COMPARATIVE ANALYSIS OF PUBLIC BUS SERVICE QUALITY IN TASHKENT BASED ON USER PERCEPTION DATA

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Abstract: This study examines changes in user satisfaction with bus services in Tashkent, Uzbekistan, by analyzing survey data collected in 2021 and 2025. Key indicators of satisfaction—including speed, waiting time, walking distance, crowdedness, comfort, fare, and driver behavior—were evaluated. The results show measurable improvement in several service dimensions by 2025, suggesting positive impacts of transportation policy or infrastructure changes. This comparative analysis contributes to understanding public perception trends and offers insights for future public transport planning in Central Asian cities.

Keyword*: Public transport, user satisfaction, service quality, statistical analysis, Tashkent*

1. INTRODUCTION

Urban public transportation systems are a cornerstone of sustainable and inclusive city development. In recent years, the city of Tashkent has made significant strides toward modernizing its bus network as part of broader smart city and digital infrastructure goals. These efforts aim to improve efficiency, accessibility, and environmental sustainability.

Between 2021 and 2025, several key initiatives were introduced to enhance the quality of bus services. These included the procurement of new buses, including a fleet of electric buses to reduce emissions and noise pollution, and the implementation of a contactless fare payment system, which improved boarding speed and passenger convenience. Additionally, improvements in scheduling, route coverage, and service reliability have been supported by data-driven urban mobility planning.

Understanding how these changes have impacted public perception is critical for measuring the effectiveness of policy interventions. Passenger satisfaction is a core performance indicator for transit systems, influencing ridership, operational success, and long-term planning (Friman et al., 2013). While prior research in global contexts has explored longitudinal changes in user satisfaction, there is limited empirical evidence from Central Asia. This study aims to fill that gap by asking:

- Has overall satisfaction with bus services in Tashkent improved between 2021 and 2025?

To answer this, we use survey data collected in both years from bus users in Tashkent and evaluate changes across key satisfaction dimensions.

2. RELATED WORK

Passenger satisfaction is widely recognized as a key performance indicator in urban transportation systems. Prior studies have shown that service attributes such as speed, reliability, cost, comfort, and driver behavior significantly influence public perception and usage (Eboli & Mazzulla, 2007; Friman et al., 2013).

Research by Dell'Olio et al. (2011) demonstrates that changes in satisfaction over time are often linked to infrastructure investments and service innovations. In recent years, attention has also turned to the role of digital technologies in improving the transit experience. For instance, the introduction of cashless fare payment systems has been associated with greater convenience, reduced fare evasion,

and increased passenger satisfaction due to smoother boarding and simplified fare control (Tran & Kumar, 2019).

The integration of electric buses has also been studied for its environmental and operational impact, with some findings suggesting that these fleets can positively influence rider comfort and public approval if managed effectively (Zhou et al., 2022).

However, most of the existing literature focuses on Western or East Asian cities. Very few studies have evaluated the combined impact of fleet modernization and cashless systems in the context of post-Soviet or Central Asian urban transport. This study addresses that gap by offering a data-driven analysis of user satisfaction in Tashkent before and after the introduction of these innovations.

3. METHODOLOGY

This study adopts a comparative cross-sectional design to evaluate changes in user satisfaction with urban bus services in Tashkent between 2021 and 2025. The analysis is based on two structured surveys conducted in those respective years, each targeting a sample of bus users across different districts of the city.

3.1 Data Collection

Respondents were asked to rate their satisfaction on a 5-point Likert scale (from 1 = Very Dissatisfied to 5 = Very Satisfied) across key service attributes, including: bus speed, waiting time at stops, walking distance to bus stops, crowdedness, onboard comfort, fare affordability, bus driver's behavior. Demographic variables such as age, gender, employment status, car ownership, and frequency of bus use were also recorded to control for differences in user profiles between the two years.

3.2 Policy Context

Between the two survey periods, several major changes were introduced in the Tashkent public bus system:

- Deployment of electric buses on multiple routes
- Introduction of a cashless fare payment system using transport cards and mobile apps
- Upgrades to fleet quality and expansion of service coverage

These reforms aimed to enhance both environmental sustainability and the overall passenger experience.

3.3 Data Processing

Data cleaning and normalization were performed to harmonize variable names and scales across both datasets. Records with missing or inconsistent responses were excluded. The analysis was conducted using Python and Excel tools, and included:

- Descriptive statistics for demographic and service satisfaction variables
- Year-to-year comparison of mean satisfaction scores
- Construction of a composite satisfaction index by averaging each user's scores across the seven service attributes
- An independent samples t-test to assess whether changes in satisfaction were statistically significant between 2021 and 2025

This methodological framework enables a clear, data-driven evaluation of how recent technological and policy interventions have influenced public perception of bus services in Tashkent.

4. DATA ANALYSIS AND RESULTS

4.1 Descriptive Statistics

The dataset in 2021 included responses from 401 passengers, while the dataset in 2025 included 472 respondents. The demographic composition of the samples was broadly similar, with respondents from a range of age groups, employment statuses, and transport usage patterns.

Key background features:

- In both years, most respondents were regular users (4+ days per week).
- A noticeable increase in young and female users was observed in 2025, suggesting broader appeal of the upgraded services.

The analysis focused on seven core service attributes: bus speed, waiting time, walking distance, crowdedness, comfort, fare affordability, and bus driver's attitude.

Table 1. Descriptive Statistics of Service Attributes (2021 vs. 2025

Attribute	2021 year			2025 year			Change
	Mean	Median	Std Dev	Mean	Median	Std Dev	
Speed	2.63	3.0	1.02	3.45	3.0	0.82	+0.82
Waiting Time	2.17	2.0	0.97	2.39	2.0	1.03	+0.22
Walking Distance	3.07	3.0	1.03	2.89	3.0	1.68	−0.17
Crowdedness	1.75	2.0	0.89	2.84	3.0	1.39	+1.09
Comfort	2.38	2.0	0.96	3.55	4.0	0.90	+1.17
Fare	3.65	4.0	1.18	4.55	5.0	0.61	+0.90
Attitude	3.16	3.0	1.12	2.93	3.0	1.43	−0.23

Table 1 presents descriptive statistics (mean, median, standard deviation) for each attribute. Notable improvements were observed in comfort (+1.17), crowdedness (+1.09), and fare (+0.90), indicating user-perceived benefits from investments in new buses, electrification, and improved fare systems. However, walking distance and attitude of drivers showed slight declines.

4.2 Satisfaction Index and Statistical Test

To assess whether these attribute-level improvements translated into overall satisfaction, a Satisfaction Index was calculated for each respondent. A comparison of the mean index scores is shown in Figure 2a, along with standard deviation error bars.

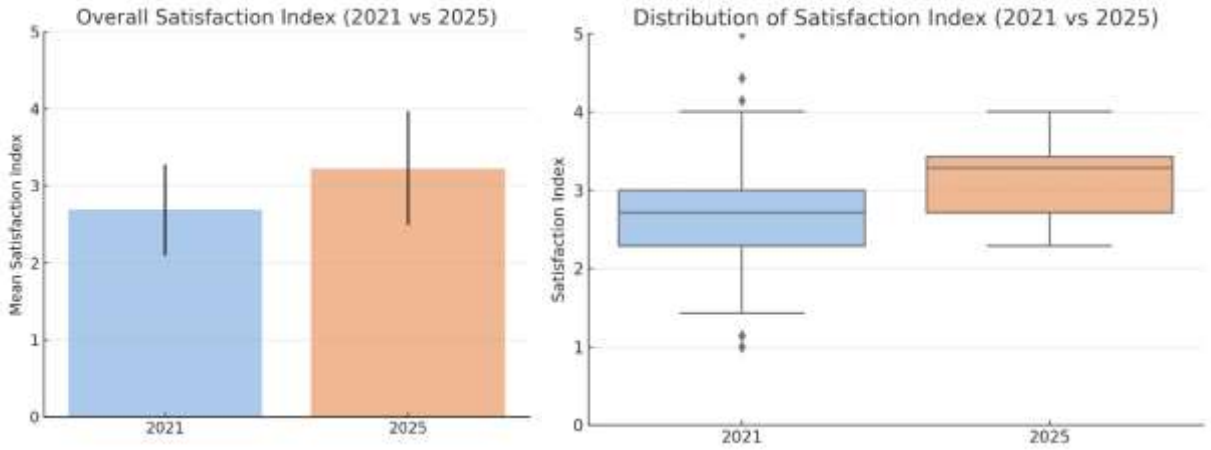
The mean Satisfaction Index increased from 2.69 in 2021 to 3.43 in 2025, indicating a substantial overall improvement. To test the statistical significance of this change, we conducted an independent t-test:

t-statistic = -10.88

p-value < 0.001

This result confirms that the difference is statistically significant at the 0.01 level, supporting the hypothesis that user satisfaction has improved.

Figure 2. a) Mean Satisfaction Index with Error Bars, b) Satisfaction Index Distribution



To further visualize the distribution of responses, a boxplot (Figure 2b) reveals a clear upward shift in overall satisfaction in 2025, with less overlap between distributions.

5. DISCUSSION

The findings of this study indicate a notable improvement in user satisfaction with the bus transport system in Tashkent between 2021 and 2025. This change aligns closely with several major reforms implemented during this period, including the acquisition of new buses, the introduction of electric buses, and the rollout of a cashless payment system.

The most significant improvements were observed in comfort, crowdedness, and fare affordability—suggesting that investments in newer, more spacious, and environmentally friendly vehicles have had a tangible impact on user experience. Additionally, improvements in speed and waiting time may reflect better fleet scheduling and route optimization.

Despite overall gains, two attributes showed slight declines. Walking distance decreased marginally, which could indicate either route reductions or stop relocations. More notably, attitudes of drivers showed a small but measurable drop. While the mean score remains moderately positive, this result may suggest a need for more attention to driver training, customer service, or perhaps increased workloads.

The significant increase in the Satisfaction Index, supported by the t-test, confirms that the overall service experience has improved. However, the increased variability in responses (as seen in the standard deviations and boxplot) suggests that the reforms may not have benefited all users equally. For instance, users in peripheral districts or those with mobility limitations might still face challenges.

This analysis provides strong empirical support that recent modernization efforts in Tashkent's public bus system are delivering measurable results. However, it also highlights areas—particularly human interaction and last-mile accessibility—where further improvements are still needed.

6. CONCLUSION AND RECOMMENDATIONS

This study assessed changes in user satisfaction with the public bus service in Tashkent between 2021 and 2025, using survey data collected during both years. The analysis revealed a statistically significant improvement in overall user satisfaction, largely driven by enhancements in comfort, service speed, fare affordability, and reduced overcrowding.

The improvements coincide with key developments in the city's public transport system, including the introduction of new and electric buses, and the implementation of a cashless fare payment system. These changes appear to have had a meaningful impact on service quality and public perception.

However, the analysis also identified areas requiring further attention, particularly:

- Slight declines in satisfaction with driver behavior, indicating a potential need for improved customer service training.
- A small drop in satisfaction with walking distance, possibly due to changes in bus stop locations or network adjustments.

Recommendations:

1. Maintain and expand investments in clean, comfortable, and efficient buses.
2. Strengthen driver training programs focusing on customer interaction and service quality.
3. Improve accessibility, especially for users who may face long walking distances or mobility challenges.
4. Monitor satisfaction regularly, using similar surveys, to ensure service quality remains aligned with user expectations.

Continued focus on both infrastructure and human factors will be key to sustaining and building upon the positive trends observed in this research. As Tashkent continues to modernize its transport system, incorporating feedback from regular satisfaction assessments will help ensure that reforms benefit all segments of the population.

6. REFERENCE

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