



iJRASET

International Journal For Research in
Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 Issue: VI Month of publication: June 2021

DOI: <https://doi.org/10.22214/ijraset.2021.35744>

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Challenges in Behaviour Modelling of Mode Choice Model - A Peek into Indian Scenario

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Abstract: Mode choice model is one of the crucial steps in the process for Transportation demand modelling. It fore-tell the share of trips attracted to public transportation. Mode choice models compacts very closely with the human choice making behaviour and this continues to attract researchers for further exploration of individual choice making process. The objective of this paper is to observe keenly on the challenges that a modeller will face in Indian scenario. A variety of models are available for prediction. But with the close review it is observed that all these models work either at aggregate level or disaggregate level which works on certain assumptions. This is definitely not going to reflect the actual mode choice behaviour. The particular characters that makes a difference from the world scenario discussed in this paper are diversity in decision making of individual, diversity in socio-economic characteristics, pride and prejudices in mindset that affect the false representation of data, concept of ridesharing and the inhibition in acceptance of the same, travel distance and mode availability in urban and rural scenario. It can be concluded that selecting a model that depict the true nature of commuter is a challenging process. The well-known models available can be trained and calibrated to suit to the need of Indian scenario. Use of machine learning and data mining could be a very useful tool in this model building as all the required changes can be incorporated efficiently

Keywords: Mode Choice, Behavior Modelling, Commuter, socioeconomic characteristics, public transport

I. INTRODUCTION

Mode choice model is one of the steps in the sequential process for Transportation demand modelling. An important objective in mode choice modeling is to foretell the share of trips attracted to public transportation. Mode choice models are used to analyze and predict the choices that individuals or groups of individuals make in selecting the transportation modes that are used for particular types of trips. It helps to predict the share or absolute number of trips made by mode.

Mode choice is one of the greatest dynamic stages in transportation planning process and it has direct impact on the policy making decisions. Mode choice models compacts very closely with the human choice making behaviour and this continues to attract researchers for further exploration of individual choice making process. The objective of this paper is to observe keenly on the challenges that a modeller will face in Indian scenario.

II. LITERATURE REVIEW

Minal and Ch. Ravi Sekhar in their paper "Mode Choice Analysis: The Data, The Models And Future Ahead" has carried out detailed review on various modeling methods of mode choice analysis and bottlenecks associated with the same. The factors that affect the psyche of the travelers have been discussed; further various types of data required and their method of collection has been briefed up. This paper particularly emphasizes on statistical mode choice models such as multinomial logit and probit models as well as recent advanced soft computing techniques such as Artificial Neural Network models (ANN) and Fuzzy approach model that are employed for modal split analysis.

EeshanBhaduria, ManojB.S, ZiaWadudbArkopal, K.GoswamiaCharisma, F.Choudhury in their paper "Modelling the effects of COVID-19 on travel mode choice behaviour in India" address these two gaps by developing mathematical models to quantify the effect of the socio-demographic characteristics of the travellers on the mode-specific trip frequencies before (January 2020) and during the early stages of COVID-19 spread in India (March 2020). The results also demonstrate significant heterogeneity based on age, income, and working status of the respondents.

The findings will be directly useful for planners and policy-makers in India as well as some other countries of the Global South in better predicting the mode-specific demand levels and subsequently, making better investment and operational decisions during similar disruptions.

III. FACTORS AFFECTING MODE CHOICE BEHAVIOUR

Mode choice of commuters is influenced by a whole panorama of social, economic, cultural, and environmental factors like travel time, travel cost, waiting time, number and ease of transfers, comfort, etc. Over the years mode choice models have been dealing with the general range of tradeoffs individuals are willing to make among these factors (Lerman, 1975; Ben-Akiva and Lerman, 1985; Koppleman and Wen, 2000; Bhat, 2000). Zhao et al. (2002) supported the ability of transit systems with highquality services to attract more users, as well as for poor services to encourage more automobile use and classified them into the four categories named as travel mode Level of Service (LOS), accessibility, land use/urban design and transit users, socioeconomic characteristics. Later, Racca and Ratledge (2004) added characteristics of a trip as a factor that affects choice of travel mode. Researchers like Stratham and Dueker (1996) and Ye et al. (2007) have identified that tour complexity influences mode choice substantially. Residential location, neighborhood type and urban form play a prominent role in determining the favored travel mode for commute (van Wee et al., 2003; Pinjari et al., 2007; Frank et al., 2008).

The above discussed factors are the most common and experienced criteria used for the choice of model. Travel time is found to be the most crucial of all factors. In today's world, where time is money, the other factor seems to outweigh this particular criterion. The traditional transportation modelling looks at various models available for study such as

- 1) Aggregate and Disaggregate Mode Choice Models
- 2) Statistical Mode Choice Models
- 3) Multinomial Logit Models
- 4) Nested Logit Models (NL)
- 5) Multinomial Probit Model (MNP)

But with the close review it is observed that all these models work either at aggregate level or disaggregate level which works on certain assumptions. This is definitely not going to reflect the actual mode choice behaviour. In addition to this, there are a few challenges particularly specific to Indian traffic and socio economic conditions.

IV. CHALLENGES IN BEHAVIOUR MODELLING – INDIAN SCENARIO

Individuals are diverse. Their thought process and the choice making behaviour are diverse and this is the biggest challenge every modeller faces. Choice of each individual under diverse circumstances will be different. And choice of different individual to same available alternatives will be quite diverse. There is even diversity in choice of same individual under same circumstances at different spatial and temporal features.

A. Diversity In Socio-Economic Characteristics

- 1) *Income*: The method of data collection is through interview. One major question reviewer asks is regarding income. Here there is a discrepancy between the actual income and projected income. The reason is social acceptance; especially in Indian scenario people give a lot of importance to status or rather calls it as pseudo status. With the advancement in the field of financing, the link between the vehicle ownership and social status is not a real reflection. These socioeconomic factors are influenced spatially and the variation can be found in different metros of India. Moreover, the choices in Urban and rural are different and to get a good correlation is difficult.
- 2) *Ridesharing*: Another parameter that can be seen in traditional mode choice model is ride sharing or car pooling. But this concept has not been well conceived in the Indian scenario. So if a modeller is using to evaluate his data with respect to these models, it's evident that a clear representation of model will not be reflected.
- 3) *Public Transport*: the public transport is yet to gain much competence in Indian scenario. Except for metro rails, the other public transport systems lack lustre that attracts public. The main criterion is lack of satisfaction. There can be a shift that could be bought into this. With improvement in technology, improved booking and scheduling options the scenario ahead for public transport can be made lucrative. Another challenge that public transportation have is vehicle occupancy factor, lack of roadway width, lane discipline etc. bringing in systems like BRTS can add value to public transportation. A policy shift in transportation can increase the attractiveness of public transport system. This would be very beneficial for Indian scenario. Also, the metro trains are a good pick by a large group of commuters especially that comes from different social economic backgrounds. But here again the feeder system is not well planned and this has created a lot of people from opting out of this public transport.

- 4) *Travel Distance*: Depending on the distance to be travelled there will be considerable difference in the choice of mode. For places whose accessibility and variability of diverse fare rates poses another challenge in mode choice modelling. Perception of an individual, though basically rooted in their socioeconomic status; is a main factor that could be a potential challenge. The situation varies again with developed and developing nations.
- 5) *Alternate Availability*: There can be alternate modes availability and fares that let the trip maker make a decision. This scenario is different in urban and rural areas. So depending upon the zone there could be a possibility that there can be variations in prediction. Another factor is availability of alternate routes. With increase in network connectivity, availability of alternate routes, better connectivity, easy manoeuvrability there could be changes that can happen in choice of mode, which may not be reflected in the model building.
- 6) *Two Wheeler*: Most of the models available is built without the consideration of two wheelers. As far as Indian situation is considered this is a major consideration. The contribution of traffic due to two wheelers is more in most of Indian states.

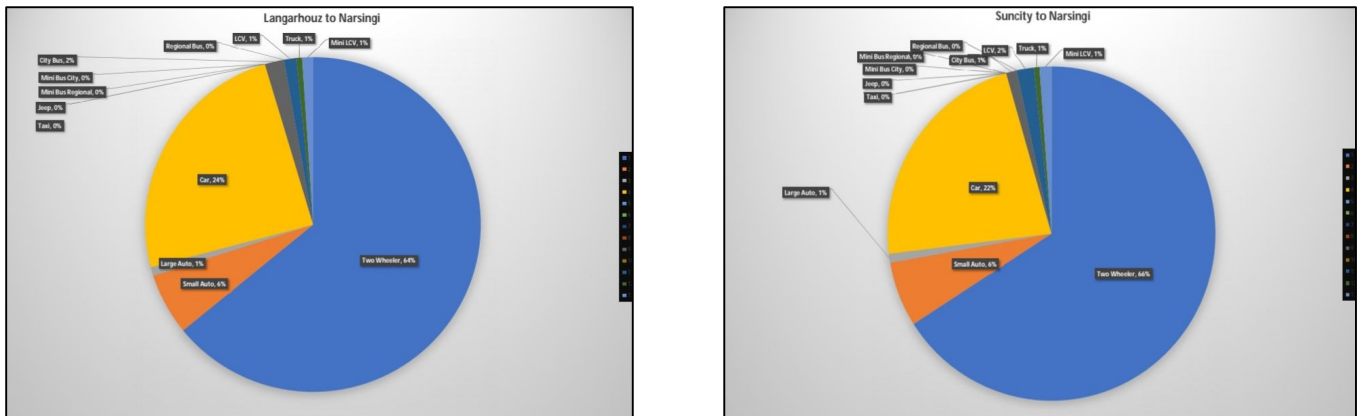


Figure1: Graph showing the composition of vehicular traffic, data collected from Hyderabad city.

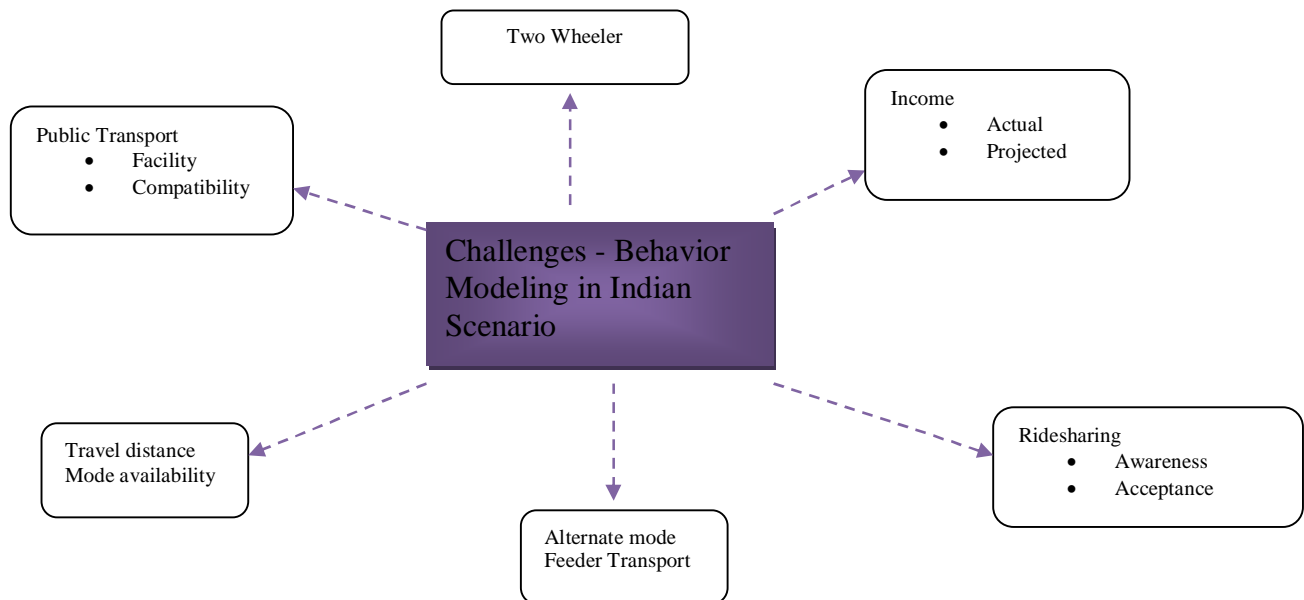


Figure2: Factors affecting mode choice behavior.

V. CONCLUSIONS

It can be concluded that selecting a model that depicts the true nature of commuter is a challenging process. But for a predictive model we generally opt for an average response. So the quality and quantity of the data collected is important. That could reflect a more realistic representation of the model. The well-known models available can be trained and calibrated to suit to the need of Indian scenario. Use of machine learning and data mining could be a very useful tool in this model building as all the required changes can be incorporated efficiently.

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