REGIONAL EFFECTS OF HIGH-SPEED RAILWAYS PROJECTS

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ABSTRACT

External effects induced by construction of high-speed railways are analyzed. It is shown that large-scale transport projects need to be evaluated from the perspective of economic and social efficiency. Taking into account only the cost-effectiveness of inter-regional high-speed lines is a theoretically incorrect task and this will practically disorient investors and the state as main participants in designed high-speed lines.

Keywords: high-speed line, project, construction, railways, multiplicative effect, public interest, regional economy, state, finances, investors.

Background. *In 1839 in the UK speed limit of 161 km / h was overcome, it was the steam locomotive «Hurricane». And in 1903, with the help of electric traction speed limit of rail transport of 203 km / h was overcome by Siemens & Halske. In 2007, during the test the French company Alstom set a world speed record of AGV trains on the railway track, bringing it up to 574,8 km / h [1]. While the last world record belongs to China, CSR company in test mode could reach speeds of 600 km / h [2].*

The first high-speed lines (hereinafter – HSL) appeared in Japan in 1964. Their construction was caused by heightened traffic situation between the cities of Osaka and Tokyo. Already in 1967, this high-speed line became profitable and for six years of operation, fully repaid expenditures of its construction [1]. Currently, 14 countries have a high-speed line. Leaders on the length of these lines are China, Japan, France, Spain and Germany. They have tracks with a length of over 1000 km.

Objective. *The objective of the author is to demonstrate effects of implementation of projects in the field of high-speed line construction.*

Methods. *The author uses general scientific methods, comparative approach, economic analysis, evaluation method.*

Results.

Realities and externalities

In most countries where there are high-speed lines, the construction scale is defined as a national priority. In our country, these projects are subject to harsh criticism from a number of government officials and experts, according to which investment risks are very high. For example, as for the project «HSL-2» (Moscow–Kazan), they call into question the assessment of predicted passenger flow [3, 4]. And then there are grounds.

Indeed, the forecast annual passenger flow between Moscow and Kazan is estimated by different experts in a large enough range from 1,5 to 7,4 mln people in 2019. And up to 10 mln – by 2030. The planned rail fare between Moscow and Kazan in prices of 2019 year is 3778 rubles (for comparison: fare for «Sapsan» in the prices of 2013 year – about 7 thousand rubles). With this passenger flow and cost of the project in the amount of 1,068 billion rubles (without taking into account the cost of construction of stations and acquisition of trains, the specified figure is reduced to 855 billion) the project will pay off for more than a dozen years. And it provided that the project cost will not increase.

In reality, technical and economic assessments, which are being developed now, do not take into account many components of costs and results, in particular concerning the so-called «externalities» and, as the experience of LSIP (large-scale infrastructure projects) shows, the cost of projects under implementation increases. Under these conditions, the holding company Russian Railways will be forced to raise a tariff or seek subsidies from the state, often in the name of regions [5].

Accumulated experience of high-speed rail transport available to the developed countries, has shown that the main issue on which it is necessary to decide is how to organize movement:

– to use the experience of Spain, and Japan, where the infrastructure of high-speed traffic is independent on the traditional scheme of rail transport, at the same time, passengers transfer from one type of traffic to another via interchanges, or;

– to rely on the experience of France, where high-speed lines intersect with the traditional scheme of movement and partly use it, or;

– to take into account the experience of Germany and Italy, where high-speed movement is organized in the framework of existing main lines [6].

What explains the popularity of expensive infrastructure projects of high-speed lines construction in different countries?

In general, the external effects of HSL construction can be divided into two main categories: a) induced by construction process, and b) induced by operation of lines. At the same time the effects induced by the construction process, are common to all large-scale regional projects, and the effect is of a multiplicative nature, continues after completion of the construction phase due to stimulation of economic growth in many sectors of the economy.

Multiplier effect (the first group of external effects) is formed in adjacent sectors of the economy (industry, construction, electric power and other sectors) in the construction process. Thus, during the construction of HSL Beijing–Shanghai the multiplier effect, according to preliminary estimates, only in the first two years of construction was 5,43 [7]. The growth was accompanied by

creation of tens of thousands of jobs. This effect is achieved largely due to the fact that China is based on its own labor force and the possibility of using materials, components and technologies produced on its territory. The country, moreover, is hardly dependent on import, which further increases the result.

Russia does not have an experience in construction of HSL «from scratch», and the share of export will be significantly more in total cost of the project. According to estimates of «High-speed lines» (a subsidiary dependent company of Russian Railways holding), the Russian business will get in the construction of HSL-2 orders for construction products in the amount of 274 billion rubles, which is only a little over a fourth of the cost of the project[8]. Hence, the multiplier effect will be considerably less. For more accurate forecasts, it is necessary to assess, using means that are based on global models of the economy (intersectoral balance, macro model of general equilibrium) taking into account the forecasts of tariff policy, which will be carried out after the construction of HSL.

The second group of external effects induced by the operation of HSL is more complex when assessing, but it nevertheless exists, and the corresponding multiplier effects must be considered. Experience in the implementation of HSL in Germany and France showed that if travel time is less than three hours, then in this direction from 50 to 75% of passenger transportation market is consolidating on HSL. Therefore, we can observe so optimistic forecasts of Russian Railways holding concerning passenger flow volumes.

Among the countries that promote the idea of HSL, China stands out. If we consider HSL Beijing – Shanghai, then in the territory where this HSL goes about 300 million people reside. While only 30 million people live in the area of HSL-2. It is necessary to note the fact that between the cities of Beijing and Shanghai was a HSL with the speed of 350 km / h, but the construction of such a new line on the same route with a speed of 380 km / h led to a reduction in movement time by 30 minutes. Meanwhile, time-saving on the route even for 1 minute is estimated for the national economy of China as US $10 million per year [7].

The conducted assessment showed that a reduction in the time of movement brings to China's economy each year 300–320 million USD. External effects of this kind occur in construction and subsequent operation of HSL due to an increase in passenger flow between individual stations, connection of a line with airports, roads and unloading of roads and conventional railway lines for bulk cargo and acceleration in container transportation. Alignment of inter-regional development occurs through the growth of interregional trade, output of products, investment, fiscal revenues, improvement of safety and comfort of movement. Thus, HSL creates conditions for inducing external positive effects (externalities). Implementation of these LSIP provides not only direct income from transportation, but also income from revenue of related industries, which ultimately affect the state budget revenues and GDP.

Projections of positions

Of course, fears of experts in relation to payback of HSL projects have a reason. But we must clearly understand what kind of payback is in question – financial or economic (social). When implementing large-scale transport projects such as HSL in the first place it is necessary to consider external effects (socially useful) from implementation of undertakings of this kind [9].

Economists in China have evaluated, which revealed that the speed of movement in terms of commercial efficiency on HSL should be at least 140 km / h, including for freight trains. Given the experience of Germany and Italy, where it is necessary to constantly look for a compromise between speed of movement for passenger and freight trains, in China it was decided to construct a separate line for them. In addition, the current cost for maintenance of mixed lines is 40–70% higher than for maintenance of lines only with freight traffic [10]. JSC Russian Railways have also already a negative experience in the use of existing infrastructure on the route Moscow–St. Petersburg. And now, the management of «High-speed lines» have decided to follow the path of Japan and Spain in the construction of HSL-2, that is, to focus on purely specialized variant, without combining traditional movement scheme.

The fact was stated that the construction of high-speed lines also generates an increase in freight turnover on traditional railway lines between those points, where high-speed traffic is organized. However, the dependence itself has been revealed, but the reasons for it have not been set. There can be several. The first is that traffic associated with passenger transportation, is removed to a separate main line, and thus the cost of infrastructure services reduces, it becomes affordable [10]. This approach does not take into account the institutional environment in which there is an increase in freight turnover. We must assume HSL increases the mobility of population, and therefore economic activity, which leads ultimately to an increase in freight turnover between cities. Data on Japanese cities, where HSL stations were built, show that the growth of budget allocations are higher than the average growth in the country by 45% and population growth – 20%. Such externalities in the work [11] are called agglomerative. In the UK, by the way, a high population growth is also marked in small towns located in a half-hour availability of HSL stations.

In addition to designated external effects JSC Russian Railways evaluates socio-economic effects of reduction in passenger's travel time. This effect is calculated using expert assessments as weighted average cost per one passenger-hour. For example, the value of the effect in the direction of Moscow–Kazan is defined as 459 million rubles [12].

Experts, negatively evaluating HSL construction, criticize only financial efficiency and conceal the need to evaluate projects of this scale for development of

national economy as a whole in the scenario «if the project is not implemented». The vast majority of effects that create large-scale investment projects such as HSL, as already mentioned, form external effects (externalities) that are left out, and it reduces the performance of their real effectiveness. In particular, when it comes to transport LSIP forming a stable network structure, a relationship with the whole national economy is formed.

Methodological approaches

Within the topic studies were carried out that are associated with Keynes multiplier, based on the technique [13]. Approved by Economic Development Ministry technique has both positive and negative aspects, but, in our opinion, an attempt that was in it was made in the assessment of large-scale investment projects (and primarily transport) is particularly important when it comes to determining multiplicative effects for the country's economy. The technique relate to three sections of LSIP assessment: cost effectiveness, budgetary efficiency and cost-effectiveness.

The financial performance means evaluation of the project on indicators, based on the net present value (developed by UNIDO) [14], budgetary efficiency can also be calculated using this methodology. The calculation of these indicators is widely used in evaluation of investment projects by private investors who wish to receive the results from their investment. Nevertheless, it is unacceptable for evaluation of large-scale investment projects.

In the world in determination of external effects forecast GDP is estimated «with a project» and «without a project». In addition to efficiency of direct construction of HSL and industries that provide construction and subsequent operation of a main line. As a general rule, to assess the macroeconomic effect of LSIP in the calculation the following models are used: «input-output», simulation and general equilibrium. While the «economic efficiency of the investment project is assessed by its ability to influence the formation of GDP of the economy and ensure the dynamics of economic growth» [14], and in the basis of macrocosmic effects figures the sum of direct macroeconomic and indirect macroeconomic effect (multiplicative). This, in fact, is an obvious advantage of the technique [14]. However, the idea is clear enough for understanding of decision-makers, in comparison, for example, a matrix multiplier, which is calculated in the models of interbranch balances (which is not, of course, their disadvantage).

Design object

The company «High-Speed Lines» reported three possible options for construction of HSL Novosibirsk–Krasnoyarsk [15]. At present, on existing railway tracks a passenger train covers the distance between these cities for 12 hours. At HSL implementation this time will be reduced to four times, and the speed will reach 250 km / h.

Evaluation of cost-effectiveness can be made on the basis of information on existing analogs, but in this context there is a problem, because JSC Russian Railways do not have enough experience with HSL. Given the large amount of data, which is necessary for calculation, the author will give the final figures. The basic background information on the project: investment volume of 1,04 bln rubles; the ticket costs 4 rubles per kilometer (in prices of 2015).

For passenger flow forecast population mobility rate was used in relation to HSL. For calculation was taken the experience of «Sapsan», which transported 4 million passengers in 2015. The coefficient is defined as the ratio of the number of passengers sent to the population number. At the same time a population number refers to inhabitants of surrounding agglomerations – Moscow and St. Petersburg, as well as the city of Tver.

As a result of calculations we have received a mobility ratio of 0,18. That is, every sixth inhabitant of the area adjacent to the route Moscow – St. Petersburg used «Sapsan» in the past year at least once. Accordingly, in determining the projected passenger flow on HSL Novosibirsk–Krasnoyarsk obtained on the main line Moscow–St. Petersburg mobility rate of population was used. Thanks to it, it became possible to obtain predicted values of passenger flow: if HSL Novosibirsk-Krasnoyarsk will pass through Tomsk, the load will be 0,702 mln people, if through taiga – 0,579 mln, through Kemerovo – 0,695 mln. It is clear from the data that passenger flow will be 5–7 times less than on the capital branch. Applying the technique [14], we obtain the result that the financial payback comes after more than 50 years, and it is given the fact that the price of a ticket will increase by 1,2% and passenger flow by 4% per year.

As already noted, in the construction of large-scale projects we should not only use the methods of financial evaluation of effectiveness, as in the project the main investor is the state, and he should know also indirect effects of implementing such a program. In this context it is necessary to apply the methodology to assess cross-sectoral interaction, the result of which will be determined from the positions of GDP growth.

Macroeconomic effect

The macroeconomic effects «refers to income generated in the economy as a result of direct and indirect impact of the investment project on the process of income generation» [13]. In accordance with the technique [13] important is the volume of purchases of exported materials and components, which influence the value of the multiplier. In calculations different versions of export volumes of the project from 50 to 80% were used. The control period is 20 years. Thus, in the aggregate multiplier effect will average 1,68 (in three variants of the project: Kemerovo, Tomsk and Taiga). A high-speed line, built through the cities of Tomsk and Kemerovo will give the highest performance result.

It should be noted that the applied technique [13] does not allow to determine on what exactly industries multiplier effect will have the greatest impact, for this techniques are suitable, based on inter-sectoral balances [16]. In addition, during the construction of a main line Moscow–Beijing HSL will move to «the next stage of development – motion in depleted environment (vacuum) that allows to increase the speed from 400 to 600–800 km / h» [17].

Conclusions. *In terms of financial performance project of HSL Novosibirsk – Krasnoyarsk is not perspective and therefore requires state support, as it is done in all countries, which are constructing HSL.*

But in terms of aggregate macro-economic effect organization of high-speed traffic on the line will bring to the economy of our country additional funds – provided that the cost of the project will not increase due to transaction costs. With a view to 20 years the multiplier effect will ensure GDP growth.

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