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Comparative Assessment of Competitiveness of Passenger Transportation

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ABSTRACT

The article presents the methodological principles and results of the analysis of key economic indicators for transportation of passengers by rail in the largest countries of the world (France, Germany, USA, Japan, China, and India) in comparison with similar indicators in Russia to determine reference objects for assessing competitiveness of the segment of rail passenger transportation in Russia.

Features of railway systems of the countries under consideration have been briefly analysed. To better demonstrate the results of the analysis, the study objects were enlarged following territorial criterion, i.e., the results are presented not for individual companies, but for the countries where the companies operate.

The calculation of quality indicators of transportation activities for each of the countries considered has been carried out resulted in compilation of a matrix reflecting to some extent the current situation in development of passenger railway transportation. Recommendations have been formulated on the choice of reference objects depending on the specified criteria of comparison.

Keywords: *competitiveness, passenger transportation, railway transport, reference object, foreign experience.*

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Background. To assess competitiveness of the object under a study, it is necessary to first determine a corresponding base reference object. The choice of a reference is important for obtaining a reliable, practical result corresponding to the objectives set in the study. Usually, a world standard or the best domestic sample can be taken as a reference. Regarding assessment of competitiveness of rail transportation, foreign companies of that mode of transport that provide transportation services in a particular country can serve as a reference object. As for the domestic experience, it is advisable to consider comparative assessment of current indicators with the best values of analogues for a given analysed period [1].

This article examines the key parameters and results of the activities of railway passenger companies for 2017–2019 in several countries in Europe, Asia, and North America. The analysis was carried out to determine the reference and its further application for comparison with the indicators and factors of competitiveness of Russian railway companies in the passenger transportation segment.

Railway transport belongs to the category of capital-intensive sectors of the economy, primarily due to significant capital expenditures required for development and modernization of infrastructure. In the world community, a modern developed railway system is considered as the basis for the country's economic prosperity. In some developing countries, railways have been either absent till recently, or existing facilities have been gradually deteriorating, passenger flow has been falling due to a lack of investment in renovation of fixed assets; there are countries where railway construction is constrained by economic reasons or natural geographic conditions. At the same time, most of the countries with the best indicators of economic growth are striving to build new railway lines, increase speed limits, and promote railway passenger transportation for various distances on the market of transportation services as the most comfortable, safe, fast, inexpensive and, most importantly, environmentally friendly mode of transportation [2].

In world statistics, the structure of passenger turnover by mode of transport is as follows: the share of railway transport is equal to 10 % of the total volume, 80 % belong to road transport, and the share of air passenger transportation is about 9 % [3]. The share of railway passenger transportation is small; however, it is worth clarifying that these statistics cover all countries of the world, including those where this mode of transport is absent.

The reasons for such a large share of road passenger transportation in the structure of world passenger turnover are as follows:

• lack of a competitive market: in many countries alternative modes of transportation are missing;

• high manoeuvrability and ability to transport passengers «from door to door»;

• repeatable short distance trips of passengers, that thanks to their multiplicity constitute considerable value in annual terms.

In Russia, railway transportation accounts for 44 % of the passenger turnover of all modes of transport, which indicates its critical importance for the country's economy [4]. The Transport Development Program until 2030 sets the tasks of developing a network of modern speed and high-speed railways in the central part of Russia. Discussions on other industry development projects touch upon outlooks for variants of their development in other regions of the country and beyond. A less ambitious, but no less important, task is to increase the occupancy of passenger cars. The achievement of financial self-sufficiency and stability indicators is possible only with an increase in passenger flow, therefore, for passenger railway companies, the key task is to find solutions to attract a larger number of consumers of transportation services, considering particularly the experience of similar activities of foreign partners. It is proposed to consolidate global experience to apply it at Russian railways based on a number of criteria.

For the analysis, countries were identified according to two criteria:

1. First group. Leading world economies with developed transportation systems: the USA, France, and Germany [5].

2. Second group. Countries with high indices of development of railways over the past decade:

• The People's Republic of China (PRC) takes a leading position in the world in construction of new railway lines and commissioning of new rolling stock.

• Japan as the country where railway transportation has got the best indicators of annual passenger traffic and passenger turnover.

• India as the country where railway transport is rapidly developing and is already second in the world in terms of passenger flows.

The railway network in Russia is unique in its structure, location, tasks, and problems. Indeed,

Table 1

Structure of internal passenger turnover by countries in 2019, %

Country	Railway	Air	Road	Other
Russia	23,4	52,6	23,9	0,1
USA	0,3	10,8	74,1	14,8
PRC	34,1	19,2	41,3	5,4
Germany	24,6	20,9	46,5	8,0
India	12,6	7,9	73,0	6,5
Japan	63,7	15,2	13,9	7,2
France	11,5	5,3	76,1	7,1

Sources: [15], [21], [22], [23].

it cannot be compared in a systemic way with any other world transportation system since technical, technological, managerial, geographic, economic, and other parameters will differ. However, it is possible to identify common vectors of development.

So, in Japan, railway transport is the most popular way of transportation among the population. A high level of transport development is ensured by competition between transport companies performing passenger railway transportation [6]. In 1987, the Japanese national railways were divided into 8 companies, 6 of which perform passenger transportation [7]. In addition to them, there are other carriers, as well as private railway lines. There is no uniform gauge standard in the country. Thus, the total length of railways is 27 182 km, where about 22 thousand km have a track width of 1067 mm, 4 thousand km – of 1435 mm, 100 km – of 1372 mm and 48 km – of 762 mm [8].

The world's first public high-speed line (HSR) appeared in Japan. Traffic on Tokyo–Osaka section was opened in October 1964 after five years of construction [9]. The High-speed rail line was named «Tokaido», the length of the route was 515,4 km, with the maximum permissible train speed of 210 km/h. The cost of building the HSR had fully paid off by 1971, so with such a successful experience, the public authorities decided to create an entire high-speed rail network, which was called Shinkansen. The Shinkansen has a European track gauge of 1435 mm.

The PRC has created the world's largest high-speed railway network. Their total length has already reached 16 thousand km in 2014, while the total length of the country's railways was about 112 thousand km. In the Strategy for Development of China's Transport by 2050, the length of roads should be 270 thousand km [10]. Increasing the network of railways more than twice is a really achievable task for the country, since the first project for construction of high-speed rail in the country had been approved in 1996, and already in 2012 the length of the high-speed rail network was over 7 thousand kilometres [11]. Starting in 2014, the second wave of active construction of high-speed lines began, which made it possible to more than double their length[1].

Unlike Japan, both passenger and freight transportation in China is carried out by a single Chinese state-owned company, China Railways[2].

Table 1 shows the structure of the internal passenger turnover of the studied transportation systems.

In the USA, Germany, India and France, domestic passenger turnover is carried out mainly by road transport, that is, using buses and private cars. They account for more than 80 % of the total passenger turnover. In the PRC, railway and road transport demonstrate almost a parity if accounted by that index. In Russia, the largest passenger turnover in domestic transportation falls on air transport (over 50 %). In Japan, on the contrary, railway transportation is the main mode of transportation of passengers: its share in passenger turnover is about 63 %. As the analysis shows, there is no any single structure of passenger turnover, characteristic of world transportation systems.

The average of passenger and freight traffic in rail transport in each country has its own value. These indices are influenced by various social, geographic, economic, and technological parameters. The most important among them are the length of the network and the level of well-being of citizens. However, it is inappropriate to single out any single factor as prevailing. So, the largest passenger turnover is in Japan, where the population

[1] According to CGTN, the total length of HSR in PRC attained about 36,000 km in February 2020 (https://news.cgtn.com/news/2020-10-01/From-nobody-to-somebody-China-s-high-speed-rail-in-numbers-Udm6mE3qqA/index.html). – *Ed. note.*

[2] China State Railway Group Co., Ltd. – *Ed. note.*

Table 2

Key indicators of the transportation activity of the passenger transportation systems by countries in 2017–2019

Country	Volume indicators						Quality indicators						
	2017		2018		2019		2017	2018			2019		
	Passenger flow, mln people	Passenger turnover, bln pass-km	Passenger flow, mln people	Passenger turnover, bln pass-km	Passenger flow, mln people	Passenger turnover, bln pass-km	Average distance, km	Passenger flow, mln people	Passenger turnover, bln pass-km	Average distance, km	Passenger flow, mln people	Passenger turnover, bln pass-km	Average distance, km
Russia	1117,9	122,9	1157,2	129,4	1197,8	133,4	109,9	0,35 %	5,3 %	111,8	0,37 %	3,10 %	111,4
USA	32,0	10,2	31,8	10,6	32,7	10,4	318,75	-0,63 %	3,9 %	333,3	2,83 %	-1,88 %	318,0
PRC	1657	685,2	1793	681,2	1845	682,4	413,52	8,2 %	-0,58 %	380,0	2,8 %	0,17 %	374,2
Germany	2055	77,5	2068	79,5	2100	79,8	37,7	0,65 %	2,6 %	38,4	0,15 %	0,38 %	38,1
India	8116	1149,8	8286	1177,7	8320	1180,1	141,7	2,10 %	0,24 %	142,1	0,40 %	0,20 %	141,8
Japan	2270,4	390,6	2237,2	403,7	2300,4	398,4	172,0	-1,46 %	3,35 %	180,5	2,82 %	-1,31 %	173,2
France	1252	93,3	1241	93,7	1238	94,2	74,5	-0,88 %	0,43 %	75,5	-0,24 %	0,53 %	76,1

Sources: https://uic-stats.uic.org/ [21]. Quality indicators are calculated by the author of the article.

is about 126 million people, that is, much less than in the USA, China, or India. And in the country with the longest distance (Russia), the passenger turnover is several times less than in China, India, or Japan.

Table 2 shows the key performance indicators of the passenger transportation systems for 2017–2019 in the context of the analysed countries.

The dynamics of changes in the key indicators of the activity of the passenger transportation system has both trends common for all countries and features which are unique for each individual country. For example, the values of the average travel distance per passenger for 2017–2019 have remained practically unchanged in the USA, Germany, India, Japan, and France. This suggests that in these countries during the period under review there were no significant changes in the structure of passenger flows. The situation is different in China, where between 2017 and 2019 the average range decreased by 50 km. This is due to commissioning of railway lines and emergence of new stations, allowing passengers to use railway transport more often and to travel shorter distances. This is evidenced by the passenger flow, which in two years has grown by 10,2 %: from 1 657 million people in 2017 up to 1 845 million people in 2019.

The dynamics of passenger turnover usually directly depends on the number of passengers transported. In 2019, an increase in both indicators under consideration was recorded in Russia, Germany, India, and China. In other countries, there are discrepancies in the dynamics of passenger flow and passenger turnover of countries. So, in Japan in 2019 there was inflow of passengers to the network, but the passenger turnover decreased because of reduction of the average distance per a trip.

In France, while passenger flow decreased by 0,3 % in 2019, passenger turnover increased by 0,5 %. And in the USA, on the contrary, in the same year, with an increase in passenger flow by almost 2 %, passenger flow showed a negative trend. The reasons for such discrepancies must be sought, first of all, in the ongoing marketing and pricing programs of passenger carrier companies.

Key indicators of operations of the passenger segment of the investigated transportation systems are shown in Table 3.

The comparative analysis of passenger turnover per capita by countries recorded the highest rates in Japan: 3220 pass-km/person. As previously revealed, this is due to the outstanding popularity of railway transportation (including maglev) among the inhabitants of this country. Also, the total combined revenue from passenger activities of all railway companies in Japan amounted to about 41 billion dollars, which is the largest result within the proposed sample. Japan transportation network has already reached the stage where it is only necessary to keep the industry at a given level. If we use the terminology of the Boston Matrix (Boston Consulting Group (BCG))[3], it has been in the category of «stars» for decades, and levelling all risks, particularly of a technological and innovative nature, railway

[3] The Growth Share Matrix developed by Boston Consulting Group (https://www.bcg.com/ru-ru/about/our-history/growth-share-matrix), whose terminology and approaches are further used by the author relates to market share and growth, suggesting cells called «star», «cash cow», «question mark», «pet». – *Ed. note.*

Table 3

Key indicators of the activity of the passenger transportation system in 2019

Indicator	Russia	USA	PRC	Germany	India	Japan	France
Passenger turnover per capita, pass-km/person	910,51	30,46	486	959,72	850,7	3220	1396
Income of companies from passenger transportation by rail transport, mln dollars	236,9	2841	–	19059	–	41084	13355
Fleet of passenger cars, units	23447	6240	61875	5192	56890	1140	3163
Transportation availability of the country, km/10000 people	5,84	4,58	0,48	4,02	0,53	1,34	4,34

Sources: [21], [24], [16], calculations of the author of the article.

transportation there will continue to remain at the achieved positions.

In two countries of Western Europe, France and Germany, the rate of transport availability is in the similar range, between 4 and 4,5 km/10000 people. Other indicators also show strong demand. At the same time, it can be seen that German railways meet a greater demand for short distances, as evidenced by the lower passenger turnover per capita with a larger car fleet and higher income than in France. It is seen that passengers prefer to use railway transportation for short trips. This indicates a high rate of mobility of citizens and that under the existing conditions of development of the transportation network, railway transport is used effectively. This is also evidenced by the stable passenger turnover values presented earlier.

In France, the emphasis within the railway passenger system is shifting towards long-distance travel, including travelling outside the country. As a result, the average passenger turnover per capita is almost 1,5 times higher than in Germany. Nevertheless, in both countries, railway passenger transportation segment takes the position of a «cash cow», consistently bringing a certain level of profit. However, to increase the share of railway transport, it is necessary to implement large infrastructure projects that is to construct new railways.

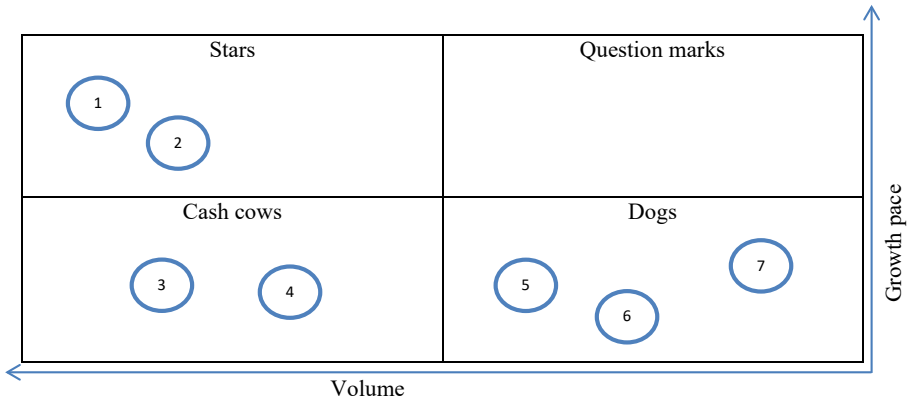
The results of the comparative analysis show, on the one hand, a similar state of the transportation systems in India and the PRC: the values of the passenger car fleet are comparable, and the country's transportation availability per capita is lower compared to other countries. However, there is a significant difference: India has neither speed nor high-speed rail, while China has the longest high-speed lines in the world. Modern speed trains attract passengers, so the share of rail transport in the PRC is over 30 % of the country's total domestic passenger turnover. And in India this figure is slightly above the 10 % mark.

Railway passenger transportation in India is a «pet» that requires colossal investments in infrastructure and rolling stock, however, they might encounter high risks of not getting the corresponding demand for transportation services. In the PRC, passenger transportation by rail is now a «star» that was a «question mark» a few years ago, and government policy is aimed at strengthening positions in the future.

In the USA, a unique situation developed in the second half of 20th century when the public authorities set themselves the task of reducing the role of railway transport and redistributing passenger flows to other modes of transport. Even though the country has the longest railway network in the world, the share of railway transportation in the total passenger turnover is less than 1 %. The country with the world's leading economy has practically got no speed and high-speed communication lines now (latest developments show that the situation is changing). Passenger railway transportation in the USA might be classified as «pets» using BCG terminology. However, the question of underestimation of this mode of transport in modern conditions has been increasingly raised. This is evidenced by the high level of income: about 2,8 bln dollars with average passenger flow of 32,7 mln people per year with an average distance of 318 km.

The positions of the studied transport systems in Boston matrix, as they are seen by the author and considering pure conditional character of such a positioning, are shown in Pic. 1.

The analysis of key performance indicators of railway transport companies providing passenger transportation services in Japan, China, France, Germany, India, and the USA showed the differences in the attitude of public authorities and business to development and popularization of railways and the outcomes.



Pic. 1. 1 – Japan, 2 – PRC, 3 – Germany, 4 – France, 5 – Russia, 6 – India, 7 – USA. Boston Matrix of the world's railway companies performing passenger transportation built by the author.

Comparing the findings regarding considered countries with the existing railway system in Russia, one can draw an analogy with each of them, but only regarding singular fields. Thus, Russian railways in their passenger segment have a high potential for development and significant growth in their economic performance. On the other hand, government-regulated social tariffs, as in India, make passenger transportation economically unprofitable, which limits the possibility of a qualitative growth in the transportation volume. The level of income from passenger transportation in Russia and India is ten times lower than this indicator in the rest of the considered countries [3].

The considered countries of Western Europe and Japan effectively use railway transport to transport passengers over short distances (up to 100 km) between large agglomerations. Their positive example can be compared with projects being implemented in Russia: implementation of MCC project (Moscow Central Circle) and of MCD project (Moscow Central Diameters). However, using the experience of France, Germany and Japan would be incorrect when assessing competitiveness of long-distance railway transport.

Chinese Railways showed the best dynamics in all respects, thanks to successful implementation of the Railway Transport Development Program. This has been achieved due to implementation of large investment projects and large passenger flow, naturally created due to high population density of large agglomerations. In general, the experience of Chinese railways, as a benchmark, can be used in assessing competitiveness of the passenger railway transportation segment in Russia and in finding solutions to improve it. However, it is worth noting the fact that under the conditions restrained by economic factors, Russian railways cannot afford implementation of large-scale projects to organize high-speed traffic of an appropriate length in such a short time. Also, in Russia, one cannot expect growth rates of passenger flow similar to the Chinese results, since density and population figures in the countries differ significantly, and this leads to an increase in the payback period of construction, which, in turn, affects the ability to attract funds invested in the project.

Conclusions. The study revealed that railway companies operating passenger transportation in India and the USA are not suitable as a benchmark for assessing competitiveness of similar companies in Russia due to low values of passenger flows in comparison with other modes of transport. To improve performance, companies in these countries need to implement large innovative projects and resolve other internal problems that limit the growth of passenger flows.

The use of the economic models of France and Germany as benchmark of performance of the activities of passenger companies is advisable for local projects (up to 150 km). It is reasonable to consider Japanese companies only when assessing competitiveness of speed and high-speed transportation, since in this country all passenger railway transport is represented in this segment.

The analysis showed that to assess competitiveness of interregional passenger transportation of Russian railway companies, it is most expedient to use data provided by China Railways, which operates in PRC, as a benchmark. Railway transport is actively developing in the country. The implementation of the development program is cost-effective, and it is aimed at creating a transport

network connecting the distant regions of the country. In Russia, the railway industry has similar goals and objectives, therefore, the positive results obtained in China can be used with the least error as a benchmark.

According to the research described in the monograph [1], the economic model of increasing competitiveness of transportation and of respective transport companies includes a number of subsystems: formation and development of economic and technological capacity, research and monitoring of the economic situation in the markets, development of financial capacity and mechanisms attracting investments, as well as improving human and managerial capacity.

In the context of these subsystems, the approaches, methods, and rates of implementation of technological innovations in the People's Republic of China, systems of adaptive regulation of the transportation process on French railways, mechanisms for increasing the financial capacity in the USA and Japan, methods of management and development of human resources in Germany deserve evaluation as reference approaches.

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