

Transport system and transport education development: some challenges and opportunities

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Abstract. It is recognized that one of the most important sectors of the modern megacities economy is their transport system (including transport system of such a rapidly developing megacity as Moscow). The transport system of the Russian capital is a complex structure, which includes numerous different types of transport, and is characterized by high congestion, high level of passenger traffic, that indicates not only the positive impact of transport on the socio-economic system of the city, but also the appearance/occurrence of various negative consequences, such as overloading of roads, deterioration of road conditions, suboptimal traffic, unworked routes, difficulties with dispatching regulation of public transport. The Moscow Government systematically solves the problems of the transport complex. At the same time, it is worth noting the significant role of educational organizations (transport education is actively developing): provision of qualified personnel, organization and conduct of various research projects. However, even here there are challenges and opportunities. **Keywords:** transport system, transport education, specialists for the transport industry, training, research projects

1 Introduction

One of the current problems that requires constant attention is the life quality issue of the population on our planet. The current economic situation in the world (including certain instability) strengthens the existence of such a problem as the dependence of the development of society as a whole on the level of quality of life. The quality of life of the population depends on the state of the environment and the conditions of people's life activity, and is determined by the life expectancy of the population and the state of health. One of the determinants (along with other factors) of the quality of life in modern cities is rightly recognized as such a factor as the level of development of the transport system.

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It is noted that in megacities transportation has a more intensive impact on the quality of life of the population, in this regard, attention is paid to the development of urban public transport [1]. Also, in this situation, the issues of training qualified specialists for the transportation industry are becoming more and more relevant.

The transport system of Moscow is currently characterized by continuous improvement of quality, growth of comfort, convenience and ease of use, as well as accessibility and safety of transport [2]. All this is confirmed by the world ratings of the development of transport systems of the largest cities in the world. Thus, in 2021 the capital of Russia took the third place in the top ten cities in terms of transport system development [3].

In the reports “Elements of success: Urban transportation systems of 24 global cities” and “Elements of success: Urban transportation systems of 25 global cities” by McKinsey&Company, experts assessed the transportation systems of different cities in five groups of indicators: infrastructure accessibility (physical accessibility), affordability, efficiency, comfort, and safety and sustainable development. Based on these indicators, a ranking of the top ten cities was compiled, while the public transport system and the individual transport system were assessed. For comparison, the results of studies in 2018 and 2021 are presented. In 2018, Moscow occupies the sixth position in this rating – 56.1%, and in 2021 it is already the third (Fig. 1 and 2). However, in terms of affordability and security, Moscow was not among the top ten cities in 2021 [3], [4]. Also, the capital of the Russian Federation took the second position in the ranking of leading cities in terms of public transport use (75%): physical accessibility of rail transport, financial affordability of public transport, efficiency of public transport, comfort of public transport, and physical safety in public transport [3]. A separate section in the report is devoted to epidemiological safety in transport and reducing the risk of COVID19 infection during the pandemic.

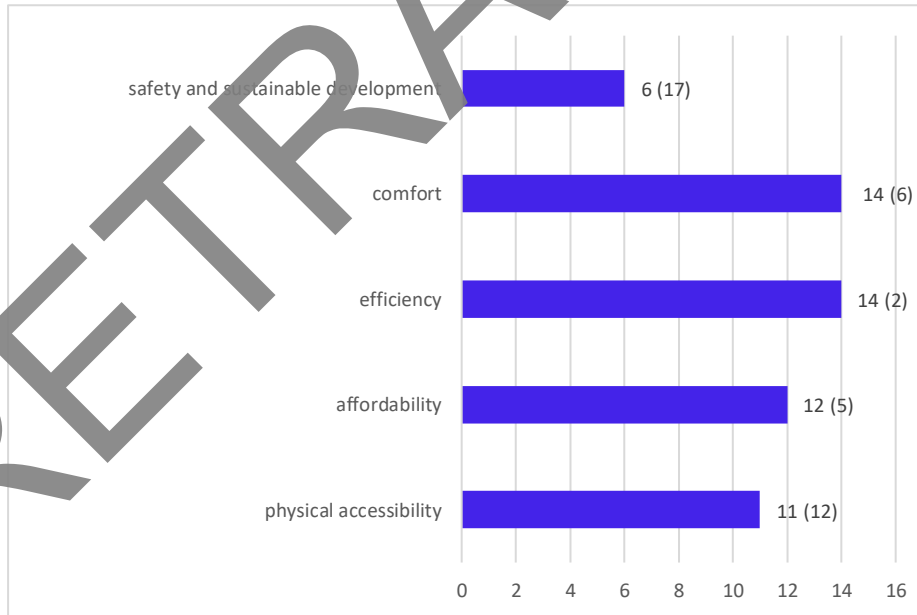


Fig. 1. Overall assessment of transportation systems by objective indicators (Moscow), in % (place in the ranking by indicator), 2018. Source: [4] (McKinsey & Company)

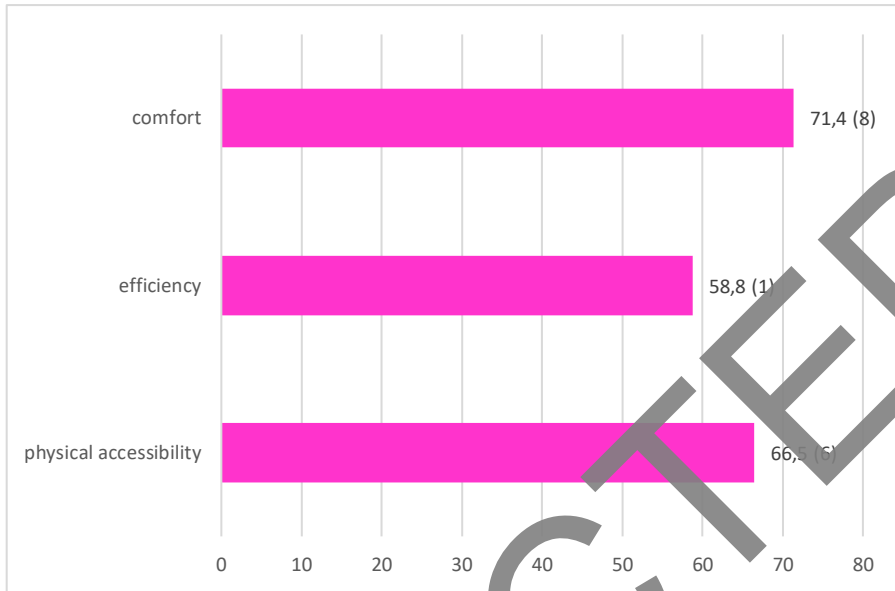


Fig. 2. Overall assessment of transportation systems by objective indicators (Moscow), in % (place in the ranking by indicator), 2021. Source: [3] (McKinsey & Company)

In 2023, in the fifth edition of the Urban Mobility Readiness Index, published on the basis of research conducted by the Oliver Wyman Forum think tank in cooperation with the University of California at Berkeley, the city of Moscow ranks 39th out of 65 cities surveyed. For the sake of clarity, Figure 3 compares Moscow's performance with that of Helsinki, which ranked first (the ranking is shown in parentheses in the figure): the Urban Mobility Readiness Index score assesses cities' readiness for future mobility trends in terms of social impact, infrastructure, market attractiveness, system efficiency, and innovation; the Sustainable Mobility Index score reflects the extent to which cities invest in structural change and facilitate its implementation through [5].

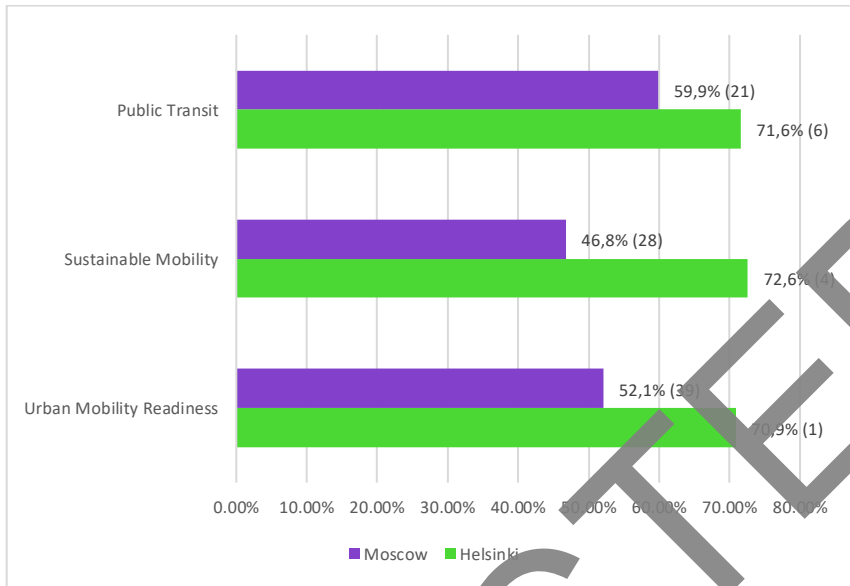


Fig. 3. Urban Mobility Readiness Index, Sustainable Mobility and Public Transit scores (Moscow and Helsinki), 2023. Source: [5] (Oliver Wyman Forum and University of California, Berkeley)

This ranking of the best cities in terms of public transport quality evaluates the Urban Mobility Readiness Index on such parameters as [5], [6]:

- 1) infrastructure (ease of use, accessibility - the availability of public transport is often one of the main indicators of why people choose public transport over private transport; quality of infrastructure and its relationship with other infrastructure, such as cycling infrastructure);
- 2) system efficiency (efficiency of movement, including continuity of operations, ensuring uninterrupted travel, responsiveness to the occurrence of risks or other crisis situations, etc.);
- 3) social impact (benefits that accrue to users: environmental, social, economic, etc.);
- 4) market attractiveness (business competitiveness, government support/funding, transportation options, etc.);
- 5) availability of innovation (in the training of personnel, as well as in the application and adaptation of new technologies, etc.).

Let us compare the cities of Moscow and Helsinki according to these parameters (Table 1).

Table 1. City scores in percentage across the five dimensions compared. Source: [5] (Oliver Wyman Forum and University of California, Berkeley)

Dimensions of the Urban Mobility Readiness Index score	Helsinki	Moscow
Social Impact	71,5%	62,1%
Infrastructure	77,9%	50,6%
Market Attractiveness	69,3%	59,8%
System Efficiency	73,4%	45,9%
Innovation	49,6%	28%

Accordingly, the results show what can still be improved in Moscow and what other opportunities exist for the development of this megacity's transportation system.

2 Methods

As sources for conducting research in the field of the need for the development of sectoral (transport) education, legal documents, scientific articles, and reports were used.

The main methods of scientific research have become general scientific methods of cognition, such as an analysis of the current situation of the Moscow transport system as a whole, and in particular, the problems of the transport education development, as well as generalization and comparison.

The main sources of information were the materials published in scientific articles and reports on research results.

Thus, the study mainly used general scientific methods of cognition (analysis, generalization, comparison, etc.), but some specific methods were also used (document analysis, understanding and explanation, observation).

3 Results

The transport complex of any city is constantly changing, and the transport system of such a megacity as Moscow is also constantly developing. However, any development does not take place without searching for optimal ways, finding opportunities and emerging problems (difficulties, complexities, barriers/obstacles).

Investment expenditures of the Moscow budget for the development of transport infrastructure in 2022-2024 will amount to almost 15 trillion rubles, or about 69.4% of the budget of the Targeted Investment Program of the City of Moscow [7], which once again confirms the close attention from the government to the transport system development.

Among the various opportunities for the development of the city transport system we can mention the optimization of public transport routes (in particular, stops, waiting time for transport, but here it should be emphasized that it is better to optimize for those who actually use a particular public transport route), transition to electric vehicles (in addition to public electric buses) to improve the environmental situation, etc. However, it should be noted that the city of Moscow is a historical capital (many historical buildings, monuments, etc.) and in such megacities the problems of transport system development are also conditioned by the capabilities of the already existing road and street network.

At present such a problem as the problem of development of transport education in the transport sphere is noted and is being solved. Clear evidence of this problem solution is the current "Concept of personnel training for the transport complex until 2035" which was approved by the order of the Government of the Russian Federation dated February 6, 2021 № 253-p.

This concept defines two main strategic objectives of transport education for the period up to 2035 - these are [8]:

- 1) – to provide the transportation system with qualified personnel for its uninterrupted operation and development;
- 2) – creating an environment that attracts and develops leaders of industry change.

The concept also identifies the priority tasks in the area of traffic education. [8]:

- enhance research activities, attract world-class research, develop scientific collaborations;
- improving and renewing educational programs in particular and educational activities in general;
- adaptation and modernization of curricula to new professions created by digitalization (especially the development of artificial intelligence);

- digitization of all educational organizations (key business processes of universities, etc.);
- and others.

The Moscow City Government plays an important role in solving the emerging problems of the Moscow transport system development. Thus, in accordance with the Moscow State Program "Development of the Transport System" approved in 2011 [9], which was updated and adjusted annually, reconstructed roads, created spaces for pedestrians and cyclists, increased the number of stations of the capital's metro, etc.

In January 2022, the Ministry of Transport of the Russian Federation approved the draft Strategy for the Development of the Transport System of Moscow and the Moscow Region for the period up to 2035 [10], the purpose of which is to create an effective tool for managing the integrated development of the Central Transport Hub as part of the transport systems of Moscow and Moscow region. In the same 2022, a draft Moscow Transport Strategy until 2023 and 2030 and in perspective until 2040 was developed.

The main directions of improvement and development of the transport system of Moscow are defined in the draft strategy [10], these are: accessibility, comfort of the public transport network, safety (roads, streets), introduction and use of digital technologies and new forms of mobility, green, healthy streets.

The implementation of these areas, taking into account limitations, including resource ones, requires serious scientific and analytical work.

The solution of the problems of the development of the Moscow transport system is also facilitated by active research and development (R&D) in close cooperation of employees of the Department of Transport and its subordinate organizations, as well as other participants (students, teachers, etc.) as part of scientific teams of the leading universities of the capital (Lomonosov Moscow State University (MSU), Russian University of Transportation (RUT (MIIT)), Financial University under the Government of the Russian Federation (Financial University), Plekhanov Russian Economic University (Plekhanov Russian Economic University), Moscow State Automobile and Road Engineering University (MADI), National Research University Higher School of Economics (National Research University Higher School of Economics), Central Research Institute for Automobiles and Motor Vehicles (NAMI) and other scientific, consulting and educational organizations (e.g. consulting firm McKinsey&Company).

Within the framework of this fruitful cooperation in the field of scientific developments, the transport preferences of the residents of our metropolis were monitored, models of Moscow traffic flows were developed, developments in the field of unmanned transport and air transport (aerotaxi) were created, and experience was exchanged through consultations, seminars, conferences, etc.

We can also note the fruitful participation in the formation of relevant research topics and in the process of organizing the implementation of research and development activities aimed at the development of the transport industry, MosTransProject (Transport Research and Design Institute) [2]. An example of this is the "Intelligent Transport" project, the creation and development of the service for assessing the accessibility of residential complexes "Learn about LCD" and the testing in urban conditions of V2X technology (vehicle-to-everything - technology of independent interaction of the car with the environment: with other vehicles and road infrastructure) [11].

However, at this point in time, there is some fragmentation and dispersion of prospective research in the transportation sector [2].

Now specialists highlight such a problem as low availability of personnel with higher education in the industry, so in 2021 A. Keller noted: "just over 20% of people with higher education will work in the transport sector" [12].

4 Discussion

Recently, the upbringing of a creatively thinking specialist (in any field of activity) has been declared as the task of higher education, but in reality, there is an approach that is based on the simple transfer of knowledge to the student [13].

In this regard, let us dwell on some aspects of improving the quality of transport education:

- orientation towards the needs of employers, monitoring these needs and therefore close relationship with employers;
- to train professionals/specialists, to attract qualified personnel (teachers, teacher trainers, practitioners, etc.);
- development of educational infrastructure (infrastructure of educational organizations);
- emphasis on obtaining practical skills (in combination with high-quality theoretical training);
- organization of research activities (including student research activities);
- joint activities with foreign educational organizations and partners on the basis of cooperation;
- development, implementation and use of a variety of innovative educational technologies (virtual simulators, gaming technologies, etc.) and new/innovative forms of learning (e.g., blended learning);
- and others.

Promising professions in the transport sector have already been identified [12]: architect of intelligent control systems (develops software for unmanned vehicles, controls automated traffic control systems); designer of intermodal transport hubs (engaged in the development of a transfer system from one mode of transport to another, calculates the wear resistance and throughput of goods and passengers), and a cross-logistics operator (chooses the optimal method of delivering goods and passengers by different modes of transport, controls the traffic flows and the throughput of transport nodes).

5 Conclusion

With a view to further improvement and development of the transport system and competitiveness of Russian transport education, the necessity of creation of a system of continuous professional education is emphasized, which will include education and training of all levels and various forms (vocational education, secondary vocational education, higher education of all levels (bachelor, specialist, master degrees, training of scientific personnel of higher qualification); full-time, part-time, extra-occupational and supplementary education, as well as education and training of specialists of higher qualification) [8].

Graduates of educational organizations should be in demand on the labor market and able to continue their education (if necessary, including pre-training, retraining and advanced training).

Also, accordingly, the study and consideration of various criteria of quality of public transport in the cities of the world, the adoption of positive experience, its adaptation to the specific conditions of Russian cities, will help to make more qualitative public transport of Moscow in particular, and in general - other cities of Russia.

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