SIMULATION MODEL FOR EFFICIENCY EVALUATION AUTOMOBILE TRANSPORT WORKS

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Abstract: *the article considers a simulation model for assessing the economic efficiency of road transport operation, which allows you to take into account control and quality parameters and get effective results when planning the main indicators of road transport operation.aThe created simulation model of the functioning of motor transport provides optimal planning of the main economic indicators, which allows you to manage the volume and study its properties in dynamics with small amounts of initial information, without which the economic assessment of transport activities will not be sufficiently objectivej.*
Keywords: *simulation, economic-mathematical model, simulation model, efficiency, system, coefficient, road transport.*

ИМИТАЦИОННАЯ МОДЕЛЬ ОЦЕНКИ ЭФФЕКТИВНОСТИ РАБОТЫ АВТОМОБИЛЬНОГО ТРАНСПОРТА

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Аннотация: *в статье рассмотрена имитационная модель оценки экономической эффективности эксплуатации автомобильного транспорта, которая позволяет учитывать параметры контроля и качества и получать эффективные результаты при планировании основных показателей эксплуатации автомобильного транспорта. Созданная имитационная модель функционирования автомобильного транспорта обеспечивает оптимальное планирование основных экономических показателей, что позволяет управлять объемом и изучать его свойства в динамике при малых объемах исходной информации, без чего экономическая оценка транспортной деятельности объективно невозможна.*
Ключевые слова: *имитация, экономико-математическая модель, имитационная модель, эффективность, система, коэффициент, автомобильный транспорт.*

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The national economy of the country is characterized by a large number of economic objects that make up a complex economic system with interconnections, in the material and material basis of which social relations are also interwoven. The structure and dynamism of the system under consideration cause certain difficulties in developing plans, since the variety and number of possible options for planning decisions significantly increases and the choice of the best ways of development becomes more complicated. Both at the highest levels of the national economy, and at the level of industrial associations and enterprises, this problem is very difficult. The main approaches to its solution should be sought through the construction and use of economic and mathematical models that fairly accurately reflect the actual relationships of economic objects and their relationships in the production process. These models should also take into account the influence of the main social factors on the production process and allow for wide variation, replacement of technological methods, use of different management methods, etc [1, 2].

The description of real relations between economic objects and planned production processes is most efficiently and fully implemented using simulation-type models. To date, many different approaches to analyzing the interaction of economic objects and studying the processes of economic dynamics have been developed. It seems that the initial approach should be considered to be one that involves the use of models that lead to problems such as mathematical programming, game theory, vector optimization, optimal process theory, etc. as an initial prerequisite for its application It was recognized that the rule of choosing the best development option exists in principle and can be written in a formal way in terms of the accepted mathematical model in advance,

before solving the problem (for example, using the objective function, payment matrix of a certain game, optimized functionality, etc.) [3, 4]. The simulation method makes it possible to widely use mathematical apparatus and computer technology to study the course of the economic process and machine experimental verification of proposed improvements. Its main characteristic feature is that the phenomenon under study is not selected from any pre-defined class, but must first satisfy the requirement of maximum approximation to the phenomenon under study.

In the process of developing planning and management systems, the method of simulation modeling finds application as a way to test and experimentally test proposals arising from theoretical propositions, as well as as a way to create an interactive human-machine system that will play an important role in implementing the main ideas of optimal planning theory. The role of simulation modeling is particularly important in the experimental verification of proposals related to structural changes, modernization of economic mechanisms, and other improvements that are not easily implemented. a formal quantitative description. The main advantage of the simulation model is its imitativeness (the ability to reproduce the process) and the accuracy of matching the real planning or management process. After selecting a particular language for describing the simulation model, it is necessary to analyze its properties.

Many simulation models, especially those that simulate the process of obtaining consistent plans, are complex systems of equations for previously unknown planned solutions. Simulation model of the economic process in its meaning it is always dynamic, because in any description of the planning or management process, time is always explicitly or implicitly present, usually in two aspects. In the first case, it manifests itself in the usual sense as the time of counting months, years-five-year plans, etc. it is used in those, for example, simulation systems where we are talking about calculating a series of development options for an economic or social unit (district, city, enterprise) In simulation systems that describe the process of interconnection in the coordination of planned decisions, time appears in a different aspect - as an internal factor (process variable). The processes of linking and coordinating planning decisions are essentially iterative, so the description of the process steps should be given on a conditional time scale. Detailed development of the simulation model and its use for research purposes are carried out in the mode of multiple access to the production process.

1. This initial stage of model development is usually associated with the elaboration of a number of documents (methodological provisions for drawing up state plans, guidelines for the development of industry systems, industrial associations and enterprises, etc.) and with the study of planning and management practices at specific sites.

2. Selection of a system of indicators that is sufficiently complete and suitable for a satisfactory description of the process under consideration and the development of this simulation model.

3. Development of the initial (initial) simulation model.

4. Studying the properties of the simulation model by mathematical analysis methods.

5. Implementation of the model as a software product in some selected programming language.

6. Performing a series of calculations with an analysis of the results.

7. Drawing conclusions about the suitability of the selected system of indicators and proposals, the structure of the model to simulate this process.

8. The use of the developed model (if a decision is made on its suitability) for performing mass variant calculations for various values consists in determining the best system of control parameters and issuing specific recommendations for the practical implementation of the simulated process. The most important principle of developing a simulation model of road transport performance indicators is, first of all, to meet the needs of the national economy in road transport. There fore, in the simulation analysis of road transport of the republic, the main indicator was the volume of passenger traffic. The simulation analysis consists in studying the automobile transport of the republic by conducting experiments with economic and mathematical models of this object implemented on it. At the same time, simulation analysis consists of studying the object and its economic and mathematical model. At the same time, using the software product, the results of influencing the model are obtained.

When constructing the simulation model, the main variables selected are: A-fixed production assets; C - cost of transportation; M-net profit; F - economic incentive fund; F - general wage fund; C-stock return; P - labor productivity; R-profitability; E-income: T - passenger transportation tariffs; S -amount of costs; K - number of employees employed in transportation; H-normalized working capital; O - all types of tax and deductions. Based on a detailed analysis of the relationship and interaction of these indicators, a general scheme of relationships between the main activities of road transport is constructed (Figure 1).

The diagram shows all the parameters and variables necessary for a generalized description of the road transport process: F ''' - fund for social and cultural events and housing construction; 3 - commissioning of fixed production assets at the expense of own funds; φ is the coefficient of reducing the consumption of materials, fuel, and energy; δ is the coefficient of increasing labor productivity; ε is the coefficient of using funds; and F'' is the fund of material incentives for bonuses for increasing labor productivity. The resulting variables are fixed production assets, transportation costs, balance sheet profit, and the economic incentive fund [5, 6]. Traffic

volume is selected as the control parameters passengers for which economic and mathematical models based on multi-factor forecasting are defined. Having formulated the problem, we start building a mathematical model, developing a software product, and verifying the software model. The process of constructing a mathematical model consists in moving from qualitative dependencies of the conceptual model to an accurate description of the mathematical model. When performing simulation modeling, variables have an external impact on forecasting models S(t), K(t), H(t), T. They can be set in advance or vary the time of the simulation experiment. At the stage of building a mathematical model, is it necessary toshb set the results, i.e. the volume of passenger traffic, obtained on the basis of a multi-factor model.

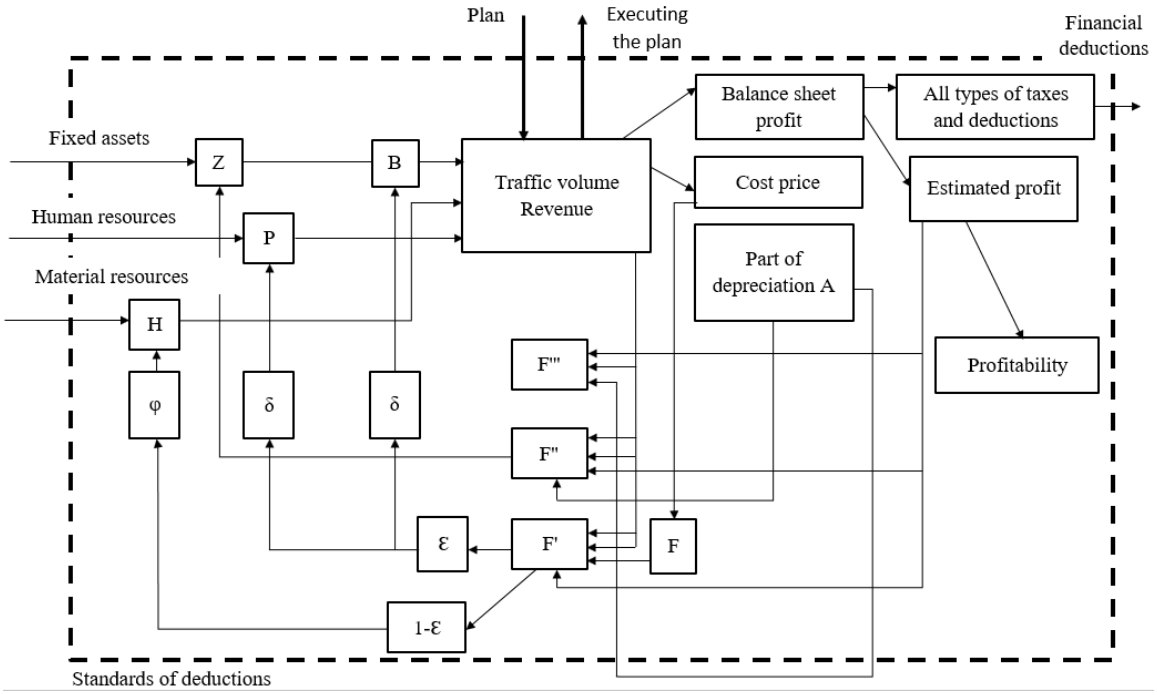

Fig. 1. Diagram of relationships the main ones transport company performance indicators

Based on the conceptual description, you can determine the following time relations that determine quantitative relationships, and forecasting models will have the following form:

$A(t) = A(t-1) + [\Delta Q(t) * T] / B(t-1)$;

$\Delta Q(t) = Q(t) - Q(t-1)$;

$C(t) = S(t) / P(t)$;

$S(t) = S_o e^{\gamma t}$;

$M(t) = D(t) - S(t) - O$;

$D(t) = Q(t) * T$;

$F'(t) = A(t) \{ \alpha_1 [\Delta P(t) / P(t-1)] + \alpha_2 R(t)\}$;

$\Delta P(t) = P(t) - P(t-1)$;

$\Delta P(t) = D(t) / K(t)$;

$R(t) = M(t) / [A(t) + H(t)]$;

$H(t) = H_o e^{\nu t}$; $K(t) = K_o e^{\gamma t}$;

$F''(t) = F(t) \{ \alpha_3 [\Delta P(t) / P(t-1)\} + \alpha_4 R(t)\}$;

$F(t) = f [Q(t), P(t)]$.

Where:

K_o, H_o – initial levels of the K and H series, respectively;

γ, ν – average growth rates of K and H, respectively;

In addition, F(t)- fund for the development of production and Services"(t) – the financial incentive fund depends on:

α_1 - standards of deductions to F'(t) from profit to stimulate labor productivity growth (share of the value of average annual fixed production assets);

α_2 - standards of deductions to F'(t) from profit to stimulate an increase in the level of profitability (share of the cost of average annual fixed production assets);

α_3 - standards of deductions from profit in F''(t) to stimulate labor productivity growth (share of the wage fund);

α_4 - standards of deductions from profit in F"(t) to encourage an increase in the level of profitability (the share of the salary fund);

During the experiment, the values will vary Q (t).

After describing the transition from a conceptual model to a mathematical one, the model parameters are evaluated by processing real static information. The created simulation model of automobile transport functioning provides optimal planning of the main economic indicators, solving a number of interrelated tasks formed in operational blocks, which allows you to manage the volume and study its properties in dynamics with small amounts of initial information. The developed simulation approach to assessing the economic efficiency of road transport operation makes it possible to take into account control and quality parameters, without which the economic assessment of transport activities will not be sufficiently objectivej.

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