by others riders	-1.53	-2.97*	-0.921	-1.71***
Alternative specific constant	Self-request riders	-19.6	-10.8*	-2.5	-3.39*
Male (gender)	Requested by others current non-riders	-0.778	-3*	-	-
Male (gender)	Requested by others riders	-2.66	-2.94*	-	-
Age 70–74	Requested by others current non-riders	1.06	2.63*	-	-
Age 70–74	Self-request current non-riders	-	-	-0.103	-1.77***
Occupation requiring transportation facilities	App-installed non-riders	-	-	-5.73	-1.96**
Occupation requiring transportation facilities	Requested by others riders	3.34	3.71*	-	-
Occupation not requiring transportation	Requested by others current non-riders	-0.773	-2.87*	-	-
Middle income (5–15 million IDR/month)	App-installed non-riders	-	-	-3.77	-1.76***
High income (>15 million IDR/month)	Self-request riders	-	-	-1.02	-3.95*
High income (>15 million IDR/month)	Requested by others current non-riders	-	-	-3.54	-2.17**
High income (>15 million IDR/month)	Requested by others riders	-	-	3.76	2.13**
Number of children (0–12 years) in household	Requested by others riders	0.7	2.06**	-	-
Number of teenagers (13–17 years) in household	Self-request riders	1.33	3.34*	-	-
Very high travel frequency (>2 trips/day)	App-installed non-riders	1.9	1.96***	-	-
Low travel frequency (once per week)	App-installed non-riders	-8.9	-12.1*	-7.04	-2.26**
Workplace located far	App-installed non-riders	-8.41	-10.7*	-	-
Workplace located nearby	App-installed non-riders	-	-	8	4.4*
Workplace located nearby	Self-request current non-riders	-	-	0.0832	2.21**
Workplace located nearby	Self-request riders	1.92	2.23**	-	-
Number of motorcycles owned in household	App-installed non-riders	-	-	-3.59	-3.46*
Number of motorcycles owned in household	Requested by others riders	-	-	-0.455	-1.9***
Number of car drivers in household	App-installed non-riders	-8.71	-13.9*	-5.21	-1.98**
Number of car drivers in household	Requested by others current non-riders	-0.398	-1.97**	-	-
Number of car drivers in household	Self-request riders	1.04	3.46*	-	-
Number of motorcycle drivers in household	App-installed non-riders	-	-	1.58	2.07**
Ability to walk (more than 500 meters)	Self-request current non-riders	1.02	1.92***	0.147	2.39**
Ability to walk (more than 500 meters)	Self-request riders	8.87	9.17*	-	-
Visual ability (reading)	App-installed non-riders	6.9	12.4*	-	-
Visual ability (reading)	Requested by others current non-riders	-	-	0.836	3.44*

Variabels	Affected alternatives	MNL Value	Rob. t-test	NL Value	Rob. t-test
Visual ability (reading)	Self-request current non-riders	1.47	3.18*	0.923	3.73*
Visual ability (reading)	Self-request riders	3.71	2.87*	-	-
Hearing ability	Self-request riders	-	-	1.65	2.1**
Presence of a caregiver	Self-request current non-riders			-0.0994	-2.42**
Presence of a caregiver	Self-request riders	-8.5	-12.2*	-7.84	-3.2*
Smartphone use for more than 10 years	App-installed non-riders	-8.63	-12.9*	-	-
Smartphone use for more than 10 years	Requested by others current non-riders	-0.884	-2.16**	-	-
Perception of travel support	App-installed non-riders	-	-	-0.594	-1.91***
Perception of driver characteristics and behavior	Requested by others current non-riders	0.33	2.12**	-	-
Perception of driver characteristics and behavior	Self-request riders	0.961	3.33*	-	-
Perception of smartphone technology barriers	Self-request current non-riders	-1.45	-5.63*	-0.147	-3.39*
Perception of smartphone technology barriers	Self-request riders	-3.95	-6.15*	-	-
Perception of travel risks	Self-request current non-riders	0.398	2.43**	-	-
Perception of travel risks	Self-request riders	1.07	2.63*	-	-
Perception of personal security	Requested by others current non-riders	-0.43	-3.43*	-	-
Perception of personal security	Self-request current non-riders	-	-	0.0401	1.98**
Correlation scale parameter (non-riders nest)	App-less non-riders; App-installed non-riders	-	-	1	1.87***
Correlation scale parameter (current non-riders nest)	Requested by others current non-riders; Self-request current non-riders	-	-	10	3.83*
Substitution scale parameter (riders nest)	Requested by others riders; Self-request riders	-	-	1	2.05**

* Significant at the 99% confidence level
** Significant at the 95% confidence level
*** Significant at the 90% confidence level

Sociodemographic characteristics further help explain the pattern of how older adults using ride-sourcing services based on their sociodemographic background. Older respondents (ages 70–74) showed a clear tendency to rely on others for trip booking, aligning with declining digital literacy at older ages. Household composition also mattered: having young children increased reliance on others, whereas having teenagers was associated with greater independence in booking trips. Physical and sensory abilities were among the most influential predictors—better vision, hearing, and walking ability significantly increased the likelihood of both self-request current non-riders and self-request riders alternatives, suggesting that functional capacity is a key enabler of independent ride-sourcing use among older adults.

Perceptual factors also played an important role. Positive perceptions of driver behavior and safety conditions were associated with higher utility for alternatives involving self-request or independent use, indicating that confidence in service safety facilitates more independent choices. Conversely, higher perceived personal security concerns tended to increase reliance on others when booking. Meanwhile, income, employment type, and vehicle ownership showed mixed or inconsistent effects and were not retained as meaningful predictors in the final model.

Finally, the nested logit results confirmed that only the current non-riders nest exhibited meaningful correlation between alternatives, reflecting the behavioral similarity between relying on others to book and previously using ride-sourcing but no longer doing so. However, because the MNL model provided better overall fit and retained more significant predictors, it was selected as the preferred specification. Overall, the findings emphasize that older adults' ride-sourcing choices are shaped primarily by technological familiarity, physical and sensory capabilities, and safety-security perceptions, highlighting the need for more accessible app design and rider support features to enable more independent mobility.

Probability market share

The MNL results indicate that the majority of respondents are requested-by-others current non-riders (54.66%), followed by self-request current non-riders (21.32%) and app-less non-riders (14.95%). Only a small share belongs to the active user categories, whether self-request or requested by others. This pattern suggests that most older adults have used the service in the past but no longer do so, and those who still use it often rely on assistance to place bookings (requested by others).

The NL model was used to examine substitution patterns among behaviorally similar alternatives. The current non-riders nest exhibited the highest logsum value, indicating the strongest collective attractiveness, while the active riders nest showed very low overall utility. Within each nest, alternatives requiring less technological engagement—such as not downloading the app or relying on others to request trips—had the highest probabilities. This reinforces the finding that technological barriers play an important role in shaping older adults' mobility choices.

Table 6. Comparison of Alternatives' Probability in MNL and NL Model

Alternatives	MNL probability	NL probability
App-less non-riders	14.95%	14.95%
App-installed non-riders	1.23%	1.23%
Requested by others current non-riders	54.66%	53.89%
Self-request current non-riders	21.32%	22.09%
Requested by others riders	3.43%	3.43%
Self-request riders	4.41%	4.41%
Total	100.00%	100.00%

A comparison of the two models shows that overall probability patterns are consistent between MNL and NL, with negligible differences across alternatives. However, because the MNL model provides better overall goodness-of-fit (higher log-likelihood, lower AIC/BIC), the MNL probabilities are retained as the final results. These findings confirm that older adults in Jakarta predominantly fall into non-active usage categories and rely on booking assistance, highlighting limited independent engagement with ride-sourcing technology. Overall, alternatives that require greater technological engagement—such as self-request active use—are less preferred. This reinforces the central role of technological barriers and the continued dependence of many older adults on family members or caregivers for app-based mobility, align with the findings of Irawan et al. (2022) study, according to which technological responsiveness remains a critical barrier impeding older adults from independently booking ride-sourcing services.

Conclusion

This study demonstrated that ride-sourcing use among older adults in Jakarta is shaped by individual characteristics, technological familiarity, and perceptions of safety and security. While most possess a positive attitude toward smartphones and view ride-sourcing as safe, their actual usage mostly non-active and dependent on others for booking. This indicates that independent engagement with app-based mobility services remains limited among older adults.

Several factors significantly influence their preferences. Sociodemographic variables—gender, age, household structure, and occupation, and income—along with mobility attributes, physical and sensory abilities, and perceptual factors—driver behavior, travel risk, personal security, technological barrier—play important roles in shaping utility across different ride-sourcing alternatives. Physical and sensory capacities, in particular, emerged as strong determinants of more independent usage patterns. Importantly, the models revealed a high degree of behavioral consistency within the non-active user group, suggesting that older adults may have the potential to transition from assisted booking to more independent use if technological and perceptual barriers are reduced.

Compared to previous research, this study found differing effects of technology-related perceptions: while earlier study identified digital barriers as major obstacles, this study suggests that positive technology perceptions alone do not necessarily translate into higher usage. However, consistent with past findings, better physical and sensory conditions strongly correspond with higher likelihood of ride-sourcing adoption. Overall, the results emphasize the need to strengthen the accessibility, usability, and safety of ride-sourcing services to support more inclusive urban mobility that can be accessed, understood, and used by everyone, regardless of age, physical ability, or technological literacy.

Ride-sourcing operators and policymakers should collaboratively enhance service accessibility by introducing dedicated features designed for older adults to accommodate their physical limitations and impaired senses, not only phone-based booking systems but also street-intercept requests. Furthermore, it is important to cultivate a safer ride-sourcing ecosystem by strictly regulating driver behavior, enhancing vehicle and driving safety standards, and mitigating concerns regarding perceived personal security.

This study had limitations that should be acknowledged. Data collection through digital surveys limited the researcher's ability to ensure full comprehension among older respondents, and the use of a 1 to 7 Likert scale introduced subjectivity that may have affected perception measurements. Moreover, the indicators used to assess safety and security perceptions were constrained by the limited availability of prior literature on this topic. Future research should therefore expand the framework of safety and security perceptions across different urban contexts in Indonesia, incorporate additional dimensions, and employ qualitative methods to capture the nuanced experiences of older adults. Further work is also needed to explore how older adults interact with broader Multi-Service Transport Platforms (MSTPs), including food and goods delivery services, to better understand how digital mobility ecosystems can be designed to support more inclusive and age-friendly urban mobility.

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