EVALUATING THE EFFECTIVENESS OF TECHNOLOGY USE IN IMPLEMENTATION OF INFRASTRUCTURE PROJECTS

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ABSTRACT

The evaluation of investment projects is central to the process of study and choice of possible options to invest in development projects. The article shows the main indicators for assessing the effectiveness of investment projects, analyzes the main advantages and disadvantages of each of them. At the same time the socio-economic importance of one of the largest high-speed rail project «Moscow–Kazan» is considered on the basis of calculation of such economic indicators as resource intensity, depreciation intensity, labor intensity and material intensity.

Keywords: transport, railways, technical means, large-scale development project, economic efficiency, high-speed rail «Moscow–Kazan».

Background. *Market conditions require from the rail transport a wide introduction of innovative infrastructure development in order to reduce costs, to ensure profitability and to further enhance the efficiency of its operations. And it concerns especially the effectiveness of large-scale projects.*

The large-scale project of railway infrastructure development is such a project, the result of which is to change the topology of the transport network, the expansion of capacity and carrying capacity, an increase in transport provision of regions and transport accessibility of population. At the same time technical facilities and industrial systems are radically updated.

Objective. *The objective of the authors is to show the main indicators for assessing the effectiveness of investment projects, analyze the main advantages and disadvantages of each of them.*

Methods. *The authors use general scientific methods, comparative analysis, particular economic methods, analytical method.*

Results. *To confirm the effectiveness of development projects of JSC Russian Railways – the largest investor in Russian rail transport – the following criteria are used [1]:*

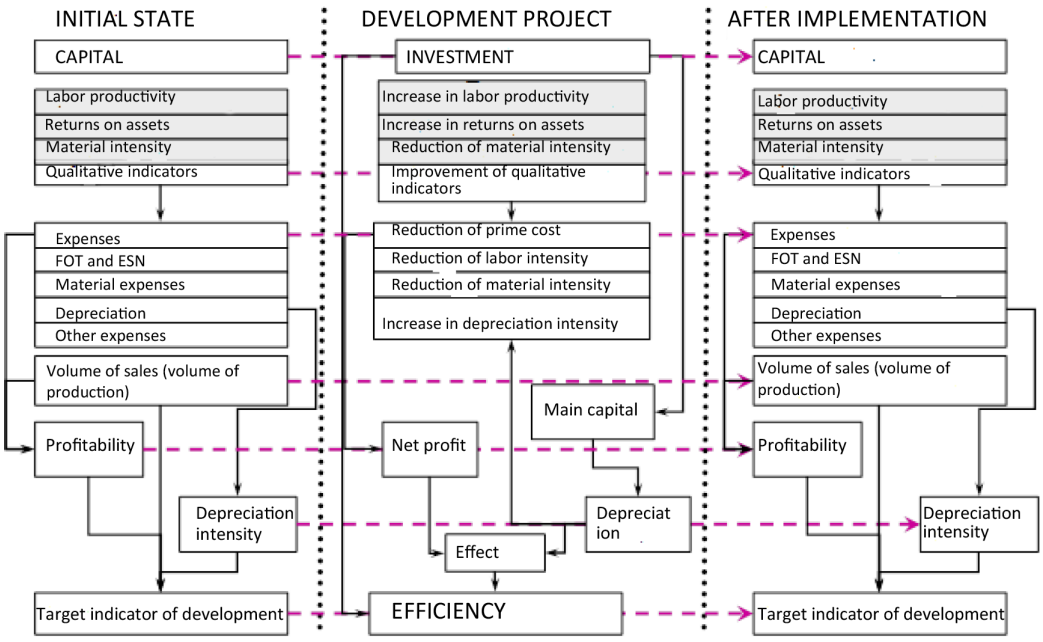
– project is deemed effective if its net present value is positive, and ineffective, if its net present value is negative or zero; the greater is the net present value, the more effective is the project;

– project is deemed effective if the net present value becomes positive for a standard term of payback, and ineffective if the net present value becomes positive during the billing period, but after the end of the regulatory payback period;

– of several alternative projects (project options) the best is considered an option with the highest net present value and the lowest within the standard of payback period;

– project is deemed effective if the internal rate of return exceeds the discount rate; in case of selection of R & D projects, a preference is given to the project with a larger value of the internal rate of return;

– project is deemed effective if the profitability index is greater than one; in case of selection of



Pic. 1. The impact of development projects implementation on the target indicators of the use of production resources [7].

Table 1

Comparative characteristics of the effectiveness of the project

Indicator	Positive characteristics	Negative characteristics
Net present value (Integral effect)	– Detalization of calculation, i.e. it allows to take into account the features of the project; – Universality, i.e. it allows to evaluate virtually any projects.	– Does not allow to rank projects according to the profitability degree; – Difficulty in substantiating discount rate; – Complexity in forecasting cash flows.
Internal rate of return	– Objectivity, as there is no need to justify the discount rate; – It allows you to compare different scale projects, and projects of different duration.	– In the calculation more than one IRR indicator can be obtained; – Does not take into account large-scale of projects.
Profitability index of costs, taking into discounting	– Allows to take into account various sources of investment risk; – Accessibility and ease of comparing projects with different levels of profitability	– Problems to justify the discount rates for different types of investments; – The problem of forecasting future cash flows; – Difficulty in the evaluation of intangible factors affecting cash flows.
Payback period	– Visualization and traditional use; – Based on the model of cash flows; – Does not take into account cash flows after the payback period.	– Does not take into account the profitability of the project; – Allows to minimize project risks.

R & D projects, a preference is given to the project with a larger index of profitability;

– project is deemed effective in case of positive value of profitability on invested capital;

– project is deemed effective in comparison with other with a minimum life-cycle cost; at the same time it must be ensured implementation of the basic parameters of the life cycle.

These figures generally reflect methodological approaches to the assessment of development projects, applied in international practice.

In the economic papers, for example [2, 3], the performance indicators are given, which can be divided into two groups (static and dynamic), depending on whether or not the time parameter is taken into account when they are being determined.

The effectiveness of the investment project is characterized by a system of indicators that reflect the cost-benefit ratio, depending on the interests of its participants.

The advantages of static characteristics are simplicity and obviousness of the calculations; a direct link with the indicators of adopted accounting system, analysis and reporting; ease of use in the material incentive system. However, the shortcomings (the alternative cost of the resources, dynamical change of internal and external environment, etc. are not taken into account) bring these benefits to nothing.

Currently, when assessing the effectiveness of investment projects dynamic indicators are mainly used. The classic methods of assessing the effectiveness can include the method of net present value, investments profitability index method, method of return on investment period and the method of internal rate of return [4, 5].

The general algorithm of dynamic methods is based on the forecast of positive and negative cash flows and comparison of the resulting balance of cash flows, discounted at the appropriate rate, with investment costs.

Features of dynamic indicators of investment projects are considered in Table 1.

In justifying large-scale projects, as a rule, the integral effect is used as a criterion. It reflects the effectiveness of bringing productive resources for the project implementation.

Implementation of development projects should be aimed at improving the efficient use of production resources. Pic. 1 shows a scheme of impact of such a project implementation on the indicators of the company.

Existing criteria of effectiveness of development projects, in our opinion, should be supplemented by indicators, characterizing the comparison of the returns of resources being invested and returns of resources, which have already been invested. Using this relation in the system of terms of assessment of the feasibility of renovation of technical means of transport companies is complemented with maximizing depreciation intensity of production and profitability of activities, maximizing the share of depreciation in expenses in terms of total reduction of prime cost of production.

Such an approach in justifying the feasibility of development projects implementation allows to maximize the efficiency of use of technical means of rail transport and, consequently, to use a limited volume of investment to increase their effectiveness.

One of the most important large-scale projects of development of passenger rail transport is the development of a network of speed and high-speed traffic. The construction of modern isolated main lines, adapted for passenger trains at speeds up to 400 km / h, helps meet the demand for passenger transportation, improving the quality characteristics and reducing the travel time of passengers.

It is planned to build high-speed rail «Moscow–Kazan» in Russia. The project envisages the realization of one of the largest capital expenditure program in the transport sector. The construction includes 770 km of new railway lines, including 131 bridge, 49 overhead roads, 33 railway overpass, 128 highway overpasses – the total length of high-speed rail on the artificial structures is around 120 km. The total cost of the project amounts to 1068.3 trillion rubles (excluding VAT) in the prices of 2015.

Table 2

Comparison of indicators of resource intensity and depreciation intensity of long-distance passenger transportation and in case of HSR organization

Indicators	Long-distance passenger transportation of JSC Russian Railway with account of JSC FPC *	HSR Moscow-Kazan**	Deviations in indicators
Resource intensity, rub./10 pass-km	20,05	17,02	3,03
Labor intensity rub./ 10 pass-km	3,95	2,43	1,52
Material intensity rub./ 10 pass-km	3,45	3,06	0,39
Depreciation intensity, rub./10 pass-km	1,48	9,53	– 8,05
Share of depreciation in expenses,%	7,5	56	– 48,5
Returns on assets, pass-km /rub.	0,44	3,74	-3,3

*defined on the basis of official accounting [10, 11].
**defined on the basis of calculation indicators, presented in official sources [12].

Funding for the project to build high-speed rail is to be carried out with the help of budget subsidies in the amount of 316.5 billion rubles (30% of total investment), public funds, provided on a repayment basis, totaling 334 billion rubles (31% of total investment), as well as with the involvement of private funding under the state guarantees in the amount of 150.1 billion rubles (14% of total investments) and without direct state guarantees in the amount of 267.7 billion rubles (25% of total investments).

Hail-speed rail «Moscow–Kazan» is a completely new high-tech project, during the implementation of which will be used modern materials and technologies that will create preconditions for the development of high-tech industries with high added value. There is a need for qualitative economic assessment of the system of high-speed rail traffic (in particular, it is necessary to know the macro-economic effects, including promoting the development of economic complex of the RF subjects, improvement in the economic rankings for investment, etc.). According to the scale, coverage area, the impact on their socio-economic status of the HSR «Moscow–Kazan» falls into the category of projects of national importance.

Construction of the main line suggests [8]:

• Increasing mobility and business activity of the population by reducing travel time between the cities in the gravitational attraction zone of the main line;

• Improving transport links of regions, the growth of the economic development of the territories;

• Creation of new workplaces: during the construction phase there will be created 80 thousand; of which 45 thousand in related industries, and in the operational phase –30 thousand places (of which 15 thousand in related sectors.), including 5.6 thousand directly in transportation;.

• flow of orders for Russian business: in the implementation of the project, their volume only for the supply of construction products will be more than 270 billion rubles.

Experts identify the economic effects of the implementation of high-speed rail project in the construction phase [6]:

• aggregate GDP growth due to the multiplier effect by 554 billion rubles;

• multiplicative GRP growth in the regions in the amount of 150 billion rubles;

• the budgetary effect in the form of additional tax revenues to budgets of all levels in the amount of 175.6 billion rubles;

• multiplier effect on the output of goods and services in the amount of 1.2 trillion rubles;

• the effects of the development of the industry of building materials – 117 billion rubles, the steel industry – 111 billion rubles, mechanical engineering – more than 41 billion rubles.

In spite of the performance indicators contained in the documents [6, 8] in our view, detalization of calculations is required to identify the reserves when using technical means. If in the framework of the project of HSR «Moscow–Kazan» we compare the indicators characterizing long-distance and high-speed transportation on such parameters of depreciation intensity, resource intensity, labor intensity, material intensity (Table 2), evaluation results will allow to more accurately substantiate the conclusions and recommendations on technical tools.

The total value of costs of long-distance passenger transportation amounted to more than 180 billion rubles. In this regard, the total resource intensity – 20.05 rub. / 10 pass-km, including labor intensity – 3.95 rub. / 10 pass-km, material intensity – 3.45 rub. / 10 pass-km, depreciation intensity – 1.48 rub. / 10 pass-km. According to the project of HSR creation the total value of investment costs will amount to 1068,3 trillion rubles with a projected volume of traffic 69,1 million people per year, resource intensity – 17.02 rub. / 10 pass-km, including depreciation intensity – 9.53 rub. / 10 pass-km, labor intensity – 2.43 rub. / 10 pass-km, material intensity – 3.06 rubles / 10 passenger-km. These data indicate the economic viability of the project for the construction of HSR in Russia.

Higher resource intensity of long-distance passenger traffic as compared to the resource intensity of HSR is explained with the creation and maintenance of the universal rail infrastructure, i.e. infrastructure for cargo and passenger transportation. At the same time depreciation intensity of HSR is higher than depreciation intensity of long-distance passenger transportation, due to the significant

investments in creation of infrastructure and the purchase of modern rolling stock for high-speed passenger transportation, which are more productive.

Conclusions.

The following can be noted as the conclusions and recommendations:

1. Assessment of economic efficiency of innovative projects is a central element in the selection process of the possible options for development of the company. Currently, when justifying the investments in innovative projects dynamic performance indicators are used, which are based on the prediction of positive and negative cash flows. The most important among them are net present value, internal rate of return, payback period, and return on investment index. According to these indicators, HSR «Moscow–Kazan» project can be considered effective.

2. In our view, in assessing the effectiveness of capital-intensive projects of type HSR «Moscow-Kazan» should be additionally calculated and compared the indicators of use of productive resources and primarily depreciation intensity, resource intensity, labor productivity, capital intensity and material intensity. Calculations show that depreciation intensity of HSR will be higher than depreciation intensity of long-distance passenger transportation. A larger resource intensity is typical for long-distance passenger transportation using the universal railway infrastructure, and for high-speed rail project in connection with the narrow specialization of the line is characterized by a higher depreciation intensity. HSR is also characterized by a low material intensity and labor intensity, which indicates the feasibility of its creation.

3. The implementation of one of the largest projects HSR «Moscow–Kazan» will allow to solve important socio-economic issues, including the emergence of new jobs, increase in economic development of territories, the creation of a base for business expansion. In connection with the introduction of new technical means of the return on assets ratio is significantly higher in HSR project. Despite the high cost of the project (over 1 trillion rubles), it enhances the effectiveness of the use of technological means in rail transport and, consequently, its implementation is more appropriate.

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