

## Choice model of transportation mode for international tourists based on travel characteristic in Bali

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**Abstract.** This study aims to analyse the travel characteristics of the most influential tourists trip in mode choices model with alternative modes based on operators. Analysis and modelling are using the Mix Logit. The distance of tourist trip could reach 190 km and for the majority of trips it's around 10-30 km per day, and for the majority of travel time it's 20-60 minutes per day. The most influential travel characteristic factors on rental for nearly all factors such as trip attraction location, number of group member, trip chains, distance, travel time and cost, then travel agent are influenced by number of group member only. Online and Public transportation also are influenced by all factors except trip attraction location. According to the mode choices model analysed, it shows that the highest probability is to use both rental-car and rental-motorbike with 22.5% and 20.2% respectively, then the choice of Agent-Bus and Agent-Car with probabilities of 18.9% and 11.7% respectively. Public transportation-Car also have a high probability of 18% to be used. The choice to use other modes such as Public-Bus and online transportation both by car and motorcycle modes, the probability is less than 5%.

### 1. Introduction

With the growth of international tourism which tends to increase, tourism in Indonesia is in fourth place in Southeast Asia in bringing foreign tourists compared to neighbouring countries such as Thailand, Malaysia and Singapore. According to the Asian Statistical Yearbook, 2018 [1] is known that Thailand is able to attract 32.58 million tourists, Malaysia attract 26.76 million tourists, Singapore arrives at 16.40 million tourists, while Indonesia in 2017 can only attract 14.04 million tourists [2]. With the same potential, Indonesian tourism needs to make efforts to attract more foreign tourists as well as other countries in Southeast Asia. Tourism plays an important role in the economy of Bali, but on the other hand, tourism travel contributes to the impact of transportation externalities such as delays, traffic jam, traffic accidents, parking problems in tourist areas and environmental problems [3]. These problems occur not only due to the limited transportation infrastructure system compared to the increasing number of tourist arrivals, but also with other problems, such as too much demand for movement compared to the systems and capacities of available transportation infrastructure [4]. As a tourism area, the highest ratio of travel destinations in Bali is for working with 47.19% of travels, followed by 20.84% for tourism activities [5], indicating that tourism travel contributes significantly to total trips in Bali. The magnitude of the movement is closely related to the type and intensity of

activities in the tourist attraction location. In favourite tourist attractions such as Kuta, Jimbaran and Ubud, high congestion occurs on weekdays and holidays. It will cause a bad image of tourism in Bali, so it must be addressed immediately.

The choice of travel mode as important elements in transportation and tourism planning, plays an important role in determining transportation policies in tourism destinations. Therefore it is necessary to analyse tourist choices and make models that are sensitive to travel attributes that affect tourists in the choice of travel modes [6]. These processes and results are important to be known by the government and stakeholders in planning, drafting regulations related to innovation in the development of transportation and tourism technology, developing appropriate tourism marketing strategies, preparing infrastructure and managing traffic. Based on the background and description as described above, the problem could be formulated with the factors of travel characteristics of foreign tourists that influence the choice of transportation modes in tourism destinations and the model of mode choice of foreign tourists based on the characteristics of their trip.

## 2. Literature review of tourism transportation and modelling

Mode selection modelling is a dynamic model and is highly necessary in transportation planning, because it involves the efficiency of movement, the space that must be provided by a region, transportation infrastructure and the number of choices of transportation modes that can be chosen by users [7]. It is important to make a model that is sensitive to the attributes of travel that affect individuals in mode choice. This can be obtained by an aggregate approach. For this reason, the innovation in this research is to develop a travel diary-based questionnaire design, by involving tourists directly as an important source in tourism planning, so that they can explore the characteristics of tourist travel directly to the choice of modes, operators, number of group member, travel time and costs.

### 2.1. Tourist travel component

Tourism is a travel activity carried out by individuals or by a group of people while visiting certain places for recreational purposes, personal development or studying the uniqueness of tourist attractions visited [8]. According to [9] the components of travel include the destination of the trip, the duration of the activity, the mode of transportation, travel time, distance, group, traffic conditions and travel satisfaction as in Figure 1.

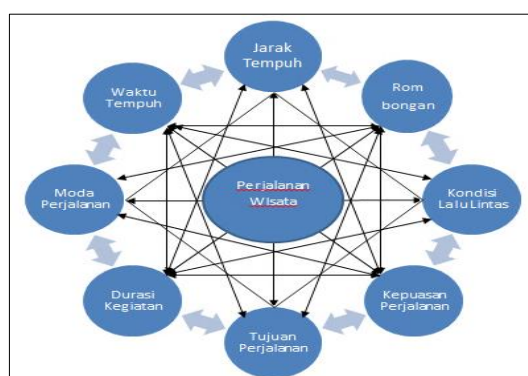


Figure 1. Tourist travel component.

### 2.2. Characteristics of international tourist travel

Based on the country of origin of foreign tourists who come directly to Bali during 2017, the five countries as the main market share of foreign tourists to Bali are Australia, China, Japan, Britain and India reaching 56.37% of the total of foreign tourists who come directly to Bali. Most of the foreign tourists coming to Bali mostly arrive through the entrance of Ngurah Rai Airport, which is 98.47% and

through the sea port are only 1.53% [10]. To get to the tourist attraction visited, the largest movement of the tourist trips production is amount 72.22% and trip attraction of 65.11% are from and to the Sarbagita region (Denpasar, Badung, Gianyar and Tabanan). This is because the location of tourist attractions and accommodation places are mostly located in the area located in South of Bali.

Characteristics of tourist travel towards tourist attractions are including distance, travel time and travel costs. Reduction in travel time and costs tends to increase travel between two places. However, in a number of cases, physical distance seems to be the main attraction for the location of tourist attractions that have certain characteristics, in fact the farther away the place will make it more attractive, the most important is the existence road network and modes of transportation so there is no problem with long distance. The travel cost to a tourist attraction can be estimated and will affect the possibility of a tourist trip. In general, the more expensive a tour will be, the fewer the requests. Cost is relative if people see costs as something relative to the value that can be obtained. In a small number of cases there is an inversion relation between cost and demand. In this case the higher the cost, the higher the demand [12].

### *2.3. Modes of transportation*

The mode of transportation is one of the important attributes of the tourist movement. The existence of various choices of tourism transportation modes grow rapidly. The modes choice in tourism destinations is influenced socio-economic characteristics of tourists and availability transportation characteristics. In the study of mode choice behaviour by tourists in Bali [13] can be identified the factors considered by foreign tourists in the choice of modes of travel in Bali, which are factors of travel costs, safety, comfort and travel time.

The modes of tourist transportation in Bali depend on the characteristics of operators and modes. Available operators are using travel agents, rental agents, public transportation and online transportation. While the characteristics of available modes include heavy vehicles, namely buses with a capacity of 20-40 seats, light vehicles including passenger cars with a capacity of 4 - 12 people, motorbikes and non-motorized vehicles.

### *2.4. Mode choices modelling*

The model is a reflection and simplification of reality for certain purposes and a good model is the more similar a model is to reality [14]. Although it is a simplification, the model can be very complex and requires a lot of data and a long execution. Models in mode choice vary greatly, depending on the purpose of transportation planning. Each mode is analysed separately during the stages of the modelling process, and user characteristics greatly influence the process of selecting travel modes. Each mode is considered to be competing in seizing of passengers, so the determinant attributes of the movement are the main factors that influence the choice of mode. Decision making to use certain modes is strongly influenced by factors according to the characteristics of road users, for example individual characteristics, travel characteristics and attributes of the trip.

To explain the mode of choice behaviour, except the socio-economic variables there are also affected by travel attributes. The travel attributes are time in the vehicle, time to stop, waiting time, transfer time, travel costs and behavioural. The results of the study [4] found that the travel attributes that influence the mode choice behaviour in Yogyakarta are: travel costs, parking fees, travel time, time between bus arrivals and time to bus stops. If more than one mode is available, the mode chosen usually has the shortest route, or the fastest, or cheapest, or a combination of the three.

## **3. Research instruments and variables**

The main instrument in this study is a questionnaire, which is designed to collect various data, including travel characteristics and attributes of travel modes. The questionnaire format refers to the questionnaire compiled in a previous similar study to record the daily travel of respondents [15]. The questionnaire was compiled in English in the form of "Travel Diary Survey Form", to record data on

the characteristics of tourist travel and daily travel for tourists when visiting tourist attractions [16]. The data collected are as follows:

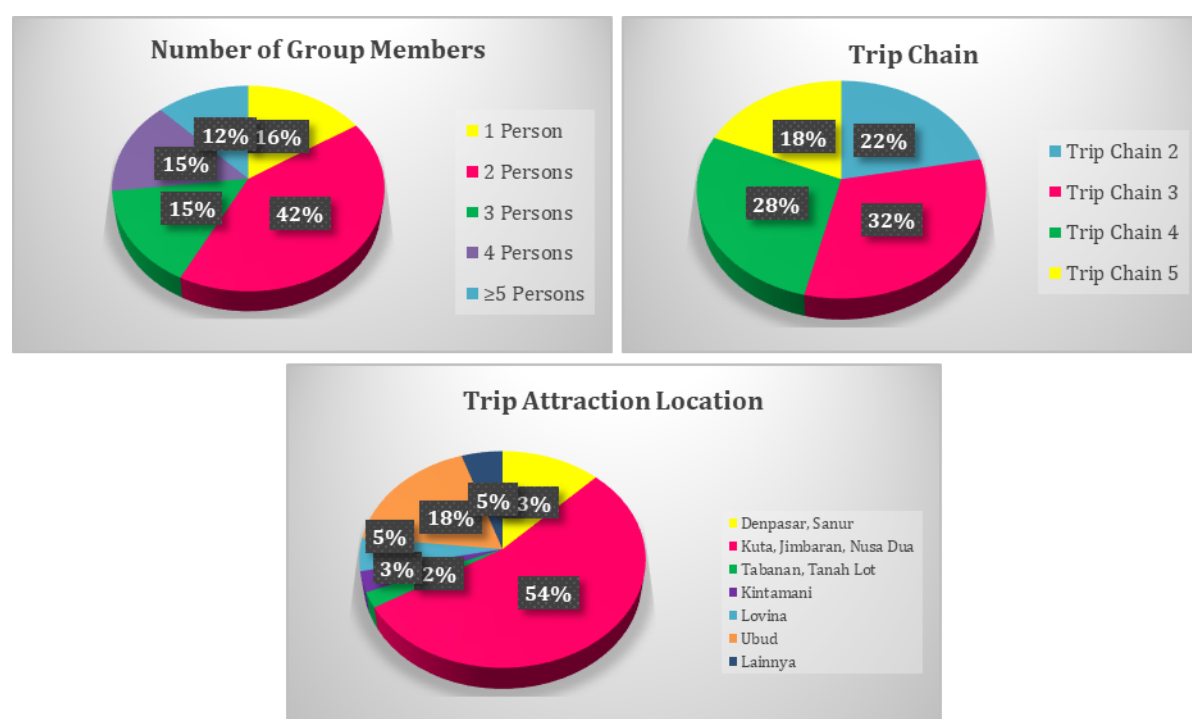
- The origin and destination of the trip, including the location and number of tourist attractions visited in one day
- Time departure and time arrival so that it can be known the travel time
- Travel costs for transportation only
- Operators and modes of transportation are used
- Number of group members

#### 4. Results and discussions

The population and sample as objects of observation in this study are expected to be able to represent the foreign tourist population visiting Bali with the aim for holiday. For this reason, in determining respondents according to the nationality of tourists visiting Bali, the majority were from Asia (38.50%), Europe (29.4%) and Australia (18.65%).

##### 4.1. Characteristics of tourist travel in bali

The characteristics of tourist travel during vacation in Bali are reviewed according to the location of tourist attraction, the number of group members and the number of trip chains according to figure 2.



**Figure 2.** The characteristic of tourist travel in bali.

The tourist attraction locations visited by most tourists are the South Badung region (Kuta, Nusa Dua, Jimbaran and Kerobokan) of 54%, which is in accordance with the government data in [16]. Whereas the second location is Ubud, visited by 18% tourists, and the third is Denpasar and Sanur, which are visited by 12% tourists. In [11], it was concluded that the highest production and attraction of tourist movements were from Kuta and Nusa Dua as much as 61.05% and the second was Ubud as much as 16.69%, it indicates the same results as this research survey. The number of members in a group towards the most tourist attraction is 2 people with 42% of group composition, one person with 16% and groups of 3 or 4 people, each with 15%. The number of members of a group going to the tourist

attraction location is related to the type of mode used, for those who are alone or both using motorbike or car modes while if the number is 3-4 people will use a car and for more than 5 people will use minibuses or buses. Furthermore, regarding the number of travel chains carried out, the survey results showed that most tourists choose 3 travel chains per day, namely 32%, then 4 chains as much as 28% and then 2 chains were chosen by 22% of tourists.

#### 4.2. The characteristic of travel mode attributes

The characteristics of the travel mode attributes that will be described are distance, travel time and travel costs as in Figure 3.



**Figure 3.** The characteristic of travel modes.

#### 4.3. The significant analysis

The characteristics of the travel mode attributes that will be described are distance, travel time and travel costs as in Table 1.

**Table 1.** The result of significant analysis (travel agent and rent).

Variable	Coef.	p >  Z	Coef.	p >  Z	Coef.	p >  Z
<i>Agent-Bus</i>						
<i>Base Category</i>						
Category	Agent-Car		Rent-Car		Rent-Motorbike	
Location	-0.0432	0.421	-0.144	0.009***	-0.3596	0.000***
Trip Chain	-0.1099	0.353	-0.0166	0.888	0.9637	0.000***
Number of Group	-0.3649	0.000***	-0.4862	0.000***	-0.8771	0.000***
Distance	-0.0194	0.905	-0.3258	0.054**	1.512	0.000***
Travel time	-0.1633	0.276	0.405	0.006***	0.8996	0.000***
Travel Cost	0.0993	0.528	-0.3809	0.018***	-3.58	0.000***
_cons	2.252	0.000	3.915	0.000	4.504	0.000

**Table 2.** The result of significant analysis (public transportation and online).

Variable	Coef.	p >  Z	Coef.	p >  Z	Coef.	p >  Z	Coef.	p >  Z
<i>Agent-Bus</i>								
<i>Base Category</i>								
Category	Public-Bus		Public-Car		Online-Car		Online-Motorbike	
Location	-0.4825	0.189	-0.0329	0.709	-0.02	0.792	-0.0756	0.503
Trip Chain	1.641	0.001***	1.719	0.000***	0.6171	0.001***	1.998	0.000***
No. of Group	-0.9238	0.021***	-0.6331	0.000***	-0.676	0.000***	-1.03	0.000***
Distance	4.719	0.000***	3.182	0.000***	-0.0699	0.763	2.781	0.000***
Travel time	1.357	0.068**	1.207	0.000***	0.3834	0.057**	1	0.000***
Travel Cost	-11.36	0.000***	-7.901	0.000***	-0.7179	0.003***	-6.722	0.000***
_cons	3.213	0.084	3.804	0.000	0.81	0.307	1.449	0.141

Notes:

\*\*\* Level of Signification 95%

\*\* Level of Signification 90%

#### 4.4. Modelling of mode choices

Based on CLogit estimation, utilities function, the Mode choices are as follows :

$$Z_{ij}(X) = \beta_{j-1} + \beta_j X_{i1} + \beta_j X_{in} \quad (1)$$

$$Z_{i1}(X) = -0.002X_{i22} + 0.008X_{i23}$$

$$Z_{i2}(X) = 2.068_{(2)} - 0.051X_{i1} - 0.347X_{i2} - 0.148X_{i3} - 0.002X_{i22} + 0.008X_{i23}$$

$$Z_{i3}(X) = 2.937_{(3)} - 0.149X_{i4} - 0.439X_{i5} - 0.191X_{i6} - 0.002X_{i22} + 0.008X_{i23}$$

$$Z_{i4}(X) = 2.456_{(4)} - 0.250X_{i7} - 0.701X_{i8} + 0.212X_{i9} - 0.002X_{i22} + 0.008X_{i23}$$

$$Z_{i5}(X) = -0.408_{(5)} - 0.059X_{i10} - 0.671X_{i11} - 0.067X_{i12} - 0.002X_{i22} + 0.008X_{i23}$$

$$Z_{i6}(X) = 2.121_{(6)} - 0.023X_{i13} - 0.527X_{i14} - 0.063X_{i15} - 0.002X_{i22} + 0.008X_{i23}$$

$$Z_{i7}(X) = -0.928_{(7)} - 0.026X_{i16} - 0.627X_{i17} + 0.297X_{i18} - 0.002X_{i22} + 0.008X_{i23}$$

$$Z_{i8}(X) = -0.634_{(8)} - 0.039X_{i19} - 0.948X_{i20} + 0.531X_{i21} - 0.002X_{i22} + 0.008X_{i23}$$

The probability of modes choices based on operator can be seen on Table 3.

**Table 3.** The probabilities of all modes.

Choices	Probabilities
Agent-Bus ( <i>Base Category</i> )	0.117
Agent-Car	0.189
Rent-Car	0.225
Rent-Motorbike	0.202
Public Transportation-Bus	0.086
Public Transportation-Car	0.180
Online-Car	0.051
Online-Motorbike	0.027

The models also was validated using Pearson correlation with value 98.7% and Root Mean Square Error with value 1.8%, that indicated that the mode choices model is valid.

## 5. Conclusions

The trip characteristic shows that the most attraction location visited is the South Badung region with around 54% of travel destination, then 42% of group composition who travel are composed by two people and the most choose three chains. The distance of tourist trip could reach 190 km and the most of the trips are around 10-30 km per day, while the travel time could reach 270 minutes, and the most of the trips are around 20-60 minutes per day. Travel costs per day are around Rp.20, 000-Rp.1, 250,000 per person depending on the distance, operator or mode choices used, and the most of majority cost by 24% is around Rp.100, 500-Rp.200, 000. The most influential travel characteristic factors on rental for nearly all factors such as a trip attraction location, number of a group member, trip chains, distance, travel time and cost, then travel agent are influenced by number of group member only. Online and Public transportation also are influenced by all factors except trip attraction location. According to the mode choices model analysed shows that the highest probability is to use both rental-car and rental-motorbike with 22.5% and 20.2% respectively, then the choice of Agent-Bus and Agent-Car with probabilities of 18.9% and 11.7% respectively. Public transportation-Car also have a high probability of 18% to be used. The choice to use of other modes such as Public-Bus and online transportation both by car and motorcycle modes, the probability is less than 5%. All models validated by observations data, and It has a very good significance level with a validation level of 93.194%.

## 6. References

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