

# DEVELOPMENT OF MODE CHOICE MODEL USING ALOGIT – A CASE STUDY

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**ABSTRACT:** With rapid urbanization and increase in population the demand for transportation facilities is ever increasing. In this paper an attempt is made to study the mode choice behavior of people of central zone of Hyderabad. In this connection suitable mode choice model is developed using ALogit software. The mode choice model helps to understand the current trend of mode competition in the study area and the effect of new transportation facility on other modes of transport and mode choice of people. Lastly, probable willingness of people to shift to new transport facility i.e., Metro rail is studied.

Keywords: Mode choice, ALogit software, travel analysis

**1. INTRODUCTION:** Transport is a key infrastructure of a country. The country's economic status depends upon how well it is served by its roads, rail ways, air ways, ports and shipping. The country's economy growth is very closely linked to the rate at which the transport sector grows. The planning aspects of transportation engineering relate to urban planning, and involve technical forecasting decisions and political factors.

The various works are:

R.Pinky Pawaskar and Mridula Goel (2016) studied the consumer's internal and external motives to travel and identify the sources of information that influence these motives in destination choice. Milimol Philip and Prof. Sreelatha et al. (2013) stated that Mode choice behavior is a fundamental element of travel behavior. It is the demand for activities that produces the demand for travel. Sven Muller and Stefan et al. (2008) stated that because of declining enrollment and school closures in some German regions students have to choose a certain school location from a reduced set of schools. The travel to-school mode choice is modeled using a multinomial logit approach, since students might switch from low cost transport modes (cycling for instance) to modes with remarkably higher costs (public transport for instance). Guzman and Emmanuel et al. (2005) has analyzed the mode choice behavior of students in exclusive schools in Metro Manila. Schwanen and Mokhtarian et al. (2005) Studied on the impact of urban form on travel behavior and recognized that residential location choice and travel choices may be interconnected.

**2. STUDY AREA:** Study area selected is the central zone of Hyderabad under HMDA, which is sprawling from Kapra to Patancheruvu (East - West) and Jawahar Nagar to Shamshabad (North - South). Available modes in the study area are 2 wheelers, 4 wheelers, private/institutional buses, auto/ para transit, RTC buses and MMTS.

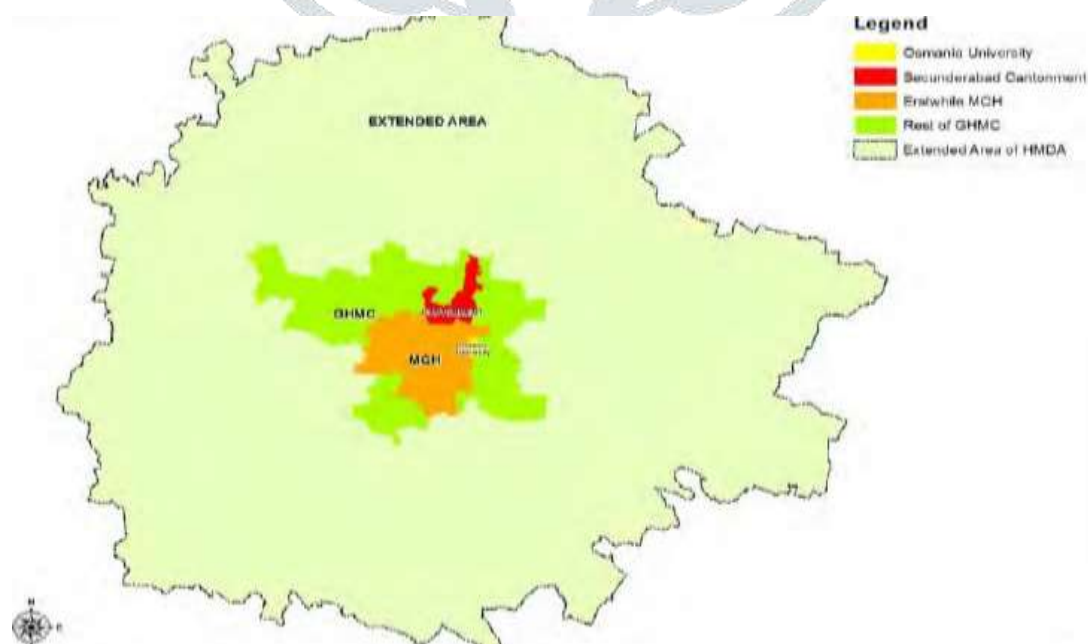


Fig.1 Subareas in Hyderabad Metropolitan Authority

**3. MODEL DEVELOPMENT - MODE CHOICE ANALYSIS:** Mode choice analysis allows the modeler to determine what mode of transport will be used, and what modal share results.

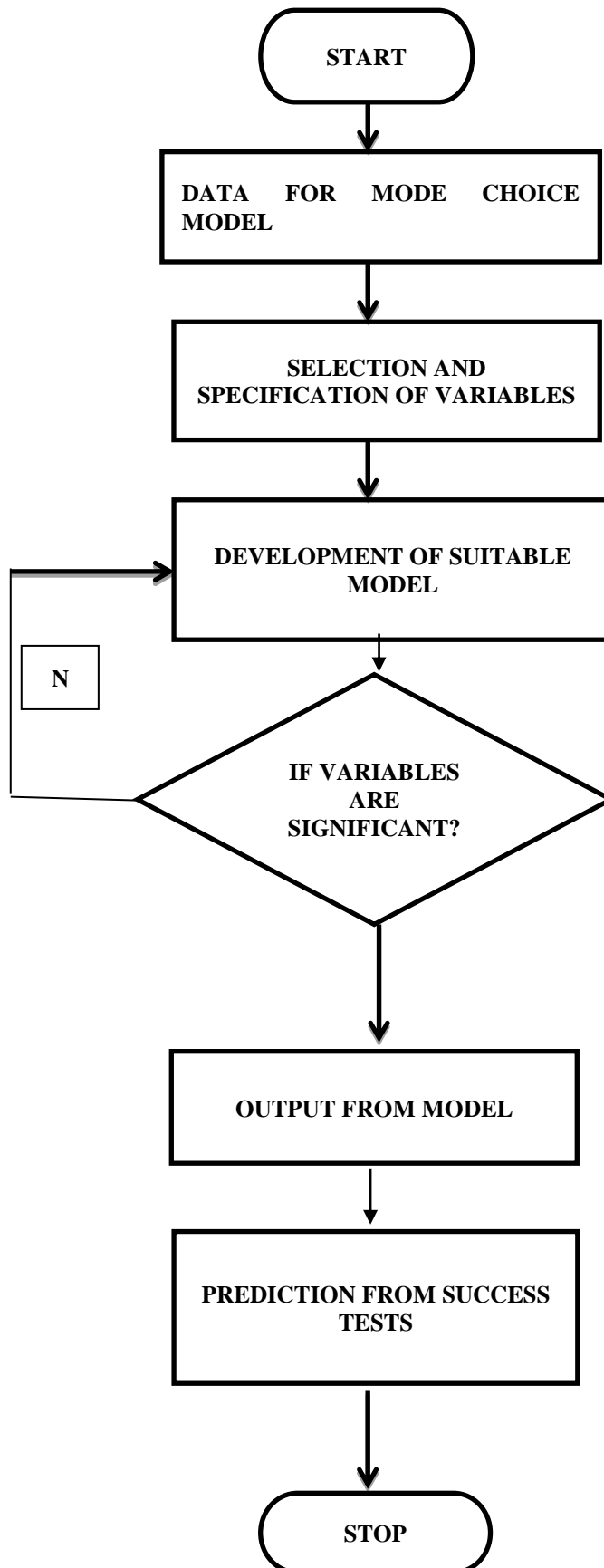
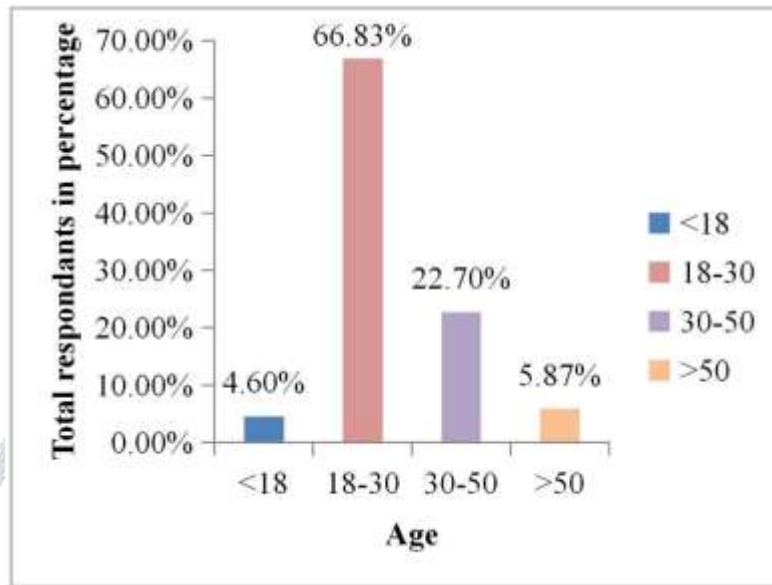


Fig.2 Flow chart of Mode choice model

**4. TRAVEL ANALYSIS AND THEIR CHARACTERISTICS:** These characters include the personal characters of the passengers who are using different modes to travel from one destination to other destination. The personal characteristics like gender, age, household income, household size, vehicle ownership, purpose of trip, mode used and main mode.

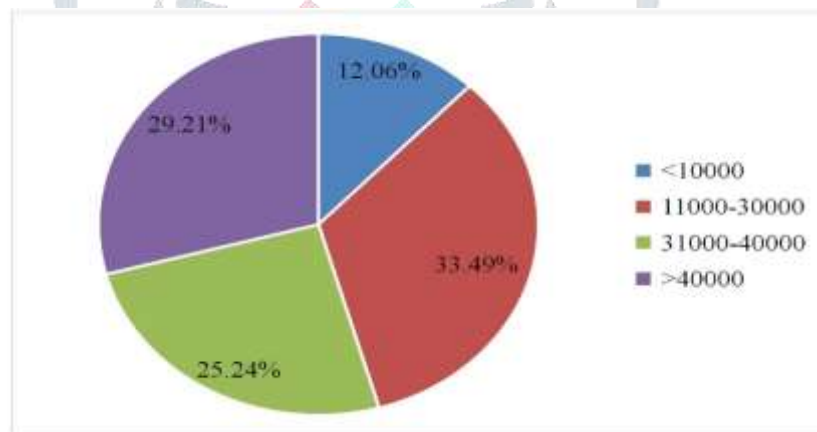
**4.1 Age**



**Fig.3 Age Vs Total respondents**

From the Fig. 3 it is observed that majority of the daily travelers who participated in the travel survey are in the age group of 18-30 yrs.

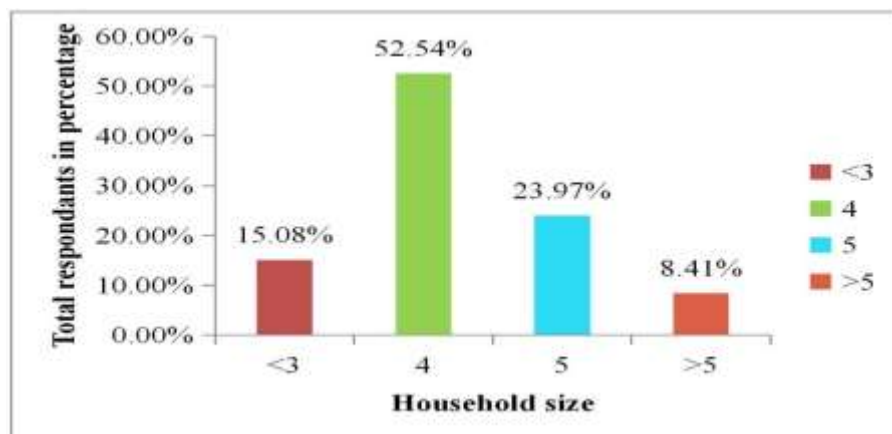
**4.2 House hold Income**



**Fig.4 Household Income Vs Total respondents**

From the Fig. 4 it is inferred that majority of the people participated in the survey have the household income in the range of Rs.11000 - Rs.30000.

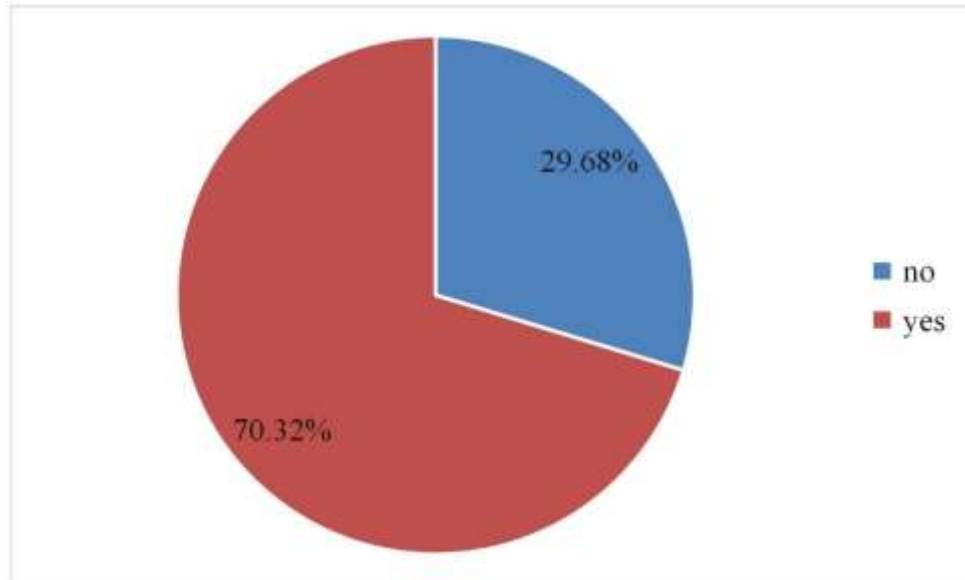
**4.3 Household Size**



**Fig.5 Household Size Vs Total respondents**

From the Fig.5 it observed that the majority of the people participated in the travel survey have a household size of 4.

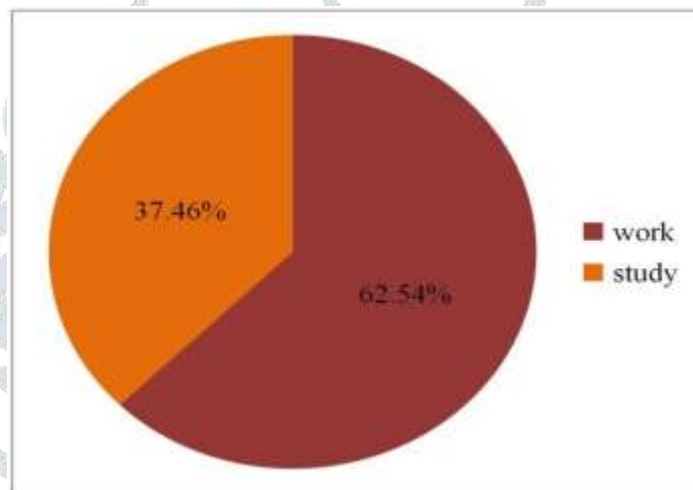
**4.4 Vehicle Ownership**



**Fig.6 Vehicle Ownership Vs Total respondents**

From the Fig. 6 it is clear that the majority of the people participated in the travel survey have a own vehicle.

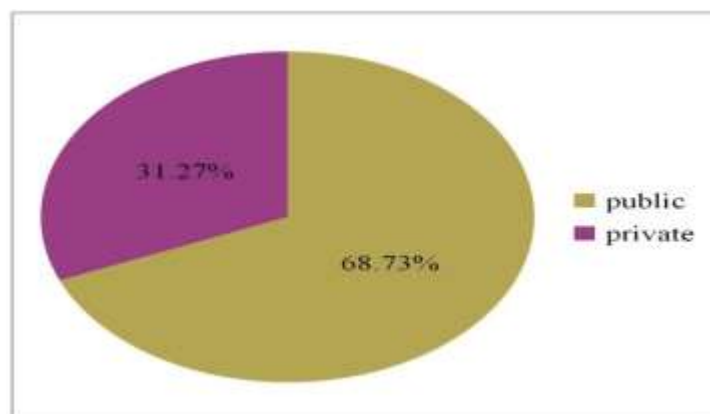
**4.5 Purpose of Trip**



**Fig.7 Purpose of Trip Vs Total respondents**

From the Fig. 7 it can be inferred that out of the total samples collected majority of the daily travel activity is made for the purpose of the work.

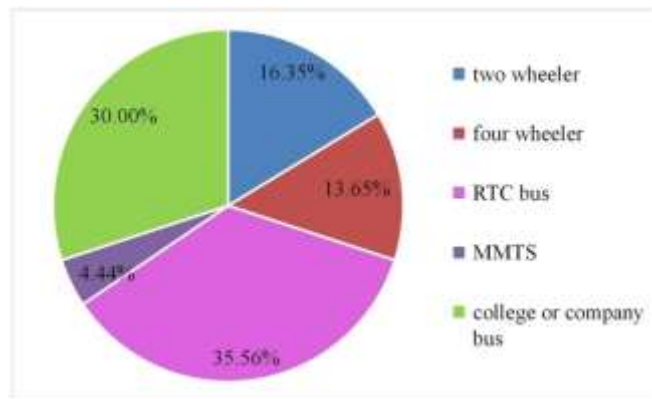
**4.6 Mode Used**



**Fig.8 Mode used Vs Total respondents**

From the Fig. 8 it is observed that majority of the respondents of the travel survey use the public mode for their daily travel activity.

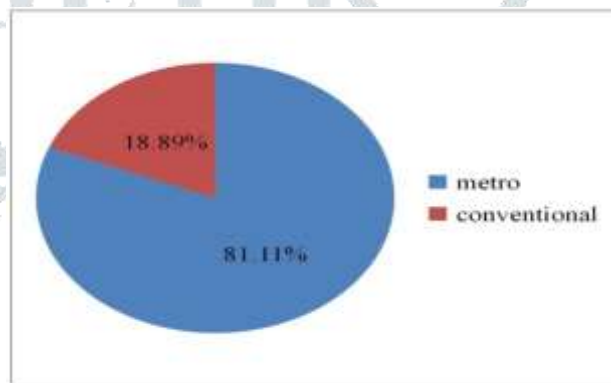
**4.7 Main Mode Used**



**Fig.9 Main Mode Vs Total respondents**

From the Fig. 9 it can be understood that out of the total respondents participated in the travel survey majority of the people are traveling by RTC bus (35.56%) and the second majority preference is college or company bus (30%) followed by two wheelers (16.35%) for their daily travel activity. While the other modes i.e. four wheelers, MMTS have a share of 13.65%, 4.44% respectively.

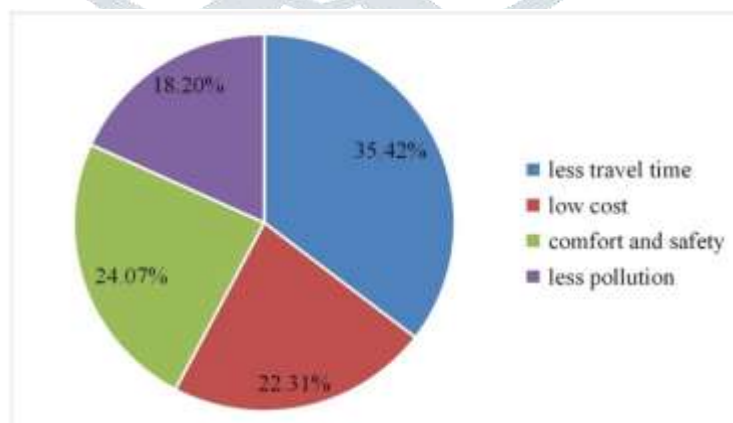
**4.8 Willingness to Shift to Metro**



**Fig.10 Willingness to shift to metro Vs Total respondents**

From the Fig. 10 it can be inferred that majority of the participants of the survey are willing to use metro for their daily travel activity.

**4.9 Reason to Prefer Metro Rail**



**Fig.11 Distribution of reasons to prefer Metro Rail**

From Fig.11 it can be inferred that majority of the respondents of the travel survey prefer Metro as their transit mode due to less travel time (35.42%), followed by comfort and safety (24.07%), low cost (22.31%), less pollution (18.20%) for their daily travel activity.

**5. METRO MODE CHOICE MODELING AND ANALYSIS:**

Table 1: Coding for different travel characteristics used in the analysis and mode choice model development

S. No	Travel Characteristics	Coding
1.	Gender	Male is coded as 1 Female is coded as 2
2.	Age	Age <18 yrs is coded as 1 Age group 18-30 yrs is coded as 2 Age group 30-50 yrs is coded as 3 Age > 50 yrs is coded as 4
3.	Household income	Income < 10000 is coded as 1 Income 11000-30000 is coded as 2 Income 31000-40000 is coded as 3 Income > 40000 is coded as 4
4.	Household size	< 3 members is coded as 1 For 4 members it is coded as 2 For 5 members it is coded as 3 >5 members is coded as 4
5.	Vehicle Ownership	No is coded as 1 Yes is coded as 2.
6.	Purpose of Trip	Work purpose is coded as 1 Study purpose is coded as 2
7.	Mode used	Public is coded as 1 Private is coded as 2
8.	Main mode used	2 wheeler is coded as 1 4 wheeler is coded as 2 RTC bus is coded as 3 MMTS is coded as 4 College/company bus is coded as 5
9.	Willingness to shift to Metro	Prefer to use Metrorail is coded as 1 Prefer using conventional mode is coded as 2
10	Reason to prefer Metro rail	Less travel time is coded as 1 Low cost is coded as 2 Comfort and safety as 3 Less pollution as 4

5.1 NESTED LOGIT MODEL (PRESENT SCENARIO):

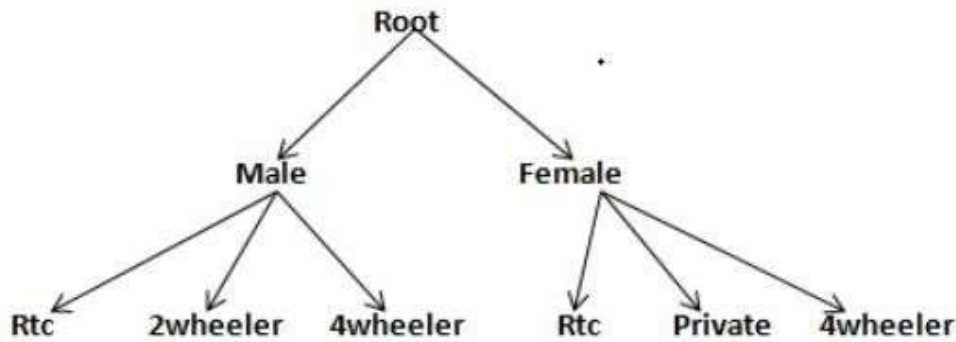


Fig.12 Nested logit model (present scenario)

Table 2 Statistics for best fit Nested logit model (present scenario)

Variables	Coefficient Estimates	Relevance of variables
<b>Generic variables</b>		
Travel time	0.6782(0.2)	Generic
Travel cost	-0.3393(0.0)	Generic
<b>Specific variables</b>		
Household income	-0.1078(-1.4)	2 Wheeler
Age	-0.2002(-2.0)	4 Wheeler
Household size	0.3064(3.5)	RTC bus
Vehicle ownership	-0.1578(0.0)	MMTS
Gender	0.8129(2.0)	Company/college bus
<b>Structural parameters</b>		
L(0)	-989.8043	
L(c)	-823.6914	
L(θ)	-834.1030	
$\rho^2$ with respect to zero	0.158	
$\rho^2$ with respect to constant	0.0094	
Log sum	0.3335(1.4)	

L (0):Likelihood value with zero coefficients

L(c):Likelihood value with constant coefficients

L(θ):Likelihood value at convergence  $\rho^2$  Rho- squared statistics

The estimates obtained can be concluded as follows. It can be concluded that the travel time is highly significant than the travel cost and negative value of travel cost indicates that as the travel cost increases utility decreases. It is observed that gender have an influence on choice of mode. As the house hold size increases the usage of RTC bus increases. The utility of MMTS decreases as the vehicle ownership increases. The results of statistical analyses are good. Log likelihood and rho-squared values are indicating goodness-of-fit of the model. (the values of both rho-squared measures lie between 0 and 1.

5.2 NESTED LOGIT MODEL (AFTER INTRODUCING METRO)

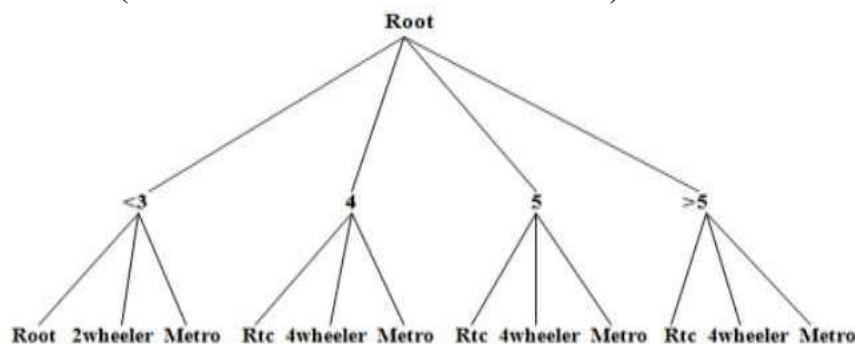


Fig.13 Nested logit model after introducing metro

Table 2 Statistics for best fit Nested logit model (after introducing metro)

Variables	Coefficient Estimates	Relevance of variables
<b>Generic variables</b>		
Travel time	0.3263(1.0)	Generic
Travel cost	-0.2137(-0.1)	Generic
<b>Specific variables</b>		
Gender	-0.5894(-3.8)	2 Wheeler
House size	-0.3708(-3.8)	4 Wheeler
Age	0.1098(1.1)	RTCbus
House income	-0.4719(-2.1)	MMTS
Vehicle ownership	-0.3392(-0.9)	Metro
<b>Structural parameters</b>		
L(0)	-989.8043	
L(c)	-825.6914	
L(θ)	-823.8327	
$\rho^2$ with respect to zero	0.1678	
$\rho^2$ with respect to constant	0.0024	

The estimates obtained can be concludes as follows; It can be concluded that the travel time is highly significant than the travel cost and negative value of travel cost indicates that as the travel cost increases utility decreases. It is observed that gender have an influence on choice of mode. As the vehicle ownership increases usage of metro decreases. The utility of MMTS decreases as the household income increases. The results of statistical analyses are good. Log likelihood and rho-squared values are indicating goodness-of-fit of the model.(the values of both rho – squared measures lies between 0 and 1.

6. RESULTS: From the results it can be concluded that,

1. The travel time is highly significant than the travel cost and negative value of travel cost indicates that as the travel cost increases utility decreases.
2. It is observed that gender have an influence on choice of mode.
3. As the vehicle ownership increases usage of metro decreases.
4. The utility of MMTS decreases as the house hold income increases.
5. The results of statistical analyses are good. Log likelihood and rho-squared values are indicating goodness-of-fit of the model.(the values of both rho-squared measures lie between 0 and 1.



6. Male participants are more compared to female participants
7. The majority of respondents were fairly spread across age of 18-30 yrs.
8. The largest household size of 4 members was participant in the survey.
9. The most popular mode choice for respondents observed from the survey was RTC bus, with a share of 35%.
10. The willingness to use Metro Rail was highest i.e., 81%.
11. The travel time is more significant than travel cost and the negative value of travel cost indicates that as travel cost increases utility decreases.
12. The mode choice of two wheelers for daily travel is high among male respondents.
13. It is observed from model 1&2 that, as household income increases the utility of MMTS decreases and as the vehicle ownership increases the usage of metro decreases.
14. It is observed from nested models that, as household income decreases the utility of public transport increases.
15. Log likelihood and rho-squared values are indicating goodness-of-fit of the models developed.

#### 7. RECOMMENDATIONS:

1. Most of the respondents are willing to reach metro station by walk, this implies that residents near to metro network have a higher opportunity to use metro.
2. For residents away from metro network appropriate awareness of the facilities available to reach metro station should be given to increase the effectiveness of new transport facility.
3. As majority of people are willing to travel by metro increasing the metro capacity and serviceability is advisable.

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