Assessment of transport company activities based on calculation of unified integral indicator

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Abstract. A universal set of indicators for assessing the effectiveness of transport companies is proposed. The practical application of the proposed set of indicators is confirmed by their versatility, a simple algorithm of actions and mathematical calculation. Moreover, to prove practical application, the proposed methodology was tested to assess the effectiveness of transport companies operating in the Tyumen region in Russia.

1. Introduction

At present, the creation of a dynamically developing, steadily functioning and balanced national transport system in Russia is a necessary condition for stabilizing and raising the economy, ensuring the integrity of the country, and raising the standard of living.

In this regard, according to the economic strategy of the Government of the Russian Federation, the relationship of transport with other sectors of the economy and the social sphere is strengthened, which determines the requirements for transport in terms of directions, volumes and quality of transport, as well as the possibility of its development, since the income of transport companies depends on the volume of traffic. Cheaper and faster freight and passenger transport stimulate the expansion of transport and economic ties.

The transfer of transport on a commercial basis and the reduction of allocated public investments have significantly aggravated the problems of development of the industry. The decrease in revenues of transport companies due to a sharp decline in traffic volumes while increasing prices for the necessary technical equipment and materials, fuel, and energy led to a significant slowdown in the renewal of fixed assets of transport companies and the deterioration of their condition.

The solution to this problem depends on the scientific justification of the system of indicators for economic evaluation of the effectiveness of the company, and in particular the assessment of the level of innovative development.

Creation of a system of economic activities evaluation will increase the validity of management decisions in the operational management of activities of transport companies, as well as in predicting the economic development of the industry in the future.

The results of the study on the development of a system of evaluation of the effectiveness of transport companies can be applied in the process of forming a system of indicators for transport companies in order to objectively assess current reserves, including solving the problems of the current stage of reforming the transport system of Russia.

The theoretical and methodological basis of the study includes the methods of economic evaluation of the effectiveness of transport companies, management and organization of the transportation
process, the integrated development of transport infrastructure at the present stage of economic relations, set forth in the works of domestic and foreign scientists: A. P. Abramov, A. V. Annenkov, I.V. Belov, B.A. Volkov, V.G. Galaburda, Yu.N. Kozhevnikov, S. N. Kochetov, B. M. Lapidus, V. N. Livshits, M. E. Mandrikov, D. A. Macheret, V. A. Persianov, V. V. Povorozhenko, S. M. Rezer, A. A. Smekhov, N. P. Tereshina, M. F. Trikhunkov, T. S. Khachaturov, R. M. Tsarev, A. D. Sheremet and many others [1,2,3].

2. Methods
In order to assess the effectiveness of transport companies, it is important to create a universal set of indicators. For this, a methodology for evaluation of effectiveness is recommended, based on the calculation of four groups of indicators, consisting of a sufficient set of individual indicators that affect overall efficiency; As a result of the assessment of group indicators, a unified integrated indicator of the efficiency of the transport company is calculated.

The author's recommendations presented in this article are based on the methodological approaches used in compiling most of the complex indices, including the index of innovative development. Each index takes into account a group of parameters whose importance weights are determined by experts.

Thus, those characteristics of the transport company that act as the main factors of its effectiveness are taken into account: financial stability, business processes, personnel management system, level of innovative development, etc.

In relation to organizations of the transport industry, it is proposed to use the following set of indicators [4]:

1. Indicators of financial stability of the company:
   - current ratio of the balance sheet;
   - fulfillment of a given plan for the provision of services;
   - dynamics of income from the provision of services compared to the previous period;
   - the number of fines for violations of financial discipline, other sanctions imposed by auditors;
   - overdue receivables.

2. Indicators of the level of innovative activity of the company:
   - expanding (or updating) the list of services provided;
   - the company has a development program for a period of at least three years with financial support;
   - the level of application of modern work technologies (the number of innovative work technologies introduced during the period).

3. Indicators of organizational development of the company:
   - bringing the average salary of the corresponding categories of workers to the average salary in the region;
   - fulfillment of target performance indicators of the company;
   - Compliance with the deadlines for advanced training of workers directly providing transport services;
   - the number of comments on the timing and quality of the established reporting and information on certain issues of the activities of transport companies;
   - the level of development of corporate culture;

4. Indicators of the personnel management system:
   - staff turnover rate;
   - coefficient of advanced training of workers (% share of the number of employees regularly undergoing advanced training to the total number of employees);
   - well-grounded consumer complaints;
   - state occupancy during the analyzed period;
   - professional activity (participation in professional competitions, training of winners).

The algorithm of actions to build an integrated indicator of the transport company’s efficiency is presented in Figure 1.
Figure 1. The algorithm for assessing an unified integrated indicator of the effectiveness of the transport company.

At the first stage, it is necessary to bring the aggregate of individual indicators to comparable values, since they are expressed in various units of measurement (percentage, value, natural, etc.). For this purpose, the assessment of each indicator in the system is translated into points (from 1 to 8). [5]

The approaches to the construction of the scale are varied, since it does not contain a mathematically clearly defined explanation, but rather is an analytical selection, which purpose is to minimize sharp deviations of individual companies from the industry average.

The actual material for determining the values of individual indicators and evaluating the activities of the transport company is collected from the internal reporting data, as well as from the information of the analytical collections of Rosstat.

At the second stage, based on dimensionless quantities, group indicators are estimated. Their number corresponds to the number of indicator groups. The set of four group indicators proposed in this methodology is mandatory and has fundamentally important analytical value for assessing the effectiveness of a company.

At the third stage, a set of group indicators is reduced to a unified integrated indicator of the effectiveness of the company. It is proposed to use two methodological approaches: regression analysis and the method of expert estimates.
In order to obtain a unified integral indicator, it is necessary to determine the weights of four group indicators, i.e. determine the share of each group in the total indicator.

To give weighted values of group indicators in a unified integrated indicator, it is proposed to use regression analysis. Regression analysis makes it possible to carry out the calculation according to the following formula (1)

\[ Y = a + bX_1 + cX_2 + dX_3 + eX_4 \]  

(1)

\(X_1, X_2, X_3, X_4\) - the values of group performance indicators of the company; \(a\) - correction factor; \(b, c, d, e\) - weighting coefficients, reflecting the degree of influence of group indicators on the value of \(Y\); \(Y\) - parameter determined by expert method.

The value of \(Y\) is determined by the method of expert estimates based on the grouping of the analyzed transport industry companies based on the results of an independent assessment of the quality of their activities.

At the fourth stage, a rating of the analyzed transport companies is formed on the basis of the results of the assessment of a unified integrated indicator.

At the final stage, the analysis of the results is carried out and, if necessary, the adjustment of a set of individual indicators for the subsequent application of the proposed methodology. This will improve the guidelines for tracking the activities of the transport company in dynamics. [6,7,8]

3. Results

In order to test the proposed recommendations, the effectiveness of transport companies operating in the Tyumen region of the Russian Federation was evaluated. It is important to note that in order to apply the methodology in assessing the company’s effectiveness, the maximum possible number of operating companies in the transport industry, including the regional market leader, is necessary.

In order to preserve the confidentiality of financial information about the activities of the analyzed companies, in this work the names of the companies are hidden and symbols (K1, K2, K3, K4, K5) are adopted for their identification.

During the data assessment, an analysis was made of the financial statements of companies, expert assessments, as well as information presented on official websites.

Qualitative parameters, such as the presence of a development program (strategy) with a validity period of at least three years, having a financial component, the quality of corporate culture, etc., are determined by expert assessments based on the total amount of information about the company’s activities. The experts also assign certain points to non-quantitative parameters: from 1 to 8, where a larger number of points means the best characteristic of the parameter, and 1 - the worst.

In tables 1-4, the possible values of individual indicators are turned into points.

| Table 1. Comparison of values of indicators characterizing financial stability in points. |
|-----------------------------------------------|-------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Indicators                                    | Points            | 1               | 2               | 3               | 4               | 5               | 6               | 7               | 8               |
| Current liquidity ratio                       | 0.5 and less      | 0.51-0.79       | 0.8-1           | 1.1-1.39        | 1.4-1.59        | 1.6-1.8         | 1.81-2          | 2 and more       | 100              |
| Fulfillment of a defined service plan         | 87.9 and less     | 88-89.9         | 90-91.9         | 92-93.9         | 94-95.9         | 96-97.9         | 98-99.9         | 100              |
| Dynamics of income from the provision of services | 5 and less       | 5-10            | 10-15           | 15-20           | 20-25           | 25-30           | 30-35           | 35 and more      |
| The number of fines for violations of financial discipline, other sanctions | 11 and more | 10-11           | 8-9             | 6-7             | 4-5             | 2-3             | 1               | 0               |
| Overdue receivables                           | 17 and more       | 14-16.9         | 11-13.9         | 9-10.9          | 6-8.9           | 3-5.9           | 0-2.9           | 0               |
Table 2. Comparison of values of indicators characterizing the level of innovative development in points.

| Indicators                                | Points | Comparison of indicators to points |
|-------------------------------------------|--------|-----------------------------------|
| Expanding / updating the list of services provided | 1 and less | 1-2  3-4  5-6  6-7  8-9  10-11  12 and more |
| Number of innovative work technologies    | 0      | 1  2-3  4-5  6-7  8-9  10-11  12 and more |

Table 3. Comparison of values of indicators characterizing the personnel management system in points.

| Indicators                          | Points | Comparison of indicators to points |
|-------------------------------------|--------|-----------------------------------|
| Staff turnover rate                 | 12 and more | 10-9-8-7-6-5-3.9 and less |
| Coefficient of advanced training of employees | 65 and less | 65-70-75-80-85-90-95 and more |
| Reasonable customer complaints      | 20 and more | 19-16-13-9 10-8 7-5 4-2 1 and less |
| Staff occupancy during the analyzed period | 80 and less | 80-83-87-90-95-98-100 |
| Professional activity               | 2 and less | 2-5 6-10 11-16 20-25 30 and more |

Table 4. Comparison of values of indicators characterizing the level of organizational development in points.

| Indicators                                                                 | Points | Comparison of indicators to points |
|---------------------------------------------------------------------------|--------|-----------------------------------|
| Bringing the average salary of the corresponding categories of workers to the average salary in the region | 60 and less | 60-69.9 70-74.9 75-79.9 80-84.9 85-89.9 90-95 and more |
| Fulfillment of target performance indicators of the company;              | 70 and less | 70-74.9 75-80-84.9 89.9 95-100 |
| Compliance with the deadlines for advanced training of workers directly providing transport services | 65 and less | 65-70-74.9 75-80-84.9 89.9 95-99.9 |
| Number of comments on the timing and quality of the provision of established reporting and information on certain issues of the activities of transport companies | 13 and more | 13-11 9-10 7-8 5-6 3-4 2-3 0-1 |

It is necessary to take into account that the analytical groups to give points to the corresponding values of indicators are not based on mathematical calculation, do not have the same “step” for grouping, but allow avoiding abnormal, non-standard values of statistical indicators.

The values of group indicators are calculated as the arithmetic average of the sum of the values of individual indicators of the corresponding company.

Table 5 presents the results of the assessment of group performance indicators of transport companies.
Table 5. The results of the scoring of group performance indicators of transport companies.

| Group indicators                                      | K1 | K2 | K3 | K4 | K5 |
|-------------------------------------------------------|----|----|----|----|----|
| Indicators of financial stability of the company      | X1 | 6.8| 7.0| 6.2| 4.8| 3.8|
| Indicators of the level of innovative activity of the company | X2 | 5.0| 4.7| 4.0| 1.3| 1.3|
| Indicators of organizational development of the company | X3 | 6.0| 6.8| 5.4| 4.2| 3.0|
| Indicators of the personnel management system         | X4 | 7.8| 6.8| 5.2| 5.6| 6.2|

Based on the correlation and regression analyzes carried out using multivariate regression in MS Excel, the following regression equation was compiled (2):

\[ Y = 0.27 X_1 + 0.31 X_2 - 0.12 X_3 + 1.41 X_4 \]  

(2)

It should be borne in mind that regression analysis shows the influence of four integral indicators on Y together, in interaction with each other. When assessing the individual contribution of each group indicator to the Y value determined by correlation analysis, the values differ.

Thus, on the basis of the identified patterns, it seems possible to propose a formula for a unified integrated indicator. The determination of weights in this case is carried out on the basis of the analytical judgment method, based on the relationship of the influence of factors obtained as a result of the correlation analysis (table 6).

Table 6. The weights of individual indicators in a single integrated indicator of the activities of the transport company, determined by experts.

| Group indicators                                      | Weights of indicators in the calculation of a unified integral indicator of efficiency, % |
|-------------------------------------------------------|------------------------------------------------------------------------------------------|
| Indicators of financial stability of the company      | X1                                                                                      | 5                                      |
| Indicators of the level of innovative activity of the company | X2                                                                                      | 35                                     |
| Indicators of organizational development of the company | X3                                                                                      | 35                                     |
| Indicators of the personnel management system         | X4                                                                                      | 25                                     |

Therefore, in order to calculate the integral effectiveness indicator for transport companies (IEI), you can use the equation of the following form (3):

\[ IEI = 0.05 X_1 + 0.35 X_2 + 0.35 X_3 + 0.25 X_4 \]  

(3)

The calculation of a unified integrated indicator of the transport company activities allows making a rating by efficiency based on the proposed methodology.

Table 7. Rating of the analyzed companies according to the integrated effectiveness indicator calculated by the proposed methodology.

| Rate | Analyzed company | Integrated Effectiveness Indicator |
|------|------------------|-----------------------------------|
| R    | K                | Y                                 |
| 1    | K1               | 6.6                               |
| 2    | K2               | 6.5                               |
| 3    | K3               | 5.3                               |
| 4    | K4               | 4.9                               |
| 5    | K5               | 4.4                               |

After compiling the rating, it is advisable to continue research to develop detailed recommendations
for improving efficiency.

4. Conclusions
It seems that the assessment of the effectiveness of companies using the proposed methodology needs to be supplemented with elements of a qualitative analysis in such parameters as the dynamics of consumer demand in the transport services market, current and future priorities of federal, regional and municipal authorities in the transport sector.

Thus, on the basis of the data obtained, the possibility of constructing an economic and mathematical model that allows us to develop an integrated indicator of the effectiveness of the company. In the regression equation, as a result, the values are included - the ranks of companies based on points scored according to the results of an independent assessment of the quality of services. As variables, the equation includes various parameters grouped into four groups, reflecting the effectiveness of the company in finance, innovation, human resources and the overall level of organizational development. As a result, we propose an algorithm for calculating a unified integrated indicator, taking into account the influence of each of the factors, compiled a rating of the analyzed companies by the value of the integrated effectiveness indicator.

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