Increasing the attractiveness of public transport among youth for the urban sustainable development

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Abstract. The growth in the number of personal vehicles in the urban environment causes significant damage to urban infrastructure and environment. European research aimed at increasing the attractiveness of public transport has mainly focused on government regulation and the development of sustainable alternative modes of transport such as cycling. The most mobile part of the Russian population is young people under the age of 30. The study is aimed at identifying behavioral responses and factors that can influence the rejection of personal transport in favor of public transport. The results showed that at the moment young people are not ready for this step. However, growing number of transport units and their comfort, as well as the creation of dedicated lanes on the roads for public transport to speed up its movement may increase the attractiveness of public transport.

1 Introduction

The problems of urban transport have been discussed for a long time both in scientific circles and among the society and public services. The rampant growth in the number of private cars has caused a number of significant problems in the urban infrastructure and in the environment in general.

According to Russian State Statistic Service, from 2005 to 2020, the number of personal vehicles (cars only) almost doubled (Fig. 1) [Transportation in Russia: Statistics Digest – 2020, Federal State Statistics Service, Moscow, 2020].

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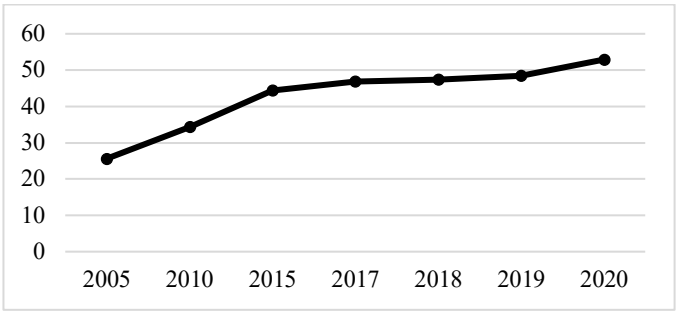

Fig. 1. The number of personal vehicles in Russia, million units.

Among the reasons for the rapid growth in the number of vehicles indicate the overall growth in the population, but the proportions of the growth in the number of vehicles and the increase in the number of inhabitants of the country are clearly not respected.

Another reason is the reduction in the cost of car production, but the analysis of the dynamics of changes in retail prices does not show a decrease.

According to another version, the abrupt availability of financing for vehicle purchases (cheap loans, installments, trade-ins, etc.) is to blame, and this reason really took place in the period 2010–2015. This is confirmed by the number of targeted loans issued by banks for the purchase of vehicles (Fig. 2).

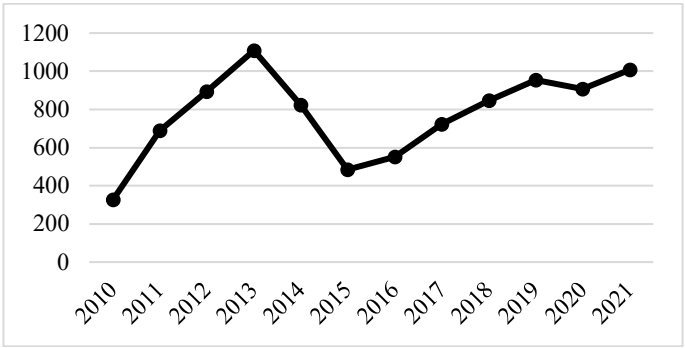

Fig. 2. Number of vehicle loans issued, thousand units [https://www.autostat.ru/press-releases/50497/?ysclid=la7v799ftn127113525].

However, objectively, Russian indicators still have not reached the level of personal vehicles that currently exists in developed countries. The average Russian indicator in 2021 was 397 cars per 1000 inhabitants, while in the USA this figure is 868 cars [https://axlewise.com/car-ownership-in-the-united-states/], 730 in Canada [https://www.statcan.gc.ca/en/topics-start/automotive], 560 on average in the EU [https://www.acea.auto/figure/motorisation-rates-in-the-eu-by-country-and-vehicle-type/] (from 1300 in San Marino to 394 in Latvia).

The study of the consequences of the growing number of personal vehicles discussed in the scientific literature helped to systematize the negative consequences of this process (Tab.1).

Table 1. Consequences of the growth in the number of personal vehicles in cities.

Road network (overload)	Traffic jams Lack of parking places Insufficiency of the road network and the need to expand and equip it
Safety	Increasing number of accidents in transport (property damage) Increasing number of injuries (life and health safety)
Environment	Growth of harmful emissions into the air Pollution of land along transport routes Growth in the number of car dumps [1]
Population well-being	Noise pollution Increased physical inactivity Growth and exacerbation of chronic nonspecific lung diseases Growth of introversion, need for solitude

Methods to increase the attractiveness of urban public transport to reduce the number of personal transports have been considered most actively in the last couple of decades in European countries. Most of the research was carried out in the field of state regulation [2-5] and alternative environmentally friendly and healthy modes of transportation [6-10].

The most mobile part of the urban population is young people under the age of 30. A feature of this category is the fact that owning a private car is more difficult for them than for older people, as they are limited in using bank financing, and their overall income is lower. The article describes a study aimed at understanding the degree of attractiveness of public transport in the eyes of urban youth, taking into account the high level of development of the taxi service.

2 Methods and Materials

The technical part of collecting young people's opinions about the attractiveness of urban public transport, as well as behavioral reactions in modeling various transport situations, was carried out using a desk survey. The survey was completed electronically using the Google-forms. The method of searching for respondents is a snowball.

The survey was conducted among 473 respondents under the age of 30 of both sexes living in cities with a population of over 500,000 people. The location of the respondents is due to the need for a developed urban transport network, as well as a developed and actively used taxi system.

The main emphasis was placed on young people, since the foundations of behavioral patterns in relation to transport are largely formed in the period after school graduation and the beginning of an independent life (student life, first job, moving to another city, etc.). In addition, traditionally, many of them get a driver's license at this age and they make the first decisions about purchasing a personal vehicle (or at least the formation of a need for a personal vehicle).

At the time of the survey, a quarter of all respondents already had their own personal transport (25.6%). To understand the current situation with the use of urban public transport, the most frequent means of transportation within the city limits were analyzed (Tab.2).

1/5 of all respondents, having their own transport, still use public transport from time to time. At the same time, respondents who do not have a car are more inclined to walk for short distances (1-2 km) - 87.8% than those who have their own transport - 26.5%.

Table 2. Use of urban public transport by respondents.

Answer	**Respondents who have their own car (car at their disposal)**		**Respondents who do not have their own car (car at their disposal)**		**Total respondents**	
	people	%	people	%	people	%
I do not use public transport at all or very rarely (less than 1 time in 2-3 months)	66	54.5	0	0.0	66	14.0
I use public transport occasionally, more than once a month	33	27.3	33	9.4	66	14.0
I use public transport often, several times a week.	22	18.2	132	37.5	154	32.6
I always use public transport	0	0.0	187	53.1	187	39.4
Summary	121	100.0	352	100.0	473	100.0

3 Results

An interesting fact is that when traveling around the city for significant distances (over 2 km), except the obvious, traveling by private car for those who have it, and by public transport for those who do not have a car, both categories equally often use taxis - 14% and 17% respectively.

The simulated situation, when the respondent is sure that it will be faster to get there by urban public transport than by car, did not cause a change in the behavior of car owners: 65% will still go by their cars and another 8.3% by taxi. At the same time, those who do not have personal cars indicated that they are forced to use urban transport, that is, they consider the situation as a “choice without a choice”. Also, there is a group in the category of respondents who do not have their own transport, who constantly use taxis, regardless of distances and conditions (about 10%), and they clearly stand out.

Moreover, the simulated situation where it is difficult to find a parking space at the destination or parking is paid (and this is known in advance) did not cause significant changes in behavior: car owners will partly go by taxis, while their opponents will continue to use public transport.

Another studied factor influencing the behavioral responses of respondents in relation to public transport was the cost of travel. The analysis showed that this factor is not significant at the moment, that is, understanding the existence of a large difference in the cost of a trip by private car and public transport does not affect behavior change (Tab.3).

Table 3. If you understand that a trip by public transport will cost you cheaper than a taxi or a private car, which will you choose?

Answer	**Respondents who have their own car (car at their disposal)**		**Respondents who do not have their own car (car at their disposal)**		**Total respondents**	
	people	%	people	people	%	people
Public transport	10	8.3	301	85.5	311	65.8
Taxi	23	19.0	20	5.7	43	9.1
Personal car	88	72.7	31	8.8	119	25.1
Summary	121	100.0	352	100.0	473	100.0

Thus, the analysis and simulated situations aimed at increasing the discomfort from using a private car did not reveal significant factors that could radically affect the behavior of young people regarding the use of public transport. This indicates a large gap in the qualitative characteristics of these modes of transport.

The next stage of the study was the search for factors to increase the attractiveness of public transport without comparison with personal transport.

4 Discussion

By brainstorming, a list of possible ways to improve the quality characteristics of urban public transport was compiled:
- Dedicated lanes for public transport (to move faster);
- More comfortable buses and trolleybuses;
- More routes;
- More stops;
- More public transport units (to avoid waiting and crowding);
- Lower cost of ride;
- Availability of price offers (bonuses, loyalty points, cashback, etc.);
- Availability of convenient electronic services;
- Electronic payment systems and refusal of conductors;
-High level of service culture (driver and conductor).

The histogram in Fig.3 shows respondents' assessment of the level of impact of these improvements.

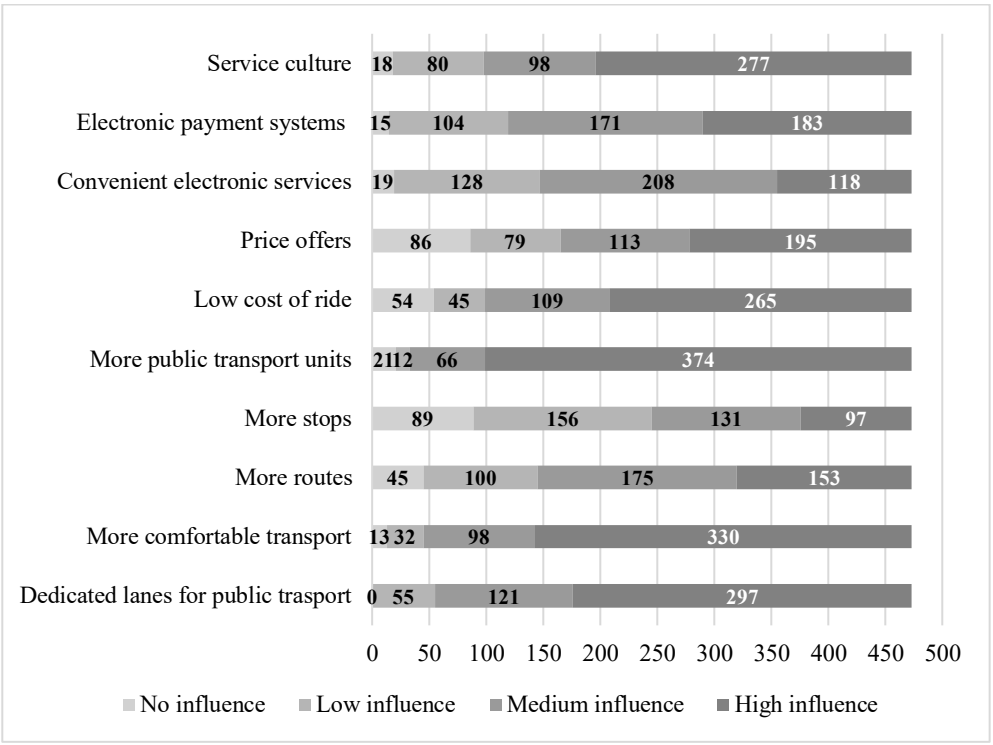

Fig.3. The level of influence of various factors on increasing the attractiveness of public transport.

The most significant factors highlighted are “More public transport units (so that there is no need to wait, and there is no crowd)”, “More comfortable transport”, “Dedicated lanes for public transport (to move faster)”. Thus, the comfort of the trip and its speed are decisive.

Due to the fact that many respondents consider taxi services as an alternative to public transport, but this solution does not satisfy the original idea of reducing the traffic load, factors that could influence the refusal to use taxis were similarly assessed. List of factors:

- Increasing taxi prices;
- Long wait for a taxi;
- Poor condition of taxi cars;
- Low culture of taxi drivers;
- Absence, failures or inconvenience in the operation of electronic taxi services;
- Significant improvement in the situation with public transport;
-Reducing the cost of using personal transport.

Respondents' assessment of the level of influence of factors is shown in Fig.4.

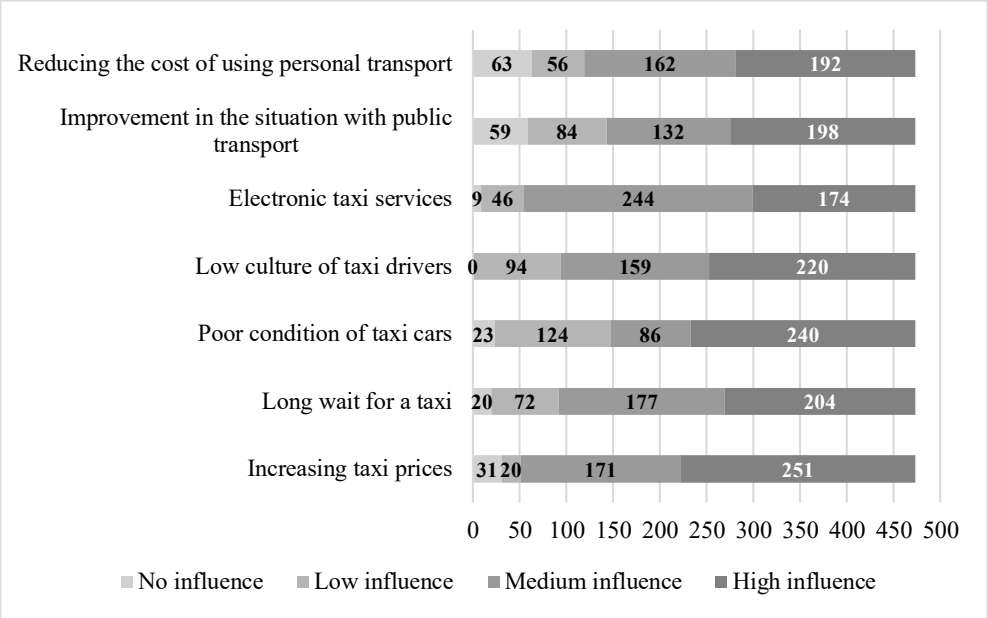

Fig. 4. The level of influence of various factors on the refusal of a taxi.

The most significant factors were "Increase in taxi prices", "Poor condition of taxi cars" and "Low culture of taxi drivers". Although it is worth noting that all the studied factors have an effect above the average.

In a similar study of possible reasons for not using personal vehicles, it was found that the biggest impact could come from rising gasoline prices (36.4%), the emergence of paid parking everywhere or not in the right places (31.4%), as well as increasing in general, the cost of cars and their maintenance (27.3%). The least effect is the increase in transport taxes (11.6%) and a significant improvement in the situation with public transport (17.4%).

5 Conclusion

The study showed that young people are not ready to give up private cars in favor of urban public transport. This is due to a large gap in the qualitative characteristics of these modes of transport. The most significant factors are increase in the number of public transport units and in their comfort, and the creation of dedicated lanes for public transport, that is, the most important is the comfort and speed of movement.

Since only a quarter of young people own a private vehicle, they actively use taxi services, but the biggest limiter to this mode of transportation is the cost of the trip.

The study has its limitations, it is possible that the validity of the results can be improved by conducting control measurements in other regions. Weather and climate factors, as well as the level of income of the population, can influence the behavioral reactions of young people regarding public urban transport.

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