

CHOICES MODELS OF TRIP CHAIN AND TRANSPORTATION MODE FOR INTERNATIONAL TOURISTS IN TOURISM DESTINATION ISLAND

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ABSTRACT: Trip chain and mode choices take the important role in transportation and tourism planning in tourist destination. This study analyzed the characteristic of individual and tourist trip to design models of trip chain and mode in Bali Island. These models are needed by the government and stakeholders in drafting regulations, innovation technology, marketing strategies, providing infrastructure and managing traffic. Data collection was conducted randomly through an interview-based questionnaire for international tourist to record the daily trips. The significance analysis of independence variables used multinomial regression. The result shows number of variables which significantly impacts trip chain and mode are age, education, number of visits, length of stay, distance, travel time and cost. Modeling used conditional regression. The model of trip chain shows that the increase in travel time and cost will be considered to prefer less on smallest chain or trip chain 2 choices, especially for repeater tourist. The probability is the more repetition visit of tourist in that island, it will be the more number of trip chain chosen. On mode choice based on operator shows that tourists who have performed trip chain 2-4 have the highest probability was Rent-Car, whereas who completed trip chain 5 or more have the highest probability was Rent-Motorcycle. This result indicates trend to transform of mode choice from car becoming motorcycle for the more number of trip chain has been made in similar operator. The more efficient modes needed for more number of trip chain with low cost and long distance.

Keywords: *Choices Models, Trip Chain, Transportation Mode, International Tourist, Bali Island*

1. INTRODUCTION

In the global tourism growth, which tends to increase generally, Indonesian tourism is now in the fourth position in Southeast Asia in bringing foreign tourists every year compared to neighborhood countries. In 2016, according to ASEAN statistic is known that Thailand could yield 32.58 million tourists, meanwhile Malaysia has 26.76 million tourists and Singapore has 16.40 million tourists, whereas Indonesia only generates 11.52 million international tourists per year [1]. The less recognized Indonesia for attracting foreign tourist is not the rarity effect of its tourist attraction, but it is the lack of tourism destination planning and management system, less excellent transportation system and accessibility [2].

Bali is a small island, one of the thousands of islands in Indonesia. It has natural attraction and culture that fixates to society daily lives. This factor has its appeal to attract international tourists. Furthermore, for 12 years Bali has been nominated as the best tourism destination island in the world [3]. In 2016, Bali has attracted 4.93 million international tourists to visit, which was 40% of the total foreign tourists who came to Indonesia [4]. Tourism is an

important role in Bali economic growth, but on the other side, tourism trips also contribute to external transportation impacts such as delay, queue, traffic accident, parking issue at tourist destination area, and environmental issues as shows by Gronau in Germany [5]. The lack of availability of a safe and comfortable public transportation makes people have their vehicle, at least a motorcycle [6]. This condition has introduced to the rarity of public transportation usage. Therefore tourists in Bali have been accustomed to renting a car or bike [7]. The mixing of various modes and destinations creates multiple problems in the traffic of tourism destinations, as mentioned by Widodo, et al in Manado [8]. The selection of trip chains and transportation modes plays an important role in determining transportation policies in island tourism destinations and requires an understanding of what influences tourists in choosing them, as mentioned by Can, V.V. in the study in Vietnam [9].

Therefore, it is considered necessary to analyze tourist choices and create a sensitive model towards trip attributes that impact tourist to choose their trip chain and transportation mode [10]. This study will examine the significance variables of individual characteristics and tourist trip as well as create

models for selecting trip chain and transportation mode for international tourist in Bali.

2. METHODS

2.1 Location and Time

This research was carried out in several locations of favorite tourist attraction that many tourists visit in Bali. It has been determined proportionally 12 locations among tourist attraction in Bali as survey locations. Study location map will be presented in Fig. 1. The survey period to collecting data was seasonal bases held on November 2016- February 2017.



Fig.1. Survey Location Map at Tourism Destinations in Bali

2.2 Data Collecting Method

Data collection for this research consists of two survey activities: (1) data collection on the characteristic of individual and trip, also attributes of trip chain and transportation mode to tourism destination. The survey method is by interviewing tourists using questions based questionnaire. The survey produced 1200 tourist daily trip data. Furthermore, a similar study was distributed as well to gather 340 trip data for model validation purpose. (2) There was also a survey for travel cost on mode operator and tourism association. This will give us a unit price of travel cost in Rupiah per kilometer for each of mode based on operator used by tourist.

2.3 Research Instrument and Variable

Questionnaire refers to instrument design of research in Malaysia and Bali [11,12], it was designed to collect data as variables as shown in Table 1 and 2 below.

Table 1. Independent Variables and Categories

I. Individual Characteristic			
No.	Variable	Category	
X1.	Gender	1. Men	2. Women
X2.	Age (years)	1. 12-19	2. 20-39
		3. 40-65	4. >65
X3.	Nationality	1. African	2. American
		3. Asian	4. Australian
		5. European	
X4.	Education	1. Highschool	2. Vocational
		3. University	

X5.	Job	1. Businessman	4. Student
		2. Professional	5. Others
		3. Employee	
X6.	Income (US \$ 1000)	1. <2	2. 2-4
		3. 4-6	4. 6-8
		5. >8	

II. Trip Characteristic			
X7.	Number of Visit Bali	1. once	2. twice
		3. third	4. ≥ fourth
X8.	Length of stay (days)	1. 1-3	2. 4-6
		3. ≥ 7	
X9.	Trip attraction	1. Nature	2. Art
		3. Artificial	
X10.	Location of trip attraction	1. Denpasar	2. Badung
		3. Tanah Lot	4. Kintamani
		5. Lovina	6. Ubud
		7. Others	
X11.	Number of the tour group	1. 1	2. 2
		3. 3	4. 4
		5. ≥ 5	

III. Chain/Mode Attributes			
X12.	Distance(Kilometers)		
X13.	Travel time(minutes)		
X14.	Travel Cost (Rupiahs)		

Table 2. Dependent Variables and Categories

No.	Variable	Category	
Y1.	Number of Trip chain	1. 2 chain	2. 3 chain
		3. 4 chain	4. ≥ 5 chain
Y2.	Mode-based of Operator	1. Agent-Bus	2. Agent-Car
		3. Rent-Car	4. Rent-MC
		5. Public-Bus	6. Public-car
		7. Online-Car	8. Online-MC

2.4 Data and Modeling Analysis

In this study, a significance analysis will be conducted between all independent variables against non-independent variables using Multinomial Logistic Regression (MNL) for main tourist trip attributes, which in this context is the trip chain and mode. Additionally, modeling for selecting some trip chain and the mode based on operator uses Modeling of Conditional Logistic (MCL) technique which takes distance, travel time, and cost aspect as part of the consideration. MNL and MCL modeling uses a STATA 13 software. The developed models will be validated using field observation data.

3. RESULT AND DISCUSSION

3.1 Individual and Tourist Trip Characteristic

Based on the data of tourist gender who visits Bali, it has shown a quite similar percentage between male tourist is 53.58%, and female tourist is 46.42%. Meanwhile from age factor, it has shown that the most dominant one is the young adult group (age 20-39 years) 69.25% and mature adult group (age 40-65 years) 24.83%. From an education aspect, university students have produced the most percentage at 62.83%. Based on occupation aspect, there is an entrepreneur at 25.75% and employee at 22.83% with the highest income ranges between US\$ 2000 – 4000 (32.67%). The characteristic of tourist travel in Bali is 48.50% counted as the first visit, with the period of stay is seven days or more at 46.33%. According to kind of attraction, visiting the natural, art-culture, and artificial have almost equal percentage visit. The favorite destination location can be seen in Table 3 and the modes uses shows in Table 4. The South Badung area has the most visited tourist which the

percentage is 54%. It was also consistent with previous study by Hermawati, et al, that South of Badung has contributed the most tourist attraction and movement area in Bali [13]. Modes use are dominated by rent-car 22.17%, travel agent- car mode 19.67% and rent-motorcycle 19.92%, with travel time is 20-270 minutes, travel distance is a maximum of 190 km per day, and travel cost is between IDR 20,000-1,250,000 per person per day.

Table 3. Tourist visits interest in each destination

Destination	Frequency	Percentage (%)
Denpasar	148	12.33
South of Badung	648	54,00
Tanah Lot	28	2,33
Kintamani	37	3,08
Lovina	59	4,92
Ubud	219	18,25
Others	61	5,09

Table 4. Use of operators and modes

Operator	Modes	Freq.	(%)
Travel Agent	Bus	161	13.42
	Car	236	19.67
Rental	Car	266	22.17
	Motor Cycle	239	19.92
Public Trans.	Bus	9	0.75
	Car	186	15.50
Online	Car	64	5.33
	Motor Cycle	39	3.25

3.2 Variable Significance Analysis

The results of parameter estimation on the trip chain and mode significance analysis, as shown in Table 5, Table 6a, and Table 6b.

Table 5. The Analysis Result of Variables Significance on Trip Chain based on Number of Visit

Variables	Coef.	p > Z	Coef.	p > Z	Coef.	p > Z
Trip Chain 2 Base Category						
Category	Trip Chain 3		Trip Chain 4		Trip Chain 5	
Gender	0.130	0.446	0.302	0.101*	0.219	0.286
Age	-0.021	0.041***	0.341	0.042***	-0.505	0.012***
Nationality	0.023	0.769	0.122	0.151	0.103	0.288
Education	0.420	0.000***	0.595	0.000***	0.413	0.003***
Occupation	0.086	0.149*	0.149	0.022***	0.092	0.220
Income	0.071	0.316	0.213	0.005***	0.079	0.355
No. of visit	-0.117	0.097**	-0.075	0.051***	0.208	0.019***
Length of stay	-0.183	0.091**	-0.621	0.000***	-0.109	0.021***
Tourist attraction	0.086	0.382	0.285	0.008***	0.452	0.000***
Location	-0.005	0.921	-0.095	0.061**	-0.061	0.267
No. of group	0.042	0.530	-0.029	0.695	-0.207	0.016***
Total distance	0.359	0.012***	0.316	0.031***	0.536	0.000***
Travel time	-0.314	0.008***	-0.192	0.018***	-0.241	0.072**
Cost	0.232	0.018***	0.406	0.000***	0.333	0.002***
_cons	-1.787	0.017	-4.341	0.000	-3.890	0.000

Table 6a. The Analysis Result of Variables Significance for Mode based on Operator
(Travel Agent and Rent)

Variables	Coef.	p > Z	Coef.	p > Z	Coef.	p > Z
Travel Agent-Bus	Base Category					
Category	Travel Agent-Car		Rent-Car		Rent-Motorcycle	
Gender	0.020	0.929	-0.455	0.045***	-1.107	0.000***
Age	0.175	0.036***	0.476	0.027***	0.460	0.077**
Nationality	0.234	0.035***	0.124	0.255	0.302	0.018***
Education	0.171	0.253	0.113	0.444	0.602	0.001***
Occupation	-0.089	0.307	-0.235	0.006***	-0.104	0.296
Income	0.309	0.002***	0.440	0.000***	0.063	0.610
No. of visit	0.469	0.000***	0.368	0.002***	0.415	0.002***
Length of stay	-0.657	0.000***	-0.335	0.034***	-0.526	0.004***
Tourist attraction	-0.571	0.000***	-0.111	0.418	0.177	0.279
Location	0.009	0.883	-0.141	0.019***	-0.399	0.000***
No. of group	-0.431	0.000***	-0.520	0.000***	-0.947	0.000***
Total distance	-0.081	0.046***	-0.444	0.016***	1.305	0.000***
Travel time	-0.060	0.105**	0.548	0.000***	0.990	0.000***
Cost	0.024	0.080**	-0.450	0.007***	-3.208	0.000***
_cons	1.733	0.104	2.966	0.005	5.543	0.000***

Table 6b. The Analysis Result of Variable Significance for Mode based on Operator
(Public Transportation and Online)

Variables	Coef.	p > Z	Coef.	p > Z	Coef.	p > Z	Coef.	p > Z
Travel Agent- Bus	Base Category							
Category	Public Transp.-Bus		Public Transp.-Car		Online-Car		Online-MC	
Gender	22.042	0.960	-0.510	0.130*	-0.226	0.505	-0.805	0.087**
Age	4.986	0.092**	0.106	0.045***	-0.387	0.335	0.366	0.362
Nationality	-1.197	0.283	0.532	0.001***	0.858	0.000***	0.636	0.006***
Education	6.076	0.015***	0.710	0.001***	0.507	0.068**	0.382	0.198*
Occupation	0.574	0.313	-0.082	0.493	-0.273	0.033***	0.124	0.450
Income	-1.104	0.234	0.724	0.000***	0.143	0.370	1.092	0.000***
No. of visit	0.823	0.028***	0.129	0.079**	0.590	0.000***	0.367	0.071**
Length of stay	-4.210	0.001***	-0.811	0.000***	-1.405	0.000***	-0.317	0.073**
Tourist attraction	2.523	0.018***	0.190	0.347	-0.044	0.827	-0.268	0.350
Location	-3.382	0.055**	-0.120	0.204	-0.057	0.517	-0.087	0.499
No. of group	-0.874	0.269	-0.761	0.000***	-0.938	0.000***	-0.964	0.000***
Total distance	8.182	0.004***	2.979	0.000***	0.015	0.095**	2.713	0.000***
Travel time	-0.405	0.084**	1.230	0.000***	0.355	0.098**	0.874	0.007***
Cost	-13.581	0.000***	-6.922	0.000***	-0.622	0.010***	-5.497	0.000***
_cons	-51.630	0.954	4.788	0.002	1.912	0.262	-0.063	0.976

Notes:

*** Significance level is 95%

** Significance level is 90%

* Significance level is 85%

In this analysis, trip chain 2 and travel agent- bus were used as each category base in the process of MNL parameter estimation of trip chain and mode. The independent variables are 14 variables of individual characteristic, travel characteristic, and mode attributes. The estimation results that is shown in Tables 5, 6a and 6b. It was demonstrated that significant level using MNL for four trip chains category and eight modes category is sufficient, based on likelihood ratio indicator, with pseudo R^2 value = 0.107 for trip chain and pseudo R^2 value = 0.366 for

the mode. They are on the acceptable value interval. Value of $p > |Z|$ has demonstrated the significance of independent variable with sufficient number on the level of 85%-95%. This result indicates some model estimation which represents significant variables that impact the trip chain and mode suitably. Based on that analysis, it can be identify persistent variables that have affected all the trip chain and mode significantly. These variables have a significant level of 90%-95%, and they are individual characteristic (age, education), travel characteristic (number of

visitors, length of stay) and mode attributes (total distance, travel time, and cost of the trip). This result is suitable for some studies in different countries. It has been explored that some factors have a significant role in choosing trip chain, for example a study by Subbarao in Mumbai, India resulted variables of individual characteristics are age and gender [14], whereas in Australia the significant variables are travel characteristic and mode attribute [15], and the most significant variable in Korea is individual character which is age [16]. A study by Ganzon, et al in Philippine has shown that travel cost, travel destination and mode are the most significant variables on mode choices [17]. These significant variables will be quantified in arranging model choices.

3.3 Choice Model of Trip Chain

The trip chain is a cycle of the trip made by people from their origin/hotel/household to other places and comes back to their origin place. It includes all trips to various destinations that have taken place between the departure point and arrival point [18]. On this study, categorize of trip chain into four alternatives, as describes in Figure 2. The model for choosing trip chain will be based on the

number of a tourist come to Bali has been performed for the last five years and also will be categorized into 4 (four) alternatives visit. The result of parameter estimation for trip chain model from each category number of the tour will be presented in Table 7.

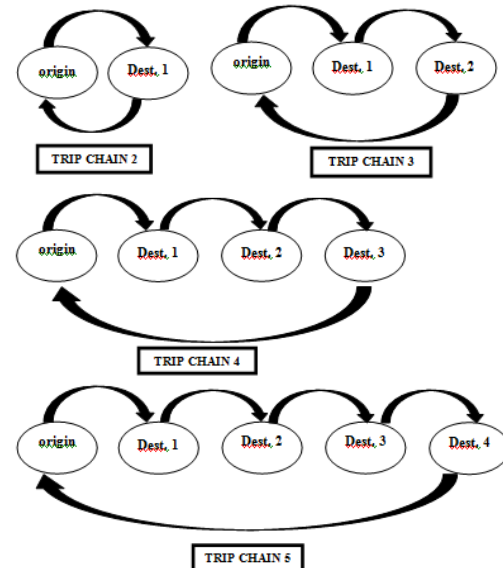


Fig. 2. Categories of trip chain based on Destination

Table 7. Parameter Estimation Result of Trip chain Model based on Number of Visit

Variables	First Visit		Second Visit		Third Visit		Fourth Visit	
	Coef.	OR	Coef.	OR	Coef.	OR	Coef.	OR
Trip chain 2 (Base Category)								
Trip chain 3	0.349	1.561	0.395	1.485	1.451	4.267	1.417	4.125
Trip chain 4	0.167	0.747	0.536	1.709	1.780	5.932	2.787	16.233
Trip chain 5	0.261	1.166	0.472	1.603	2.487	12.022	2.865	17.555
Travel Time (minutes)	0.024	1.024	-0.009	0.991	-0.021	0.979	-0.111	0.895
Cost (IDR 10.000)	0.103	1.108	-0.010	0.990	-0.041	0.960	-0.214	0.808

Refer to travel time coefficient also with odds ratio (OR) values, it appears that for the first visit the travel time coefficient has a positive mark (+). It's mean an increase of one minute travel time on the base category, meanwhile travel time on other trip chain has remained the same, this will impact on the increasing choice for trip chain 2 for 2.4%. On the other side, travel time coefficient becomes negative (-) on repeating visit and will decrease the opportunity of trip chain 2 for 0.9% on the second visit, 2.1% on the third visit, and 10.5% on the fourth visit and more. Furthermore, still referring to table 5, the travel cost coefficient has a positive mark (+) on the first visit. This coefficient and OR values shows an increase in cost at IDR.10.000 at base category meanwhile the price for other trips remained the same, therefore it will increase the option for those trips for 10.8%. On the other side for repeating visit, it will decrease the possibility for trip chain 2 on the second visit for 1%,

on the third visit for 4% and fourth visit and more for 19.2%.

Based on the above analysis, there is an indication for first visit tourist with increased travel time or cost using the trip chain 2 will improve the selecting of the chain. Meanwhile, for repeating visit, it will decrease the option for trip chain 2. In other research, a model of trip chain for the work trip, in this case a journey of an employee from Ternate Island to Halmahera Island has generated a commuter of the state employee who considers travel time more important than the cost of it to be punctual [19]. In this relevant matter, they have allocated a budget for their travel cost monthly. A study case in Norway has shown that the life pattern of the family with children has profoundly affected the choice of trip chain and makes it more complicated [20]. Next case, an analysis of a trip chain for the student in Bandung was profoundly affected by the status as each student, residential, location of the campus, and the social

economic characteristic [21]. This research on trip chain analysis at island tourism destination is for the first time being studied, and it generates a conclusion of that the increase of travel time and cost could be a consideration to decrease trip chain 2 choices or to increase other choices of more trip chain, especially for repeat visitors.

Furthermore, the trip chain model probability of each visit category and its validation of field observation data will be displayed in Table 8. According to OR value in Table 7 and model probability in Table 8, it shows that first visit tourist has chosen trip chain 3 for 1.561 times more than trip chain 2 with 34.9% probability. On the second visit category, they mostly have trip chain 4 which is 1.709 times more than trip chain 2 with 29.5% probability. Additionally, for the third and fourth visit category, trip chain 5 has the highest choice with 12.022 times more and 17.555 times more than trip chain 2 with each probability is 51.8% and 45.1%. These probabilities indicate the more visit tourists have, they tend to choose the higher number of trip chain.

Meanwhile, a trip chain comparison study between female and male from household to the workplace has generated more trip chain on female by consideration that female usually has the role as the caretaker of the domestic family [22].

The model validation for the trip chain of the first visit will be displayed on the graph in Fig. 3 and for repeating visit will be in Table 8. It has performed the values of a model parameter from the trip chain after being compared to field observation data has resulted in a solid validation figure. The average of validation for the first visit is 88.59%, the second visit is 90.03%, the third visit is 92.98%, and fourth visit or more is 90.84%. The other indicator is the difference probability of the chosen trip chain between model and observation has a very minimum error, based on Root Mean Square Error (RMSE) value 0.014 -0.036 or less than 0.05. By using those indicators, it has shown that the designed trip chain model is valid and could fully represent variables to choose a trip chain at tourism Destination Island.

Table 8. Validation of Trip Chain Choice Model

Number of Trip chain	Validation Level											
	1 st Visit(%)			2 nd Visit(%)			3 rd Visit(%)			4 th Visit(%)		
	M	O	LV	M	O	LV	M	O	LV	M	O	LV
Trip Chain 2	22.4	24.4	91.43	17.2	21.1	81.64	4.3	4.9	88.28	2.6	3.3	78.38
Trip Chain 3	34.9	28.6	81.90	25.6	26.8	95.72	18.4	19.5	94.19	10.6	11.5	92.38
Trip Chain 4	16.7	19.0	87.85	29.5	25.4	85.99	25.5	26.8	95.21	41.7	39.3	94.32
Trip Chain ≥ 5	26.1	28.0	93.16	27.7	26.8	96.77	51.8	48.8	94.22	45.1	45.9	98.28
Average			88.59			90.03			92.98			90.84

Notes: M = Model Probability O = Observation Probability LV = Level of Validation

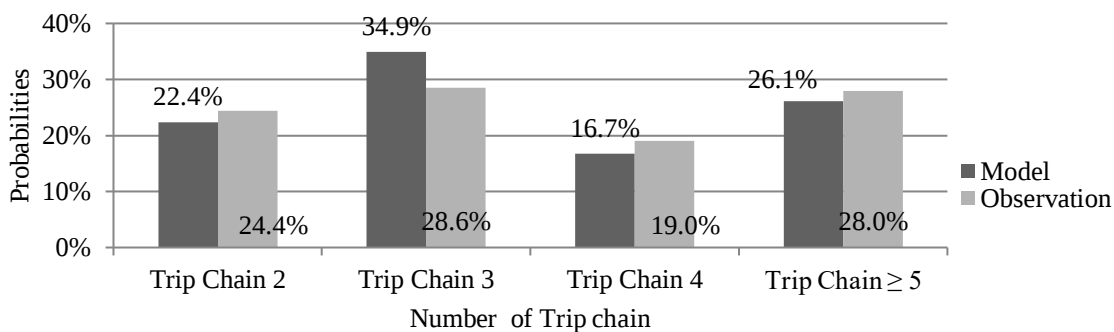


Fig. 3. Validation of Trip chain Model for First Visit Category

3.4 Choice Model of Mode Based on Operator

The model of mode choice is based on some trip chain on the period of stay in Bali. The option of mode based on operator is categorized into 8 types of mode which are : Travel Agent-Bus (TA-Bus), Travel Agent-Car (TA-Car), Rental-Car (Rent-Car), Rental-Motorcycle (Rent-MC), Public Transport-Bus (PT-Bus), Public Transport-Car (PT-Car), Online-Car

(OL-Car), Online-Motorcycle (OL-MC). Trip chain is categorized into 4 (four) alternatives. The result of parameter estimation for mode choice model from each category trip chain will be presented in Table 9. Refer to travel time coefficient in that table, on categories of trip chain 2, 3, and 4, where travel time coefficient is negative (-), it has shown an increasing travel time for 1 (one) minute on TA-Bus as a base

category, this factor will decrease the option of the previous mode on trip chain 2 by 0.3%, on trip chain 3 by 0.5% and trip chain 4 by 1.5%. On the other side when the travel time coefficient is positive (+) on trip chain 5 or more, it will increase the option for TA-Bus by 0.6%. Another point from Table 9 about cost, when all trip categories have a positive (+) cost

coefficient meaning there is an increase in price for IDR 10,000 on TA-Bus mode, It will increase the selection of this mode by 2.8% on trip chain 2, on trip chain 3 by 0.2%, on trip chain 4 by 0.4% and on trip chain 5 or more by 1.8%. This condition applies if travel time and cost on the other modes are unchanged.

Table 9. Parameter Estimation Result of Mode Choice Model based on Trip Chain

Variable	Trip Chain 2		Trip Chain 3		Trip Chain 4		Trip Chain ≥ 5	
	Coef.	OR	Coef.	OR	Coef.	OR	Coef.	OR
<i>TA-Bus (Base Category)</i>								
TA-Car	0.804	2.234	0.094	1.099	0.092	1.096	0.411	1.509
RENT-Car	1.015	2.760	0.193	1.213	0.825	2.283	-0.224	0.800
RENT-MC	0.692	1.997	-0.071	0.931	0.596	1.815	1.103	3.014
PT-BUS	-2.279	0.102	-3.086	0.046	-2.668	0.069	-2.680	0.069
PT-Car	0.726	2.067	0.131	1.140	-0.211	0.810	0.815	2.260
OL-Car	-1.049	0.350	-1.852	0.157	-0.113	0.894	-0.846	0.429
OL-MC	-2.307	0.100	-1.704	0.182	-1.520	0.219	-0.078	0.925
Travel Time (minutes)	-0.003	0.997	-0.005	0.995	-0.015	0.985	0.006	1.006
Cost (IDR. 10,000)	0.028	1.028	0.002	1.002	0.004	1.004	0.018	1.018

Based on the above analysis, for tourist with trip chain 2, 3, and 4, there is an increase in travel time on TA-Bus, and it will decrease the option for this mode. In fact, it will increase the preference for this mode on trip chain 5 or more. Whereas, the increased travel cost will induce the increasing preference for mode TA-Bus for all trip chain categories. A study has generated useful mode information for traffic and facility management at one of a tourist resort in Japan [23]. Many studies about transportation mode only emphasized on work travel, school trip, and shopping trip but rarely about tourist trip. Therefore through this study, the modeling to choose transportation mode has been explored especially based on mode operators, which is specific in tourism trip. It has demonstrated that a tour with the number of trip chain 5 or more, if there an increased travel cost and time,

tourists will prefer an operator who can manage their tours such as a travel agent in comparison to rent, public transport, and online modes, regardless they need to pay more.

Referring to OR value in Table 9 and probabilities on Table 10, a tourist who did trip chain 2, 3, and 4, the highest probability on Rent-Car, which is 26.0%, 21.0%, and 27.9%, with a value of 2.760 times, 1.213 times and 2.283 times more than TA-Bus. Whereas for tourist who did trip chain 5 or more the highest probability is 30.1% on Rent-MC which is 3.014 times more than TA-Bus. This indicated that the more significant number of trip chain, the higher motorcycle selected compare to the car, with the similar rental operator. This preference is because tourist who travels with some trip chain 5 or more needs a more efficient mode.

Table 10. Validation of Mode Choice Model

Modes Based on Operator	Validation Level											
	TC 2 (%)			TC 3 (%)			TC 4 (%)			TC 5 (%)		
	M	O	LV	M	O	LV	M	O	LV	M	O	LV
TA-Bus	9.4	10.1	93.06	17.3	17.7	97.91	12.2	12.0	98.53	10.0	10.5	94.96
TA-Car	21.1	21.5	97.86	19.0	19.8	96.24	13.4	13.0	96.82	15.1	15.8	95.51
RENT-Car	26.0	25.3	97.32	21.0	20.8	99.05	27.9	27.8	99.60	8.0	8.8	91.12
RENT-MC	18.8	19.0	99.13	16.2	14.6	90.29	22.2	23.1	95.79	30.1	31.6	95.39
PT-BUS	1.0	1.3	76.25	0.8	1.0	76.03	0.8	0.9	91.57	0.7	0.0	0.00
PT-Car	19.5	19.0	97.49	19.8	19.8	99.85	9.9	10.2	97.13	22.6	21.1	93.19
OL-Car	3.3	2.5	76.65	2.7	3.1	87.08	10.9	10.2	93.30	4.3	3.5	81.80
OL-MC	0.9	1.3	74.11	3.2	3.1	99.09	2.7	2.8	96.24	9.2	8.8	94.92
Average			88.98			93.19			96.12			92.41

Notes: M = Model Probabilities O = Observation Probabilities LV = Level of Validation TC = Trip Chain

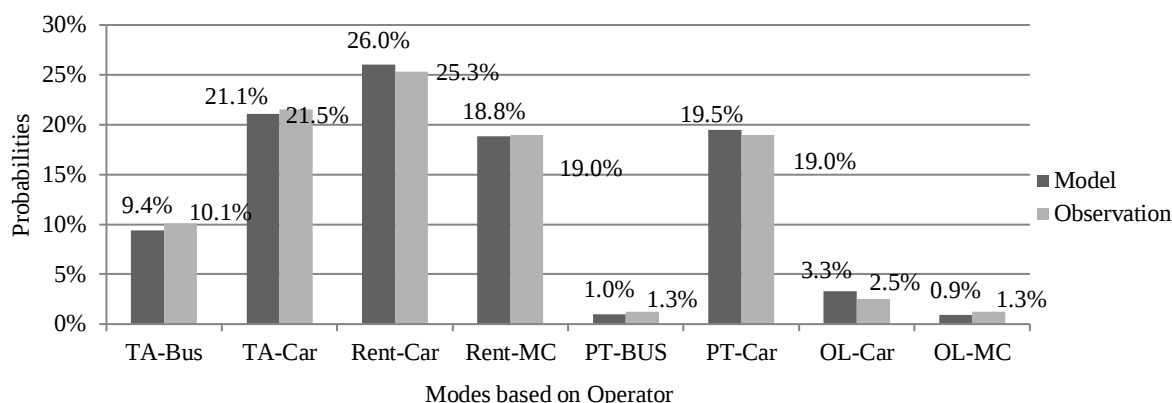


Fig. 4. The Validation of Mode Choice Model for Trip Chain 2

The estimation result on the model parameter to select a transportation mode is validated by field observation data shown in Table 8. The model validation for trip chain 2 also displayed as the graph in Fig. 3. The validation data in Table 8, that model of trip chain two has presented a reasonable level of significance with average validation is 88.983%, whereas trip chain3 has 93.194%, trip chain 4 has 92.412%. The RMSE value indicates the discrepancy indicator between the model parameter and observation data in the range of 0.006-0.020 or less than 0.05, which considered minor. These indicators refer to a valid model and representative variables for selecting a good mode based operator.

4. CONCLUSIONS

Significant factors that affect tourists to decide the trip chain and transportation mode in Bali as a tourism destination are age, education, number of visit, the length of stay, and travel mode attributes (such as distance, travel time, and travel cost). This result corresponds to other studies from different countries. It has also stated that contributed significant factors to the mode choices are individual characteristic, trip characteristic, and trip attributes. The type of variable will be slightly different in between countries for example in Vietnam they have mode quality variable, and in Philippine they have trip destination factor. In the model of selecting trip chain, it has shown that increased travel time and the cost will decrease the choice of trip chain 2 especially for repeating visitor or more than two times visit. Therefore, if there is the increasing number of travel time and cost, tourist will choose the number of trip chain that more significant than 2. But for first-time visitors, they usually prefer trip chain 2 with a sightseeing purpose. The probability and Odds Ratio shows that the more visits tourist has, the more amount of trip chain they choose. This is a sign for repeating visitors, aside from visiting a new tourist destination they also visit places they have visited before with a shorter period. That repeated visits will increase the number of the trip chain. This trip chain and mode choice analysis at

tourism destination Island are genuinely explored in this study, especially mode choice based on operator which is specific to tourist trip. The mode choice result is for tourists whose have trip chain 5 or more, if there is an increase on travel time and cost for Travel Agent-Bus, they still prefer an operator who can manage their tour like a travel agent in comparison with another operator like rent service, public transportation or online ones. They prefer to have a relaxing journey, enjoy the scenery and able to visit more destinations even with the more significant cost. The probability of selecting mode based operator shows that tourists who performed trip chain 2,3 and 4 have chosen Rent-Car as the mode and operator. Meanwhile, for tourist who did trip chain 5 or more, the highest probability was using Rent-Motorcycle. This explains that the more trip chain they have, there will be a mode transition from the car to the motorcycle using a rent service based operator. Therefore, it is necessary to choose a more efficient transportation mode to travel around faster between locations, avoid the traffic jam, has the low cost for long distance.

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