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Original Article

Study on the Effect of Implementation of Transit System between Pandharpur Railway Station to Vithoba Temple-A way towards Sustainable Transportation and Congestion Mitigation

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Abstract: *On the banks of the Candrabhaga River, close to Solapur City in the Solapur District of Maharashtra, India, is the well-known pilgrimage town of Pandharpur. One of the eleven tehsils in the District, its administrative territory is also a state legislative assembly electoral constituency. Pandharpur to honour Vithoba, the Wari or Wari yatra travels to Pandharpur, Maharashtra. It entails transporting a saint's paduka in a palkhi from their individual shrines to Pandharpur, most notably for Dnyaneshwar and Tukaram. In this procession, many pilgrims are on foot. The distance between Pandharpur railway station and Vithoba temple is nearly about 2 km. Most of the people will travel from Pandharpur railway station to Vithoba temple using Three-Whelers or Walk as mode of transport. It causes to increase heavy rush and pedestrian traffic on most of the roads of Pandharpur. It is necessary to look into new mode of transport between Pandharpur railway stations to Vithoba temple. Hence in this paper, study on the effect of Implementation of Transit System between Pandharpur railway station to Vithoba temple is described in detail. Binomial Logit Model is applied for do-nothing condition for two modes of transport namely walk and 3W. Multinomial logit model is applied after implementation of transit system between railway station and Vithoba Temple. It is found that after implication of transit system people will shift to the transit system. Percentage of people will shift from Walk as mode of transport to the Transit system.*

Keywords: *Railway station, Mode, Three-Whelers.*

I. INTRODUCTION

On the banks of the Candrabhaga River, close to Solapur City in the Solapur District of Maharashtra, India, is the well-known pilgrimage town of Pandharpur. One of the eleven tehsils in the District, its administrative territory is also a state legislative assembly electoral constituency. Pandharpur to honour Vithoba, the Wari or Wari yatra travels to Pandharpur, Maharashtra. It entails transporting a saint's paduka in a palkhi from their individual shrines to Pandharpur, most notably for Dnyaneshwar and Tukaram. In this procession, many pilgrims are on foot. The Marathi word "warkari" means "one who performs the wari." The custom dates back more than 700–800 years. There were totally about 10-12 lakhs of people will come to Pandharpur from various regions of Maharashtra. It is found from the survey that about 70 % of the people will travel by railway as mode of transport. The distance between Pandharpur railway station and Vithoba temple is nearly about 2 km. Most of the people will travel from Pandharpur railway station to Vithoba temple using Three-Whelers or Walk as mode of transport. It causes to increase heavy rush and pedestrian traffic on most of the roads of Pandharpur. It is necessary to look into new mode of transport between Pandharpur railway stations to Vithoba temple. Hence in this paper, study on the effect of Implementation of Transit System between Pandharpur railway station to Vithoba temple is described in detail. Binomial Logit Model is applied for do-nothing condition for two modes of transport namely walk and 3W. Multinomial logit model is applied after implementation of transit system between railway station and Vithoba Temple.

II. LITERATURE REVIEW

Masoumi et al. 2019 [1] studied discrete choice analysis of transport mode choice causality and perceived barriers of sustainable mobility in the MENA region. 11 variables related to travel characteristics, perceptions, land use and neighbourhood, socioeconomics, and self-selection were found to be significantly or marginally significant in explaining all four models: the barriers to walking, bicycling, and using public transportation, as well as the drivers of car

use. This was done by applying a multinomial logistic regression model. Concisely, perceived factors and decisions about mode-choice are context-sensitive. The findings of this study could be used in the MENA region's urban and transportation planning to support more environmentally friendly modes of transportation. Zhao et al. 2020 [2] studied prediction and behavioural analysis of travel mode choice: A comparison of machine learning and logit models. This research fills this vacuum by comparing and contrasting the logit and machine-learning models for mode-choice modelling in terms of model construction, evaluation, and behavioural interpretation. Using stated-preference survey data, we empirically compare the two methods. Cheng et al. 2020 [3] studied application of a random forest method approach to model travel choice behaviour. In terms of travel mode choice prediction, the comparison findings demonstrate that the random forest method performs noticeably better due to its higher accuracy and lower computational cost. The suggested approach also provides an estimation of the relative significance of explanatory factors and how they relate to mode selections. For a deeper comprehension and more accurate modelling of people's travel behaviour, this is essential. Huang et al. 2020 [4] studied analysis of travel mode choice and trip chain pattern relationships based on multi-day GPS data: A case study in Shanghai, China. In order to understand how travellers decide between choosing a mode of transportation and a trip chain pattern, this paper looks at two different structures: one in which the decision to choose a mode of transportation comes first, and another in which the decision to organise a trip chain pattern comes first. Thanh et al. 2019 [5] studied possibility of AI application on mode-choice prediction of transport users in Hanoi. With a focus on Hanoi, Vietnam, this study intends to determine whether artificial intelligence (AI) techniques may be used to predict the mode of travel using data from travel habit surveys. First, 311 transit users from various land-use kinds participated in a travel interview survey. The second part of the study predicts the consumers' preferred mode of transportation using Ensemble Decision Trees (EDT). The suggestion for a potential AI application on the selection of a mode of transportation is also made. The findings of this study may be useful to transportation authorities and planners. The use of big data for estimating transportation demand also benefits from the application of AI to estimate parking demand.

III. METHODOLOGY

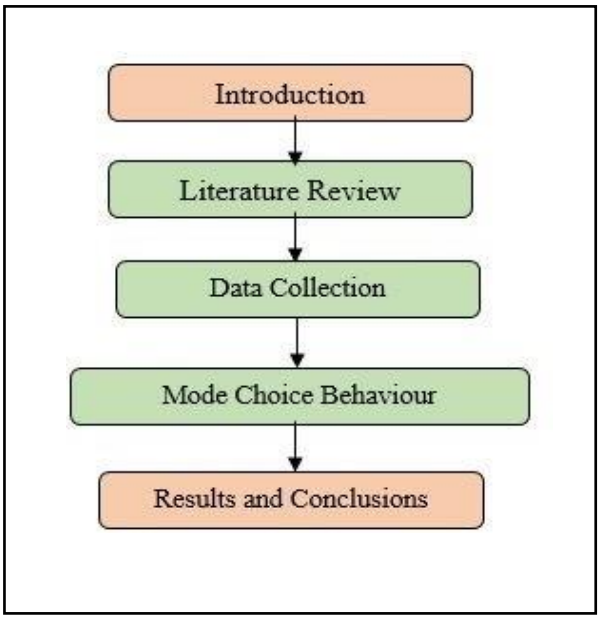

Figure 1: Detailed Methodology of the Study

IV. DATA COLLECTION

Data is collected using personalised interview survey. The detailed form is prepared which contains personal details of traveller including age, gender, and appearance, person with luggage or without luggage. Data is collected at the Pandharpur railway station. Total 150 samples are collected at Railway station. After data collection, data analysis is carried out. Multinomial Logit model is developed for do-nothing condition and after application of transit system. Effect of transit system is studied in terms of percentage of modal split of individual trips.

V. MODEL DEVELOPMENT

Multinomial Logit model is applied for do-nothing condition. Utility equations are framed considering Travel Time (TT), Travel Cost (TC) and appearance of traveller as independent variables.

a) Do-Nothing Condition

Following utility equations are framed for do-nothing conditions. U (Walk) = a0+ a1*(TT) + a2*(TC) + a3*(Appearance)

U (3W) = b0+ b1*(TT) + b2*(TC) + b3*(Appearance)

Model is calibrated by using N-Logit software. Table 1 shows the calibrated parameters of the model.

Table 1: Calibrated Parameters of the Model

Variables	Coefficient	Significance
A0	-1.34	0.002
A1	-0.856	0.0014
A2	-0.421	0.0042
A3	-0.315	0.0031
B0	1.24	0.0017
B1	-0.721	0.0023
B2	-0.514	0.0074
B3	1.14	0.00021

Table 2 shows values of modal split for walk and three-wheelers as mode of transport.

Table 2: Modal share for do thing condition

Modes	Probability
(3W)	0.34
(WALK)	0.66

b) Implication of Transit System

Following utility equations are framed for do-nothing conditions. U (Walk) = a0+ a1*(TT) + a2*(TC) + a3*(Appearance)
U (3W) = b0+ b1*(TT) + b2*(TC) + b3*(Appearance)

U (Free Transit System) = c0+ c1*(TT) + c2*(TC) + c3*(Appearance) U (Paid Transit System) = d0+ d1*(TT) + d2*(TC) + d3*(Appearance)
Table 3 shows the calibrated parameters of the model.

Table 3: Calibrated Parameters of the Model

Variables	Coefficient	Significance
A0	-1.22	0.0012
A1	-0.324	0.0014
A2	-0.541	0.145
A3	-0.412	0.0134
B0	1.84	0.00453
B1	-0.314	0.00314
B2	-0.854	0.00452
B3	2.105	0.00341
C0	-0.145	0.00142
C1	-1.24	0.00324
C2	-3.41	0.00452
C3	1.24	0.00782

Do	-0.415	0.00641
D1	-2.14	0.00854
D2	-1.346	0.00325
D3	2.43	0.00421

Table 4 shows values of modal split for walk, three-wheelers, free transit system and Paid transit system.

Table 4: Values of modal split for

Modes	Probability
(3W)	0.24
(WALK)	0.42
(Free Transit System)	0.24
(Paid Transit System)	0.10

VI. CONCLUSIONS

The following important conclusions are drawn from the study.

- Three important factors of the travellers namely Travel Time (TT), Travel Cost (TC), Appearance greatly affect the mode choice of the people form Pandharpur railway station to Vithoba Temple.
- Modal share of the people by walk is 66 percent and by Three-wheelers is 34 percent. It proves that most of the people will choose walk as mode of transport causing to increase traffic and conflicts on roads between station and temple.
- After implication of transit system, Modal share of the people by walk is 24 percent by three-wheelers, 42 percent by walk, 24 percent by free transit system and 10 percent by paid transit system. It proves that people will shift to the transit system such as Bus or BRTS from walk as mode of transport and reducing traffic congestion the road.
- Implementation of Transit system is the best approach to make the transportation between Pandharpur Railway station and Solapur sustainable and to mitigate the congestion on the roads.

VII. REFERENCES

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