Mode Choice Behaviour in Leisure Travel: A Case Study of Indian Cities

Praveen Samarthi and Kumar Molugaram

Abstract Travel behaviour exploration of Mode choice is burdensome for leisure travel and is influenced by the heterogeneity of traveller preferences. One of the indicators of improvement in living standards is an increase in leisure travel. The research is an effort to comprehend the mode choice process of domestic tourists in India, which has witnessed rapid growth in the last 20 years. Data required for the study is collected through on-site personal interviews at selected tourist destinations having a distinct leisure value, viz., cultural and historical heritage. Two cities, Hyderabad and Delhi and are chosen as the study cities. Logit models depicting the mode choice decision of a tourist are developed for the two cities. In addition to traveller characteristics and mode characteristics, the level of importance accorded to modal characteristics is incorporated into the model framework. Analysis of modal share indicates that train takes a predominant share among the travel modes. The mode choice models developed indicate that all the modes are competing in Delhi, while in Hyderabad, paid modes of transportation w.r.t road (bus and taxi car), train, and self-driven car are in competition with one another. The value of travel time is found to be comparatively higher when compared to commuter travel for both destinations. Household income and the importance factor associated with hand budget are found to be significant variables influencing the choice of a mode while travelling to a historical heritage destination. The study results highlight the need to incorporate qualitative attributes in modelling of mode choices. The need to evolve specific strategies to improve the patronage of the public transport system is emphasised.

Keywords Destination choice · Leisure travel · Mode choice · Models · Traveller preferences

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1 Introduction

Travel behaviour research entails determining how people plan their trips, including the destination they choose, the time they travel, the kind of transportation they use, and the route they take. Travel behaviour studies are a useful link in transportation planning as the motivations for the traveller in transportation choices are to be ascertained. Among the various trip purposes, like travel to work, shopping, education, etc., leisure travel has received less attention on account of its inherent heterogeneity and flexibility. This is so, even in developed countries like Germany, where in 1997, 48% of all the person-kilometers has travelled for leisure and holiday purposes, which was twice the amount for commuting [1]. Developing countries like India are also witnessing a number of domestic tourist visits which steadily increased from 66 million in 1991 to 560 million in 2019, an increase of 740% over a 28-year period [2]. Because of the large range of leisure activities sites and flexibility associated with personalised modes which are coupled with an inefficient public transport system, therefore individual motorised modes are being widely used for domestic leisure travel. This has a bearing not only on the congestion on the existing road network, but also on energy use and emissions of greenhouse gases [3].

Leisure travel, often known as tourism, refers to excursions taken by a traveller outside of his or her typical surroundings for less than a year and a primary purpose other than to work for a resident entity in the destination [4]. Travellers undertaking the trip for the purpose of leisure are referred to as tourists and qualify as a domestic tourist. In this paper, the travellers undertaking travel for the purpose of leisure are referred to as tourists. Leisure trips are characterised by greater flexibility and the choice of mode may involve a single or combination of modes which cannot be classified as primary and secondary based on travel distances as in commuter travel. Network connectivity is also an influencing factor. This makes the modelling of mode choices more challenging.

A review of earlier studies on mode choice aspects of commute trips indicate that the factors influencing mode choice can be classified as user characteristics such as age, gender, socio-demographics, etc.; transport system characteristics such as access time and cost, frequency of service, etc., and travel characteristics such as total travel time and total travel cost. Modelling structures such as multinomial logit and nested logit are also attempted by researchers to study the intercity and commuter mode choice scenario [6–21]. Variables used in utility function specification include travel time, travel cost, departure time and frequency, access time, and socio-demographic characteristics like household income, group size, occupation, etc. The use of artificial intelligence methods like neural networks, fuzzy logic, multi-recursive partitioning, bayesian network, and neuro-fuzzy techniques are also used in the prediction of mode choice selection [21–24].

A few studies are also conducted in the aspect of mode selection in the leisure travel context. The mode choice decision for leisure travel is found to depend on the Trip type, destination, travel party size, travelling with children, and trip length are all factors to consider [25]**.** The forces driving leisure travel demand are identified

as determinants and motivators [26]. Income, free time, and pricing, as well as the quantity and quality of the product provided by service providers, are all determinants. Motivators are linked to personality traits and attitudes, and they're likely to be influenced by the consumer's socioeconomic and demographic features. It is emphasised that when assessing determinants and motivators, it is also necessary to recognise the special role that modes play in leisure travel. Constraint variables such as age, income, and life stage have also been proven to influence travel preferences [27]. The sensitivity to the distance of tourists was also investigated, and it was discovered that household income, the number of children on the trip, the size of the city of residence, the mode of transportation, the desire to discover new places, variety-seeking behaviour, and the motivations for taking the trip will influence the sensitivity to distance [28]. The influence of trip context on the mode choice decision of leisure tourists in Australia was also explored [29].

Researchers have studied transportation mode decisions in depth for a variety of travel purposes, but leisure trips and, in particular, tourism, have not been studied due to heterogeneity in travel preferences and, most likely, because transportation authorities have given the work commute top priority. Furthermore, the majority of the studies are based on data from rich countries; only a few studies from developing countries have been reported. Due to disparities in vehicle ownership levels, mobility needs, infrastructure provisions, and travel and activity characteristics, mode choice options in industrialised and developing countries may differ significantly. Several context-specific elements of mode choice behaviour in developing nations, such as leisure context, must be explored. In such conditions, research in this direction is required to understand the effect of different variables on mode choice in the Indian context. This study analyses the mode choice behavior of domestic leisure tourists to two historical heritage destinations in India, namely Delhi and Hyderabad, and aims to identify the influencing dimensions. Models were developed for two destinations, namely Delhi and Hyderabad. Significant factors affecting the choice behaviour are identified. The mode choice model aids in determining the current trend in leisure travel destination selection as well as the necessity for any improvements at the destinations in order to enhance the number of visitors to a specific region [33]. The effect of new transportation facilities on other forms of transport and people's mode choice is studied in the central zone of Hyderabad. The mode choice model aids in comprehending the current mode competition trend in the research region as well as the effects of new transportation systems on existing modes of transportation and people's mode preferences [34]. The factors considered include household traits such as household income, vehicle ownership, and the number of elderly or children in a family; trip traits such as travel time and travel cost; and behavioral intents measured on an importance rating scale for variables related to social aspects, destination values, travel, and other factors [35].

2 Methodology Adopted

This section is divided into sections that describe the study cities and sample and the study instrument used for the study.

2.1 Study Areas and Sample

The mode choice behaviour of domestic tourists visiting two renowned tourist destinations in India, United Delhi and Hyderabad, having historical significance are considered for the study. United Delhi includes Old Delhi and New Delhi, Old Delhi comprising of the formidable mosques, monuments, and forts, while New Delhi displays the fine architecture of the British Raj. The famous attractions in Delhi include the Red Fort, Qutub Minar, India Gate, and Raj Ghat. Hyderabad, popularly known as the Pearl City, is home to a plethora of tourist attractions including heritage sites, lakes, parks, and museums, as well as excellent cuisine and a pleasurable shopping experience. Hyderabad gives an interesting glimpse into the past, with a 400-year-old cultural and historical legacy. The Charminar, Hussain Sagar Lake, Salar Jung Museum, and other tourist sites in Hyderabad. Domestic tourists are interviewed at locations within the study cities. The eligibility criteria fixed for the selection of a respondent is that he/she should not be a resident of the city in which the data is collected and he/she should be staying in the city for at least one night. 300 tourists in each study city are interviewed.

2.2 Study Instrument

A self-administered questionnaire is used to collect the relevant information from the tourists. Although the aspect of mode choice behaviour of domestic tourists is part of a larger study to analyse the travel behaviour of domestic tourists, this section describes aspects relevant to mode choice only. The aspects influencing mode choice are grouped under four categories namely characteristics of the decision maker like household income, vehicle ownership; household demographics, etc., journey characteristics, which include a budget for the trip, trip sponsor, trip planner, group size, etc., features of transportation facilities such as journey time by main and other modes; cost of trip; service offered, etc., and qualitative factors which include the level of importance in a 5 point type scale. Travel-related dimensions include direct connectivity, availability of affordable travel modes, comfort and convenience of travel, distance from home, and safety during travel; social dimensions include the budget available and the number of elderly or children in the family; and social dimensions include direct connectivity, availability of affordable travel modes, comfort and convenience of travel, distance from home, and safety during travel.

3 Sample Characteristics

The socio-demographic details and mode share of the tourists are given in Table 1. The sample data indicates that the majority of tourists visiting the two cities are of the middle-income group. The family size in general ranges between 5 and the majority of the tourists have a car as well as a two-wheeler. The majority of tourists visiting Hyderabad are in groups of 3–4 members, while those visiting Delhi have a group size of 1–2. The train is found to have the highest patronage, followed by air in the case of Delhi and bus in the case of Hyderabad. The average travel distance travelled by tourists to Delhi is higher than those to Hyderabad. However, the average unit cost per 100 km distance is higher for the train mode at Hyderabad, while it is higher by bus mode for Delhi. The average travel time is similar for air, hired car, and self-driven car at both destinations.

4 Model Development

This section presents the details of the model development with respect to the variables considered for modelling, selection criteria for variables, and details of model estimation and validation. Multinomial logit (MNL) and Nested logit (NL) models are based on random utility techniques provided by Domencich and Mcfadden [20]. Ben-Akiva and Lerman developed discrete choice (logit analysis) which stated that visit to multiple destinations was viewed as a rational behaviour pattern that reduces the time and cost associated with travel [4].

4.1 Variable Specifications

The measurable part of the utility equation consists of unique variables, specific variables-alternate and specific constant-alternate. In this study, time of travel and cost of travel are considered as unique variables; personal or household characteristics like household income, vehicle ownership, etc., are considered alternative-specific variables. The details of the variables used in the development of the model are given in Table 2.

4.2 Selection Criteria of Variables

The minimal utility function definition is studied first, which comprises variables that are regarded as fundamental to any realistic model. Such variables included travel time, travel cost, household income, group size, travel frequency, etc. Each stage

Table 1 Leisure travel characteristics of tourists visiting different cities

Characteristics	Delhi	Hyderabad
Monthly household income (')	(%)	(%)
LIG-upto Rs.20,000	8.0	6.0
MIG-Rs.20,001—75,000	81.0	93.0
HIG- > Rs.75,001	11.0	1.0
Household size	(%)	(%)
1–2	0.0	0.0
3–4	13.0	34.0
5–6	60.0	66.0
7–8	19.0	0.0
> 8	8.0	0.0
Vehicle ownership	(%)	(%)
Only car	9.0	5.0
Only Two-wheeler	16.0	14.0
Both car and two-wheeler	72.0	80.0
No vehicle	3.0	1.0
Group size	(%)	(%)
1–2	42.0	22.0
3–4	33.0	51.0
5–7	10.0	23.0
8–10	6.0	2.0
> 10	9.0	2.0
Trip frequency	2.7 (1.0)	2.8 (0.9)
Modal share	(%)	(%)
Air	12	2
Train	77	68
Bus	6	21
Hired car	1	6
Self-driven car	4	3
Average travel distance travelled (km)	985.9 (590.5)	641.4 (407.2)
Average unit cost paid by distance (')	1.8 (1.2)	2.0 (1.8)
Avg. Travel time per distance of 100 km (Hours)	0.19	0.21
Air transport	2.15	2.73
Train transport	2.90	1.92
Bus transport	1.96	2.50
Hired car transport Self car	2.24	
Average rating based on the importance of qualitative dimensions	4.52 (0.61)	4.30 (0.71)

(continued)

Table 1 (continued)

Characteristics	Delhi	Hyderabad
Travel safety		
Travel comfort and convenience	4.00 (0.67)	3.81 (0.83)
Hand-Budget for making the trip	3.95 (0.89)	3.59 (0.88)
Affordability of transportation modes	3.60 (0.99)	3.52 (0.79)
Involvement of the elderly/children in the family	3.40 (1.00)	3.19 (0.90)
Direct communication	3.83 (0.87)	(0.99)
The distance from your residence	3.20 (1.06)	3.32 (0.95)

Table 2 Variables used in the development of model

Factors name	Definition	Details of data coding
Cost of travel	Cost of travel in Rs	In numbers as actual
Travel time	Time taken in travel in minutes	In numbers as actual
Monthly Household Income	Taken in Rs. Per month in seven categories	In increasing order from 1 to 7 as income increases
Vehicle Ownership	Total number of vehicles in the family	In numbers as actual
Persons accompanying	Number of people accompanying the respondent	In numbers as actual
Trip frequency	Average number of times in a year a leisure is made	In increasing order as frequency increases
Service used	Service class availed in a mode	In decreasing order as cost and comfort increases
Rating given to factors	Importance given in a 5 point Likert type scale	1 indicates 'Extremely Unimportant' to 5 indicates 'Extremely important'

of the model creation process introduces incremental changes to the modal utility functions, and the model is re-estimated to arrive at a more precise model specification. A variable's inclusion or exclusion is determined by its sign and statistical importance. The variable's sign should be logically correct. For any variable, t-ratio should always be more than +1.960 and less than –1.960 for 95% confidence level.

4.3 Model Estimation and Validation

The software, 'ALOGIT' is used for estimation of the model and validation. The statistical importance of the estimation results is checked by maximum likelihood values and their convergence. Also the value of ρ^2 value, more than 0.25 is considered reasonably good [32]. A nested structure that improved the model convergence (given

by likelihood ratio) and ρ^2 value is considered to be good. With this reasoning, various nested structures are attempted in search of a more refined model. In case, the log sum value is found to as equal to one, multinomial logit (MNL) structure is considered. About 15% of the total sample is randomly selected to carry out the validation process. The significance of validation results is checked by total likelihood and prediction success. The validation percent right of value of more than 50% is considered satisfactory.

5 Results

The mode choice models for Delhi and Hyderabad are discussed in the following sections.

5.1 Mode Choice Model for Delhi

A MNL structure is found to be the best-fit structure defining the mode choices of the tourists visiting Delhi. The estimated values of various variables and other statistical parameters of the Multinomial Logit (MNL) model are provided in Table 3.

Travel time is found to influence tourists more than travel cost. Household income and service preference are highly significant variables. It is clear that a small change in household income may affect the use of air travel. The increase in the importance given to comfort and convenience by tourists affects the use of bus adversely as a long-distance travel mode. The presence of children or elderly on a trip encourages the use of car category (owned car or hired car), though not in a proportionate manner. In case the service quality of the train reduces, the use of the train as a long-distance travel mode also reduces. This also implies that these tourists place a higher value on comfort and ease throughout their travels than on cost. When choosing a means of transportation, the presence of the elderly or youngsters in the family is given a higher priority than comfort and convenience during travel. The calculated values of the air and car category constants suggest that some unanticipated characteristics impede the utilisation of those modes.

The results obtained from statistical tests are found to be logically correct. Log likelihood with variables values showed good convergence as compared to log likelihood with constants only. Rho-squared values indicate towards high good-fit model ($\rho^2 > 0.25$). Percent right (59%) found to be satisfactory. The SVT is perceived by the tourists in Delhi to be quite high. In terms of 'per family' or 'per person', it comes out to be 1.04 times and 5.25 times, respectively, of the SVT in general. A higher value of time may be perceived by the tourists due to the large number of historical and cultural monuments present in the city for their visit and the value they derive out of the visit.

Table 3 Statistical values for the best fitting model of tourists visiting Delhi

Factor	Coefficient estimates	Variable relevancy
Travel time	−0.1082 (−3.5)	Generic
Travel cost	-0.4347×10^{-3} (−2.0)	Generic
Household income	1.430 (4.7)	Air
Service	−0.5325 (−5.2)	Train
Importance factor for comfort and convenience during travel	−0.3704 (−1.6)*	Bus
Importance factor for the presence of aged and children in family	0.8262 (2.2)	Car category
Constants		
Beta 10	−11.76 (−6.2)	Air specific constant
Beta 30	−3.311 (−2.8)	Bus specific constant
Beta 40	−8.610 (−5.2)	Car category-specific constant
Structural parameters		
Coefficient of utility of nest (logsum)	MNL model	
L(0)	−234.9540	
L(c)	−194.1346	
Initial likelihood	−234.9540	
L(θ)	−149.0469	
ρ^2 with respect to zero	0.3656	
ρ^2 with respect to constant	0.2322	
Sample size	222	
% Right	59.04	
Subjective Value of Time (SVT) (‘/Hr)	248.90	
Average Income/month (‘)	47,646	
Average household size	5.023	
SVT per family	1.04	
SVT per member	5.25	

* Not significant at 95% confidence level Values in parentheses are t–statistics
L (0): Likelihood ratio with zero coefficients L(c): Likelihood ratio with constants
L (θ): Likelihood ratio at convergence ρ^2: Rho-squared statistics

5.2 Mode Choice Model for Hyderabad

The best fit nested mode choice model for tourists visiting Hyderabad is shown in Fig. 1. Air mode was not considered for model formulation on account of the small sample size. Bus and hired car are found competing with each other in a nest named as ‘road based paid’, while train and self-driven cars are competing separately at the root. Air is not included as a choice due to the very small sample size (2%). The

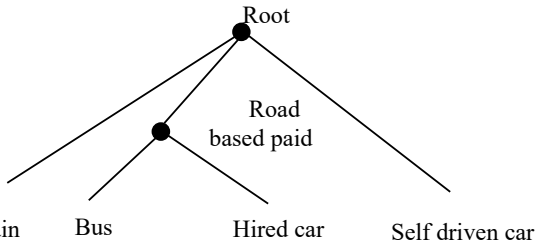

Fig. 1 Nested structure for mode choices for Hyderabad

estimated values of various variables and other statistical parameters are given in Table 4.

Travel time to Hyderabad by tourists is perceived as more significant and found to be more influencing than travel cost. All the estimated variables are found to be significant. The positive influence of household income and the importance of the budget available in hand for the trip are found in the choice of train and bus, respectively. An increase in household income is found to increase the probability of the use of train for long distance travel by tourists. Similarly, higher importance to budget is expected to bring a substantial increase in bus use for the same. This may be attributed to the large number of tourists of middle-income tourists visiting Hyderabad. AC services are least preferred in hired car due to higher fare charges. Higher household size is found to discourage the use of personalised vehicles, as it may cause discomfort in travel. Household size is found highly estimated which indicates that small changes in household size may bring more changes in the utility of self-driven cars. Household income and importance factor for budget are the next highly influencing variables after household size. The constant for self-driven car is found to be quite high and positively influences the use of self-driven car. The results of the statistical analyses are good. The logsum value is between 0 and 1, thus defining the nest in which bus and hired car are taken together, while train and self car competed separately. Log likelihood values showed higher convergence with variables as compared to with constants only or otherwise. Rho-squared values are indicating towards high goodness-of-fit of the model, according to the literature. The percent right (73%) is found to be good indicating towards better accuracy of the model in the prediction of mode choices.

The SVT for tourists in Hyderabad is higher than that at Delhi. This may be due to the shopping potential, for which the city is known. The perceived value of time by family or a member is also found to be higher (1.68 times and 7.91 times with respect to SVT in general) as compared to Delhi.

5.3 Discussion of Results

Mode choices made by tourists visiting Delhi and Hyderabad, both historical heritage cities, are studied. Multinomial and nested logit models are developed to explain the

Table 4 Statistics for best fit mode choice model for tourists visiting Hyderabad

Variable	Coefficient estimates	Relevance of variables
Travel time	−0.2645 (−3.3)	Generic
Travel cost	-0.7789×10^{-3} (−2.2)	Generic
Household income	1.481 (4.0)	Train
Importance factor for budget available in hand for the trip	1.179 (4.0)	Bus
Service	0.4202 (3.0)	Hired car
Household size	−2.032 (−2.3)	Self-driven car
Constants		
Beta 20	−6.216 (−3.5)	Bus specific constant
Beta 40	12.74 (3.0)	Self car specific constant
Structural Parameters		
Coefficient of utility of nest (logsum)	0.7592	
L(0)	−227.6983	
L(c)	−124.8566	
Initial likelihood	−90.8189	
L(θ)	−90.4536	
Structural parameters		
ρ^2 with respect to zero	0.6027	
ρ^2 with respect to constant	0.2755	
Sample size	223	
% Right	72.50	
Subjective Value of Time (SVT) (‘/Hr)	339.59	
Average Income/month (‘)	40,355	
Average household size	4.70	
SVT ratio per family	1.68	
SVT ratio per member	7.91	

* Not significant at 95% confidence level Values in parentheses are t–statistics
L (0): Likelihood ratio with zero coefficients L(c): Likelihood ratio with constants
L (θ): Likelihood ratio at convergence ρ^2: Rho-squared statistics

mode choices and to identify the significant variables influencing mode choices. The influence of socioeconomic characteristics like household income in influencing mode choice is observed. Household income is found to have a positive influence on the choice of air mode in Delhi. It is evident from Table 1 that the HIG tourists use air as their travel mode. Moreover, an increase in household income increases the utility associated with air mode. This implies that an increase in household income and associated disposable income can increase the patronage of air mode for tourists visiting Delhi. In case of Hyderabad, household income is found to influence the train mode and is a highly significant variable in the model. It is observed that the

majority of the MIG tourists visiting Hyderabad use train and bus as their travel modes. It is presumed that an increase in income can cause a shift from bus to train mode. The service availed by the tourists is observed as another significant factor. For the train users in Delhi, the influence of service on the use of train is negative in nature, indicating that lower-level services decrease the utility of train usage. This implies that a decrease in the comfort level of train can reduce the patronage of train. This is substantiated by the higher score for dimensions 'comfort and convenience during travel' by the tourists in Delhi. At Hyderabad, the variable 'service' is found influencing the usage of hired car. A decrease in service quality is found to positively influence the usage of hired car. The service quality in hired car relates to the use of air-conditioned car for travel, which translates into greater cost. It is seen from Table 1 that the average cost of travel per km at Hyderabad is comparatively higher and the rating for 'comfort and convenience during travel' is comparatively less. This implies that the tourists visiting Hyderabad are less likely to use comparatively high class services offered in hired car mode as they do not want to incur greater cost and also because the travel distances are comparatively less. Household size is also found to have a negative influence on the use of self-driven car and families having higher household sizes are less likely to use the self-driven car in Hyderabad.

The influence of qualitative attributes in mode choice is highlighted by the study results. 'Comfort and convenience during travel' is found to have a negative influence on the choice of bus for tourists visiting Delhi. This implies that tourists who give a higher rating for the variable are less likely to choose the bus as their travel mode. This is logical as travel for longer distances is not preferred by bus and the average distance travelled by tourists visiting Delhi is also comparatively high. 'The presence of aged or children in the family' is found to have a positive influence on car category users visiting Delhi. The importance rating given by the tourists visiting Delhi to this factor is also high. This implies that tourists having elderly or children in the family are more likely to use the car modes to access Delhi. The importance given to the comfort of the elderly and children in the family by Indian households is emphasised in this context. The importance rating for 'budget available in hand for the trip' is found to positively influence the choice of bus mode for tourists visiting Hyderabad. A relatively high modal share and less travel time for the bus mode may be prompting the use of the bus as a viable travel option.

The best-fit model for Delhi indicates that there is competition between modes in Delhi and all the modes compete with each other. Delhi, being the national capital, is well connected by road, rail, and air modes and hence the competition between modes is not surprising. Although the modal shares indicate a predominant preference for train as the travel mode, all the modes are found to compete with each other. On the other hand, in Hyderabad, bus and hired car are competing with each other in a 'road-based paid' nest and compete with train and self-driven car at the root. It is observed that the average travel time of 100 km for bus and hired car is almost the same for tourists visiting Hyderabad. It is presumed that the similarity in time for travelling is the reason for both the modes competing with each other in a nest. On the other hand, although train and self-driven car take comparative average travel time,

they are found to compete at the root with the 'road-based paid' mode on account of the differences in travel cost, travel time, and comfort level.

6 Conclusions

Various combinations of alternate travel modes to leisure cities are observed to define the mode choice decisions of the tourists. The presumption that mode choice characteristics of tourists visiting cities with similar leisure values are similar is found to be invalid, based on the developed models. Destination-specific policy initiatives are recommended for improving mode patronages. The nested structures developed indicate that in the case of Delhi, since all the modes compete with each other, policy initiatives that focus on all the available modes, viz., air, train, bus, and car categories are to be evolved so that competition between modes will improve patronage for all the modes. On the other hand, in case of Hyderabad, competition between train, road-based paid modes (bus and hired car), and self-driven car is seen. This implies that strategies that aim to improve competition and patronage of these modes with distinct policy strategies for train, road-based paid alternatives and personalised modes are to be evolved. Since the use of public transport facilities for travel is to be encouraged for sustainable travel, patronage for train can be improved by evolving special package tours for domestic tourists. The models also illustrate the use of qualitative attributes in mode choice modelling and emphasise their importance in the mode selection context. Studies on combined mode and destination choice relating to leisure travel can also be undertaken to explore the travel behaviour of domestic tourists in greater detail.

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