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Evaluating the Public Transportation System using Service Quality Gap

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ABSTRACT: Traffic congestion, air and noise pollution, and traffic accidents are all major concerns in metropolitan areas as the number of private automobiles on the road increases. To give an effective solution to these main difficulties, it is critical to identify variables that drive transit passengers to choose public transportation as their preferred form of transportation. This paper examines the methodology for identifying those influencing factors by evaluating the public transportation system in Nagpur as it is a developing city service quality gap between importance and satisfaction of various attributes such as travel time, comfort, fare, safety, and so on. The public transportation systems of Nagpur was chosen for this study. The impact of covid-19 on public transportation mode choice is also investigated. The findings reveal a large disconnect between the user's important features and satisfaction. As a result, there is a lot of room for public transportation service providers to improve their service quality such that transit consumers prefer public transportation.

KEYWORDS: Urbanization, Service quality gap, Public transport

I. INTRODUCTION

Today, about 45.22% of Maharashtra's population lives in urban areas. In the last ten years, the urban population of Maharashtra has increased by 45%. The wide scope of earning money, luxurious lifestyle, quality education, and ample job opportunities are why people migrate from rural areas to the city (Verma & Tiwari, 2020). Which automatically tends to increase in population and urban sprawl. An increase in population leads to an increase in motorization at an alarming rate in high populated cities. Affordable vehicle price, ease of moving with comfort, luxurious lifestyle, unsafe pedestrian pathways, and lack of accessibility (Verma & Tiwari, 2020) are some of the reasons why people prefer to travel by private vehicle. In megacities, rapid urbanization has resulted in traffic congestion and substantial carbon emissions (Narh Tetteh et al., 2018). This is due to rising travel demand and the lack of a reliable and comprehensive public transportation system, which significantly increases the share of private transport, resulting in a slew of issues such as traffic congestion, pollution, and collision (Chauhan et al., 2021). The only way to address these issues is to encourage people to use public transit rather than own vehicles because it is the easiest, cheapest, and best option. Public transportation is a locally provided shared transportation service that allows ordinary people to travel along predetermined routes. Today's modernity requires the use of public transportation. It is one of the cheapest means of transportation available to the public.

This study intends to assess the service quality provided by most public transportation modes in the Nagpur city of Maharashtra by comparing commuters' views of actual service levels to their expectations and satisfaction to identify service gaps that require remedy. Knowledge about what people expect from the public transport system. Are they satisfied with the service provided by it? Etc. can enable the planner to improve the existing quality of service, easy to use the system, and provide essential and valuable information to the transit users. The transit quality of service of Nagpur was evaluated from various aspects such as transit availability, comfort, time, the preferred mode of travel, safety, cost, and convenience. The transit users' perspective about using public transportation after the covid pandemic is also evaluated. It can help make the transportation system more sustainable and efficient, improve urban life quality, and reduce traffic congestion, pollution, and greenhouse gases.



II. RELATED WORK

Studies on the evaluation of public transportation operations have been prompted by the issues mentioned below. The most common methods include fuzzy analysis, analytic hierarchy process (AHP), clustering analysis, and BP artificial neural network. Fuzzy analysis and AHP, for example, may produce erroneous findings when weighted subjectively. Furthermore, clustering and the BP artificial neural network analysis necessitate considerable statistical data. Data Envelopment Analysis (DEA) is a nonparametric method that emphasizes objectivity while simple to apply (Li et al., 2013). The difference between customer perception and customer expectation of the service is sometimes referred to as service quality. Previous research on service quality was confined to analyzing the performance of transportation services, and there were fewer attempts to evaluate service quality (Luke & Heyns, 2020). For enriching evaluations, an integrated MCDM technique based on the Delphi method, group analytic hierarchy process (GAHP), and preference ranking organization method is presented for evaluating public transportation systems. (PROMETHEE). (Nassereddine & Eskandari, 2017). To see if the gaps were statistically significant T-tests were used. One element under one mode had a non-significant gap, showing that the respondents' expectations were met (Luke & Heyns, 2020). Because of their less competitive service performance, high-occupancy public bus transportation services have gradually declined in various countries. Understanding the performance of service of a public bus system could help reverse the fall in public bus ridership. The impression and expectations of users are used to assess the performance of a public transportation system. When the outcome of the service delivered meets or surpasses their expectations, people are satisfied. The contentment of commuters is frequently used to assess the service quality from the perspective of users. Satisfaction refers to commuters' expectations and the actual performance of the public transportation service from the perspective of transit users (Atombo & Dzigbordi Wemegah, 2021).

(Chauhan et al., 2021) aims to find the attributes that determine the Multimodal Transportation Hub's (MMTH) service quality in Anand Vihar, Delhi, and their effects. Using structural equation modelling, relationships between service quality attributes and overall service quality are identified. (Anable, 2005) For driving, convenience, comfort, speed, and independence of the individual are all well-known arguments. Multiple overlapping attitude statements were used to design the questionnaire, each of which was hypothesized to relate to one of the components in a conceptual model. Focus groups with National Trust visitors and a review of the travel behavior and social psychology literature on behavioral choice inspired this model. (Ho et al., 2014) Prepared and sent a detailed questionnaire survey to primary care providers. The information was analyzed using a data-driven analytical methodology (5-point Likert scale). The mean of the four dimensions' importance and satisfaction was calculated. Fear of crime and public transportation security perceptions have a harmful and vital link. The most detrimental effect of fear of crime within the vehicle is utility, followed by bus stops and BRT stations, which have minimal effects. (Soto et al., 2022). (Chen et al., 2018) proposes a systematic methodology, aided by Geographic Information Systems (GIS), for identifying relative spatial gaps in public transportation supply. Public transportation is a necessary infrastructure that has a long-term impact on the dynamics and morphology of neighborhood expansion and urbanization's long-term viability and resilience. Energy consumption and carbon footprints can be reduced by providing efficient transportation systems and traffic congestion and accidents. (Atombo & Dzigbordi Wemegah, 2021) The second segment includes crucial service quality features like dependability, accessibility, safety, affordability, availability, and comfort. Commuters were asked to score things on a Likert scale based on their opinions of service quality attributes. The contentment of commuters is the subject of the third section. Commuters were asked to rate a single item on a 7-point Likert scale to show how satisfied they are with the quality of service given by public bus transportation.

III. METHODOLOGY

The analysis was conducted using a simple framework for evaluating the public transport system. The information for this analysis was gathered through an online questionnaire survey. A well-structured questionnaire was designed using a google form and circulated through the online platform from 6th May 2022 to 19th May 2022. Total 310 responses were observed. The data was collected using a questionnaire survey. The questionnaire included socio-demographics, preferences, frequency of travel, vehicle ownership, the importance of public transportation for environmental factors, factors that user typically consider necessary while using public transport. In this paper, Microsoft Excel was used for statistical analysis. The survey responses were analysed using the statistical hypothesis approach of gap analysis between importance and satisfaction. A gap analysis was used to determine the importance, satisfaction, and performance index for the analysis hypothesis. Commuters can prefer public transportation when they are fully satisfied with the service provided and when the outcome extends to or exceeds their expectations from the attributes, they think important. When the negative divergence is present, dissatisfaction occurs. The results are then evaluated to determine the implications for the variation in consumers' reported satisfaction with public transportation systems in Nagpur.



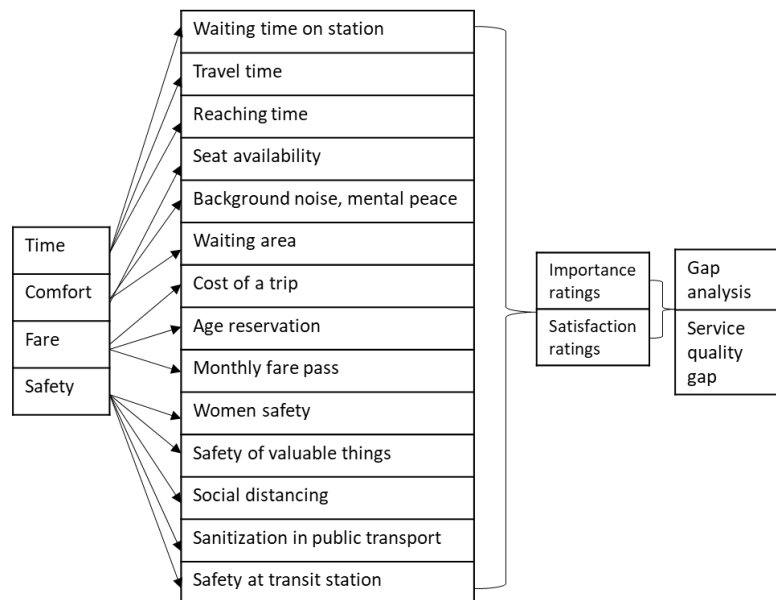
service quality gap

The service quality gap is determined by the difference between the average importance score and the average satisfaction score for each question. When the outcome matches or exceeds commuter's expectations, commuters might be happy with the services offered by public transportation. Dissatisfaction emerges when a negative divergence between the commuters' expected and actual service outcomes. As a result, the service quality may be expressed using equation 3.

$$Q_i = E_i - X_i$$

Where Q_i denotes the service quality of factor i , E_i indicates the perception of commuter i , and X_i signifies the expectation of commuter i .

The results of the comparison could reveal three possible outcomes. The perception (actual) is assessed as equal to, better than, or worse than expected. When $0 > E_i - X_i$, it indicates more than a satisfactory level of service quality. $E_i - X_i = 0$, implies a satisfactory level of service quality, and when $E_i - X_i < 0$, it represents less than a satisfactory level of service quality (Atombo & Dzigbordi Wemegah, 2021).



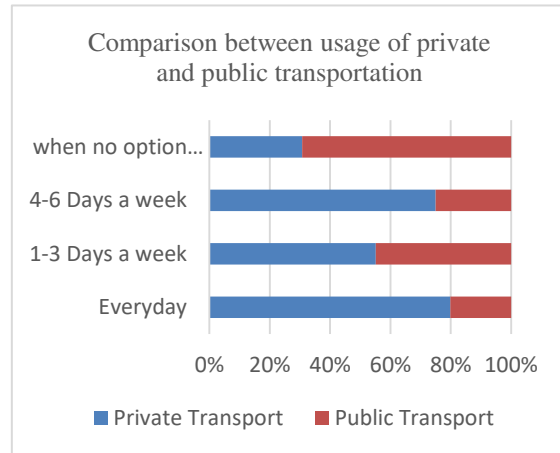
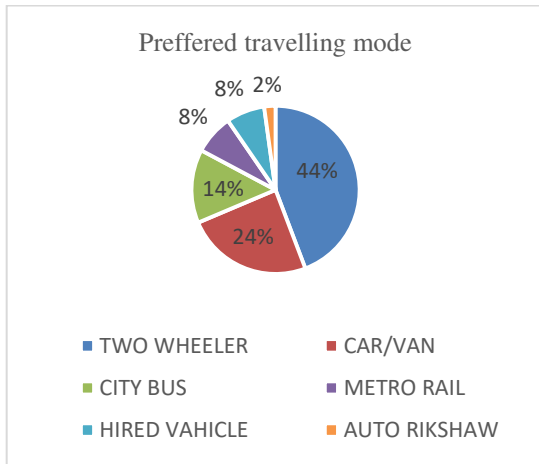
1: Methodological framework of the study

IV. EXPERIMENTAL RESULTS

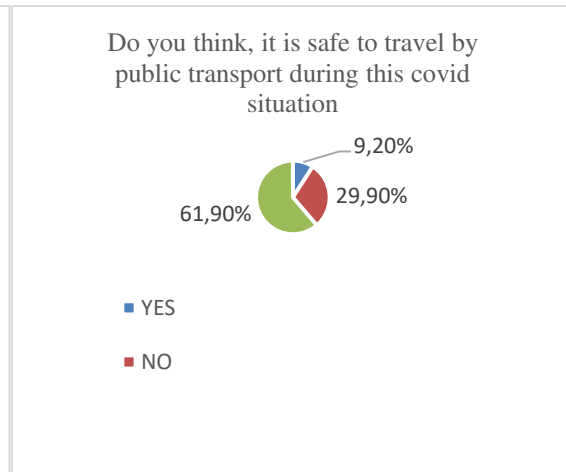
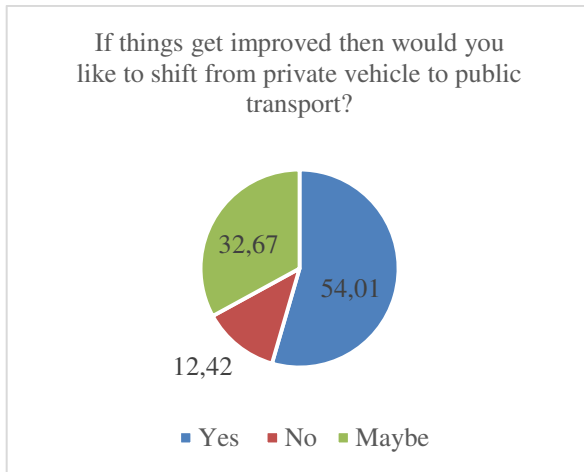
The study found that most of the response (64.83%) were males between the ages of 20-40 years which is 72.9% and are single (71.6%). Most of the response are graduates (38.06%), followed by postgraduates (16.45%).

Participants were asked about their preferred mode of travel. From Figure it is noted that most of the response (45%) use a two-wheeler. About 30% of response use city buses, metro, and hired vehicles as their preferred mode of travel. 25% of response prefer a car or van. It is seen that 83% of response have vehicle ownership. Among those, 74% of the people have two-wheelers and four-wheelers. we observed a significant gap between private and public transport usage. About 55.16% of response uses personal vehicle every day, whereas only 13.87% of response uses public transportation every day.

almost 30% of the total response agreed that it is not safe to travel by public transportation during this covid pandemic. This is because of fear of getting infected due to not following government instructions, such as wearing a mask social distancing. 61.9% of response are ready to travel by public transport after proper sanitization of the transport system followed by wearing a mask and social distancing. About 54.9 % of response are prepared to travel by public transport once the situation gets improved, and 12.42% of response deny travel by public transport even after things get improved.



2: Preferred traveling mode3:Comparison between private and public transportation use



4: Respondent's attitude towards public transport post covid-195: Respondent's safety concern of covid-19 in public transportation

Service quality gap

Table 1 indicates that the overall importance score and satisfaction score for the service quality attributes are 3.54 and 2.89, respectively, which gives less satisfaction (-0.65). Specifically, no attribute provides a positive service quality score between importance and service satisfaction. The worst performance was sanitization in public transportation from all the service quality attributes, with the most significant negative overall service gap score of -0.88.

Table 1. Service Quality Gap

Criteria	Ave. Importance score	Ave. Satisfaction score	Service Quality Gap
waiting time on station	3.210191083	2.77124183	-0.438949253
Travel time (during a trip)	3.474522293	2.986928105	-0.487594188
Reaching time	3.585987261	2.990196078	-0.595791183
seat availability	3.464968153	2.836601307	-0.628366846
Background Noise, Mental Peace	3.554140127	2.882352941	-0.671787186
Waiting Area	3.461783439	2.823529412	-0.638254028
Cost of a trip	3.452229299	2.964052288	-0.488177012



Age reservation	3.356687898	2.947712418	-0.40897548
Women safety	3.789808917	2.990196078	-0.799612839
Safety of valuable things	3.700636943	2.970588235	-0.730048707
Social distancing	3.621019108	2.774509804	-0.846509304
Sanitization in public transport	3.662420382	2.784313725	-0.878106657
Safety at transit station	3.675159236	2.905228758	-0.769930477

V. CONCLUSION

Work patterns, education, income, and attitude have impacted transit selection patterns. This study was conducted to evaluate public transportation and the impact of the covid-19 pandemic on public transit in five developing cities of Maharashtra through an online questionnaire survey. A total of 310 responses were used in this research to evaluate and analyse the service gap between the importance and satisfaction of transit users of Nagpur and found that all the respondents rated all the attributes as important but were not satisfied with it.

From the study, it was seen that respondents who use public transport considered factors such as safety, travel time, reaching time, comfort, and cleanliness as significantly essential but are not at all satisfied with the service provided to them, which influenced public transport mode choice. So, the transit agencies need to improve these service qualities to access the demand of the public transportation system. Respondents' feedback plays a vital role in this study. From their feedback and suggestions, it was seen that noise of the vehicle, discomfort due to extra passengers than the limit, not proper cleanliness, and sanitization, not following government rules and regulations while traveling during this pandemic affects the choice of public transportation than the fare they pay for the trips. Public transport is vital to expand business development and work opportunities. It's a system that moves people from one place to another in an efficient, affordable manner. So important is to improvise it, especially now when pandemic has changed, everything says one respondent.

The findings in this study that require attention are safety, comfort, availability, and time, leading to not choosing public transport over private vehicles. So, travel agencies of public transport need to pay attention to such attributes to improve the service quality provided by then to minimize the gap between satisfaction and importance. This paper focused on understanding service quality attributes from the user's point of view. Findings have a wide application across the tier 2 cities like Nagpur.

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