METHODOLOGY FOR INVESTMENT ASSESSMENT OF INNOVATIVE HIGH-SPEED LAND TRANSPORT PROJECTS

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ABSTRACT

To attract private investment in innovative development of a country's transport system, a more sophisticated methodology for assessing the investment attractiveness of capital projects is needed. The article presents a methodology for assessment of innovative projects for development of high-speed land transport infrastructure, which, in the opinion of the authors, will ensure making an economically justified decision on participation in investing upcoming works, through rationally weighted assessment and consideration of the interests of stakeholders.

Keywords: investment attractiveness, innovative project, high-speed land transport, assessment technique, stakeholders.

Background. *The decisive vector of development of the national transport system according to the innovative scenario of Transport Strategy of the Russian Federation until 2030 is the increase in speed of transportation. This task, in addition to optimization of logistics chains and business processes, can be solved by implementation of investment projects for development of high-speed land transport based on technical and technological innovations, since existing technologies and technical solutions have in many respects exhausted their capabilities [1].*

To attract private investment in innovative development of the transport industry, it is necessary to improve the methodology and assess the investment attractiveness of innovative projects, including those aimed at development of high-speed land transport, in a manner that should combine economic, commercial, budgetary, social and other types of efficiency estimations with positions of interests of different stakeholders.

At the same time, assessment of investment attractiveness of innovative high-speed land transport projects should take into account such important features as:

1) high uncertainty in initial data and, as a result, a large number of assumptions made in calculations, which raises the level of investment risk;

2) need to take into account not only physical, but also moral depreciation of fixed production assets;

3) in view of the fact that innovative projects have a pre-investment phase of considerable duration, assessment prior to the start of the investment phase should be made carefully and lead to estimations (available to the current moment) of both future and past cash flows.

Also, when assessing high-speed land transport projects, there are problems associated with probable viability of designed facilities in the face of increased risks, rapid changes in market conditions in the field of innovation, and high level of transport intermodal competition.

Objective. *The objective of the authors is to consider the methodology for assessment of innovative high-speed land transport projects.*

Methods. *The authors use general scientific methods, comparative analysis, economic assessment, specific methods of investment and financial analysis.*

Assessment of investment attractiveness of innovative high-speed land transport projects is proposed to be carried out step-by-step. The algorithm for performing assessment is shown in Pic. 1.

Results.

I stage: Collection of initial data and identification of basic characteristics of the project.

1.1. Development of initial data.

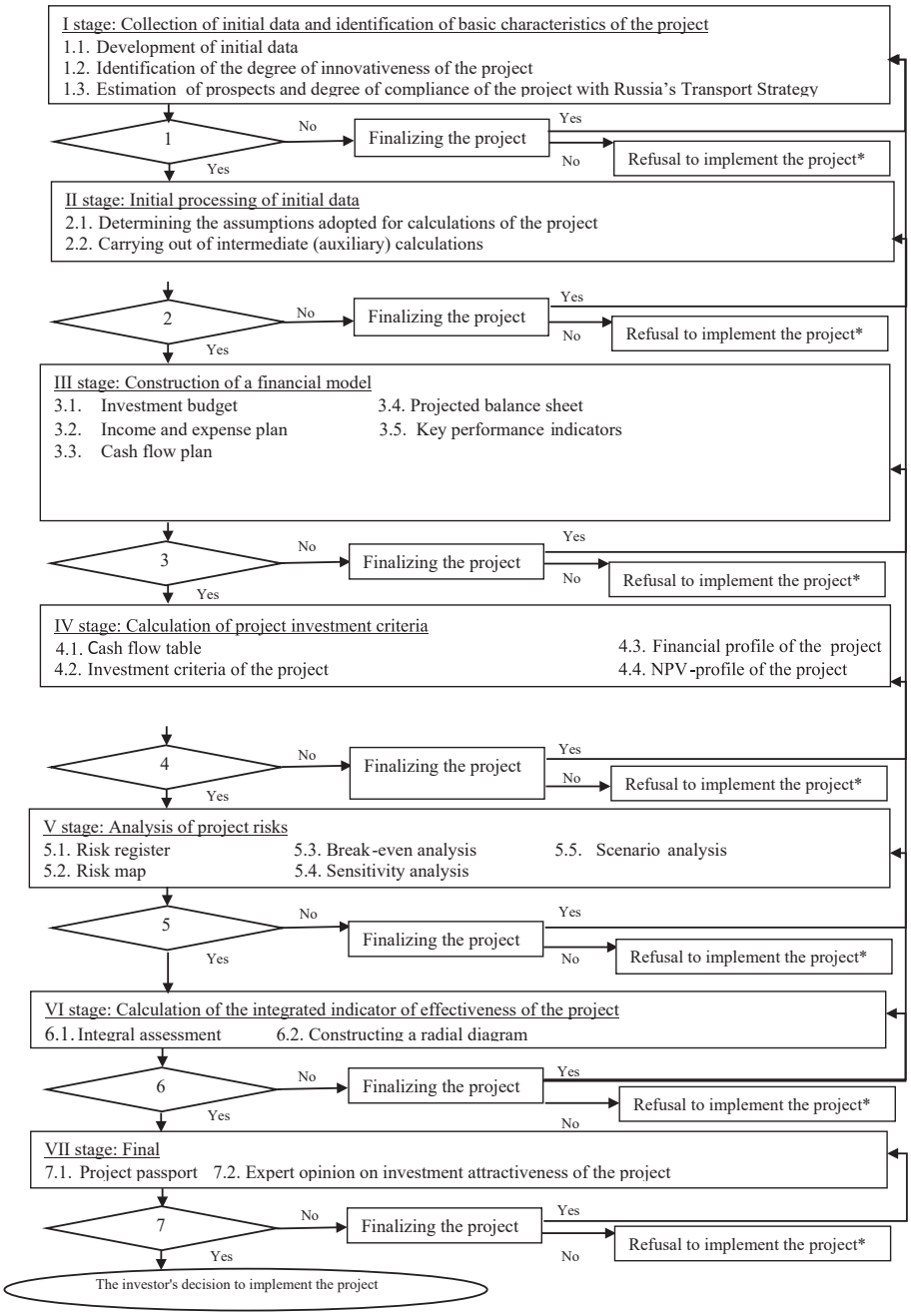
When determining the planning horizon, it is possible to use any of the known methods: useful life, payback period, and others. Year is selected as a planning interval. At this stage of the project assessment, a schedule is given for acquisition and commissioning of fixed assets in operation in natural and monetary units. In case of construction and purchase of equipment, a full list of construction costs, a complete list of equipment for operation of the project is provided. Prices and rates for repairs are considered, if such a need exists. As a result, the flow of investment costs for the project in terms of maintenance is being built.

It is necessary to estimate the average number of staff and costs for industrial production and administrative personnel (salaries, insurance premiums, income tax rates, property, etc., possible tax incentives for innovative projects). Next, it is necessary to determine a list of overhead costs, for example, rental costs, office maintenance, communication, information support, maintenance of own vehicles, advertising and marketing, training and selection of personnel, security, insurance, travel and entertainment expenses.

The task is to ensure the completeness of the revenue and expenditure part of the project, positive and negative cash flows that will be reflected in the tables «Income and expense plan», «Cash flow plan», «Forecast balance sheet», «Cash flow table» and are needed to calculate investment criteria.

It is necessary to take into account the moral wear and tear of equipment. In case of a negative deviation of actual depreciation from the moral one by 50% (this value is determined expertly), it is necessary to initiate modernization, improvement of the used equipment, technologies in order to ensure the planned payback period of the project.

The proposed structure of capital is provided, with all sources of financing identified, as well as arguments for the selected financing scheme (equity, loans, financial leasing, etc.). For each source of financing, the cost of its attraction is determined to calculate the weighted average cost of capital, which will be used in future as a discount rate for cash flows of the project. A positive attribute is description of willingness of credit institutions to allocate credit funds. An important aspect in the analysis of projects is the choice of the settlement currency. It is offered to use rubles as such.



Pic. 1. Algorithm for assessing investment attractiveness of an innovative high-speed land transport project. Explanations to Picture 1: 1 – a positive conclusion on the degree of innovation, prospects and compliance of the project with the strategic development vector of the national transport system; 2 – sufficiency of initial data and accepted assumptions for carrying out calculations; 3 – compliance of financial model parameters with the target values of the indicators (criteria); 4 – compliance of the values of investment criteria of the project with investors' expectations; 5 – compliance of the level of the overall risk of the investor's project of tolerance to risk; 6 – compliance with expectations of project stakeholders; 7 – approval of the conclusion by the investor.

**** Note – at the time of making an investment decision. In the event of further significant changes in the conditions of the internal and external environment, the investment decision on the project can be reviewed.***

1.2. Identification of the degree of innovativeness of the project.

It is recommended to start assessing the investment attractiveness of the innovative high-speed land transport project with identification of the degree of innovativeness according to the relevant criteria [2]. For assessment, a restrictive condition is introduced: the international level of novelty and the

Table 1

Interrelation of principles of prospects and compliance in assessing the investment attractiveness of innovative high-speed land transport projects

Interrelation of principles of compliance and prospects	Measures	Restriction
Compliance is present, prospects are absent	A) not to implement the project, B) to implement the project in case the project life cycle fits within the time interval of prospects	for B) in case of positive assessment of its social-economic efficiency
Compliance is present, prospects are present	Project implementation	in case of positive assessment of its social-economic efficiency
Compliance is absent, prospects are present	A) active dissemination of information about the project, initialization of changes in the priority list, B) postponement of the project implementation to a later date	in case of significant social-economic effect of the project

innovative or pioneering level of scientific and technical significance. If the project does not meet these requirements, it is not eligible to be assessed as an investment project according to attractiveness.

1.3. Determination of prospects and degree of compliance of the project with Russia's Transport Strategy

It should be noted that there is influence on the decision on implementation of the project of such principles of assessing the investment attractiveness of innovative high-speed land transport projects, considered in the authors' article [6], as the principle of compliance of the project with the transport strategy of the Russian Federation and the principle of prospects. Their interrelations and recommendations for the decision on project implementation are shown below (Table 1).

If the project meets the criteria considered, the processing of the original data should begin.

II stage: Initial processing of initial data.

2.1. Determining the assumptions adopted for calculations of the project.

Due to high uncertainty of innovative projects, some data are unknown at the assessment stage. This requires the adoption of certain assumptions for subsequent calculations. Due to the novelty of the technology and possible difficulties with direct assessment of expected investments, some parameters can be determined expertly on the basis of analogs, and also with the help of large-scale calculation.

2.2. Carrying out of intermediate (auxiliary) calculations.

Intermediate calculations are operations on determination, based on the initial data, of values of the indicators used in the financial model, if these initial data require additional processing. These include, for example, calculation of depreciation charges, calculation of the weighted average cost of capital, income calculation and others.

Calculations to assess the investment attractiveness of innovative transport infrastructure projects are recommended to be implemented in real prices due to a long planning horizon and insufficient information on the forecast inflation rate. Non-operating income and expenses are recommended to be taken into account in case of significant exchange differences, in case of equipment sales, etc. In view of the fact that at the time of project assessment it is impossible to accurately predict the rise in prices for goods, materials, works and services, the following should be used to forecast cash flows:

- *forecasts of leading analytical centers;*
- *ratio of the government official forecasts for inflation expectations and industry-specific coefficients (for example, correlation between the average building index and the inflation rate);*
- *if participation in the project of export-import operations is awaited, then it is necessary to provide for inflation forecasts of the countries participating in the operations;*
- *possible fluctuations in domestic and world prices for consumed resources and products sold;*
- *product life cycle – as prices change depending on the stage;*
- *cost reduction with increasing production volume.*

To determine the amount of depreciation deductions by a linear method, the initial value of the object and its useful life are determined, the depreciation rate is calculated. Typically, a linear method of calculating depreciation is used. However, in order to take into account the outrunning rates of moral depreciation in comparison with physical depreciation for a number of fixed assets, it is recommended to use the accelerated depreciation rate. The initial value of an object is calculated by summing all the costs of its acquisition or construction. If a reassessment of the property value was carried out, then an indicator such as replacement cost is used for calculation. The operational period is established by studying the classification list of fixed assets that differentiate them by editing depreciation groups. If the object is not fixed in the list, then the term of its operation is appointed by the organization depending on the forecasted time of use, expected physical deterioration, expected operational conditions.

WACC (Weighted Average Cost of Capital) – shows how much is the average ruble invested in business capital. It is calculated by the formula:

$$WACC = (Coc \cdot OC + Cbc \cdot BC)/IC, \quad (1)$$

where Coc – cost of own capital; OC – own capital; Cbc – cost of borrowed capital, taking into account the effect of the tax shield; BC – borrowed capital; IC – invested capital.

This indicator is used for assessment of investment projects as a discount factor, compared with return on invested capital, ROIC.

III stage: Construction of a financial model.

3.1. Investment budget.

The investment budget reflects the costs of design work, acquisition / construction of fixed assets, working capital. The schedule of acquisition and input of fixed assets into operation in natural and monetary units is given.

Table 2

Recommended values of project investment criteria

Investment criteria	Meas. units	Recommended value
Net present value (NPV)	mln rub.	> 0
Internal rate of return (IRR)	%	> WACC
Profitability index (PI)	coefficient	> 1,0
Payback period of the project (PBP)	years	compliance with investor's expectations
Discounted payback period (DPBP)	years	
Return on invested capital (ROIC)	%	> WACC

3.2. Income and expense plan.

The planned revenues are proposed to be determined based on the transportation rate, the planned volume of transportation. The costs are recommended to be classified into constant and variables ones (depending on the volume of traffic). This is necessary to determine later the break-even point. Constant costs, in turn, are divided into direct and indirect.

Direct constant costs include wages of industrial and production personnel, insurance premiums, maintenance and repair of equipment, depreciation of fixed assets and other fixed costs. In this clause, the standards and cost of repair are determined, if such a need exists.

Regarding indirect constant costs, it is necessary to take into account labor payment of administrative and managerial personnel, insurance premiums, depreciation of basic non-production assets and intangible assets, office rent, fixed and mobile services, Internet and data transmission network services, vehicle maintenance services, software maintenance, and household goods, accounting and audit services, legal, notarial services, marketing and advertising. This list of costs is exemplary and can be adjusted depending on the specifics of the project.

3.3. Cash flow plan.

Such a plan displays information on cash inflows and outflows, net cash flows for the project, including operating, investment and financial activities, as well as the cash balance at the beginning and end of the planning period.

Cash inflows from operating activities may include, for example, revenue from transportation, income from other activities. The planning of positive cash flows is proposed to be based on capacity utilization, production plan, and also based on marketing research. It is worth noting that this component of the income and expenditure plan and cash flow plan is, as a rule, the most uncertain and, accordingly, the most risky. Therefore, we must pay special attention to this issue.

Cash outflows from operating activities include electricity costs, other variable expenses, labor costs (including insurance premiums), maintenance and repairs, overheads, tax payments, interest on loans.

Cash outflows from investment activities coincide with the investment budget considered in paragraph 3.1.

Cash inflows from financial activities include such items as contributions to the authorized capital, attraction of investment loans, other income.

Cash outflows from financial activities include repayment of investment loans, payment of dividends, and others.

For each type of activity, net cash flow is defined as the difference between inflows and outflows for the corresponding type of activity.

It should be noted that in terms of cash flow and the cash flow table, only relevant flows (relating directly to the project) should be considered.

3.4.Projected balance sheet.

Due to this, the idea of assets (property) and sources of their financing in the course of the project is formed. The projected balance sheet provides the basis for assessing the project's security of assets and the effectiveness of their use, financial sustainability.

3.5.Key performance indicators.

It is recommended to determine the values of the following key performance indicators: return on sales (ROS); financial lever (FL); return on equity (ROE); labor productivity; coefficient of asset turnover from the position of complexity, maximum consideration of interests of stakeholders. The results of calculations of the indicators allow us to evaluate the performance indicators (during the operational phase) and the project's effectiveness and to timely implement corrective control actions.

IV stage: Calculation of project investment criteria.

4.1. Cash flow table.

The basis for calculating investment criteria of the project is the cash flow table, which summarizes the data on cash flows for each year of the project. It is necessary to distinguish between the cash flow table and the cash flow plan. In the cash flow table, unlike in the cash flow plan, cash flows from financial activities may not be taken into account. To compare different cash flows, they are reduced to the present moment by discounting method.

4.2. Investment criteria of the project.

According to the cash flow table, it is proposed to calculate the following indicators: net present value, internal rate of return, profitability index, simple and discounted payback period, return on invested capital (table 2).

4.3. Financial profile of the project.

According to the cash flow table, the financial profile of the project is built on the basis of the indicators «net cash flow» and «discounted net cash flow».

4.4. NPV-profile of the project.

Also, according to the cash flow table, the NPV project profile is built (the NPV value is used depending on the change in the discount rate).

V stage: Analysis of project risks.

At this stage, tools for qualitative and quantitative risk analysis are used (for example, a risk map, a break-even point analysis, sensitivity analysis, scenario analysis). A risk register is formed. When analyzing the risks of innovative high-speed land transport projects, it is recommended to assess the impact of such indicators as, for example, the volume of traffic, the cost of transportation, the amount of investment costs.

5.1. Risk register.

The register contains information on the risks of the project, includes their description, objects and persons bearing the risks, the causes and likelihood of occurrence, the degree of impact on the objectives, the anticipated activities to respond to risks.

5.2. Risk map.

It is a graphic and textual description of an organization's risks. The map includes risk assessment criteria, namely: the level of damage from the risk occurence and the likelihood of occurrence of a risk event during a certain period of time. Each criterion is ranked from the minimum to the maximum value. The final level of risk is determined at the intersection of two criteria, for example, those that are most likely to cause catastrophic risks and can cause significant damage to the project.

5.3. Break-even analysis.

It is also called SVP analysis, it shows what will happen with a profit when the volume of production, price and basic cost parameters change. Break-even analysis is performed under the following conditions: the performance does not change significantly within the considered sales volume changes, the prices remain stable.

5.4. Sensitivity analysis.

It refers to methods to improve the reliability of the results of the calculations and is to assess the impact of changes in the initial parameters of the project on its final characteristics, which use the net present value. Its toolkit allows to assess the potential impact of an individual risk on a NPV project. As a result of the analysis, it is possible to identify the most critical parameters, according to which the smallest deviation of the limiting (threshold) value from the base one is noted. The logical consequence of the conclusions should include the following steps: a technique for overcoming (warning) critical parameters, forming a strategy for responding to risks.

5.5. Scenario analysis.

It includes the simultaneous modification of several project parameters that are checked for risk, and it is the development of a sensitivity analysis – a group of several project variables, as a rule, those to which the net present value of the project is most sensitive, is subjected to a simultaneous, consistent (realistic) change. As a result, the impact of a simultaneous change in all the main project variables that characterize its cash flows on investment criteria is determined. An important advantage of this method is that the deviations of the parameters are calculated taking into account their correlation.

VI stage: Integral assessment.

As the criteria for integral assessment of the innovative high-speed land transport project, it is proposed to consider the following components: speed increase, economy, safety, environmental friendliness, investment criteria, manufacturability, proactivity, social and budgetary efficiency. For each criterion, the scores of the indicators forming their scores are summarized. Further, the degree of influence of a particular criterion on the investment attractiveness of the project is determined expertly, using the scale of values: very high – 5 points; high – 4 points; average – 3 points; low – 2 points; very low – 1 point. The final indicator of the investment attractiveness of the project is calculated as the weighted sum of points according to the criteria:

$$Z = \sum_{j=1}^{m} a_{y_j} \cdot y_j, \qquad (2)$$

where Z is integral assessment of the investment attractiveness of the innovative transport infrastructure project, points; a_{y_j} – degree of influences of the j-th criteria on integral assessment; y_j – value of the j-th criterion in points (j = 1,...m); m – number of assessment criteria (m = 9).

VII stage: Final.

7.1. Project passport.

At the last stage of assessment of the investment attractiveness, a passport (or a specificatons' file) of an innovative high-speed land transport project is compiled, including all the main data and the results obtained.

7.2. Expert opinion on investment attractiveness of the project.

Based on the passport of the innovative high-speed land transport project, a decision is made on its implementation.

If it is necessary to finalize the project, it is possible to return to each of the previous stages, this process is multi-iterative, and iterations should be carried out until the result is obtained, which is expected by the main stakeholder of the project namely the investor.

Conclusions. *The developed methodology for assessing the investment attractiveness of innovative high-speed land transport projects allows us to make the most reasonable, rational investment decisions, since it takes into account, in addition to financial indicators, indicators reflecting the interests of various stakeholders, and at the same time can be revised depending on changes in strategic objectives, innovations exceeding initial performance parameters of the project.*

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