

# Macroeconomics Aspects of the Effectiveness Evaluation of Outsourced Services Directorate of «Russian Railways» Infrastructure

I.Y. Solskaya

Irkutsk State Transport University  
Irkutsk, RF  
Irina\_Solskaya\_@mail.ru

S.V. Belomestnyh

Irkutsk State Transport University  
Irkutsk, RF  
seregabelom@mail.ru

**Abstract**— the article is devoted to the problem of theoretical substantiation of methodological approaches to assessing the effectiveness of third-party services provided on the terms of outsourcing and performed in the areas of infrastructure Management of JSC "Russian Railways". The basic provision of the theoretical justification is the representation of the effects arising for single-product production functions in relation to the growth of the volume of production (work). The only cost deterrent is the new promising technologies, the use of which increases capitalization, reducing costs in a short time period.

The theoretical justification allows formulating a scientific hypothesis about the possibility of transformation of methods of assessing economic efficiency, as well as choosing an effective option on the basis of generalization of the principles and methods of transformation of the economic result. The formulated properties of the evaluation model make it possible to justify its applicability as a case of services provided to the infrastructure Directorates of JSC "Russian Railways", and to adapt the model of production efficiency evaluation to other organizations similar in nature to the production function, attracting third-party service organizations on the basis of outsourcing agreement.

**Keywords** — *theory of non-refundable costs, methodical approach to assessing the effectiveness of technological solutions, indicators of evaluating the effectiveness of services*

## I. INTRODUCTION

A necessary condition for the reasonable formation of budget parameters for the elements of cost items is the choice of the most effective option of technical (technological) solutions at the level of all structural units. The conclusion of life cycle contracts [1] (LCC) as a cost management tool seems to be a practically solved problem from the point of view of generalization of theoretical principles and practical methods of transformation of the category of economic result taking into account the peculiarities of industry production of railway transport.

The structural reform of the railway transport of the Russian Federation led to the removal of non-core types of work for outsourcing, the emergence of other organizations that provide the transportation process, which are in relation to JSC "Russian Railways" (hereinafter the Company) third-party consumers.

The program of measures for increase of efficiency of activity of Open joint stock company "Russian Railways" ("RR") at the expense of intensive development of other activities generated in the development of budget management activities in the formation of strategic business units. Activities involve movement aimed primarily at reducing costs for low-profit businesses. This direction is implemented due to, among other things, the development of the corporate regulatory framework for cost management.

## II. MODELS AND METHODS

The analysis of the regulatory framework and practice of its application allowed assessing a number of specific features of the cost management system of infrastructure, activities and government support.

As an object for assessing the effectiveness of planning operating costs, first of all, it is necessary to consider such a low-profit sphere of activity as infrastructure [2]. In our case, the East Siberian Directorate of infrastructure—a branch of the Central Directorate of infrastructure of JSC "Russian Railways", which is located on the territory of the East Siberian railway with management in Irkutsk, was considered as the object of research directions of development of the cost management system.

The formed model for evaluating the effectiveness of third-party services provided by JSC "Russian Railways" under the terms of outsourcing agreements must meet the following requirements:

- reduction of one-time costs for repairs and maintenance;
- optimization of resources of both the Contractor and the Customer;
- centralization of continuous responsibility of the Contractor for goods (services) [3].

The purpose of the study - a model of evaluation of third-party services, which will take into account the functional relationship and interdependence between the following elements in the cost management system: - expenses for repairs and maintenance of repaired objects of active and passive fixed assets, maintenance of which is carried out through outsourcing; - optimization of costs of the outsourcing company (Contractor), identified through the justification of the cost parameters under the outsourcing agreement; - optimization of costs of JSC "Russian Railways" (Customer), identified through the analysis of the structure and dynamics of the cost at the established rates of expenditure on generalized units of fixed assets (active and passive), repair and maintenance of which is carried out under the outsourcing agreement; - terms of the outsourcing contract and methods of selecting the contractor repairs and maintenance works (services).

### III. RESULTS

In the part of a customer we are talking about the costs of JSC "Russian Railways" (Customer), identified through the analysis of the structure and dynamics of the cost, the efficiency of which is planned in the amount of up to 966.3 billion rubles for the period 2019-2025 (Table 1).

TABLE I. PROGRAM OF IMPROVING THE EFFICIENCY OF ACTIVITIES AND COST OPTIMIZATION FOR 2019-2025

<i>Measures for optimization of expenses for 2019-2025.</i>	<i>Central Directorate of infrastructure, from the cumulative effect, %</i>
Optimization of current activities	5,5
The introduction of modern technologies, innovation policy current activities	15,8
The effectiveness of the asset management	19,0

In the process of providing infrastructure services there is a need for repairs of elements of the infrastructure (order of JSC "Russian Railways" №75R from 18.01.2013 "Technical conditions for the reconstruction (modernization) and repair of the railway"). The choice of repair method is carried out taking into account, first of all, technological features, as well as the level of costs.

When assessing the total cost of the current maintenance of one temporary recovery site per year (maintenance in good condition, undigested rail joint) compared to the cost of welding, the following can be noted:

- increasing the cost of work performed on the technology of aluminum-thermal welding of rail joints (ALTS) (12%),
- reduction the share of welding costs in relation to the cost of the current maintenance of one temporary recovery site per year from 27, 1 to 9%. Thus, it can be assumed that the existing economic model of attracting third-party organizations to perform outsourcing does not provide a solution to the most important components of the cost

optimization problem and requires improvement or fundamental change.

The consideration of the economic content of production, carried out in order to provide services of railway infrastructure, allows with a sufficient degree of formalization attributing the production of many factors of production and outputting to a variety of production functions with non-refundable costs [3].

A study of the factors of production included in the contracts for performance of works (rendering of services) by contract method, signed by the Directorate of infrastructure and its regional divisions, with the position taken by the production decisions allows assessing some of the production costs of repairs to fixed assets as non-performing.

First of all, this applies to the existing infrastructure itself, since the costs of ensuring the necessary level of its condition in accordance with the established regulatory framework are taken into account in the tariffs for transportation indirectly and not fully [4].

For the purpose of theoretical substantiation of the formed model of assessment of efficiency of the carried-out repairs the following designations were entered:

$Q = (q_1, \dots, q_m) \geq 0$  - levels of production and output of goods (services);

$Z = (z_1, \dots, z_{L-M}) \geq 0$  - volumes of use of (L-M) factors of production, assuming that the volume of use of factor of production  $z_i$  is a nonnegative value (considering all goods, not actually used in the production process, factors of production).

In accordance with the Regulation, the single-inlet model is valid for the infrastructure. This is due to the fact that the main purpose of the company is to provide transport and logistics services of railway transport.

Based on this purpose, there are business functions that actually need to be performed to achieve it and that bring the company income. In addition, there are auxiliary and supporting functions.

Auxiliary functions do not generate income by themselves, but without them it is impossible to carry out business functions. Providing-these are the functions that are common to all organizations, regardless of their activities.

The actual value of costs is paid by the enterprise in the process of forming costs, that is, it is quantitatively determined, and in fact it pays off in the process of forming costs. Thus, the value of capital costs cannot have a universal monetary measure, since it is set exogenously and depends on parameters external to the functioning of capital. However, these parameters have an impact on the functioning of capital in the form of the circulation of capital costs due to the formation of the so-called costs of maintaining physical and financial capital.

Considering a given industrial purpose and position in the organizational structure of management of railway transport infrastructure as a company with a single output and strictly

convex technology (non-decreasing returns to scale), we can assume that the irrevocability of the costs occurs because one of the factors of production, namely, the initial state of the infrastructure cannot be changed without changing the specified level of output – the quality of infrastructure services.

In the case when the production set  $Y$  describes a technology with one output and differentiable production function  $f(z)$ , we can consider the problem of the firm as a problem of a choice of levels of use of factor of production  $z$ . In this case, using  $p > 0$ , we can denote the price of the finished products of the company, and using  $w \gg 0$  – prices of factors of production. [5]

The vector  $z$  delivers maximum profit at prices  $(p, w)$ , if it is the solution of the following problem:

$$\begin{aligned} \max \quad & pf(z) - w * z \quad (1) \\ & z > 0 \end{aligned}$$

Taking the non-decreasing factor as a condition for the implementation of the production function, it is possible to consider the terms of the contract with a third party for the provision of services for the repair and maintenance of infrastructure as the only factor of production.

In this case, the task of minimizing costs is of particular importance, since it is possible to obtain very important results and relations from a technical point of view, if the production set is convex, then the conditions of the first order (1) are not only necessary, but also sufficient for solving the problem of maximizing profits.

By reformulating profit maximization using the cost function and treating rail infrastructure as a monopoly with state-regulated tariffs for services, marginal costs can be considered extremely small. This phenomenon is related to the effect of non-anthogonistic consumption, as the infrastructure simultaneously meets the need for the transport of a large number of users-carriers with extremely low barriers to entry into the transport market.

A natural monopoly provision of infrastructure in the conditions of rigid state regulation of rate setting results in costs to the maximum, but because of industry-specific regulation and the uniqueness of a service provider's infrastructure on the level of average costs.

The theoretical justification of the new model is based on the implementation of the method of economically justified costs, i.e. on the basic provision that by converting costs (the sphere of purchasing factors of production) into costs (the sphere of selling finished products), the formation of production costs occurs, that is, the costs of circulation should ensure the functioning of capital production costs, and consequently, the capital itself.

The consideration of the economic content of production carried out for the purpose of providing railway infrastructure services makes it possible, with a sufficient degree of formalization, to attribute the production set of factors of production and outputs to the set of production functions with non-returnable costs.

The production process is characterized by a non-decreasing return on scale if for any  $y \in Y$ ,  $\alpha y \in Y$  is satisfied for any  $\alpha \geq 1$ .

Here:

$y = (y_1, y_2)$  - production vector (input-output vector), describing the output of goods in the production process.

The set of all admissible production vectors  $Y$  is the production set; any  $y \in Y$ . In other words, any admissible input-output vector can be proportionally increased.

Norma technical replacement can be used as a meter to evaluate the necessity of changing the technology of performed works, as it shows what the additional amount of the factor  $K$  should be used so that the issue remained at the level  $q = f(\hat{Z})$  has reduced the use of the factor  $L$  at a small value.

The single-output model that most closely corresponds to the production function of the infrastructure described by the production function  $f(z)$  shows what maximum output  $Q$  can be produced by  $(z_1, \dots, z_{L-M}) \geq 0$  units of factors of production.

The marginal rate of technical substitution of the factor of production  $T$  to the factor of production  $L$  at the point  $\hat{Z}$  can be interpreted in the framework of innovative transformations of transport infrastructure. In particular, this may be due to the expansion of high-speed traffic.

Technical replacement function  $MRTS_{lk}(\hat{Z})$  in this case is the limiting norm for the transformation of factor  $K$  into factor  $l$  in the case of single-release technology and many factors of production.

Considering repairs carried out on the basis of outsourcing as a factor of production, it is possible to determine each of the possible repair technologies as an interchangeable factor, since the change of technology entails not only a change in the cost estimate (costs under a contract with a third party), but also a change in the time characteristics of the production process infrastructure.

It is possible to evaluate the feasibility of selecting (changing) the contractor in this case from the position of assessing the technical replacement rate on the basis of comparing the costs of the appropriate technology. Thus, from the perspective of the Customer of work performed to the effective functioning of capital it is necessary to minimize production costs, since minimizing the total cost (capital and operating) is not possible, the process of capital formation, while minimizing costs value added generated in the process of treatment costs will cover the costs of the poor performance of the sector of address.

In the normal functioning of the capital of the enterprise, the costs of production (or capital costs) are covered by the regulation of the costs of circulation, which allow reproducing the capital spent in the production process. Since only the costs of circulation can actually be measured, the efficiency of spending and reproduction of capital can be estimated on the basis of the directions of use of the costs of circulation.

Taking into account that the non-decreasing factor is a condition of realization of production function, it is possible to consider conditions of the contract with the third-party organization for rendering services in repair and the maintenance of infrastructure as the only factor of production.

In this case, the problem of cost minimization is of particular importance, since it is possible to obtain very important results and relations from a technical point of view, if the production set is convex, then the conditions of the first order are not only necessary, but also sufficient to solve the problem of maximizing profits.

With this goal in mind using the cost function the maximization of profits and considering the infrastructure of rail transport as a monopoly regulated by the state service rates can be considered very small marginal cost. This phenomenon is related to the effect of non-antagonistic consumption [6], as the infrastructure simultaneously meets the need for transportation of a large number of users – carriers with extremely low barriers to entry. This situation is also true for the rail market of other countries [7].

The natural monopoly position of infrastructure in the conditions of strict state regulation of the tariff leads to the establishment of costs at the level of marginal, and because of the industry specifics of regulation and the uniqueness of the infrastructure service provider – at the level of average costs. In such a situation, the criterion for choosing a service provider is cost. Moreover, most of the planned cost reduction (86%) is expected to be due to lower prices during competitive procedures for procurement services (Table 2).

**IV. DISCUSSION**

In the proposed model we propose an approach to optimization of operational costs on the basis of the calculation of the cost of repairs with the innovative schemes of their implementation. The choice of this method of allocation of costs is primarily due to the lack of the possibility of calculating profit as a financial result within the work of the Directorate of infrastructure units.

TABLE I MEASURES TO REDUCE THE COST OF INFRASTRUCTURE OF JSC "RUSSIAN RAILWAYS" FOR THE PERIOD UP TO 2025

<i>Cost reduction measures</i>	<i>Expected effect, billion rubles</i>
Optimization of non-core assets (sale, gratuitous transfer, liquidation, lease, etc.)	1,6
Efficient use of fixed assets	0,5
Cost reduction due to the price policy of Russian Railways with the main suppliers of products	3,9
Cost reduction due to reduction of prices in the tender procedures	36,7
Transfer of work to contractors	0,08
In the sum	42,7

The expediency of new ways of repair on railway transport has to be proved comprehensively. This process begins with the design decision stage, when a preliminary assessment of technical and economic positions is given.

The introduction of production of new technologies "Welding rails aluminothermic method" and "Welding rails with a wide gap" on the railway network of JSC "Russian Railways" is an important factor that affects the results of economic activity, in particular the quality, completeness and timeliness of work, and, consequently, the volume of services provided, their cost, the financial condition of the organization. [8]

In order to improve the cost management system, it is proposed to use the method of economically justified costs based on the basic provision that due to the conversion of costs (the sphere of purchase of factors of production) into costs (the sphere of sale of finished products), production costs are formed, that is, circulation costs should ensure the functioning of the capital of production costs.

On the example of the economy of the way of the East Siberian Directorate of infrastructure, it was proposed to manage costs on the principle of ensuring the functioning of capital. The basis of the practical implementation of the proposed method is a comparison of the existing technology- the change of a single rail and rail repair technology-surfacing, welding, grinding. [9]

**Acknowledgment**

In order to assess the effectiveness was adopted by the versatile indicator of tetraenite: expenses for one rouble of cost of work completed, calculated as the ratio of the value of work performed to eliminate a defect in the rail to the cost of the current contents of the defective places. As a planned result of the implementation of the proposed method can be considered a transition to the repair scheme by achieving a guaranteed rail resource. In accordance with the accepted schemes of repair and the expected guarantee for the operating time of rails up to 700 million tons gross, it is possible instead of performing a continuous replacement of rails with new accompanied work in the amount of medium repair of the track to plan an average repair, which will significantly reduce the cost of repair..

**References**

- [1] I. Solskaya, S. Belomestnykh "Methodical approach to evaluating the services of third parties Directorate of infrastructure JSC "Russian Railways" Issues of the new economy. № 2(46), pp. 60-72, 2018.
- [2] S. Belomestnykh, I. Solskaya "Cost management in track of railway transport infrastructure EPD Science" Matec Web of Conferences). X International Scientific and Technical Conference "Polytransport Systems" Tomsk, 2018
- [3] V. Gapanovich, I. Shubinsky, E. Rozenberg, A. Zamyshlyayev System of adaptive management of railway transport infrastructure technical maintenance (urran project) available at: <https://cyberleninka.ru/article/n/system>
- [4] I. Peter "Harmonisation of directives of the Interoperability of the community rail system Railway Transport and Logistics V.III No.2 2007 available at: URL:<https://docplayer.net/>
- [5] A. McCallal, M. Winston, D. Green "Microeconomic theory". Book 1. M.: Publishing house "Delo" 2016
- [6] C. McConnell, S. Brue "Economics: principles. Problems and politics". M.: INFRA-M, 2009
- [7] Locomore shows the need to remove barriers to market entry, says ALLRAIL. available at: <https://www.railwaygazette>.

- com/news/policy/single-view/view/locomore-shows-the-need-to-remove-barriers-to-market-entry-says-allrail.html
- [8] I. Solskaya, V. Burovcev “Methodology for research of the market of public services in the field of licensing” Bulletin of Baikal State University V. 25, № 6 pp. 956–967. 2015. — DOI : 10.17150/1993-3541.2015.25(6).956-967.
- [9] I.Solskaya, S. Belomestnyh “Microeconomic Aspects of Evaluating the Effectiveness of the Services Provided by Outsourcing Organizations to the Infrastructure Directorate of the JSC "Russian Railways" Issues of the new economy. № 2(50). pp. 78-83, 2019.