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A review of factors influencing car owners' shift to public transport in Tashkent

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Abstract:

This research examines the factors influencing car owners' decisions to transition to public transport in Tashkent, focusing on various socio-economic, environmental, and infrastructural elements. By analyzing the interplay between car usage and public transport, the study provides valuable insights into improving transportation systems and reducing environmental impact. A detailed literature review reveals various studies on transport choices, psychological factors, and economic motivations behind shifts from private vehicles to public transport. A survey of car owners in Tashkent was conducted to collect data on factors such as transport cost, convenience, environmental concerns, and infrastructure quality. The findings highlight key barriers to using public transport, such as inconvenience, safety, and insufficient infrastructure, while suggesting improvements that could encourage car owners to make the switch.

Keywords:

public transport, private car ownership, sustainable transport, transportation choices, built environment, traffic congestion, infrastructure development, environmental impact

1. Introduction

The development of urban transport systems necessitates a comprehensive analysis of the interactions between private vehicles and public transport. Investigating the factors that influence car owners in Tashkent to shift to public transport is critical for improving the efficiency of the transport system and reducing its adverse environmental impacts. Given the current challenges of pollution and climate change, public transport is projected to remain a cornerstone of sustainable urban mobility in the future.

Traffic congestion has prompted initiatives aimed at promoting walking and public transport as means to enhance public health and overall quality of life. However, the increasing reliance on motorized transport and inadequate planning of pedestrian and public transport systems have resulted in suboptimal travel experiences for urban residents. To address these issues, this study proposes a cost-effective survey methodology and a suitable sampling strategy.

Various methodologies are available for evaluating mobility options among car owners, each differing in their focus on qualitative or quantitative measures, composition, and selection criteria. Public transport, as a fundamental mode of mobility, supports pedestrian accessibility across varying distances and times. Vehicle-sharing services, in particular, contribute to reducing private vehicle ownership, encouraging a shift towards public and non-motorized transport modes such as walking and cycling. These shifts have been shown to decrease Vehicle Miles Traveled (VMT) and promote sustainable transportation solutions [9].

This study aims to analyze the primary factors influencing car owners in Tashkent to transition to public transport.

2. Literature review

Examining the factors that influence car owners in Tashkent to transition to public transport is crucial for enhancing the efficiency of the transport system and reducing its negative environmental impacts. Previous studies have yielded significant insights into the efficiency of transport systems and their influence on public transport usage.

A study conducted by Martin and Shaheen, based on a survey of over 6,000 car-sharing members in North America, investigated the impact of car-sharing on public transport and non-motorized travel [9]. Their findings highlight the potential of car-sharing to encourage shifts towards sustainable transportation modes, thereby reducing reliance on private vehicles.

According to the study conducted by Gabriela Beirão and J.A. Sarsfield Cabral, individuals' transportation choices are shaped by factors such as travel time, cost, convenience, and the psychological benefits associated with private car use [13]. In our research, it is crucial to review previous scientific studies and practical examples. Numerous academic works explore the interaction between private vehicles and public transport. The importance of public transport pricing and quality, as well as the costs of vehicle ownership and road usage, constitutes the economic motivations that encourage car owners to shift to public transport [1].

Environmental pollution and deteriorating air quality have been analyzed from psychological and atmospheric perspectives in Anable's (2005) study, which highlights how reducing environmental impacts can promote public transport usage [2]. Urban infrastructure and the efficiency of transport systems, particularly improvements in congestion reduction and road networks, influence decisions to transition to public transport. De Vos (2013) emphasized the reliability and efficiency of mass transit systems as critical factors [3].

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The study by Liya Yang, Chuan Ding, Yang Ju, and Bin Yu examined the influence of the built environment on car ownership and commuting choices, applying a multilevel choice model to reveal significant regional differences [16]. In Peshawar, a study analyzing factors influencing the acceptance of car-sharing systems as an alternative to public transport demonstrated potential benefits for high-income individuals and specific groups, such as students and employees. The findings underscored the importance of public awareness and understanding of these systems in reducing urban congestion [5].

Key factors such as reduced travel time, improved service quality, and the higher willingness of younger individuals to adopt public transit underscore the vital role of enhancing public transport infrastructure in mitigating traffic congestion [4]. The relationship between private car owners and public transport highlights differences in user profiles, the impact of car-sharing on vehicle ownership and travel behavior, and the potential for expanding free-floating car-sharing systems to other cities, demonstrating that car-sharing, particularly the free-floating model, provides a flexible alternative to private vehicle ownership while effectively complementing public transport systems [8].

A study by Renske van 't Veer et al. (2023) analyzed the intention to adopt Mobility as a Service (MaaS) among car owners in the Netherlands using Latent Class Cluster Analysis (LCCA). The findings revealed that factors such as age, education level, and reliance on public transport increased the propensity to adopt MaaS, while conservative car owners were less likely to accept the service [11].

In his research, Konstantinos Panou utilized Revealed Preference (RP) and Stated Preference (SP) methods to examine car users' willingness to switch to other modes of transport and the impact on airport parking facilities by exploring users' perceptions of transport modes and parking services [14]. Similarly, a study by Jing Li, Kevin Lo, and Meng Guo applied binary logistic regression to survey data to analyze how factors such as car ownership, gender, age, income, and the availability of public transport influence the choice of transport modes [15]. The following methodology will be employed to analyze the factors influencing car owners in Tashkent to transition to public transport:

- Survey: A survey will be conducted among car owners in Tashkent, focusing on the availability, cost, and quality of public transport, as well as their perceptions and attitudes toward transportation options.

- Statistical Analysis: The collected data will be analyzed using statistical methods, including social analysis and correlation techniques.

Our approach begins with the development of a comprehensive framework that incorporates the key factors affecting the transition of car owners in Tashkent to public transport. The survey will be conducted using multiple methods, with Google Forms serving as the primary platform for data collection [6]. The survey will primarily utilize Google Forms as it provides easy access and usability for both participants and researchers. Ensuring sufficient statistical significance in the process is crucial. Understanding multimodal travel behavior and promoting a balance in the modal mix significantly influence transportation choices [7].

Data privacy policies will be strictly adhered to, ensuring participant confidentiality in compliance with ethical research practices. No personal data will be collected, and participants will be informed that their participation is

voluntary, with the right to withdraw at any time without any consequences. According to a study conducted by Sigrun Beige and Kay W. Axhausen, there is a significant relationship between residential relocation during one's lifetime and vehicle ownership, as well as the influence of factors such as age, education, and employment status on mobility choices [12].

Criteria for Data Development: The survey is designed based on the following criteria.

- **Demographic Criteria:** Factors such as age, gender, education level, marital status, income, travel time, and residential conditions influence transportation choices. These variables are crucial for understanding the perspectives of individuals residing in city centers versus suburban areas regarding transportation preferences. Factors such as social attitudes, age, marital status, income, as well as personal preferences and psychological perspectives, play a significant role in public transport selection. Studies indicate that younger age groups and low-income groups are more inclined to use public transport [1]. Household size, income, socio-demographic factors, and built environment elements collectively influence car ownership, with the correlation between residential location choices and ownership patterns shaped by both personal and environmental factors [10].

- **Economic criteria:** The costs of public transport and private car usage, monthly income, and the efficiency of the transport system significantly influence transportation choices. The free-floating car-sharing system attracts younger, higher-income individuals who value spontaneity, while station-based systems appeal to self-employed individuals who prefer flexible and planned transportation, with each system catering to distinct travel purposes [8]. Factors such as transport costs, time, and convenience influence users' attitudes toward their choice of transportation [14].

- **Social criteria:** Personal preferences, psychological perspectives, and the quality of public transport influence the choice of transportation. Effective organization of public transport requires robust infrastructure, reliable transport systems, and consideration of psychological and social factors [1]. Considering psychological factors in transportation choices is essential, as each group has unique needs and perspectives [2].

- **Environmental criteria:** Environmental factors, such as air pollution and ecological impact, play a significant role in transportation choices. Car ownership, gender tendencies favoring men's preference for vehicle use, the proximity of public transport facilities negatively influencing private vehicle choice, and the substantially higher CO₂ emissions from private cars collectively highlight the environmental and behavioral dynamics of transportation preferences [15].

- **Infrastructure and transport system:** The convenience, speed, congestion levels, and time efficiency of public transport reflect the impact of infrastructure and the transport system. Well-designed built environments, such as high building density and improved access to public transport, can help reduce car ownership and driving, highlighting the need for policymakers to enhance urban form to decrease dependency on cars [16].

- **Personal experiences and behavior:** Distance and speed in transportation significantly influence urban transport conditions. Policymakers are encouraged to implement specific measures to promote the use of public

transport, particularly targeting individuals with a psychological attachment to cars [13].

Data processing. Once data is collected, it undergoes an initial review to ensure completeness and accuracy of responses. Any incomplete or ambiguous answers are carefully evaluated and excluded from the analysis if necessary. To maintain anonymity, the data is coded and stored in a database for subsequent statistical analysis.

Quality assurance. A series of measures are implemented to ensure the quality and reliability of the data:

- Pilot Testing: The survey instrument is tested on a small group of participants prior to distribution to ensure the clarity and relevance of the questions.
- Consistency in data collection: The data collection process is monitored to maintain methodological consistency throughout.
- Automated data entry and processing: Automated tools are used for data entry and processing, minimizing the likelihood of human error.

The processed data forms the foundation of our subsequent analysis, which aims to explore the interaction

between public transport and car owners' perceptions in the urban context.

3. Methodology

This research methodology is designed to analyze the factors shaping decisions to transition to public transport. The primary objective of the study is to explore the tendencies of car owners in Tashkent toward choosing public transport. To achieve this goal, the following methodological approaches are employed. Interviews were conducted with car owners to understand their opinions and preferences, and the following questions were posed to gather relevant data. Collecting individual information about these aspects is crucial for understanding car usage patterns.

The research focuses on addressing the following questions:

- What motivates car owners to transition to public transport?

How do the availability and quality of public transport in Tashkent influence this decision?

Table 1

Types of surveys, their advantages, and disadvantages

Survey types	Advantages	Disadvantages
Mail surveys	Flexible traditional surveys, suitable for respondents who feel comfortable with written forms, can collect responses over a long period	Requires a mailing list, response rate may be low, time-consuming
Email or social media surveys	Cheap, accessible for respondents with internet access, can speed up response time	Internet complexity for both surveys, potential for dropped responses, dependence on respondents' internet access
Internet (website-based surveys)	Convenient for explaining to respondents, can collect detailed individual information, fast outreach to the public	Requires time and money to create a website, technical difficulties may arise
Interviews, online interviews (google forms)	Cheap, forms are fully filled out, issues can be analyzed visually	Some respondents may not respond, maintaining anonymity can be difficult
Telephone surveys	Quick and easy to implement, fewer geographical limitations, easier to establish contact	Respondents may refuse telephone surveys, responses may be brief
Focus groups	Allows in-depth exploration of opinions, can obtain detailed insights on specific issues or topics	Small group of respondents (usually 6-12 people), dominant voices may influence others
Observational surveys	Provides the ability to collect real-time data in real-world settings, direct observation of respondent behavior	Difficult to track actions accurately, other influencing factors
Panel surveys	Provides the ability to conduct long-term observation, useful for studying trends	Respondents must participate multiple times, can interfere with personal privacy
Personal interviews	Full explanation of survey questions, easier to establish contact	Time and cost-intensive, respondents may provide inaccurate answers
Structured and unstructured surveys	Structured surveys present strict questions, unstructured surveys allow respondents to freely express opinions	Structured surveys do not allow for flexibility, analysis of unstructured responses can be challenging



Table 2

Types of questions for respondents and their objectives

Nº	Question	Answer options	Purpose
1	Age. What is your age?	18-25, 26-35, 36-45, 46-55, 56 and older	To identify age-related trends in choosing public transport or using a car. To understand how decisions vary across age groups.
2	Gender. What is your gender?	Male, Female	To analyze car owners' views on transportation by gender. To identify differences in transportation choices between men and women.
3	Education level. What is your level of education?	High school, Higher education, Master's, PhD, Other	To determine the relationship between education level and the decision to switch to public transport. To investigate whether highly educated individuals are more likely to choose public transport.
4	Occupation and job Type. In which sector is your workplace?	Public sector, Private sector, Freelance, Student	To identify how occupation and working conditions influence the decision to switch to public transport.
5	Marital status. What is your marital status?	Single, Married, Divorced, Other	To identify the factors that influence car owners' decisions based on marital status. To assess the relationship between family size and the likelihood of using public transport.
6	Family size. How many members are there in your family?	1-2 people, 3-4 people, 5 or more	To analyze the role of family size in choosing a car. To assess if individuals with larger families are more likely to use public transport.
7	Monthly income. What is your monthly income?	Low, Average, High	To analyze the relationship between monthly income and the decision to maintain a car or switch to public transport.
8	Time spent on transportation. How much time do you spend on transportation daily?	Up to 1 hour, 1-2 hours, 2 hours or more	To analyze the impact of daily commuting time on the decision to use public transport. Those who spend more time commuting may be more inclined to switch to public transport.
9	Housing and transport choices. Is your residence located near the city center or the outskirts?	City center, Outskirts	To analyze the role of housing location in choosing transportation. People living near the city center may be more inclined to choose public transport.
10	Car usage frequency. How often do you use your car?	Daily, Several times a week, Rarely, Never	To analyze the frequency of car use and its relationship with the decision to switch to public transport.
11	Purpose of car usage. What is your main purpose for using your car throughout the day?	Going to work, Leisure with family, Shopping, Other	To determine the reasons why car owners use transportation. To assess whether people prefer public transport for their daily needs.
12	Availability and quality of public transport. Is public transport in Tashkent convenient for you?	Very convenient, Somewhat convenient, Not convenient at all	To examine public transport's convenience and availability. The convenience of public transport can influence car owners' decisions to switch.
13	Public transport vs car costs. Do you feel that using public transport is cheaper than maintaining a car?	Yes, No	To identify car owners' economic views on public transport and car maintenance costs. If public transport is cheaper, car owners may be more inclined to switch.
14	Environmental and ecological factors. Do you feel that using fewer cars has a better impact on the environment?	Yes, No	To analyze how ecological factors influence the decision to switch to public transport.
15	City transport infrastructure. How do you evaluate the potential for reducing traffic jams and providing dedicated lanes for public transport in Tashkent?	Good, Average, Poor	To evaluate the efficiency of public transport and its infrastructure. If there are good options for reducing congestion and providing dedicated lanes, car owners may be more inclined to switch.
16	Traffic congestion and time spent. How does traffic congestion in Tashkent affect your daily movements?	Major impact, Moderate impact, No impact at all	To analyze how traffic congestion affects car owners' decisions to switch to public transport.

17	Biggest barriers to switching to public transport. What is the biggest factor preventing you from switching to public transport?	Inconvenience of public transport, Distance to transport stops, Prices, Safety, Other	To identify the main barriers preventing car owners from switching to public transport.
18	Car maintenance Costs. Are you satisfied with the monthly maintenance costs of your car?	Yes, Satisfied, No, Not Satisfied	To determine how car owners perceive maintenance costs. If the costs are high, they might be more willing to switch to public transport.
19	Social and personal factors. Do you prefer traveling by public transport or feel more comfortable in your car?	Prefer public transport, Feel more comfortable in a car	To identify personal preferences and psychological factors. Whether car owners are open to using public transport.
20	Social and cultural influences. How do you perceive the social acceptance of switching to public transport in Tashkent?	Widely accepted, Occasionally accepted, Not widely accepted	To study the social acceptance of public transport and identify the factors that influence people's decisions.
21	Safety of transportation. Do you think public transport in Tashkent is safe?	Very safe, Average safety, Unsafe	To examine the safety of public transport in the city and how safety concerns affect the decision to switch.
22	Pedestrian safety. How do you feel about the safety of pedestrian walkways in Tashkent?	Very safe, Average safety, Unsafe	To analyze pedestrian safety and its role in deciding to switch to public transport. Those who feel safer may be more inclined to use public transport.
23	Public transport fare. Do you think the fare for public transport in Tashkent is reasonable?	Very reasonable, Average, Poor	To evaluate the influence of public transport fares on car owners' decisions.
24	Proximity to transport services. How close are the main routes and stops of public transport to your residence?	Very close, Average, Not good	To examine the proximity of public transport services to residential areas. If public transport is close, people may be more inclined to leave their cars behind.

The analysis results show that the most significant factors influencing car owners' decision to switch to public transport are the convenience, cost, safety, and quality of the city's infrastructure. Many respondents expressed concerns about the safety and reliability of public transport. Public transport is often considered cheaper and more convenient compared to the costs of maintaining a car. However, obstacles such as the distance to transport stops, safety concerns, and the lack of dedicated lanes for public transport still remain significant challenges.

4. Conclusion

This study demonstrates that overcoming the main barriers to switching to public transport requires improving the efficiency and safety of public transport, as well as making changes in transport infrastructure and urban planning systems. The analysis highlights that the convenience and affordability of public transport play a crucial role in encouraging car owners to switch to this system. As cities grow, it is essential to make public transport systems more effective and attractive in order to incentivize people to give up their cars. These changes can contribute to the stability of urban infrastructure and support environmental sustainability.

Future research should delve deeper into the impact of various public transport improvements on the willingness of car owners to transition from private vehicles to public transit. This can be achieved through a multi-faceted

approach that examines specific changes in urban transport infrastructure, policy interventions, and behavioral factors influencing transportation choices.

One of the key areas of study could involve assessing the effects of expanding and optimizing public transport networks. A more extensive and well-integrated transport system with increased route coverage, higher frequency of service, and reduced waiting times may significantly enhance the attractiveness of public transport for car owners. Investigating how these improvements influence daily commuting patterns, travel times, and user satisfaction would provide valuable insights for urban planners and policymakers.

Another crucial aspect is the introduction of dedicated lanes for buses and trams, which can substantially increase the efficiency and reliability of public transport. By reducing delays caused by mixed traffic congestion, these dedicated lanes could make public transport a more competitive alternative to private cars. Future studies could evaluate the effectiveness of these lanes in different urban settings, considering factors such as road space allocation, traffic management strategies, and potential trade-offs with other transport modes.

Safety and security improvements in public transport systems should also be a focal point of future research. Many car owners are hesitant to switch to public transport due to concerns about personal safety, particularly during late-night hours or in less monitored areas. Research into enhanced security measures, such as real-time surveillance, increased

police presence, better lighting, and safer waiting areas, could help address these concerns. Additionally, studies could explore how emergency response systems and user-friendly reporting mechanisms for safety issues influence the public's perception of transport security.

Beyond physical infrastructure, future research could also focus on behavioral economics to gain a deeper understanding of the psychological and economic factors that shape transportation decisions. Car owners may weigh factors such as perceived convenience, status, autonomy, and financial costs when deciding whether to switch to public transport. Conducting surveys, controlled experiments, and case studies in different cities could provide comparative insights into the motivations and barriers influencing this transition.

Furthermore, future research should explore the integration of emerging transport technologies to improve urban mobility. Mobility as a Service (MaaS), for example, has the potential to revolutionize urban transportation by offering flexible and seamless multimodal travel options. By integrating ride-sharing, carpooling, public transport, and micro-mobility solutions such as e-scooters and bike-sharing, MaaS platforms could create a more efficient and user-friendly transportation ecosystem. Investigating the adoption rates, technological feasibility, and policy frameworks required for the successful implementation of MaaS in different urban environments would be highly beneficial.

Finally, a crucial aspect of future research is public policy and governance. Understanding how regulations, subsidies, pricing models, and public-private partnerships influence the development and adoption of improved transport systems is essential. Future studies could analyze how financial incentives, congestion pricing, parking regulations, and taxation policies can be leveraged to encourage car owners to use public transport.

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