

Article

Users' Preferences in Selecting Transportation Modes for Leisure Trips in the Digital Era: Evidence from Bandung, Indonesia

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Abstract: Leisure trips have become more important in an era where people are increasingly concerned with quality of life. Leisure trips are unique in that they are not as strict as mandatory trips, while, at the same time, they have wider characteristics because of their flexibility. Research on leisure trips from developing countries is still under-represented as there is still a focus on commuting trips. This study aims to identify factors that influence the mode of transportation choice for leisure trips by domestic travelers who live in cities surrounding Bandung, Indonesia. Data were collected using stated-preference self-report questionnaires distributed to locals who have the intention to travel for leisure in Bandung in the future. Based on responses from 305 respondents with a total number of 1220 observations, a multinomial logit model was estimated. It was found that trains and buses were selected more often by locals than other modes of transportation, including private cars, for leisure trips. Our model showed that locals considered travel time and travel costs as the most significant factors in selecting the mode of transportation for their leisure trips. Besides the existence of online transportation—hailing rides through mobile apps—as an alternative, this study also reveals payment method to be a unique consideration of locals when travelling leisurely in this digital era.

Keywords: leisure trip; transportation mode choice; attributes of alternatives; stated preference; multinomial logit; cashless payment



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1. Introduction

People are becoming more concerned about their quality of life. The understanding and measurement of quality of life have grown from focusing on fulfilling material and physical needs to incorporating subjective factors [1]. Happiness and well-being have been used as important indicators to measure the impact of development or policy [2]. Thus, investigators can glimpse the rationale behind the growing popularity of leisure activities.

Leisure includes freely chosen activities that bring satisfaction or enjoyment and provide opportunities to strengthen social contacts and realize certain personal goals [3–5]. Leisure includes activities for humans to find refreshment after their daily routines; leisure is often engaged in outside normal working hours or domestic activities. It includes recreation, cultural events, sports, and social visits [6]. Cumulative satisfaction with leisure activities (*hedonic well-being*) can, therefore, impact both eudaimonic well-being and life satisfaction [5].

Leisure is broader than *recreation*, which refers to the activities that occur during leisure. Tourism is considered to be a subset of recreation with an addition of time and distance

factors [6]. *Tourism* denotes sightseeing, travel, or exploration, especially outside of one's homeland. Tourism-related travel is a subset of recreational travel. However, as argued by Carr [7], tourism and leisure behavior are inextricably linked and should not be studied separately. Finally, the theories and concepts derived from leisure studies can be utilized to better comprehend tourist behavior and vice versa.

As leisure activities become more important in the digital era, it is understandable that trips during leisure time are growing in popularity. Leisure trips have become more important, in part, as a result of studies that have accumulated knowledge around how travel experiences have consequential implications for well-being [8]. Furthermore, De Vos [2] explained that the life satisfaction that comes from short-term episodes, such as brief leisure trips and activities, influences people's overall life satisfaction. De Vos [9] also emphasized that travel satisfaction mainly has an indirect effect on life satisfaction, through participation in—and satisfaction with—leisure activities.

Huang et al. [10] explained that leisure activities provide an opportunity to stimulate an individual's creative potential, making positive contributions to health and well-being. Thus, it is understandable that leisure becomes the most important reason for travel and accounts for a substantial part of the increase in kilometers travelled in recent times [11,12]. The importance of leisure activities has increased steadily over the last 40 years, compared with other activities [11]. As economic prosperity continues to rise worldwide, it can be expected that the demand for discretionary activities and associated travel—including leisure trips [13]—will continue to rise too.

Tarigan and Kitamura [14] have reported that the more choices for leisure activity types and locations that individuals have seems likely to encourage them to pursue a variety of leisure locations and leisure activity types. Leisure trips are closely related to tourism activities in local, regional, and international settings. Tourism is globally recognized as one of the largest and fastest-growing economic sectors, while in developing countries, tourism is specifically seen as a tool to promote economic development [15]. In Switzerland from 1984 to 2005, there was a 15% increase in person-kilometers travelled in leisure time [16]. Indonesia has seen a growing number of domestic tourism trips from 2018, with as many as 303 million trips to 722 million trips in 2019 [17]. Although in 2020 the number declined to 518 million trips due to COVID-19 restrictions, this figure is still higher than the 2018 level. A study by Dubois and Ceron [18] has projected that French leisure travelers will increase their passenger-kilometers 200% by 2050, using business-as-usual scenarios.

Despite its importance and flexibility in terms of specific locations and times, leisure travel is the most difficult kind of travel to analyze [16]. Even though it is a complex topic, a substantial number of studies have been conducted by researchers who have mainly gathered empirical evidence from developed countries. In his dissertation, Nawijn [19] explored the potential effects of leisure travel on individuals' happiness; he studied which leisure activities increase happiness and who receives the benefit from these activities. Nawijn and Veenhoven [20] disentangled cause and effect in the relationship between happiness and leisure activity, using data from Germany. Ohnmacht et al. [16] researched leisure travel behavior with regard to interrelationships between lifestyles, social networks, and social influence. De Vos et al. [5] studied the effect of satisfaction with leisure trips on the satisfaction with the leisure activity at the trip's destination. They employed data from Ghent, Belgium, and found that spill-over effects exist from trip satisfaction on leisure activity satisfaction and that both these short-term satisfactions affect eudaimonic well-being and life satisfaction, whether directly or indirectly.

Several other topics related to leisure trips have been studied. For example, Almlöf et al. [21] conducted a study in Stockholm regarding the impact of autonomous technology on leisure and work trips. They found that the impacts of self-driving technology may have varied societal impacts even within a region and may lead to increased car travel, especially during off-peak travel periods. Kim and Mokhtarian [22] examined long-distance (overnight) leisure trips by residents of the state of Georgia based on a survey conducted in 2017–2018. Große et al. [23] compared the leisure travel patterns of people living in

a central urban district in Copenhagen, Denmark, with those of people living in a small town in the commuter belt. Priya et al. [24] attempted to analyze the trips undertaken by senior citizens for leisure activities. Dubois and Ceron [18] investigated the impact of French tourism/leisure trips on greenhouse gas (GHG) emissions and found a projected increase in GHG emissions by 90% in 2050, using business-as-usual scenarios. Meyer and Meyer [15] investigated the role of tourism in South Africa in the economic development of local regions. Laroche et al. [25] examined the role of tourists' holiday preferences in shaping the carbon footprint of leisure travel within the EU by calculating demand and impact indicators associated with eight holiday styles. A study by Wicker et al. [26] in 2020 examined the economic impact (measured by visitor spending) and environmental impact (measured by carbon footprint) of leisure trips on the natural environment. Chincholkar [27] explored Indian consumers' behavior towards tourism and identified their preferences when planning leisure trips.

Studies on leisure trips are mostly carried out in the context of travel behavior. Tarigan and Kitamura [14] examined the effect of the frequency of leisure trips per week on the variability in the number of such trips over weeks, and found that the effects varied substantially across activity types, using data from Germany. Using data from households in Bristol and Greater Manchester, England, Farag and Lyons [28] studied the relative strength of various factors affecting the use and non-use of pre-trip public transportation information for business and leisure trips. Mokhtarian et al. [13] conceptually explored the potential impacts of information communication technology (ICT) on leisure activities and associated travel. Using Mobidrive data based on interviews in the cities of Karlsruhe and Halle, Germany, Schlich et al. [11] answered the questions of how repetitious leisure traffic is, how much does one day resemble another in terms of what people do in their free time, and how many different places are visited. Cai [29] examined U.S. household lodging expenditure patterns on vacation. Duffell and Harman [30] examined the factors influencing and inducing leisure travel by focusing on leisure marketing by Britain's national railway corporation. The mobility of senior citizens with respect to various leisure activities was analyzed using data from the Dutch National Travel Survey [31]. Simma et al. [32] studied the destination choice within Switzerland for different activity types. A study on the characteristics of everyday leisure trips for social and recreational purposes was conducted by Strömblad et al. [33]. Sener et al. [34] studied discretionary leisure activity engagement by children in detail, using data from the United States. Strömblad et al. [35] conducted a study with a focus on everyday leisure trips for social and recreational purposes to cope with COVID-19 in Sweden. The "value of leisure" (VoL) for different population segments has been estimated by Hössinger et al. [36].

Studies on transportation mode choice for specific trips, for instance leisure trips, have been widely conducted. Limtanakool et al. [37] investigated the influence of spatial configuration of land use and transport systems on mode choice for medium- and longer-distance travel across the trip purposes of commuting, business, and leisure by employing data from the Netherlands. Acker et al. [38] built a modal choice model for leisure trips, using data on personal lifestyles and attitudes from Ghent, Belgium. Wardman et al. [39] examined the degree of interaction between rail and car modes in the interurban leisure travel market in Great Britain. Anable and Gatersleben [40] examined the relative importance that people attach to various instrumental and affective journey attributes when travelling either for work or for a leisurely day trip. Strömblad et al. [41] analyzed factors affecting mode choice for everyday leisure purposes and reasons for reducing car mileage for leisure trips by conducting an interview study among residents of Gävle, Sweden.

In terms of variables in investigations of transportation mode choice, the impact of travel time, cost, and transit burdens on mode of commuting choice have been examined based on the binomial logistic regression model in a transit-oriented mega city: Seoul, Korea [42]. Attributes of the elderly's demographic characteristics, latent variables, and heterogeneity were employed to evaluate the accessibility of public transit in China; the investigators used confirmatory factor analysis and a latent-class logit model (LCM) [43].

A study using data from households surveyed in Budapest examined travel-time variables and travel characteristics, such as travel time, travel cost, age, gender, income, and car ownership, which were analyzed using a multinomial logit (MNL) model [44]. Different leisure travel types among urbanites were analyzed using an LCM on data from Berlin and Munich, Germany; the researchers analyzed everyday travel, norms and attitudes, socio-demographic characteristics, spatial aspects, and mode choice [45]. The linkage between the built environment and travel behavior was investigated by employing a path model to evaluate objective and subjective influences on mode choice for leisure trips, using data from Ghent [38]. Baumgartner et al. [46] reported an online choice experiment in Switzerland to test the effectiveness of two financial and three non-financial treatments to reduce car-based leisure travel control for a wide range of determinants proven to be relevant for mode choice using an MNL model. Schwanen et al. [31] investigated the link between the choice of travel mode for leisure trips to personal characteristics, car ownership, and residential environment, using an MNL model with data from The Netherlands.

A review of the literature has shown that a large number of studies have been conducted using empirical data from developed countries. Less common is literature regarding leisure trips in developing countries, keeping in mind that there is a close relationship between tourism efficiency and transportation accessibility [47], thus the present authors' motivation to study transportation-mode choice behavior specifically for leisure trips.

Some shared features of tourism and leisure include voluntary activities and activities conducted during free time. Although both terms share a common feature, tourism emphasizes a more substantial break in routine [48]. Moreover, the effect of ICT exists in the form of the service of *online transportation*—car- and motorcycle-based ride-hailing through mobile applications.

Thus, the results of this study intend to enrich the body of knowledge regarding travel behavior for leisure trips, using data from a developing country in the digital era. The aims of this study are to identify the significant attributes that influence the decisions of people outside Bandung in choosing transportation modes for leisure trips to Bandung. For this research, we ran four different MNL models. In the first one, we inputted all travelers, whereas for the others, we employed car users, motorcycle users, and public transport users, respectively.

This remainder of this article is organized as follows. Section 2 describes the materials and methods used in this study. Section 3 presents the results, which is followed by the discussion in Section 4. The final section provides conclusions, policy implications, study limitations, and ideas for future research.

2. Materials and Methods

2.1. Study Area

The study area in this research was Bandung (Figure 1), the capital city of West Java, Indonesia. Bandung is located about 150 km southeast of Jakarta. It can be reached in around 2.5 h by road from Jakarta. There are many available modes of transportation in Bandung City, from the motorcycle, paratransit (*Angkot*), taxi, and bus, up to online transportation (Figure 2). In fact, the Government of Indonesia proposed several economic development plans where tourism activity is the main driver. Several new tourism destinations have been recently built to attract visitors. Each local government also strives to improve their city's amenities, including the City of Bandung.

Bandung has grown to become an important center in Indonesia, demonstrating a higher economic growth rate than the national average [49]. Bandung has become a major tourism destination with its proximity to the Indonesian capital city of Jakarta. Bandung has diverse tourism potential with its unique natural sites, culture, heritage buildings, culinary attractions, fashion, recreation, and entertainment options [50], as well as the geo-tourism possibilities in the Bandung Basin [51]. Bandung attracts not only visitors from faraway cities, but also visitors from surrounding cities, such as Cimahi City, Bandung Regency, and West Bandung Regency.

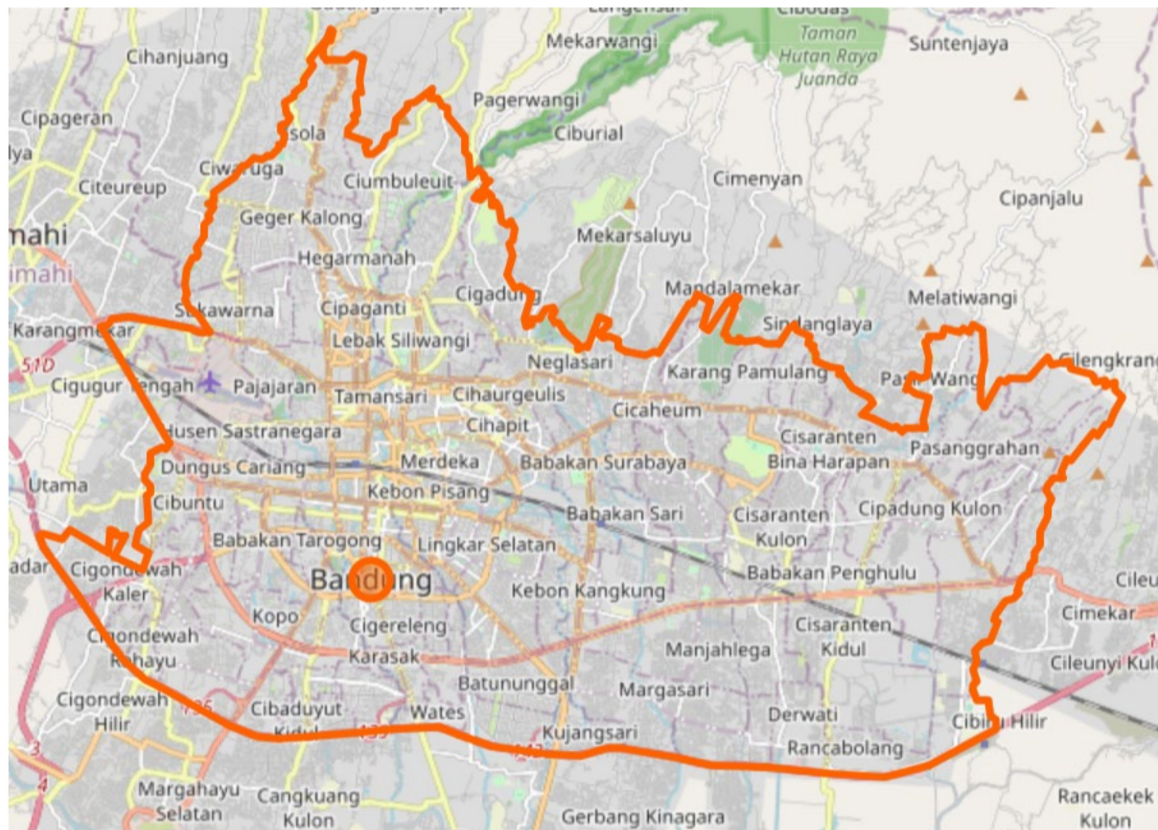


Figure 1. Map of Bandung City [52].



Figure 2. Available Modes of Transportation in Bandung City [53–58].

2.2. Data and Survey Implementation

A key element of the survey used in this study is the prospective travel choices based on stated preferences in the choice experiment. Stated-preference (SP) surveys have been widely used in the field of transportation to analyze people's travel behavior [43]. SP surveys can be designed to capture people's preferences for a set of hypothetical scenarios, such as alternate kinds of transportation that are not yet available or a change in the value of a given alternative. In the SP survey, various hypothetical scenarios are presented to respondents, who then select their preferred choice(s) regarding each scenario from a finite set of attributes and alternatives [59,60].

In this study, seven choice alternatives of transportation mode were provided to respondents, including train, privately owned car, privately owned motorcycle, *angkot* (a kind of paratransit that drives a fixed route. It is a small four-wheeled vehicle (e.g., a minibus) that has been modified for use as public transportation. They are mostly operated by private organizations or individuals.), motorcycle ride-hailing (MRH), car ride-hailing (CRH) (which also includes conventional taxis), and bus rapid transit. The choice alternatives in this study are the existing modes in Bandung; more detailed information regarding the mode services there can be found in [61,62].

The five attributes to describe the services available in each mode included travel time, waiting time, travel cost, access time, and payment method, which were presented in the SP questionnaire to respondents. These attributes were drawn from prior studies that found they were the most popular in describing each mode choice for an Indonesian context, for example travel time and travel cost [63–67]. Some consider waiting time [63,64,66,67] for public transport, and some also consider access egress [64]. However, payment method is seldom considered, especially the cashless method; therefore, we have added that attribute to our SP experiment.

To increase the realism of the choices, the distance provided in this survey is the same route for each scenario. A preliminary study was conducted to identify the real range of values characteristic of each mode. The travel-time value of the alternatives was collected using Google Maps applications for two conditions—during a *peak period* with heavy traffic and during normal conditions on the weekend. The peak period usually lasts over the lunch and dinner hours, while normal conditions are experienced outside peak periods during weekends. For more on the value of the waiting time and *access-egress time* see Rizki et al. [62]. The travel costs of a private car and motorcycle were calculated by including fuel and parking costs, while the private car mode included the cost of tolls. The travel costs of the bus rapid transit, train, *angkot*, MRH, and taxi were calculated from existing fares, using the available apps. The payment methods for this study were divided into cash and cashless. After conducting several runs of preliminary data collection to simulate the real services, a list of the range values was able to be gathered. Based on the range values for each attribute, the values for each attribute were selected for each choice alternative. The levels' values for each alternative are presented in Table 1.

Table 1. Levels of the attributes for each alternative.

Attributes	Private Car	Private Motorcycle	Angkot	Train	Bus Rapid Transit	Motorcycle Ride- Hailing (MRH)	Car Ride- Hailing (CRH)
Travel Time (min.)	40, 60, 80	40, 50, 60	60, 75, 90	25, 35, 45	60, 75, 90	40, 50, 60	40, 60, 80
Waiting Time (min.)	NA	NA	5, 10, 15	5, 10, 15	5, 10, 15	5, 10, 15	5, 10, 15
Travel Cost (IDR) ^a	45,000, 55,000, 75,000	25,000, 30,000, 40,000	2000, 5000, 7000	5000, 7000	10,000, 12,000, 15,000	50,000, 60,000, 70,000	90,000, 120,000, 150,000
Access Egress (minutes)	NA	NA	5, 10, 15	5, 10, 15	5, 10, 15	5, 10, 15	5, 10, 15
Payment Method	Cash, Cashless	Cash, Cashless	Cash, Cashless	Cash, Cashless	Cash, Cashless	Cash, Cashless	Cash, Cashless

^a USD 1 equaled IDR 15,729.37. <https://www.xe.com/currencyconverter/convert/?Amount=1&From=USD&To=IDR>, accessed 5 November 2022.

With seven choice alternatives and five attributes with two or three levels, a total of 32 scenarios were obtained. The scenario arrangements were conducted using NGENE software for generating experimental designs that are used in stated-choice experiments for the purpose of estimating choice models, particularly of the logit type [68]. The 32 scenarios were segmented into eight blocks with four scenarios each. Each block was later assigned

to each set of questionnaires. The questionnaire was divided into three parts. The first part asked respondents to report their daily mode of transportation and also their preferred mode of transportation during holidays. The second part presented the scenarios, and the last part asked respondents to report their demographics. The English version of the distributed questionnaire is provided in Appendix B.

In this study, data were collected from respondents who lived outside Bandung City. Residents from outside Bandung City who visited Bandung during weekends or holidays for leisure were chosen as respondents. The data for analyses were collected from 5 August 2022 to 27 August 2022. A convenience sampling method with snowball distribution was used, and the team collected responses from 305 participants. As each respondent received four scenarios, the total number of observations collected added up to 1220.

2.3. Multinomial Logit Model

The MNL model is frequently used to interpret and calibrate mode-choice data [69]. In MNL models, the probability of a decision-maker (n) choosing an alternative (i) over a set of alternatives (j) is when the utility of an alternative (i) is bigger than other alternatives, as can be seen in Equation (1), where C_n stands for the available set of alternatives.

$$P_{in} = \Pr(U_{in} > U_{jn}, \forall j \in C_n, j \neq i) \quad (1)$$

where P_{in} is the probability of individual or decision-maker (n) choosing an alternative (i) over a set of alternatives (j). U_{in} is the utility of the alternative (i) chosen by the decision-maker (n). U_{jn} is the utility of non-chosen alternatives for a set of alternatives (j) by the decision-maker (n). In this study, the alternatives were private car ($i = 1$), private motorcycle ($i = 2$), angkot ($i = 3$), train ($i = 4$), bus rapid transit ($i = 5$), MRH ($i = 6$), and CRH ($i = 7$). The utility (U_{in}) is then decomposed into systematic (V_{in}) and random utility (ε_{in}), as can be seen in Equation (2).

$$U_{in} = V_{in} + \varepsilon_{in} \quad (2)$$

The systematic utility function (V_{in}) is further decomposed, as can be seen in Equation (3). The random utility (ε_{in}) is assumed to be an extreme value (i.e., Gumbel-distributed) with a variance of $\frac{\pi^2}{6}$ and identically and independently distributed across observations.

$$V_{in} = \alpha_i + \sum_k \beta_{ki} X_{kin} + \sum_k \gamma_{ki} S_{kin} \quad (3)$$

where α_i is the alternative-specific constant with paratransit as the reference alternative, and β_{ki} provides the alternative (i) specific parameters related to attribute X_{kin} . These attributes are travel time, travel cost, waiting time, access egress, and payment method. γ_{ki} describes the alternative-specific (i) parameters related to the socio-demographic characteristics of participant S_{kin} , where the characteristics included age, education, gender, domicile, and income.

The utility function of the first alternative, car, can be seen in Equation (4). We estimated the alternative-specific constant of car against the reference alternative, which is angkot. Attributes are travel time, travel cost, and payment method. There is no waiting time and access egress, since we assumed that the decision-maker could directly use the car. Payment method in this context is for buying fuel. Regarding socio-demographic characteristics, we estimated them against the reference alternative, angkot.

$$V_{Car_n} = ASC_{Car_n} + \beta_{TravelTimeCar_n} TravelTimeCar_n + \beta_{TravelCostCar_n} TravelCostCar_n + \beta_{PaymentMethodCar_n} PaymentMethodCar_n + \sum_k \gamma_{ki} S_{kin} \quad (4)$$

The utility function of the second alternative, motorcycle, can be seen in Equation (5). The attributes are mostly similar to the car alternative, since we assumed that the decision-maker could use their motorcycle directly.

$$V_{motorcycle_n} = ASC_{motorcycle_n} + \beta_{TravelTimeMotorcycle_n} TravelTimeMotorcycle_n + \beta_{TravelCostMotorcycle_n} TravelCostMotorcycle_n + \beta_{PaymentMethodMotorcycle_n} PaymentMethodMotorcycle_n + \sum_k \gamma_{ki} S_{kin} \quad (5)$$

The third alternative's utility function can be seen in Equation (6). For this alternative, we did not estimate the alternative-specific constant as well as socio-demographic characteristics since this alternative is the reference alternative. The attributes are travel time, travel cost, waiting time, access egress, and payment method. Waiting time and access egress become relevant for public transport since the decision-maker cannot access it directly.

$$V_{Angkot_n} = \beta_{TravelTimeAngkot_n} TravelTimeAngkot_n + \beta_{TravelCostAngkot_n} TravelCostAngkot_n + \beta_{WaitingTimeAngkot_n} WaitingTimeAngkot_n + \beta_{AccessEgressAngkot_n} AccessEgressAngkot_n + \beta_{PaymentMethodAngkot_n} PaymentMethodAngkot_n \quad (6)$$

The fourth alternative's utility model can be seen in Equation (7). The attributes for this alternative, train, are almost similar to angkot. However, we added an alternative-specific constant and we also estimated the socio-demographic characteristic parameters.

$$V_{Train_n} = ASC_{Train_n} + \beta_{TravelTimeTrain_n} TravelTimeTrain_n + \beta_{TravelCostTrain_n} TravelCostTrain_n + \beta_{WaitingTimeTrain_n} WaitingTimeTrain_n + \beta_{AccessEgressTrain_n} AccessEgressTrain_n + \beta_{PaymentMethodTrain_n} PaymentMethodTrain_n + \sum_k \gamma_{ki} S_{kin} \quad (7)$$

For the fifth alternative, we can see the utility function in Equation (8). For bus, the attributes are travel time, travel cost, waiting time, access egress, and payment method. For this alternative, we also estimated an alternative-specific constant and the socio-demographic parameters.

$$V_{Bus_n} = ASC_{Bus_n} + \beta_{TravelTimeBus_n} TravelTimeBus_n + \beta_{TravelCostBus_n} TravelCostBus_n + \beta_{WaitingTimeBus_n} WaitingTimeBus_n + \beta_{AccessEgressBus_n} AccessEgressBus_n + \beta_{PaymentMethodBus_n} PaymentMethodBus_n + \sum_k \gamma_{ki} S_{kin} \quad (8)$$

The sixth alternative is motorcycle-based ride-hailing. We can see the utility function in Equation (9). Other than the alternative-specific constant and socio-demographic parameters that we estimated, we also have attributes similar to other public transport alternatives.

$$V_{MRH_n} = ASC_{MRH_n} + \beta_{TravelTimeMRH_n} TravelTimeMRH_n + \beta_{TravelCostMRH_n} TravelCostMRH_n + \beta_{WaitingTimeMRH_n} WaitingTimeMRH_n + \beta_{AccessEgressMRH_n} AccessEgressMRH_n + \beta_{PaymentMethodMRH_n} PaymentMethodMRH_n + \sum_k \gamma_{ki} S_{kin} \quad (9)$$

Finally, the last alternative utility function can be seen in Equation (10). We can see that the estimated parameters are the alternative-specific constant for car-based ride-hailing, travel time, travel cost, waiting time, access egress, and payment method.

$$V_{CRH_n} = ASC_{CRH_n} + \beta_{TravelTimeCRH_n} TravelTimeCRH_n + \beta_{TravelCostCRH_n} TravelCostCRH_n + \beta_{WaitingTimeCRH_n} WaitingTimeCRH_n + \beta_{AccessEgressCRH_n} AccessEgressCRH_n + \beta_{PaymentMethodCRH_n} PaymentMethodCRH_n + \sum_k \gamma_{ki} S_{kin} \quad (10)$$

The probability (P_{in}) of each individual n choosing alternative i from a set of alternatives j ($j = 1, 2, \dots, J$) can be estimated as follows in Equation (11).

$$P_{in} = \frac{\exp(V_{in})}{\sum_{j=1}^J \exp(V_{jn})} \quad (11)$$

A summary of the model framework can be seen in Figure 3. Rectangles represent the observed variables, which consist of socio-demographic characteristics and five attributes of alternatives. The ellipse represents one latent factor utility of alternatives, for which the equations can be found in Equations (4)–(10). The solid arrows denote the regression relationship, while dashed arrows represent the indicator measurement relationship. Epsilon represents the random utility, while the utility maximization is as expressed in Equation (12).

$$y_i = \begin{cases} 1 & \text{if } U_{in} > U_{jn}, \forall j \neq i \\ 0 & \text{otherwise} \end{cases} \quad (12)$$

where y_i is 1 if the alternative i is chosen, and 0 otherwise.

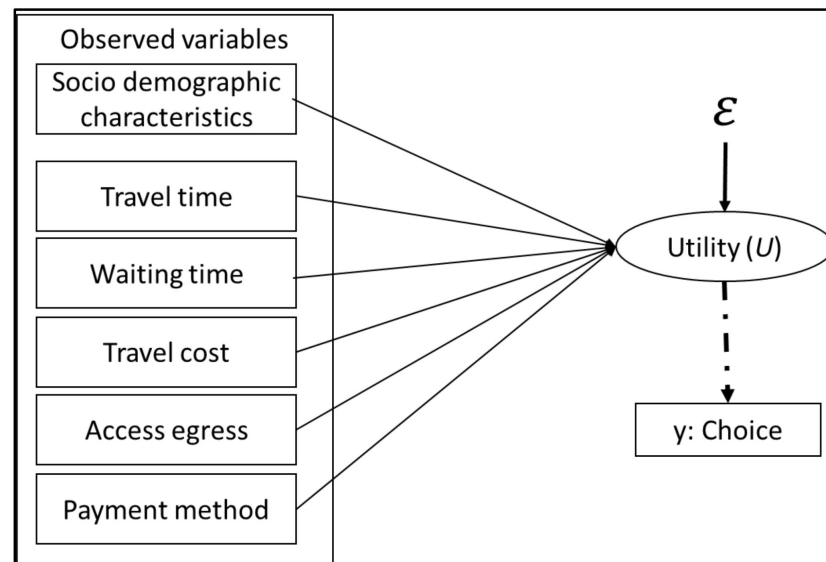


Figure 3. Multinomial logit model framework.

We estimated the MNL model parameters with maximum likelihood estimation using Biogeme, an open-source freeware. By using Biogeme, we were able to estimate the parameters of a model, test hypotheses about those parameters, and estimate by maximum likelihood a broad range of random utility models. In the end, simulations results will provide a number of estimates and robust t -tests [70].

3. Results

3.1. Characteristics of Respondents

A total 305 respondents who travelled to Bandung City were recruited. All of them lived outside Bandung City. Table 2 shows that most respondents were female (72%). Most respondents were either high school- or undergraduate-educated (93%). Respondents working at private companies made up the majority (60%), whereas civil servants comprised only 3% of the sample.

Table 2. Respondent characteristics.

Variables		n		Proportion (%)	
Gender	Male	87		28	
	Female	218		72	
Age	Students	147		48	
	Young adult	113		37	
	Senior	46		15	
Education	High school	94		30	
	Undergraduate	194		63	
	Graduate	17		7	
Occupation	Student	39		12	
	Civil servant	12		3	
	Private officer	182		60	
	Other	73		25	
Monthly income (IDR)	1–6 million	234		76	
	6–12 million	49		16	
	>12 million	13		8	
Existing mode of transport for leisure	Privately owned car	210		69	
	Privately owned motorcycle	50		16	
	Bus	18		6	
	Taxi	13		4	
	Bandung local train	7		2	
	Angkot	3		1	
	Microbus	1		1	
	Rent-a-Car	3		1	
Ownership (units)		MC	Car	MC	Car
	0	12	191	4	62
	1	153	94	50	30
	2	104	19	34	6
	3	30	0	10	0
	4+	6	1	2	0.3

Travelers in this study with a monthly income ranging from IDR one to six million comprised 76% of the sample, while travelers with a monthly income more than IDR twelve million comprised 8% (IDR three million is the monthly minimum wage in the Bandung area). Most travelling respondents, therefore, fell into the medium range of income. Most of the respondents used private cars for leisure trips to Bandung City, while the choice of using public transportation added up to 15% of the sample. This fact is in line with the number of cars or motorcycles owned by respondents in their households. Data show that 93% of respondents owned at least one motorcycle (MC), and 63% owned at least one car.

3.2. Model Estimation

The estimation results are presented in Table 3, while the results of the respondent demographic analysis are presented in Table A1. There are four models: (1) general respondents, (2) car users, (3) motorcycle users, and (4) public transport users. General respondents included all respondents in the sample by existing mode use. From the model fit, we can see that the rho-square is between 0.2 and 0.5; therefore, we can say these models were acceptable.

Table 3. Estimation results.

Alternative/Attribute	General Respondents		Car Users		Motorcycle Users		Public Transport Users	
	Estimate	Robust <i>t</i> -Test	Estimate	Robust <i>t</i> -Test	Estimate	Robust <i>t</i> -Test	Estimate	Robust <i>t</i> -Test
Private Car	0.0731	0.0986	4.35	4	0.513	0.422	2.19	1.72
Private Motorcycle	0.782	1.12	4.9	4.48	1.21	1.17	−0.395	−0.334
Ride-hailing	1.62	1.42	1.99	1.29	3.82	1.72	6.31	2.97
Taxi	1.19	1.1	5.79	4.07	−9.7	−3.39	1.82	0.655
Train	2.56	2.87	6.97	5.42	−0.527	−0.416	2.60	1.69
Bus	6.1	4.65	7.09	3.66	3.44	1.19	3.59	1.58
Travel Time_Car	−0.00468	−0.351	−0.015	−0.915	−0.00562	−0.167	0.0218	0.575
Travel Cost_Car	0.00261	0.294	−0.00557	−0.516	−0.0014	−0.0617	0.0366	1.48
Payment Method_Car	0.0612	0.906	0.0892	1.12	−0.288	−1.53	0.213	1.03
Travel Time_Motorcycle	−0.0146	−1.7	−0.0224	−1.91	−0.0123	−0.653	0.000605	−0.0248
Travel Cost_Motorcycle	−0.0166	−1.88	−0.035	−2.82	0.000164	0.00908	0.0454	1.66
Payment Method_Motorcycle	0.0496	0.0971	0.11	1.56	−0.0623	−0.594	0.0322	0.218
Travel Time_MRH	−0.0186	−0.718	0.00468	0.141	−0.103	−1.72	−0.0784	−1.14
Waiting Time_MRH	−0.0186	−0.718	−0.00553	−0.137	−0.0842	−1.08	−0.0828	−0.899
Travel Cost_MRH	−0.0591	−2.37	−0.0473	−1.46	−0.114	−1.86	−0.213	−2.02
Payment Method_MRH	−0.292	−2.93	−0.24	−1.9	−0.46	−1.71	−0.644	−2.63
Travel Time_CRH	−0.0295	−1.84	−0.0292	−1.48	0.0186	0.265	−0.128	−2.38
Waiting Time_CRH	−0.0502	−0.927	−0.0593	−0.936	−0.00146	−0.00532	0.00255	0.0109
Travel Cost_CRH	−0.00994	−0.896	−0.0132	−0.986	0.0812	1.91	−0.0551	−1.39
Payment Method_CRH	−0.057	−0.576	−0.0711	−0.604	0.342	0.744	−0.108	−0.377
Travel Time_Angkot	−0.00181	−0.115	0.00241	0.0726	0.0108	0.455	−0.0176	−0.546
Waiting Time_Angkot	−0.000329	−0.00979	0.0521	0.803	0.00912	0.166	−0.0523	−0.664
Travel Cost_Angkot	−0.0429	−0.553	−0.106	−0.637	0.0312	0.254	−0.107	−0.683
Access Egress_Angkot	0.00548	0.15	−0.00751	−0.109	0.0258	0.424	−0.0271	−0.371
Payment Method_Angkot	0.192	1.45	0.252	0.995	0.146	0.72	0.0464	0.189
Travel Time_Bus	−0.0455	−2.51	−0.0559	−2.16	−0.0448	−0.862	−0.0275	−0.747
Waiting Time_Bus	−0.0621	−2.09	−0.0656	−1.57	−0.0988	−1.23	−0.0432	−0.732
Travel Cost_Bus	−0.175	−1.63	−0.264	−1.58	−0.112	−0.374	−0.0732	−0.335
Access Egress_Bus	−0.0247	−0.595	−0.0762	−1.08	−0.0202	−0.195	0.0612	0.722
Payment Method_Bus	−0.0739	−0.821	−0.144	−1.01	0.0059	0.0264	−0.0195	−0.105
Travel Time_Train	0.0258	1.53	0.0209	0.891	0.032	0.926	0.0298	0.321
Waiting Time_Train	−0.00203	−0.0725	−0.0224	−0.564	0.0102	0.192	0.0235	0.321
Travel Cost_Train	0.0929	0.673	−0.027	−0.139	0.288	1.04	0.116	0.31
Access Egress_Train	0.00327	0.149	−0.00803	−0.263	−0.00245	−0.0561	0.0496	0.782
Payment Method_Train	0.0352	0.64	−0.134	−1.76	0.318	2.76	0.0725	0.423
Model Fit								
Number of estimated parameters:	149		149		149		149	
Observation:	1376		800		356		220	
Init. log likelihood:	−2677.572		−1556.728		−692.744		−428.1002	
Final log likelihood:	−2144.414		−1193.522		−420.4835		−296.1037	
Rho-square for the init. model:	0.199		0.233		0.393		0.308	
Rho-square-bar for the init. model:	0.143		0.138		0.178		−0.0397	

The first column in Table 3 displays the general respondents' model. By achieving a robust *t*-test, the model shows that train and bus results were significant. The results indicate that, all else being equal, respondents would rather choose to take a train or bus (with the latter being most preferred) than an angkot for leisure trips. The model also shows that seven attributes were found to be significant in influencing leisure mode. Travel time and travel costs for private motorcycles, travel costs and payment method for ride-

hailing, travel time for CRH, and travel time and waiting time for the bus were found to be negatively significant.

The second column in Table 3 presents the results of the car-users model. This model used data from respondents who mainly used a car as their preferred mode for leisure travel. There were 200 respondents in this category; therefore, we gathered a total of 800 observations. The two alternatives, train and bus, were significant. The results indicate that, all else being equal, people were more likely to choose to take a train or a bus over using the angkot, ride-hailing, CRH, or private car modes. The model also shows four significant attributes. Travel time for motorcycle mode, travel costs for motorcycle mode, and travel time for bus mode were negatively significant. In the payment method for the train, the results were significant with a negative value, which indicated that people were more likely to choose the train if the payment was using cash.

The third column in Table 3 shows the results of the motorcycle-users model. This model used data from respondents who preferred to use a motorcycle in their leisure activities. It can be seen that ride-hailing is the alternative which was significant. It also can be concluded that, all else being equal, people were more likely to choose ride-hailing than using a private motorcycle. The model also shows four attributes that were additionally significant; they were travel time with ride-hailing and travel cost with ride-hailing, but the result was negative for MRH, which indicates it was negatively significant. However, for CRH, the travel-cost attribute was positively significant. In the case of payment method, a positive significant result means that our respondents preferred to pay for their tickets using a cash method.

The last column presents model results from respondents who did not own any vehicles and currently used public transport as their preferred mode for leisure travel. Two alternatives were found to be significant: private cars and trains. Therefore, all else being equal, respondents who did not have private transport still preferred taking a private car or train for leisure travel.

The model also shows four significant attributes: travel costs of the motorcycle mode, travel costs and payment method for MRH, and travel time for CRH. Motorcycle travel costs were positively high, contrasting findings with the travel costs associated with ride-hailing, which is reflected in the result being negatively significant. Users of ride-hailing had a higher preference for low costs when they used those modes.

For the findings from the socio-demographic investigation, see Appendix A. For the socio-demographic characteristics, we grouped them into three categories: students (18–25 years old), young adults (26–41 years old), and seniors (42–56 years old). From the *t*-test results, students who used the bus had a significantly positive value. This means that students preferred the bus over the angkot. For the young adults, their result shows that they preferred the bus for their leisure trips. Last, for the seniors, all the mode alternatives were found to be significant except for the private car mode; those respondents were more likely to use the motorcycle, ride-hailing, CRH, bus, or train modes than the angkot.

As per the demographic of gender, the results show that males preferred to use the train or take the bus over the angkot. Furthermore, motorcycle, ride-hailing, train, and bus show positive results for females. Female respondents preferred to use a motorcycle, ride-hailing, train, or bus over an angkot.

The educational backgrounds of the respondents were also examined. High school, undergraduate, and graduate degrees comprised our three divisions. For their leisure trips, the respondents with those three backgrounds were more likely to use private cars, private motorcycles, or ride-hailing than they were to use angkots. The negative findings, however, indicate that angkots were more frequently utilized than ride-hailing, trains, or buses by respondents with those three backgrounds.

Respondents' domiciles were separated into two groups, West Java and outside West Java. With trains and buses, significant values were found from respondents who lived in West Java. According to this, commuters from West Java and outside West Java might be more likely to take the train or bus than the angkot.

We also surveyed respondents' incomes and divided them into three categories: Income A: IDR 1,000,000–IDR 6,000,000; Income B: IDR 6,000,001–IDR 12,000,000; and Income C: >IDR 12,000,000). First, respondents categorized into Income A and Income B were more likely to use CRH services over angkots for commuting. Furthermore, the results for respondents with incomes above IDR 12,000,000 differed, which shows that they were less likely to choose buses for their leisure trips than angkots. However, respondents in the Income C group preferred cars, motorcycles, ride-hailing, CRH, and trains over angkots.

1. Car users

Similar to before, we divided respondents' age into the same three groups. The outcomes of all the alternatives in car-user respondents were significantly positive. In order to avoid using angkots, respondents in the student age group were more likely to use a car, motorcycle, ride-hailing service, CRH service, train, or bus. It is clear from the results for both young adults and older adults that individuals preferred utilizing angkots over ride-hailing, since the ride-hailing result was negatively significant. However, because some of the alternatives—such as a private vehicle, motorcycle, ride-hailing service, train, and bus—are also favorably significant, some respondents were less likely to use angkots.

Furthermore, the respondents with high school and undergraduate backgrounds preferred to use a car for their leisure travel. Motorcycle and ride-hailing users were positively significant too, indicating that high school and undergraduate respondents were more likely to choose a car, motorcycle, or ride-hailing than use an angkot. However, the results from respondents with a high school and undergraduate background were different from respondents with a graduate school background. They were more likely to choose to use a private car or motorcycle than an angkot.

In terms of gender, male respondents were less likely to use ride-hailing, as the ride-hailing results were negatively significant. However, for female respondents, the results show that all the alternatives were positively significant. Therefore, female respondents were less likely to use angkots.

Based on respondents' domiciles, respondents came from either West Java or outside of West Java. The results from respondents from both West Java and outside West Java were mostly similar. However, respondents living outside West Java were less likely to use ride-hailing, since ride-hailing was insignificant.

As per respondents' income, data from those with Income A revealed that the bus result was positively significant, indicating that those individuals were more likely to use buses than angkots. Along with strong negative results, there were also significant positive results for the use of cars, motorcycles, and trains, indicating that respondents with Income A were more likely to use angkots than other modes of transportation. Similar findings are shown for Income B respondents. Those with incomes between IDR 6,000,001 and IDR 12,000,000 were more likely to use ride-hailing and to take the train than use an angkot for leisure travel. Finally, Income C respondents provided positively significant results for ride-hailing and CRH, indicating that they were more likely to utilize e modes than angkots.

2. Motorcycle users

By age, especially for students, the results for bus use were significant. Students preferred to use buses over angkots. Young adults preferred ride-hailing and bus trips over motorcycle trips for leisure travel. Results for young adults also show a significant value, but results were negative for CRH; therefore, it can be concluded that young adult respondents preferred to use angkots rather than CRH services. However, for senior respondents, the results were positively significant for motorcycle use and ride-hailing.

For males, only one alternative was significant with a negative result and that was for CRH; therefore, male respondents preferred to use CRH rather than angkots. However, the results for females were different from those for male respondents, which shows that females were more likely to use motorcycles or ride-hailing than angkots.

Respondents with a high school or undergraduate education provided significant results for train use. Respondents with a high school or undergraduate educational back-

ground were more likely to choose to use a train rather than an angkot for their leisure travel. Respondents with a graduate education background showed only positive significant results for CRH, meaning graduate respondents preferred to use CRH over angkots.

As per incomes, as depicted in Table A1 below, CRH characteristics for Income A respondents show significant results. It can be concluded that CRH for respondents with incomes between IDR 1,000,000 and IDR 6,000,000 were more likely to use CRH than angkots. However, Income B respondents preferred to use angkots over ride-hailing, trains, or buses; ride-hailing, train, and bus use for leisure were negatively significant. Last, Income C respondents reported positively significant car and motorcycle use, which indicates that respondents with incomes above IDR 12,000,000 were less likely to use angkots than cars or motorcycles.

3. Public transportation users

We also analyzed data from respondents with no private vehicle at their disposal. First, according to the results by students' ages, it can be seen in Table A1 that mostly negatively significant results were found with cars, motorcycles, and trains. Therefore, students were more likely to choose an angkot than a car, motorcycle, or train for leisure travel. For the young adult age group, the results of all transportation mode alternatives were significant but negative; this means that angkots were still the preferred choice for young adult respondents. Young adults reported entirely different results from seniors. They were most likely not to choose angkots, as all other alternatives, including car, motorcycle, ride-hailing, CRH, bus, and train results were positively significant for senior respondents.

Based on educational background, respondents educated to the high-school level were more likely to choose a car, train, or bus over an angkot, as the *t*-test value was positive and significant. However, according to respondents with undergraduate backgrounds, the results show that the ride-hailing and CRH choices were positively significant. Therefore, people with undergraduate backgrounds preferred ride-hailing or CRH for their leisure commuting.

Regarding respondents' gender, as seen in Table A1, for males, ride-hailing and motorcycle use show a significant value. However, ride-hailing shows a positive significance, meaning male respondents (who do not own any vehicle) were likely to choose ride-hailing over angkots. The results differed with motorcycle use, showing negatively significant results, meaning that respondents were more likely to use angkots than motorcycles.

Next, we analyzed the socio-demographic characteristic of respondents' domicile. Regarding respondents from West Java, the results show that four significant alternatives were car, ride-hailing, train, and bus use. The results of the four alternatives were positively significant, so it can be concluded that people travelling from the West Java area for leisure were more likely to use a car, ride-hailing, train, or bus than an angkot. However, respondents who lived outside West Java were more likely to use ride-hailing for commuting than angkots (i.e., ride-hailing was positively significant).

Finally, with respect to respondents' income, as can be seen in Table A1 below, motorcycle is the transportation alternative that was positively significant, which indicates that respondents with incomes between IDR 1,000,000 and IDR 6,000,000 were more likely to choose motorcycles over angkots. However, respondents with Income B were more likely to choose angkots versus alternatives that had negatively significant results.

4. Discussion and Conclusions

Using an SP questionnaire, this research aimed to identify the significant factors that influenced the decision of people living outside Bandung to choose leisure transportation modes to the City of Bandung. From the answers of 305 respondents, from which 1220 observations were garnered, four MNL models were estimated: (1) general respondents, (2) car users, (3) motorcycle users, and (4) public transportation users.

Each MNL revealed distinct findings that complement each other. First, from the general model, the train and bus mode were most popular for leisure trips to Bandung. This finding contradicts previous studies on leisure travel mode preferences in developing countries,

such as from Sabogal-Cardona et al. [71] in Mexico and Acheampong et al. [72] in Ghana, who found that ride-hailing was mostly used for occasional trips. This can be explained by the fact that not only were the journeys in the present study long distance—originating outside of Bandung—but they were also typically conducted in groups of more than two people. Thus, trains or buses would be an appropriate transportation mode choice for parties involving more than two people. As also indicated by Bhat and Gossen [73], based on respondents in San Francisco, California, individuals with children or who live together with other households preferred outdoor recreation for leisure.

For the second model, the results showed that ride-hailing was less likely to be chosen by car-use respondents. However, the third model—where respondents currently used a motorcycle—shows that ride-hailing was preferred over an angkot. Last, the fourth model shows that car, ride-hailing, and train were the preferred modes. Moreover, the estimation results of the socio-demographics show that age, income, gender, educational background, and domicile influenced respondents' decision in choosing their transportation mode for leisure trips. This finding emphasized the effect of ICT on the decisions of people in developing countries, such as those in Bandung, in finding mobility for leisure travel in the digital era.

Our findings are also partly explained by the fact that our sample was dominated by females (71%). As Alemi et al. [74] pointed out in their study in California, women were more likely to use ride-hailing services than men, and the women were more inclined to use on-demand services. Additionally, our sample was dominated by productive-age respondents (19% students versus 71% workers) and educated individuals (64% with a bachelor's degree). Educated users tend to utilize ride-hailing services more frequently because they are more familiar with technology.

Payment methods also influenced preferences of travel modes for leisure trips. Interestingly, we found that when a cashless payment method was available (as in ride-hailing services), the respondents tended to choose paying with cash. On the contrary, when a cashless payment method was not available yet (as in the case of angkots), the respondents preferred paying with a cashless method. This finding implies that users should have access to a variety of payment options, including cashless and cash payments, as also suggested by Sikder [75] and Phuong and Tran [76]. Again, this study revealed an interesting finding regarding travel behavior in the digital era in fulfilling mobility needs for leisure trips, namely that flexibility—in terms of payment and mobility options—is valued more highly by Indonesians when travelling for leisure.

Travel time and travel costs have a significant effect, but the results are negative, which means that if the travel time is long, respondents will choose other modes of transportation. This finding is in line with the study by Mahdi et al. [44]. Travel time became significant for private motorbike users because they must drive their own vehicle, and it is different from using ride-hailing, where individuals do not need to steer their own motorbikes. Additionally, high travel time will also impact costs incurred by private motorbike users. This result is supported by the findings from Ha et al. [42], who found that individuals behave rationally when choosing transportation modes by taking into account both the travel-time gap and ratio. In tandem with travel-time factors, people also made mode choices based on travel-cost considerations.

The preference for using public transportation (e.g., ride-hailing services, taxis, and buses) for leisure trips is also found to be sensitive to travel time and travel cost, with bus users being the most sensitive. To alleviate the severe congestion that occurs in Bandung every weekend as a result of the high volume of recreational trips, public transportation should be promoted. A reliable service that guarantees efficient travel times with reasonable fares should be offered to encourage people to use public transportation.

5. Recommendations and Future Research

Based on the findings from this study, some recommendations can be made. The findings from the estimated model show that the local travelers who take leisure trips

have a variety of transport mode preferences, but their previous or daily mode has a strong influence. The findings from the experiment using the SP questionnaire in this study show the effect of including the sensitivity of the common variables in mode choice. Moreover, our study also employed online transportation as a possible mode choice, in the form of motorcycle- and car-based ride-hailing. Our study also involved a variety of payment methods, from cash to cashless. These ride-hailing modes as well as cashless payment are the manifestation of the effect of digitalization, especially in leisure trips for local travelers. These findings motivate the first recommendation, namely the need to better understand the travel behavior or travel patterns of people who take leisure trips by considering the possible effects of digitalization. This information may provide a broader view of the effective potential of leisure trips, even if there is complexity surrounding this topic and high car dependence [33]. This understanding will also possibly mitigate tourism's externalities and implications for inequality and sustainability issues [77]. In fact, leisure trips are uniquely flexible and provide unusual independence. This uniqueness may differentiate the pattern or behavior of users in travelling leisurely from taking mandatory trips, such as commuting to work. Leisure trips often involve cars [46], especially in the case of domestic leisure trips that are short to medium in duration. This explains why CRH has become a popular choice, as ride-hailing provides flexibility as well as independence. It is a challenge for city governments to provide a series of mode choices that resonate with the city populace by utilizing positive features of ICT in this digital era. Mokhtarian et al. [13] suggested 13 dimensions of leisure activities to integrate ICT into the urban transportation system. Moreover, a study by Nawijn [19] found that people who took one or more holiday trips appeared to be significantly happier, even when income, health, and personality were controlled for. This finding implies a need to understand what aspects of leisure trips contribute most to happiness in both the present and future, especially in the face of increasing digitalization.

In the field of transportation, the accessibility of transportation is key [78]. As accessibility can be explained by several attributes, this study highlights the importance of travel cost, travel time, waiting time, access egress, and payment method. This study also highlights the sensitivity of those attributes, since travelers can be quite familiar with the urban transportation system at their destination (i.e., the travelers in this study from surrounding cities who visited Bandung City for leisure). Travelers showed sensitivity to price, time, and payment method, and these aspects might become more crucial as the features of ICT in transportation services may be employed to support the flexibility of leisure trips.

It is widely acknowledged that domestic tourism can provide an impetus to further economic growth in holiday regions and that domestic tourism may assist in solving some of the problems facing a country's international tourism industry [79,80]. This study investigated leisure trips by local travelers in Bandung City. The estimated models revealed the detailed characteristics of travelers based on their socio-demographic characteristics in selecting mode choice. The understanding of the individual characteristics of travelers is beneficial to developing a suitable marketing strategy for local governments to support tourism campaigns. Thus, the second recommendation is that city governments should define the characteristics of leisure-tourism trips in their cities. This will depend on the wide variety of possible leisure destinations and activities in the city. Tourists' actual choices were influenced by past experiences and by regional differences in the qualities of the wider environment [81]. In the case of Bandung City, which has a wide variety of tourist attractions, such as natural sites, cultural attractions, heritage buildings, culinary options, fashion outlets, recreation options, and entertainment venues [50], as well as geo-tourism possibilities in the Bandung Basin [51], the city will need a comprehensive plan regarding tourism transportation. Based on this plan, the city government will be able to provide concise and comprehensive information to travelers.

Comprehensive information will influence the experience of travelers. Related to our first recommendation, the third recommendation is to provide information to tourists

regarding transportation services, which should carefully leverage scientific findings on travel behavior and socio-demographics, including travel attitudes, information factors, and social surroundings, as suggested by Farag and Lyons [28]. By referring to the findings from this study in terms of the mode characteristics, the basic information that needs to be provided concerns the possible transportation modes in the city, combined with each service's attributes; the value of this resource will be increased with additional information on connectivity, places of attraction, and other local features and characteristics. Again, the possible benefits of ICT may be utilized in supporting information provision to bolster and improve tourism-related transportation services.

This research has some limitations that could be addressed in future research. First, this study sampled only people from outside Bandung City, and different results may be obtained if respondents actually live and work in Bandung. Second, after the collection period for this study, the city governor provided new rules for ride-hailing payments; therefore, the results pertaining to ride-hailing significance in this study might change in future research just based on that fact alone. Last, the mayor of Bandung City introduced an initiative called the Bandung Urban Mobility Project, which is meant to provide new mobility options available soon in Bandung. A future study might measure people's choices regarding these new mobility alternatives to determine whether there are any differences between the existing modes of transportation and the new options.

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Appendix A

Table A1. Estimation results by socio-demographics.

Attribute/Alternatives		General		Car User		Motorcycle User		Public Transport User	
		Estimate	Robust <i>t</i> -Test	Estimate	Robust <i>t</i> -Test	Estimate	Robust <i>t</i> -Test	Estimate	Robust <i>t</i> -Test
Age	Students–Car	−0.191	−0.501	1.84	3.87	−0.372	−0.514	−1.72	−2.47
	Students–Motorcycle	0.177	0.482	2.21	4.6	−0.668	−1.07	−1.99	−3.25
	Students–Ride-hailing	0.207	0.426	1.04	1.69	−0.361	−0.392	−0.263	−0.252
	Students–Car Ride-hailing	0.21	0.414	2.15	3.55	0.707	0.276	1.58	1.17
	Students–Train	0.212	0.513	2.39	4.4	−1.72	−2.65	−2.42	−3.49

Table A1. Cont.

Attribute/Alternatives		General		Car User		Motorcycle User		Public Transport User	
		Estimate	Robust <i>t</i> -Test	Estimate	Robust <i>t</i> -Test	Estimate	Robust <i>t</i> -Test	Estimate	Robust <i>t</i> -Test
	Students–Bus	1.89	3.55	2.51	3.34	3.5	3.26	−0.621	−0.704
	Young Adult–Car	−0.259	−0.744	1.46	2.94	−0.571	−0.815	−2.74	−4.75
	Young Adult–Motorcycle	−0.183	−0.541	1.54	3.06	−0.00279	−0.00473	−3.94	−6.3
	Young Adult–Ride-hailing	0.178	0.379	0.624	0.981	1.66	1.65	−4.07	−4.17
	Young Adult–Car Ride-hailing	−0.315	−0.688	1.79	2.93	−13.4	−3.94	−10.2	−9.59
	Young Adult–Train	0.604	1.58	2.45	4.44	−0.375	−0.601	−2.4	−3.72
	Young Adult–Bus	1.9	3.67	2.48	3.3	4.73	4.1	−2.22	−2.62
	Senior–Car	0.524	1.18	1.05	1.73	1.46	1.35	6.64	8.92
	Senior–Motorcycle	0.788	1.83	1.16	1.93	1.88	1.87	5.53	7.48
	Senior–Ride-hailing	1.23	2.28	0.322	0.443	2.52	2.03	10.6	8.4
	Senior–Car Ride-hailing	1.3	2.37	1.86	2.61	2.96	0.393	10.4	7.73
	Senior–Train	1.75	3.73	2.13	3.26	1.57	1.56	7.51	9.79
	Senior–Bus	2.31	4	2.09	2.54	−4.79	−3.66	6.43	6.42
Education	High school–Car	2.96	3.98	3.67	2.87	0.131	0.182	1.59	2.02
	High school–Motorcycle	2.54	3.46	2.88	2.27	−0.12	−0.203	0.802	1.13
	High school–Ride-hailing	2.61	3.21	3.97	2.98	0.885	0.949	1.37	1.29
	High school–Car Ride-hailing	−5.84	−4.16	−5.76	−3.45	−12.5	−7.63	−5.06	−3.54
	High school–Train	−4.61	−3.67	−4.71	−2.78	3.55	5.64	1.61	1.79
	High school–Bus	−7.36	−7.17	−6.83	−4.5	0.958	0.868	2.26	1.92
	Undergraduate–Car	3.33	4.57	4.32	3.18	0.607	0.765	0.597	0.759
	Undergraduate–Motorcycle	2.52	3.45	2.89	2.13	0.547	0.795	−1.2	−1.58
	Undergraduate–Ride-hailing	3.21	4.08	4.57	3.27	1.12	0.961	4.94	3.55
	Undergraduate–Car Ride-hailing	−4.91	−3.55	−5.07	−2.91	−1.29	−0.826	6.89	4.12
	Undergraduate–Train	−4.58	−3.66	−4.88	−2.77	4.42	6.22	1.08	1.18
	Undergraduate–Bus	−7.59	−7.58	−7.15	−4.58	0.364	0.305	1.33	1.04
	Graduate–Car	3.69	3.9	3.75	3.39	−0.225	−0.184	-	-
	Graduate–Motorcycle	2.29	2.35	1.27	1.06	0.783	0.714	-	-
	Graduate–Ride-hailing	1.68	1.35	−7.77	−6.5	1.81	1.42	-	-
	Graduate–Car Ride-hailing	−5.03	−3.09	−16.5	−10.2	4.06	1.72	-	-
	Graduate–Train	−5.24	−3.69	−5.95	−3.78	−8.5	−7.69	-	-
	Graduate–Bus	−7.26	−5.87	−7.31	−5.28	2.12	1.17	-	-
Gender	Male–Car	−0.216	−0.528	1.67	2.56	0.0658	0.0967	0.55	0.717
	Male–Motorcycle	0.0714	0.184	2.13	3.24	−0.138	−0.249	−1.26	−1.72
	Male–Ride-hailing	0.472	0.781	0.522	0.6	0.835	0.673	2.5	2.23
	Male–Car Ride-hailing	0.447	0.772	2.18	2.71	−4.7	−4.29	1.69	1.08
	Male–Train	1.04	2.18	2.95	4	−0.559	−0.838	0.723	0.814
	Male–Bus	3.15	4.59	3.6	3.45	1.93	1.27	1.42	1.18
	Female–Car	−0.528	0.746	2.68	4.57	0.448	0.641	1.64	2.3
	Female–Motorcycle	0.184	1.92	2.77	4.75	1.35	2.19	0.867	1.24
	Female–Ride-hailing	0.781	1.95	1.47	1.8	2.98	2.65	3.81	3.27
	Female–Car Ride-hailing	0.772	1.31	3.61	4.62	−5.01	−2.5	0.135	0.0972
	Female–Train	2.18	3.3	4.02	5.9	0.0319	0.0465	1.97	2.27
	Female–Bus	4.59	4.43	3.48	3.48	1.51	1.03	2.17	1.81

Table A1. Cont.

Attribute/Alternatives		General		Car User		Motorcycle User		Public Transport User	
		Estimate	Robust <i>t</i> -Test	Estimate	Robust <i>t</i> -Test	Estimate	Robust <i>t</i> -Test	Estimate	Robust <i>t</i> -Test
Domicile	West Java–Car	0.369	0.369	2.64	3.93	0.965	1.35	1.47	1.9
	West Java–Motorcycle	0.875	0.875	2.87	4.23	2.06	3.56	0.441	0.589
	West Java–Ride-hailing	1.06	1.06	1.29	1.46	3.22	2.65	2.59	2.32
	West Java–Car Ride-hailing	0.597	0.597	3.21	3.88	−3.97	−3.04	0.831	0.537
	West Java –Train	1.78	1.78	4.15	5.49	0.604	0.903	1.97	2.24
	West Java–Bus	3.24	3.24	3.76	3.45	2.54	1.68	2.06	1.66
	Outside West Java–Car	−0.296	−0.78	1.71	3.53	−0.452	−0.692	0.719	0.966
	Outside West Java–Motorcycle	−0.0936	−0.263	2.03	4.2	−0.847	−1.43	−0.836	−1.24
	Outside West Java–Ride-hailing	0.554	0.984	0.704	0.965	0.592	0.536	3.72	2.99
	Outside West Java–Car Ride-hailing	0.596	1.05	2.59	3.74	−5.73	−3.48	0.994	0.651
	Outside West Java Train	0.781	1.71	2.82	4.72	−1.13	−1.64	0.721	0.791
	Outside West Java–Bus	2.86	4.39	3.33	3.66	0.9	0.62	1.53	1.31
Income	Income_A–Car	−0.334	−0.266	−6.53	−5.34	−0.7	−0.466	−7.5	−5.94
	Income_A–Motorcycle	−0.312	−0.256	−5.84	−4.25	0.934	0.712	3.39	2.88
	Income_A–Ride-hailing	−0.917	−0.724	1.72	1.46	1.06	0.714	−11.4	−6.99
	Income_A–Car Ride-hailing	6.22	5.35	0.222	0.183	13.2	4.15	−6.07	−3.25
	Income_A–Train	−0.795	−0.682	−6.29	−5.41	0.159	0.134	−7.61	−5.98
	Income_A–Bus	−2.29	−2.02	3.62	3.11	−2.45	−2	−9.86	−9.52
	Income_B–Car	−0.279	−0.208	−5.76	−3.67	−1.67	−0.98	−9.14	−6.41
	Income_B–Motorcycle	−1.43	−1.09	−6.36	−3.75	−1.21	−0.819	0.788	0.538
	Income_B–Ride-hailing	−1.12	−0.824	2.62	1.7	−12	−7.3	−12	−6.98
	Income_B–Car Ride-hailing	6.37	5.05	1.05	0.653	1.22	0.385	−4.54	−1.72
	Income_B–Train	−1.39	−1.1	−5.59	−3.67	−2.52	−1.79	−11	−6.89
	Income_B–Bus	−2.35	−1.9	4.28	2.74	−3.25	−2.3	−11.4	−8.87
	Income_C–Car	6.58	4.75	1.11	0.876	8.27	2.92	-	-
	Income_C–Motorcycle	6.04	4.47	1.44	1.01	7.83	3.04	-	-
	Income_C–Ride-hailing	6.58	4.64	10.6	8.65	−2.86	−1.02	-	-
	Income_C–Car Ride-hailing	14.3	10.7	9.51	7.54	2.9	1.18	-	-
	Income_C–Train	4.94	3.76	0.315	0.258	4.55	1.4	-	-
	Income_C–Bus	−3.25	−2.55	−0.318	−0.259	−5.37	−1.69	-	-
Model Fit									
Number of estimated parameters		149		149		149		149	
Observations		1376		800		356		220	
Init. log likelihood		−2677.572		−1556.728		−692.744		−428.1002	
Final log likelihood		−2144.414		−1193.522		−420.4835		−296.1037	
Rho-square for the init. model		0.199		0.233		0.393		0.308	
Rho-square bar for the init. model		0.143		0.138		0.178		−0.0397	

Appendix B

[Introduction]

We from the Universitas Katolik Parahyangan Research Team would like to introduce ourselves. Currently we are conducting research on the selection of modes of transportation in the City of Bandung.

There are several provisions in filling out this questionnaire:

1. Completing of the questionnaire will take 5–10 min

2. There are no right or wrong answers.
3. It is expected that the respondent will fill in the answers honestly and thoroughly.
4. The information obtained from this questionnaire is CONFIDENTIAL. It will not be misused and is only for research and publication purposes.

Thank you

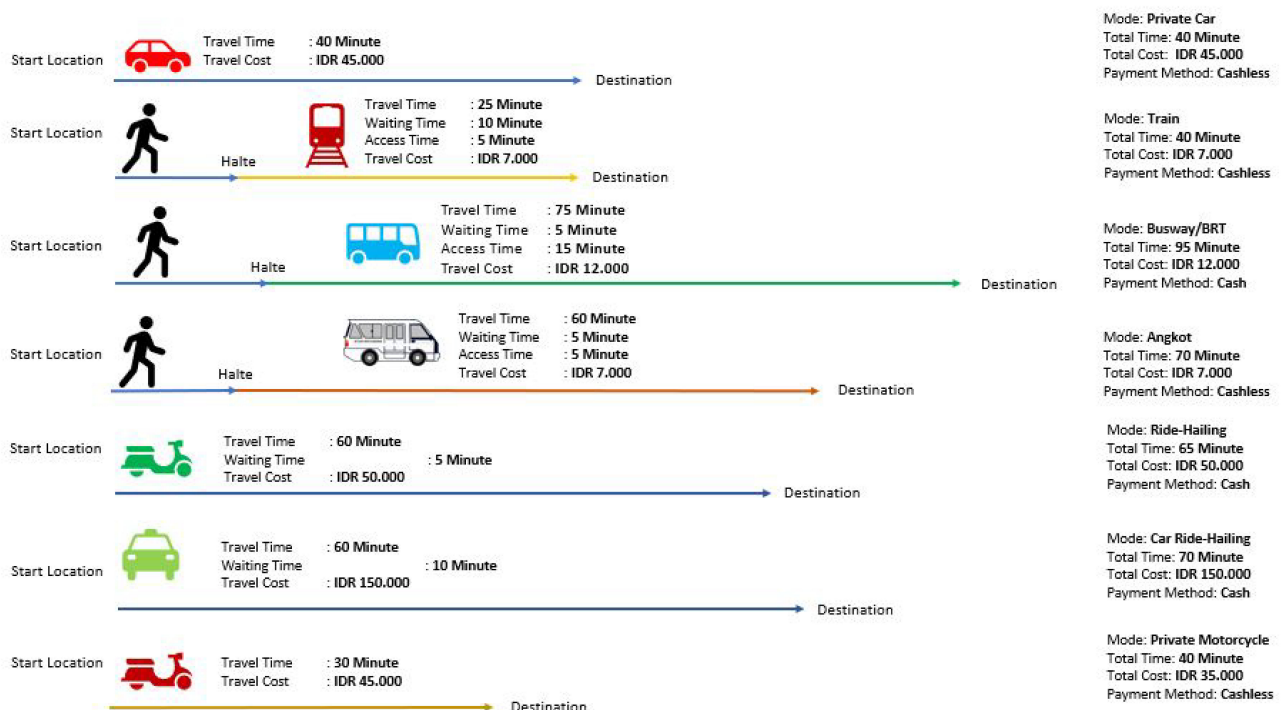
[Respondent Categorisation]

1. Respondent Domicile (Please fill in)
2. Birth Date

- (a) 1–8
- (b) 9–16
- (c) 17–25
- (d) 26–31

[Selection of Scenario]

Scenario (Example 1 out of 32 scenarios)



From Scenario 1, which mode of transportation fits your criteria?

- (a) Private Car
- (b) Train
- (c) Busway/BRT
- (d) Angkot
- (e) Ride-Hailing
- (f) Car Ride-Hailing
- (g) Private Motorcycle

[Demographic Profile]

1. Gender
 - (a) Male
 - (b) Female
2. Age (Please fill in)
3. Educational Background

- (a) High school
- (b) Undergraduate
- (c) Graduate
- 4. Current Job
 - (a) Student
 - (b) Private Employee
 - (c) Civil Servant
 - (d) Self-Employed
 - (e) Other: Please fill in
- 5. Monthly Income (1 USD = IDR 15,114)
 - (a) <IDR 1 Million
 - (b) IDR 1–3 Million
 - (c) IDR 3–6 Million
 - (d) IDR 6–9 Million
 - (e) IDR 9–12 Million
 - (f) >IDR 12 Million
- 6. Estimated Travel Time from Home to Office (Please fill in)
- 7. Estimated Distance from Home to Office (Please fill in)
- 8. Car Ownership (Please fill in)
- 9. Motorcycle Ownership (Please fill in)

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