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Consumer Behavior Towards Metro Rail Services in Bengaluru

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Abstract

With an emphasis on important elements including timeliness, cleanliness, ticketing effectiveness, security, price, accessibility, and general convenience, this study investigates commuter satisfaction with metro systems. The majority of commuters value the metro's dependability, effectiveness, and affordability, according to the study's findings, which are based on a poll of metro users. The respondents were pleased with the cleanliness of the station and felt that the ticketing process was simple. The necessity for real-time service updates, accessibility for individuals with impairments, and last-mile connectivity are among the issues that still exist. Some commuters want improved interaction with other public transportation networks, even though the fares are thought to be fair. Additionally, station infrastructure, seating availability, and security need to be improved. Many respondents are hopeful about the future of metro services, expecting improvements and expansions in spite of these problems. The study emphasizes how crucial it is to make ongoing investments in accessibility, technology, and infrastructure in order to raise user happiness and encourage sustainable urban mobility. Metro systems are crucial for effective and sustainable urban growth because they may encourage more people to use public transportation, lessen traffic, and have less environmental impact.

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Keywords: Metro services, Public transportation, Metro usage, Perceived utility, Last-mile connectivity.

1. Introduction

Modern transportation combines both established and emerging technologies. The era of electric vehicles is here. Electric vehicles are now used as a greener substitute for fossil fuel-powered automobiles. Many nations are developing high-speed rail networks, which provide economical and environmentally responsible long-distance transportation (Vuchic, 2007). As space tourism and speed travel are growing in popularity, the aerospace sector still continues to push the boundaries. In addition, the digital revolution has implemented technology into the transportation industry, standardizing GPS navigation, driverless cars, and ride-sharing services. The development of transportation has promoted economic growth, interaction between cultures, and globalization. By providing people with opportunities, establishing and developing new markets, and promoting intercultural understanding, it has altered and transformed societies (Jean-Paul Rodrigue,2024). Yet there are disadvantages as well, including pollution, traffic jams, and dependence on fossil fuels. Addressing these challenges requires achieving a balance between sustainable habits and technological innovation. Given factors like urbanization, climate change, and new technological developments, it is certain that transportation will continue to evolve in the future.

Over 56% of people live in urban areas worldwide, indicating a major increase in urbanization. This number is expected to expand dramatically over the next several decades (United Nations, 2023). The need for effective and efficient transportation methods has grown as a result of these factors. Metro systems' immense capacity and efficiency have made them an essential part of urban infrastructure today. Their rapid growth and advancement are a reflection of urban planners' objectives as well as the shifting needs of urban residents. The emergence of metro systems has drastically changed the urban landscape and has provided an appealing solution to the complex problems resulting from the fast pace of urbanization. These high-speed public transportation networks are vital resources for cities dealing with the combined tragedies of

environmental degradation and heavy traffic. In the past, people living in cities were dependent on their personal vehicles for daily travel, leading to traffic jams, increased pollution, and a decreased quality of life. Metro systems stand in direct opposition to this strategy. Because metro trains operate on specially constructed tracks, whether elevated or underground, they are significantly faster and more efficient than surface-bound vehicles. This allows commuters to maximize their free time and productivity by saving a significant amount of time. Metro services are the preferred mode of transportation for millions of people because of their regularity and predictability, which also contribute to a feeling of convenience. Beyond personal comfort, metro systems significantly enhance the city overall. By enabling a rapid and efficient mode of transportation, they encourage a shift away from the usage of private vehicles and reduce traffic jams (Optraffic,2024). As a result of the decrease in car emissions, the air quality has improved noticeably, creating a healthier atmosphere. Metro systems also play a key role in reducing the consequences of climate change by reducing greenhouse gas emissions.

Investing in metro infrastructure becomes essential as cities throughout the world work to meet sustainability targets (Banister, 2012). Understanding and evaluating customer behavior with regard to metro utilities is important for enhancing the performance of metro infrastructure, networks, and services which results in improving their impact on urban life. A thorough understanding of consumer behavior is necessary to enhance the influence of metro systems on urban life. The choices, objectives, and attitudes of metro passengers can be thoroughly examined in order to help transportation authorities and legislators better integrate these systems into the overall urban framework. By evaluating and reviewing passenger satisfaction, feedback, and complaints, transportation agencies can identify areas that require improvement. This can mean improving onboard conditions, improving station services, or improving customer support protocols. Furthermore, knowing how consumers assess metro services is essential to developing effective marketing and communication strategies. By tailoring their message to appeal to different passenger demographics, transit authorities can encourage more ridership and

a favorable perception of the metro system. The behavior of customers is the fundamental element of efficient metro operations. By investing in research and data analysis to gain a comprehensive understanding of passenger wants and preferences, cities may fully fulfill the potential of their metro systems. In addition to improving urban dwellers' general quality of life, this knowledge will aid in the creation of more fair and sustainable transportation systems (Cowrie, 2009).

While numerous studies have examined service quality, ridership patterns, and demographic influences in metro systems across Indian cities like Delhi, Hyderabad, and Mumbai, few have focused on Bengaluru, and even fewer have explored how commuter satisfaction and perceived utility shape expectations about the metro's future expansion and service quality. This is particularly relevant as Bengaluru continues to expand its metro network amidst concerns over last-mile connectivity, infrastructure adequacy, and commuter engagement. This study fills that gap by analyzing how user satisfaction and the perceived utility of the Bengaluru Metro influence commuter expectations for future development and service coverage, providing valuable insights for planners and policymakers. Unlike previous research that isolates demographic trends or technical performance metrics, this study integrates passenger psychology, usage frequency, and expectation forecasting into a single analytical model.

The critical insight derived from this research is that improving satisfaction and increasing regular usage are stronger predictors of future commuter expectations than perceived utility alone. This suggests that metro development strategies should focus not just on functional improvements, but also on fostering a positive commuter experience to encourage long-term public support and usage.

1.1 Objectives

1. To examine the relationship between demographics and usage of metro rail services.
2. To analyse the influence of satisfaction and perceived utility on future expectations regarding the quality and coverage of the metro.

3. To assess the influence of factors affecting metro usage on future expectations regarding the quality and coverage of the metro.

2. Literature Review

Prashant & Dev (2023) aimed to comprehend the ridership patterns, mode-choice behaviors, trip goals, and readiness to change due to fare differentials in Delhi's metro train system during peak and off-peak hours. The findings indicated that while people traveling for leisure are willing to switch to non-peak hours if the cost of travel during peak hours changes, those traveling for work are willing to pay more but are not willing to forgo peak-hour travel. Sachdeva (2020) emphasized studying the level of satisfaction that customers have been deriving from using Jaipur Metro and its impact on other means of transport viz., auto-rickshaws, taxis, buses, etc. Kumar (2021) aimed to identify the components of Hyderabad Metro Rail service quality. It was indicated that the quality of service directly affects the satisfaction of customers.

Huan & Yao (2022) aimed to reveal the impact of TDM on metro commuters' behavioral loyalty using stated-preference data collected in Guangzhou, China. Commuters' behavioral response to TDM strategies was investigated in terms of the possible shift in departure time and travel mode. Mandhani et al (2021) findings revealed that males consider passenger ease, whereas females consider service availability as the most influential factor in explaining overall service quality. Females are less concerned about passenger ease and seamless connectivity, as compared to males. Parihar et al (2021) indicated that commuters' shifting behavior toward new-generation transportation services is somewhat influenced by categorical characteristics, including age, gender, and occupation.

Sharma & Singh (2022) examined the factors influencing metro commuters' willingness to adopt smart ticketing systems in the Bengaluru Metro. Their study revealed that while tech-savvy younger commuters are inclined to shift toward digital ticketing options, older passengers still prefer traditional ticketing due to usability concerns and a lack of familiarity with technology. Verma

et al. (2019) analyzed the role of last-mile connectivity in determining metro ridership in Mumbai and found that inadequate feeder services and poor pedestrian infrastructure significantly deterred potential commuters, despite high metro service quality. Rao & Patel (2021) investigated passenger perceptions of safety and security in the Ahmedabad Metro and highlighted that female commuters rate safety measures as the most critical determinant of continued metro use, particularly during late hours.

Chatterjee & Kar (2020) studied the price elasticity of metro services in Kolkata and found that moderate fare increases have a limited impact on daily commuters, particularly those traveling for work, but significantly affect low-income groups and non-essential trips. Li & Liu (2018) focused on the relationship between metro service reliability and commuter satisfaction in Beijing and concluded that frequent delays negatively affect passenger loyalty, pushing them toward alternative modes of transport like buses and taxis. Mishra et al. (2023) further explored gender differences in metro travel behavior in Lucknow, finding that female passengers are more sensitive to security-related attributes, while male passengers prioritize travel time and frequency of trains.

In order to deepen the theoretical grounding of metro service research, it is useful to incorporate established models such as SERVQUAL and the Theory of Planned Behavior (TPB). The SERVQUAL model, developed by Parasuraman et al. (1988), provides a structured approach to evaluating service quality across five dimensions: tangibles, reliability, responsiveness, assurance, and empathy. These dimensions are frequently applied to public transportation to assess factors such as cleanliness, punctuality, and staff conduct. On the other hand, TPB, introduced by Ajzen (1991), explains commuter decision-making based on attitudes toward the behavior, perceived behavioral control (e.g., ease of last-mile connectivity), and subjective norms. By integrating these frameworks, the present study not only builds on existing empirical findings but also situates the analysis within a broader theoretical discourse, offering a more comprehensive understanding of commuter satisfaction and usage behavior.

3. Research Methodology

3.1 Research Hypothesis

H_1: There is a significant association between age and the frequency of metro usage.

H_2: There is a significant association between gender and the frequency of metro usage.

H_3: There is a significant association between occupation and the frequency of metro usage.

H_4: Satisfaction with metro services influences future expectations regarding the quality and coverage of the metro.

H_5: Perceived utility of metro services influences future expectations regarding the quality and coverage of the metro.

H_6: Factors affecting metro usage influence future expectations regarding the quality and coverage of the metro.

3.2 Research Design

The study used a structured questionnaire divided into three sections: demographic details, travel behavior, and service quality ratings based on a 5-point Likert scale. The questionnaire was developed with expert input and pilot-tested with 20 metro users to ensure clarity and relevance. To ensure validity and reliability, statistical checks such as Cronbach's alpha (ranging from 0.74 to 0.88) and factor analysis were conducted, confirming good internal consistency and construct validity. A total of 144 valid responses were collected. This sample size meets commonly accepted guidelines for survey research, including Green's rule for regression analysis, Hair et al.'s recommendation of five respondents per variable, and Krejcie and Morgan's sample size table, all of which support the adequacy of our sample for robust analysis. Statistical tests included chi-square tests to examine relationships between demographics and usage, and multiple regression to explore factors influencing future metro use. Subgroup analysis using t-tests and ANOVA revealed useful patterns, such as higher frequency of use among younger commuters and greater emphasis on security by female users. These findings help in identifying specific areas for targeted improvements in metro services.

4. Data Analysis and Discussion

The demographic profile of the respondents is summarized in Table 1 below. A total of 144 respondents participated. In terms of gender, 53% were male and 47% were female, indicating a relatively balanced representation. The age distribution shows that the majority of respondents (58%) were between 18 and 24 years old, followed by 20% in the 25–34 age group, 9% in the 35–44 age group, and 13% aged 45 and above. Regarding occupation, more than half of the respondents (55%) identified as students, 35% were employed, 6% were homemakers, and 4% were unemployed. This demographic profile highlights that a significant portion of the sample consists of young and student respondents, which may influence the perceptions and travel behavior outcomes analyzed in the study.

The bar graph (Fig1) illustrates the frequency of metro usage by respondents. The x-axis represents different categories of metro usage frequency—Occasionally, Monthly, Daily, and Weekly—while the y-axis shows the number of respondents for each category. The data suggests that most respondents use the metro occasionally, followed by monthly users, while daily and weekly users are fewer in comparison.

Table 1: Demographic Profile of Respondents

Frequency	Counts	% of Total
GENDER		
Female	68	47%
Male	76	53%
AGE		
18-24	84	58%
25-34	29	20%
35-44	13	9%
45 and above	18	13%
OCCUPATION		
Employed	51	35%
Homemaker	8	6%
Student	79	55%
Unemployed	6	4%

Fig 1: Frequency of Metro Usage

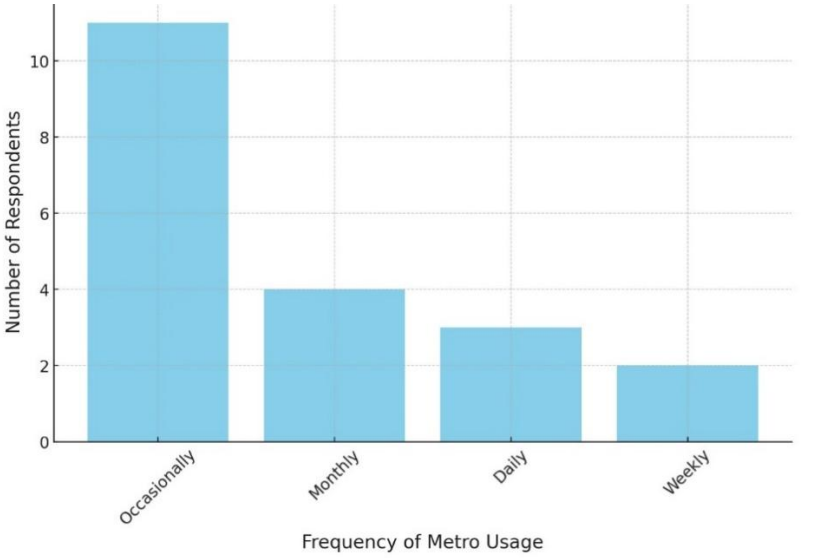

Table 2: Chi-square Test - Age and Frequency

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	17.112[a]	9	.047
Likelihood Ratio	12.901	9	.167
Linear-by-Linear Association	1.074	1	.300
N of Valid Cases	144		

a. 11 cells (68.8%) have expected count less than 5. The minimum expected count is .10.

It was observed that there is a significant association between Age and Frequency of metro usage since the Pearson Chi-Square is less than 0.05. Younger individuals and working professionals may use Metro service more frequently when compared to older age groups.

Table 3: Chi-square Test - Gender and Frequency

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1.326[a]	3	.723
Likelihood Ratio	1.345	3	.718
Linear-by-Linear Association	.768	1	.381
N of Valid Cases	144		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 6.61.

It was observed that there is no statistically significant association between Gender and Frequency of metro usage since the Pearson Chi-Square is more than 0.05. The test determines that Gender alone does not play an important role in determining how often individuals use metro services.

Table 4: Chi-square Test - Occupation and Frequency

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	12.891[a]	9	.168
Likelihood Ratio	12.717	9	.176
Linear-by-Linear Association	.008	1	.929
N of Valid Cases	144		

a. 11 cells (68.8%) have expected count less than 5. The minimum expected count is .10.

It was observed that there is no statistically significant association between Occupation and Frequency of metro usage since the Pearson Chi-Square is more than 0.05. This indicates that a person's occupation does not determine their usage of metro services.

Table 5: Multiple Regression

Model Summary						
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate		
1	.401[a]	.161	.143	.6047		
Coefficients						
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.038	.447		4.559	<.001
	Satisfaction	.280	.139	.226	2.019	.045
	Perceived Utility	.067	.121	.061	.553	.581
	Usage	.238	.078	.244	3.052	.003
Predictors: (Constant), Usage, Perceived Utility, Satisfaction Dependent Variable: Future Expectations						

The multiple regression analysis presented in Table 5 explores the influence of Satisfaction, Perceived Utility, and Usage on Future Expectations. The model explains approximately 16.1% of the variance in Future Expectations, suggesting that these predictors together have a moderate impact on shaping users' expectations.

Among the predictors, both Satisfaction and Usage emerged as significant. Satisfaction has a positive and statistically significant effect (B = .280, p = .045), indicating that higher satisfaction levels are associated with higher expectations for future metro services. Similarly, Usage also shows a positive and significant relationship with Future Expectations (B = .238, p = .003), suggesting that more

frequent users of the metro are likely to have greater expectations for its future. The standardized Beta values indicate that Usage (.244) has a slightly stronger impact than Satisfaction (.226).

On the other hand, Perceived Utility does not significantly influence Future Expectations (B = .067, p = .581), implying that merely finding the metro service useful is not enough to shape higher future expectations if not accompanied by actual satisfaction or regular use.

The findings highlight that to enhance users' future expectations of metro services, efforts should focus on improving user satisfaction and encouraging consistent usage. Other factors not included in the model may also play a role, suggesting avenues for further research.

Implications for Future Ridership and Policy Recommendations

The regression analysis indicates that satisfaction ($\beta = 0.226$, $p = 0.045$) and usage frequency ($\beta = 0.244$, $p = 0.003$) are significant predictors of future expectations toward metro services. This suggests that commuters who are currently satisfied and use the metro frequently are more likely to hold positive expectations about its future development and continue their patronage. On the other hand, individuals who perceive the system as merely functional, without a sense of overall satisfaction, do not exhibit a corresponding increase in future expectations. This finding highlights the role of perception as a leading indicator of ridership behavior: if user experience is neglected, particularly in aspects like last-mile connectivity, real-time information, or travel comfort, future ridership potential may decline, even if network expansions are underway.

To address these issues and strengthen both current satisfaction and future engagement, metro authorities should implement targeted policy interventions. First, technological enhancements such as live service dashboards, unified smart ticketing across transport modes, and predictive maintenance systems can improve reliability and reduce user uncertainty, reinforcing the image of the metro as a modern and dependable service. Second, infrastructure improvements—including barrier-free station access, shaded and

ventilated platforms, and better-designed first- and last-mile connectivity options—are essential for enhancing user comfort and expanding the demographic reach of regular passengers. Third, safety protocols must be strengthened through full-coverage CCTV, visible and diverse security staff, platform screen doors, and proactive public communication about emergency preparedness. These measures are especially critical for fostering confidence among female and night-time commuters.

Implementing these interventions in a phased manner—starting with visible quick wins such as live train-arrival boards or basic station upgrades—can generate early improvements in user perception. This, in turn, feeds back into increased satisfaction and usage, creating a virtuous cycle that supports the long-term growth of metro ridership. By aligning investment priorities with user-reported gaps, metro planners can bridge the perception-to-behavior gap and ensure that system expansions translate into actual public engagement.

Table 6: Summary of Hypotheses Testing

Hypothesis	**Test**	**P-value**	**Result**
H_1: There is a significant association between age and the frequency of metro usage.	Chi-Square	.047	Accepted
H_2: There is a significant association between gender and the frequency of metro usage.	Chi-Square	0.723	Rejected
H_3: There is a significant association between occupation and the frequency of metro usage.	Chi-Square	0.168	Rejected
H_4: Satisfaction with metro services influences future expectations regarding the quality and coverage of the metro.	Multiple Regression	.045	Accepted

Hypothesis	Test	P-value	Result
H_5: Perceived utility of metro services influences future expectations regarding the quality and coverage of the metro.	Multiple Regression	.581	Rejected
H_6: Factors affecting metro usage influence future expectations regarding the quality and coverage of the metro.	Multiple Regression	.003	Accepted

5. Conclusion

This study explored the influence of demographic factors, satisfaction, and perceived utility on the usage and future expectations of metro rail services. The results highlight that age is significantly associated with metro usage, indicating that younger individuals are more frequent users, while gender and occupation do not significantly affect usage patterns. Furthermore, satisfaction with metro services and actual frequency of usage positively influence future expectations, emphasizing the importance of user experience in shaping perceptions of future service quality and coverage. However, perceived utility alone does not significantly impact future expectations, suggesting that commuters' experiences matter more than just recognizing the usefulness of the service.

According to the data, the majority of respondents value metro operations' general quality, timeliness, and efficiency. The ease of buying tickets and the cleanliness of the station had been viewed favorably by several users. Some aspects including last-mile connection, accessibility for people with disabilities, and the availability of real-time service updates, require development. Some respondents highlighted concerns regarding fair pricing and the need for more integration with other forms of transportation, despite the fact that metro services are typically thought of as reliable and reasonably priced. The survey showed that passengers want better service quality and wider coverage, stressing the need for ongoing improvements.

While this study provides valuable insights into commuter satisfaction and behavior toward metro services in Bengaluru, it is important to acknowledge its limitations. The use of a cross-sectional design restricts the ability to assess how perceptions may change over time. The relatively small sample size (n=144), dominated by younger respondents and students, may also limit the generalizability of the findings. Additionally, the possibility of response bias due to self-reported data cannot be ruled out. Future research could address these constraints by employing longitudinal designs and larger, more diverse samples. Incorporating qualitative methods, such as interviews or focus groups, would also provide a deeper understanding of passenger expectations and experiences, complementing the quantitative results presented here.

Overall, to improve public perception and future expectations of metro services, efforts should focus on enhancing satisfaction and encouraging regular use, particularly among young and working populations. These insights can guide policymakers and metro authorities in designing better service strategies and expansions aligned with user expectations.

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