TRANSPORT SERVICE MANAGEMENT UNDER THE ACTION OF RANDOM FACTORS

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ABSTRACT

The article deals with possible approaches to improve the quality of transport service management using information technology in terms of random factors. Particular attention is given to further improvement of accuracy of transport efforts' estimation. The procedure provided by the authors, can be used for drawing up a typology and comparative analysis of the activities of various companies and comparison of different types of activities within the transport company.

Keywords: transport service management, information technology, random factors, transport efforts assessment.

Background. *Solving transport services management tasks under the action of many random factors, when there is a need to assess the efforts of a transport company, a particular relevance is acquired by the methods and means of information technologies. The features of the latter allow to handle in a real time mode significant volumes of data and provide an indirect estimation of the unobservable important characteristics of the production process, particularly guidance, efforts exerted by an organization and its employees.*

Objective. *The article deals with possible approaches to improving the quality of transport service management under the conditions of random factors.*

Methods. *The authors use general scientific methods, comparison, mathematical calculation.*

Results. *For an indirect assessment of the level of effort of transport companies* e *according to the given levels of rendered services* y, *it is proposed to use the information about the values of related variables* z *(for example, information about the share of cargo detained in some areas of a supply chain), available for measurement and their dependence on these efforts* e. *Using the method of analysis of the system of simultaneous equations with random effects*

$y = f(e) + \varepsilon', z = \phi(e) + \varepsilon''$

and the linear regression $y = b_0 + bz + \varepsilon$, *it is possible to obtain a desired dependence for determining the effort required e with its more accurate assessment than excluding related variables. This is a multi-dimensional effect in mathematical statistics, allowing to assess the component of interest with such a greater accuracy, the greater is the number of associated components at the same time included in the analysis [1, 2].*

A similar approach using simultaneous statistical equations solutions is used in econometrics and other fields, for example, in biotechnology for evaluation of the fundamental constants of the process, inaccessible to direct measurement [3, 4].

The additional increase in accuracy of assessment of transport efforts e *is possible by the optimal placement of measurement of related variables for the most accurate estimation of linear regression coefficients in the obtained equation* e *and its dispersion. It is known from the experiment theory that for the most accurate estimation of linear regression coefficients it is enough to place measurements only in two extreme points at the ends of the observed range of values* z *[1, 2]. This not only increases the accuracy of the evaluation of efforts* e*, but also simplifies and reduces the cost of the procedure of indirect estimation. Taking into account several related variables, using modern information technologies, the accuracy of indirect estimation of transport efforts can be substantially increased.*

In addition, in case of availability of the so obtained data on the production function of the transport company y = ψ *(*e*) in the form of a monotonically increasing dependence with upward convexity with saturation of values* y *and* e *of its piecewise-linear approximations it is possible to represent this dependence by an analytical model*

$$y = \frac{\Theta_1 \bullet e}{\Theta_2 + e} + \varepsilon$$

with assessment of it parameters Θ_1 *and* Θ_2*. The latter can be actually used to compile a typology and comparative analysis of the activities of the various companies in these parameters of the production function or the comparison of different types of activities within the transport company by their intensity and effectiveness. Parameter* Θ_2 *can be interpreted as an indicator of the intensity of the transport company activity, and* Θ_1 *– as the maximum probable level of services at a given level of effort and organization of the company's work.*

Exact «passport», well interpreting estimates of useful parameters can be obtained, using the values of efforts at just two optimal points:

e_1 *= arg max y and* $e_2 = \frac{e_1 \bullet \Theta_2}{e_1 + \Theta_2}$ *when* s_y *= const*

and $e_1 = e_{max}$ *and* $e_2 = e_{min}$ *when* $s_y \equiv y$*.*

It is convenient to calculate the coefficients of the model

$$y = \frac{\Theta_1 \bullet e}{\Theta_2 + e} = \frac{y_{max} \bullet e}{k + e}.$$

using its linearization

$$\frac{1}{y_\Theta} = \frac{k}{y_{max}}\left(\frac{1}{e}\right) + \frac{1}{y_{max}} = ae + a_0 \ ,$$

where $a_0 = \frac{1}{y_{max}}$, $a = \frac{1}{k}$,

according to the following expressions:

$$\Theta_1 = y_{max} = \frac{e_i - e_j}{\frac{e_i}{y_i} - \frac{e_j}{y_j}};$$

$$\Theta_2 = k = \frac{e_i}{y_i}\left(y_{max} - y_i\right).$$

Further it is possible to calculate the median of coefficients' values obtained for each pair of measurement results, for the corresponding transport process implementations:

$\Theta_1 = med\{\Theta_{1i}\}$; $\Theta_2 = med\{\Theta_{2i}\}$.

Such estimates of unknown parameters of the model are more resistant to disruption of prerequisites of normality of distribution of errors in the definition Θ *(if they have «heavy» tails).*

Conclusions. *These calculations can be easily programmed and their results can be obtained via information technology in a real time mode.*

In the first step of this procedure through the current values y *and related variable* z *(preferably in its optimum points of measurement) are determined the values* e *on implementation of transport process. Then on the basis of a set of the obtained values* e *and the corresponding values y can be restored the dependence* y = ψ *(*e*) and selected the values* e *with account of errors in determining* y *at the optimal points, according to data of which the unknown parameters of the production function of the transport process are calculated.*

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