Indian Journal of Spatial Science
Autumn Issue, 10 (2) 2019 pp. 14 - 19

Indian Journal of Spatial Science
Peer Reviewed and UGC Approved (Sl No. 7617)
EISSN: 2249 - 4316 homepage: www.indiansss.org ISSN: 2249 - 3921

The Socio-Economic and Environmental Perceptions of the Metro Rail Commuters: A case study of Bengaluru City

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Article Info

Article History

Received on:
31 December 2018
Accepted in *Revised Form* on:
31 July, 2019
Available *Online* on and from:
23 September, 2019

Keywords

Metro Rail
Commuters
East-West Corridor
Environmental Perspective
Rapid Transit System
Environmental Perception

Abstract

The metro rail commuters were surveyed about their satisfaction with various features of rail services, including mode of transport, frequency of usage, preference of public transport, cost and travelling time, traffic flow, parking facility, safety aspects, areas of improvement, pollution, health and significant aspects of the metro. Ninety-five percent of the commuters opined that Metro rail was the most convenient mode of public transportation in Bengaluru city. There was 68% reduction in travel cost after shifting from a previous mode of transport to the metro rail. These figures were supported by the increase in ridership figure to 34% from June 2016 to July 2017. Forty-three percent of the commuters said that the travel cost was reduced by Rs.21-50 per trip. Ninety-nine percent of the commuters stated that using metro rail reduces travel time when compared to other means of transport. Commuters who used metro rail daily or occasionally opined that there was 100% safety while travelling in metro rail. Another significant aspect of the survey was that about 41% of the commuters reach the metro station by walk. As per this, there were a number of commuters opting to walk rather than use a vehicle to reach the metro station. Sixty percent of the commuters travelling occasionally stated that there was a partial reduction in vehicle density after the introduction of the metro rail. Most commuters (96%) opined that they did not experience any health-related issues while travelling in metro rail. Fifty-five percent of the commuters mentioned that there was a partial reduction in pollution levels and 48% opined that there was a partial improvement in air quality after the introduction of metro rail. A greater proportion of the commuters (65%) opined that there was an improvement in the flow of traffic of Bengaluru city after the introduction of metro rail. Overall, aspects such as connectivity, frequency and parking facility were the major areas that required improvement.

Introduction

Among the innumerable issues being faced by the metropolitan cities across the world, air pollution is of utmost concern that has been aggravated by developments such as rapid industrialization, high influx of population to urban areas, unplanned urban development, increasing traffic, rapid economic development and higher levels of energy consumption (SoER India, 2011). Currently, in urban areas, air pollution is widespread as vehicles are the major contributors to the atmospheric pollutants. Vehicular emissions are of particular concern since these are ground level sources and thus have a maximum impact on the general population (SoER India, 2011). Similar issues are being faced in Bengaluru and the solution to the problem is an efficient public transportation system.

Bengaluru is one of the fastest growing cities in India and expanding vastly in all directions (Kashyap, 2011). The city houses many of the reputed Information Technology companies and is known as Silicon Valley of India. As a result of the larger floating population with increasing existing population of the city, there has been an increase in vehicular population adding to

extreme congestion and air pollution on the city roads. Mumbai with a population of 18.41 million has 25.71 lakh vehicles registered whereas Bengaluru with a population of 11.5 million has 67.22 lakh vehicles registered. Bengaluru, with one third the population of Mumbai, has 62% more vehicles registered. Thus, an efficient and reliable public transport system is the way forward in tackling the issue. Hence, the mass rapid transit system was implemented in the year 2011 by Bengaluru Metro Rail Corporation Limited (BMRCL). The main objective behind the introduction of metro rail in Bengaluru was to ease the traffic pressure off the roads. The mass rapid transit system (MRTS) was encouraged, so that commuters could start using public transport more and more, instead of using private vehicles. Metro rail system in the city is considered to be a complimentary transit mode rather than a competitive one (Map Unity, 2017). In this context, the present study was taken up to assess the metro rail system as a means of mitigation strategy to climate change.

Objectives

The objective of the study was to evaluate the socio-economic and environmental impacts of the introduction of mass rapid system on the commuters of the Metro Rail in Bengaluru city. The survey was undertaken with the intent to understand the behavioural attitudes and perceptions of the metro rail commuters. The opinions and suggestions obtained as part of the study would be formulated as recommendations to Bengaluru Metro Rail Transport Corporation (BMRCL), Bengaluru.

The Study Area

The study area was the East-West corridor of the metro rail, also known as a purple line which stretches across 18.10 km from Baiyappanahalli in the East and terminates at Mysore Road terminal in the West. It consists of 17 stations, the names of which are listed in Table 1.0.

Methodology

Design of Questionnaire

The questionnaire was designed into four parts consisting of 28 questions; the first part covered the socio-economic profile of the commuters such as age, gender, education, occupation, and annual income, the second part covered the mode of transport and usage characteristics followed by the third component-environmental and economic perceptions of the commuters and the fourth part consisting of general suggestions/concerns of the commuters.

Training of Pollsters

The in-house pollsters (EMPRI research staff) were selected and trained to carry out the survey. A pilot survey was carried out to obtain the response from the commuters and certain instructions were given to the pollsters based on the learning from the pilot study.

Commuter Survey

The commuters were surveyed along each of the 17 stations of the East-West corridor of the Metro rail. A stratified random sample was adopted for the study. The survey was scheduled for a duration of 12 hours between 8.00a.m. to 8.00 p.m. The commuters' perspectives were assessed through a structured questionnaire using specific factors related to the transport sector.

Data Analysis and Interpretation

The raw data generated after the survey were subjected to numerical coding and re-arrangement as per the requirement of the statistical software. The processed data were subjected to univariate, bivariate, multivariate analysis along with the Classification and Regression Tree analysis and represented accordingly.

Results and Discussion

A survey on socio-economic and environmental impacts of the metro rail system on the commuters along the east-west corridor of the metro rail was undertaken. About 1067 commuters were surveyed across the seventeen stations of the east-west corridor of the metro rail. Sixty percent of the commuters using metro rail were under the age group of 25-45 who were mostly students and working professionals. Fifty-seven percent were male and 43% female. About 65% of people commuting in metro rail had qualification above the Bachelor's degree. As per the survey analysis, the most commonly used mode of transport by commuters to transit from home to metro station was a bus (22%) and two-wheeler (19%). A large majority of the commuters opted to walk (41%) from home to the metro station. This shows that the metro stations were in proximity to the residential areas, due to which greater number of commuters felt it was convenient to walk and travel using metro rather than opt for some other mode of transport. Greater number of commuters preferred to walk (41%) to the home from the metro station. The rest of the commuters transited by bus (22%), two-wheeler (19%) and bicycle (2%). As only a few commuters used bicycle to reach the metro station, we need to promote usage of bicycles by providing the cycle lanes along the stretches of the metro rail. Fifty percent of the commuters reach from home to the metro station within ten minutes.

Among the commuters surveyed, 70% used the metro on a daily basis as against 17% who used the metro on a weekly basis. The remaining commuters travelled fortnightly (5%), monthly (2%) and occasionally (6%). Ninety-nine percent of the commuters opined that there was a reduction in transit time by usage of metro rail when compared to other modes of transport. Twenty-seven percent of the commuters spent between Rs.21-50 per trip for commuting in metro rail whereas 20% of the commuters spent between Rs.10-20. Further, 14% of the commuters spent between Rs.51-70 and only 2% of the commuters spent about Rs.71-100 to commute by metro rail. As per the analysis, 43% of the commuters stated that there was Rs.21-50 reduction in travel cost/trip. About 33% of the commuters saw Rs.51-70 reduction in travel cost/trip as represented in Fig.1.

Commuters were sought opinion on the areas of improvement needed in the metro rail system. As indicated in this study, the introduction of the metro rail has clearly helped improve the transport scenario of the city. In terms of the areas of improvement, 62% of the commuters opined that connectivity was a major issue, followed by frequency (33%), parking (23%), travel cost (18%) and ticketing (4%) (Fig.2). The frequency was another issue to be considered, as there was variation in the

frequency of metro rails plying in the early morning, noon and late evening. At times, commuters spend more time waiting at the stations which would result in unnecessary delay in reaching their destination. In order to avoid this inconvenience, there needs to be an increase in the frequency of the metro rail during the peak hours of travel. Provision of the parking facility at the stations would attract number of commuters to travel by metro. Presently, due to non-availability of parking facilities, many commuters refrain from using metro services and instead opt for other modes of transportation. Considering the travel cost of other modes of public transportation, metro travel fare was found to be slightly expensive. This could also de-motivate the commuters from using the metro. Therefore, comparing the fare of other modes of public transportation, the metro fare could be made more affordable and economical, which would thereby increase the usage of the services by a larger number of commuters. Increase in ticketing counters at the stations could also ease the delay caused to the commuters while procuring the ticket.

Commuters were seeking information on the mode of transport they prioritized and the most convenient mode of transport they preferred to transit (Fig.3 and 4). Among the total commuters surveyed, 88% prioritized metro rail for day-to-day travel, whereas 4% and 2% of the commuters prioritized bus and private vehicle respectively. About 94% of the commuters felt that metro rail was the most convenient mode of public transport to transit, whereas 5% of the commuters opined that bus was the convenient mode of public transport.

Environmental Impacts: Commuters Perception

The commuters were asked to express their opinion about the impacts of the introduction of mass rapid system on the environment. All major factors having an effect pm the environment such as a reduction in vehicle density, pollution and sound levels, improvement in the quality of air and traffic flow, health effects while commuting in the metro were assessed.

As per the analysis, 53% of the commuters opined that there was a partial reduction in vehicle density on the road whereas 33% felt that there was a moderate reduction in vehicle density. About 8% opined that there was no reduction in vehicle density in spite of many commuters plying in metro rail. The perceptions of the commuters varied tremendously as there were no quantifiable and verifiable figures available to claim that there has been a significant reduction in the vehicle density.

About 55% of the commuters felt that there was a partial reduction in pollution levels and 28% opined that there was a moderate reduction in pollution levels. Lesser number of commuters (9%) opined that there was a complete reduction in pollution. To ensure a reduction in pollution levels, particularly the Greenhouse Gases (GHGs), we need to encourage a number of commuters to shift from other modes of transport to metro rail. To achieve this objective, we need to establish connectivity, increase frequency and parking facility at the stations which would see an increase in ridership of metro services over a period of time. This would directly affect the vehicle population on road thereby bringing in a reduction in GHG emission in the environment. As opined by the commuters, there was a partial improvement (48%) in air quality followed by moderate improvement (26%). Eighteen percent of the commuters felt that there was complete improvement in air quality (Figure 6). Sixty-five percent of the commuters mentioned that there was a partial improvement in the flow of traffic and 23% of the commuters that was moderate in traffic flow (Fig. 7).

Commuters revealed about the likely impact of health caused while commuting in metro rail. Ninety-six percent of the commuters mentioned that they did not experience any health problems. Two percent of the commuters suffered from headache and 1% each from dizziness and sleepiness (Figure 8). Therefore, we could conclude that travelling by metro does not result in any health effects on the commuters and is one of the safest modes of the public transportation system.

About 83% of the commuters stated that there was a reduction in sound levels whereas 17% felt that there was no change in the present sound levels (Fig. 9). A larger percentage of commuters opined that there was a significant reduction in sound levels due to the replacement of a large number of vehicles on road. From this, it was evident that there was a considerable modal shift from a previous mode of transport to the metro rail.

The commuters were sought response about one significant factor of metro rail services that made them shift from a previous mode of transport to the metro. About 87% of the commuters stated that reduction in transit time was a significant factor for them to opt for modal shift. Prior to usage of the metro, the commuters spend several hours commuting to their destination. The time saved in travelling could be constructively spent doing other works. Therefore, a larger population of the commuters felt that, time was the most important factor for them to opt for the metro. The other commuters opted to transit by metro rail as it was found to be comfortable (40%), convenient (36%) and have good ambiance (10%) (Fig. 10).

Conclusion

Commuter's preference to mass transit system has increased ever since its launch but the traffic congestion has not reduced significantly. In spite of an increase in commuter population in the metro, the pollution levels have not reduced significantly and so is the fuel consumption. Metro has emerged as the safe mode of transport, but still, commuters continue with unsafe modes of transport due to limited connectivity of the metro rail. Therefore, in order to reduce the Green House Gas emissions we need to ensure that there are better parking facilities, provision of metro bikes, cycling lanes, increase connectivity with feeder services and increase frequency. With these improved facilities, more commuters would shift to metro rail thereby lessening the number of vehicles on road, conserving more energy and lower emissions and contributing towards lesser pollution load on the environment.

Recommendations

To establish a new bus station at the outskirts of Bangalore city and stretches of the metro up to the bus stand, so that people can stay outside the city reducing congestion. A number of coaches need to be added to the existing rail, which in turn would facilitate more commuters per trip.

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Table – 1: Metro stations along the East-West Corridor

Sl.No.	Name of the station	Type
1	Baiyappanahalli	Surface
2	Vivekananda Road	Elevated
3	Indiranagar	Elevated
4	Halasuru	Elevated
5	Trinity	Elevated
6	M.G. Road	Elevated
7	Cubbon Park	Underground
8	Vidhana Soudha	Underground
9	M.Visveshwaraya	Underground
10	Majestic	Underground
11	City Railway Station	Elevated
12	Magadi Road	Elevated
13	Hosahalli	Elevated
14	Vijayanagar	Elevated
15	Attiguppe	Elevated
16	Deepanjali Nagar	Elevated
17	Mysore Road	Elevated

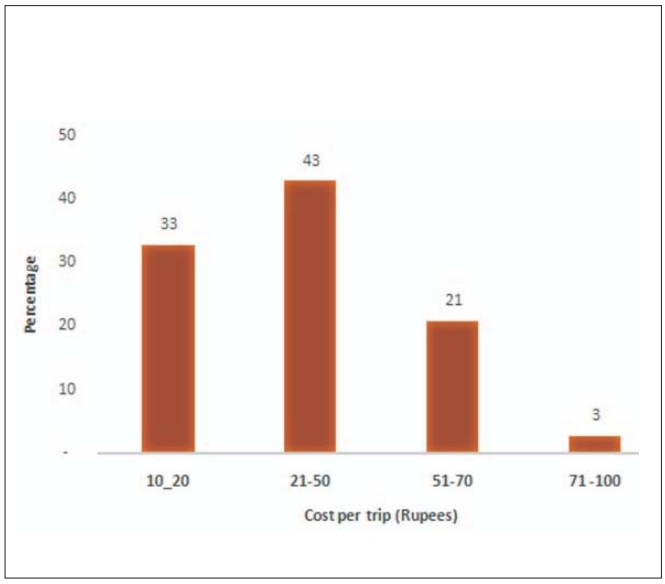

Fig. 1: Reduction in Travel Cost per Trip

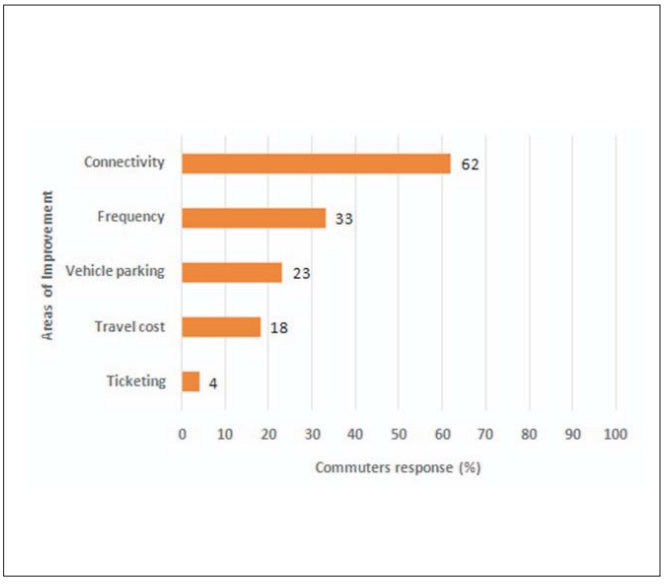

Fig. 2: Commuters' Response on Areas of Improvement

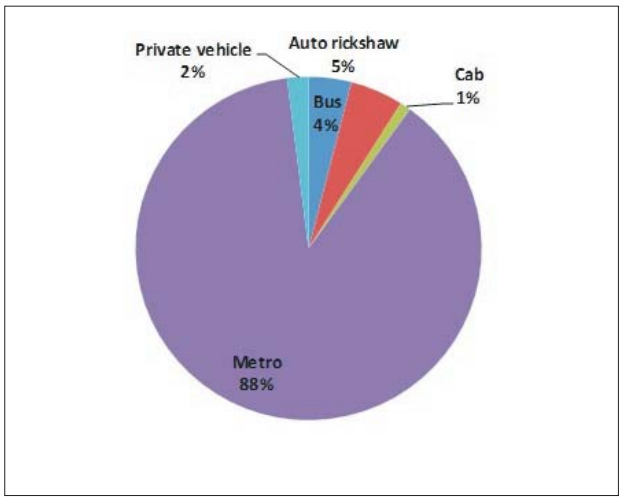

Fig. 3: Mode of Transport prioritized by Commuters

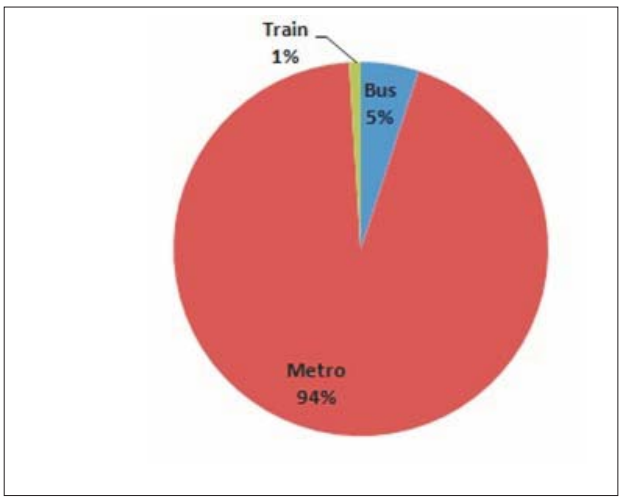

Fig. 4: Mode of Public Transport convenient to the Commuters

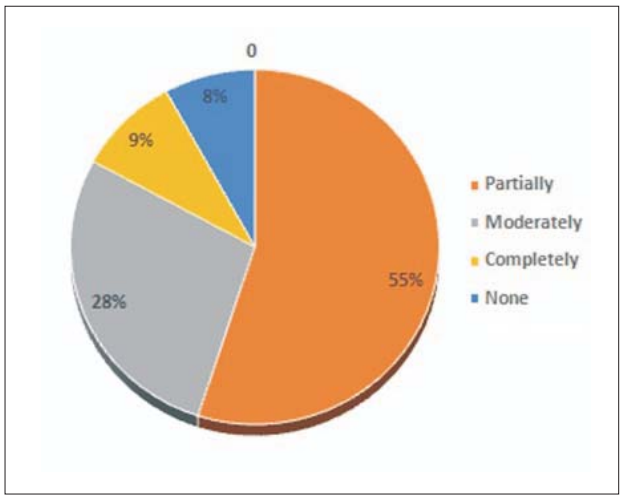

Fig. 5: Commuters' Response on Reduction in Pollution Levels

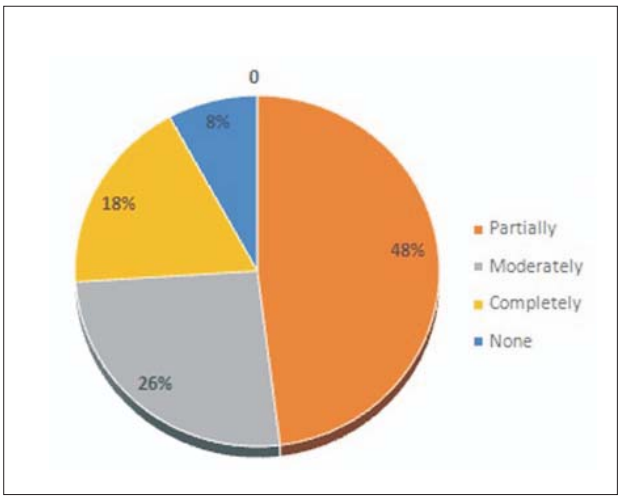

Fig. 6: Commuters' Response on Reduction in Air Pollution

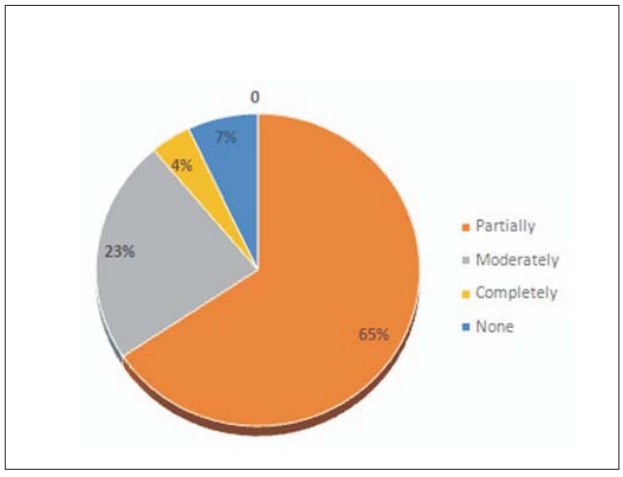

Fig. 7: Commuters' Response on Improvements in Flow of Traffic

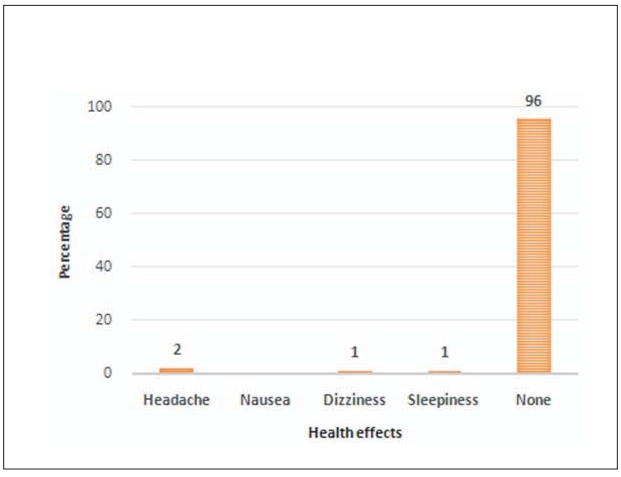

Fig. 8: Commuters' Response on Health Effects due to Travel in Metro

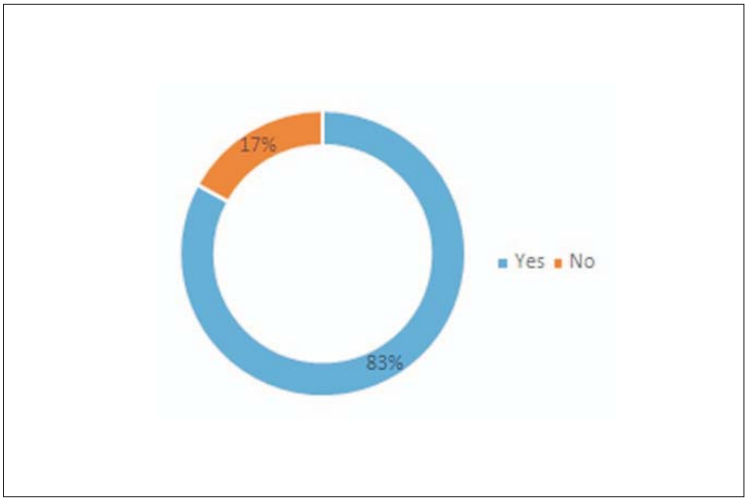

Fig. 9: Commuters' Response on Reduction in Sound Levels

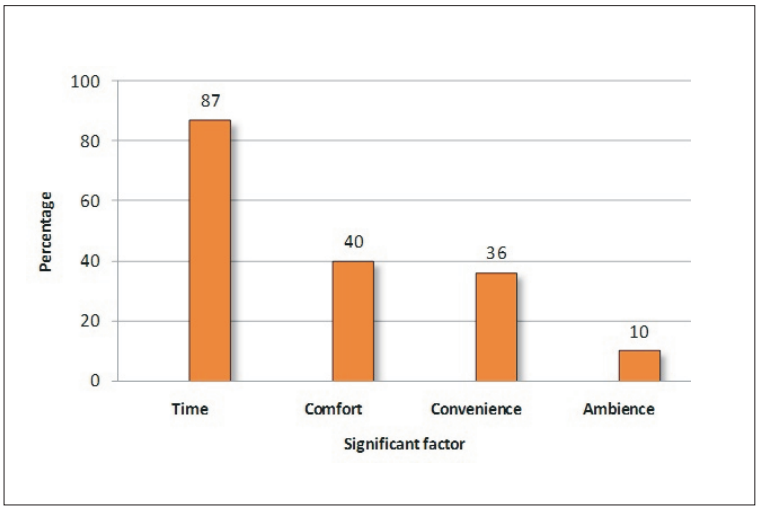

Fig. 10: Commuters' Response on Significant Factor of Metro Rail

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