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ALGORITHM OF OPERATIONAL RISK ASSESSMENT OF BULGARIAN POSTS PLC

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Abstract: *The report examines the main activities of the management technology of Bulgarian Posts and defines the organization and factors of management processes. The proposed algorithm aims to validate these interconnected relationships that make up a logistics system. An approach was adopted for mathematical modeling of operations and criteria for evaluating socio-economic indicators.*

Keywords: *mathematical model, management process, logistics system.*

The operational risk of direct or indirect losses is related to causal processes, technologies and changing infrastructure, as well as external factors directly related to international social, legal and economic relationships. The purpose of the algorithm is to balance the factors related to the operational management and management structure of the logistics system. This, in turn, necessitates the definition of the following areas:

- requirements for appropriate distribution of activities, monitoring and control of management procedures;
- periodic assessment of activities related to the adequacy of management procedures subject to corrective actions;
- training and professional development of personnel, as well as standards related to process management in the system. An analysis of the logistics systems used (information, transport, financial, etc.) shows the need to build a slightly different structure, based on a provider of social services to the population, especially in small residential places. Based on the theory of mathematical modeling of logistics systems and those in the field of

management, it is now possible to study various dynamic processes. The increased possibilities of using computational technique provide the author to formulate the purpose of the article.

The object of research is the management of the structural units of Bulgarian Posts and their interaction with customers.

The subject of research are the possibilities for optimizing activities through economic-mathematical modeling of complex processes.

The purpose of the research is to analyze the various mathematical models and methods used to model the logistics systems of Bulgarian Posts, as well as the opportunities to optimize management processes and training organizations to achieve better economic indicators in their field.

To achieve the goal of the research, the following research tasks are set:

• To systematize, analyze and further develop theoretical-methodical statements about the essence of the mathematical modeling of the activities defining the goals and tasks of Bulgarian Posts;

• To present an overview of the known models for managing logistics systems used in economic-mathematical modeling;

• To systematize prerequisites for the use of economic-mathematical models and critical factors for their success in managing social-economic activities. The theoretical and methodological basis of the study is based on the concepts formulated in the works of Bulgarian and foreign scientists dedicated to the management of client portfolios. A descriptive and comparative method, the methods of analysis, synthesis, induction, deduction, chronological analysis, etc. were used.

Various statistical approaches are currently being successfully used to optimize management options and their development. The main points that impose these approaches are the following reasons [2]:

1. The internal interconnections of the logistics system defined between the subsystems of the structure of Bulgarian Posts, their organization and socio-economic justification.

2. The management of the systems and their economic resources at their disposal, as well as the consideration of the various external and internal factors influencing the organization and the potential of the staff.

3. Traditional management methods are not efficient enough, and this necessitates the use of various modeling methods with high-performance computing.

4. Use of hybrid models of different types, combining the advantages of functional and simulation modeling in order to improve the management and economic indicators of the company.

The variety of models and the different creative approaches of the authors make it difficult to formulate a common definition, determine generally valid structural elements and derive a unified typology of models. This is because

different studies use different methods, which differ significantly in their theoretical premises, purposes of analysis, selected criteria and opportunities for practical application. In the presented overview of models for managing logistics systems, they can be systematized in separate categories according to criteria such as: used indicators for analysis; used methods for analysis and visualization of results; stages of application; justification (conceptual or empirical), the strategies used for the distribution of resources, etc. This, in turn, necessitates proposing a new classification of activities directly linked to the changed structure of Bulgarian Posts (Fig. 1).

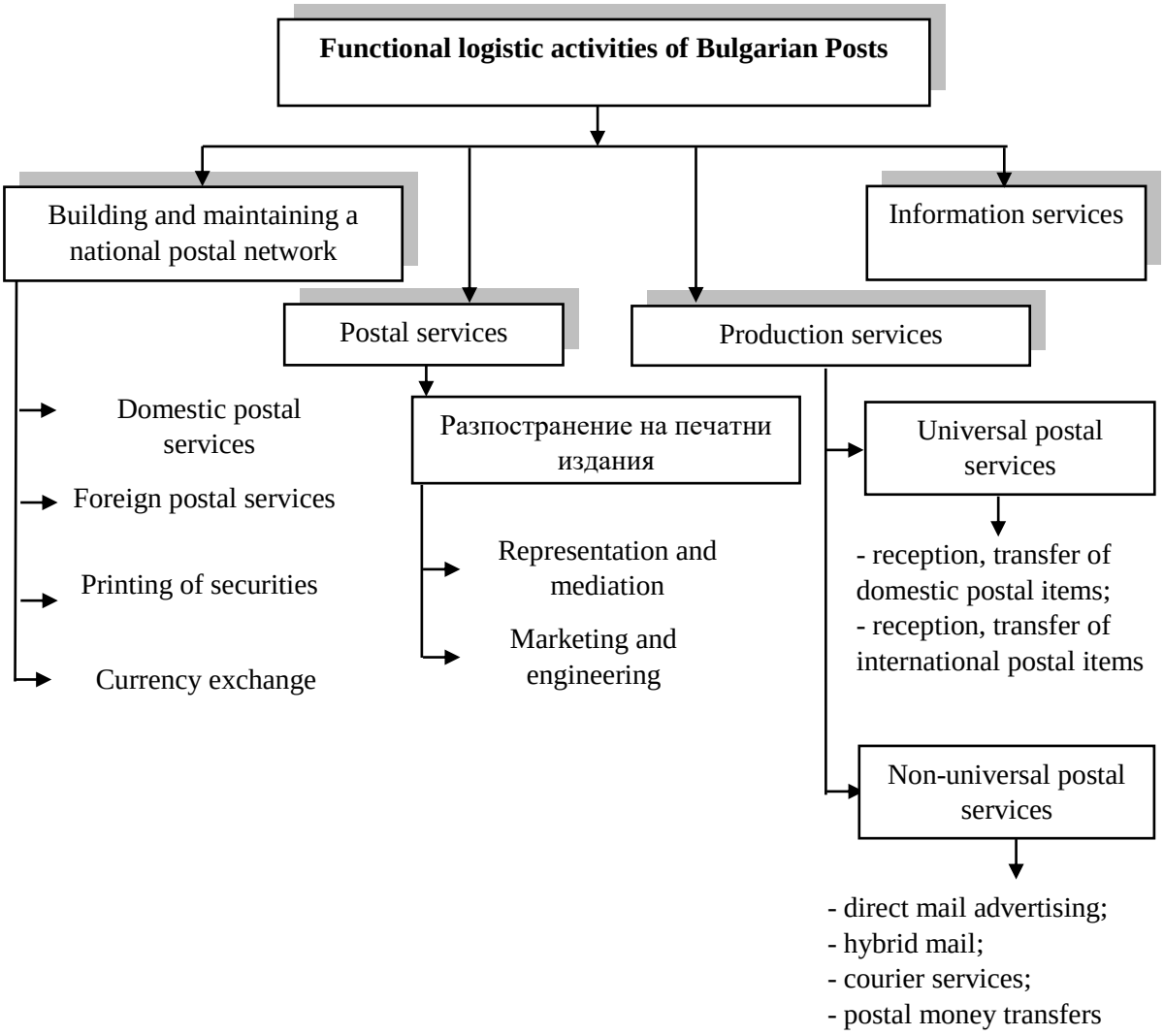


Fig. 1. Classification of logistic activities

Analysis of logistics activities in Fig.1. enables us to formulate the model of the system and apply different types of mathematical approaches to their study. We need to open a bracket that we don't always need to use models. Sometimes we have to apply a ready-made model and adapt it to certain logistics activities.

Main logistics in the postal service deals with the processes of managing the movement of material and information flows from one supply and material department to another and to the end user. In time, this process is defined as the duration of the service cycle. The goal of this technology is the synchronization of delivery processes and logistics operations in the interconnected divisions of postal departments and between individual workplaces. Individual units in logistics are considered subsystems generating material flows, which set the rhythm of the work of other subsystems of the type [4]:

Supplier => supply => material flow warehouse => preparation structures => distribution warehouse => main forwarding activities => warehouse assembly activities => service units => warehouse for finished shipments => distributors => final user.

The organization of management in the company is developed on the basis of one of the existing two concepts of organization and management of operations: traditional and logistic concept. This gives us the opportunity to apply the Analysis of Variance (ANOVA), which is a statistical method for the individual factors that appear to be categorical variables. It is applied when the factors are quantitative values and provide rich and in-depth information about their dependencies. To test the hypothesis, Fisher's F-criterion is used, and the main tasks are the following [6]:

- revealing and statistically proving the existence of connections and dependencies between phenomena and processes;

- checking the activity of the regression model - it is proved which of the selected factors have dependencies and lead to some result;

- the statistical significance of the factors is evaluated and on the basis of this decisions can be made about expediency or effectiveness.

According to the number of factors, ANOVA can be one-factor, two-factor and multi-factor, and according to the type of criterion applied – parametric and non-parametric, when a normal distribution is present it is parametric (Fisher's F-criterion), and when χ^2 distribution is present it is non-parametric. In the study, the multifactor analysis of variance with Fisher's F-criterion was used to evaluate the statistical error and the graph-analytical model for the implementation of the individual technological operations. Analysis of variance has the task of checking the statistical significance of the difference between the flow of requests and the delivery time of the shipments (for groups or variables). This check is done by dividing the sum of squares into components, i.e. by dividing the total variance (variation) into parts, one of which is due to random error (that is, within-group variability), and the second is related to the difference in average values. The latter variance component was then used to

analyze the statistical significance of the difference between the average values. If this difference is *significant*, the null hypothesis is *rejected* and the alternative hypothesis that there is a difference between the means is accepted.

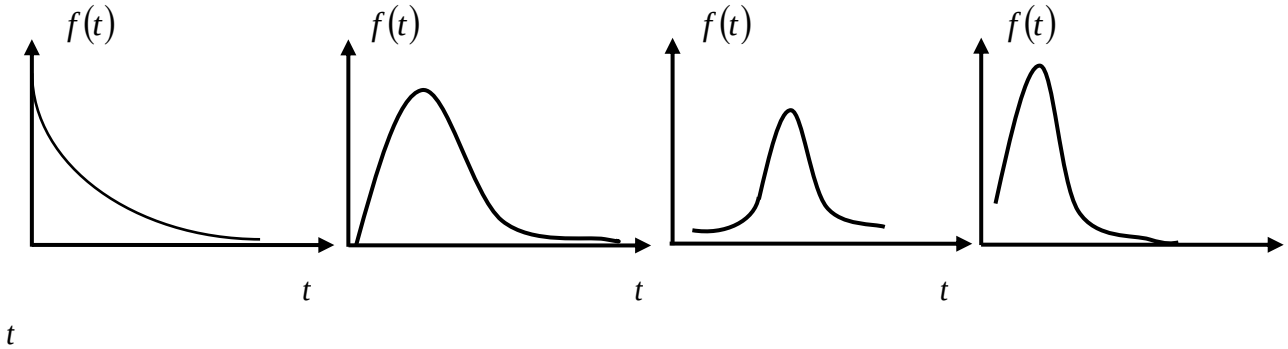
With a normal distribution law, the random value can take arbitrary values from - ∞ to +∞. Since the values of work-to-failure (the time until failure occurs) can only be positive, the distribution can also only be measured with a normalizing factor C in the interval t1 — t2.

Mathematical dependencies used in the model

Probability distribution	Probable density in stationary period	Probability of failure-free operation in stationary period
Exponential	$f(t)=\frac{1}{T_0}\exp\left(-\frac{1}{T_0}\right)$	$P_{Бр}(t)=\exp\left(-\frac{1}{T_0}\right)$
Erlang	$f(t)=\frac{4}{T_0}.t.\exp\left(-\frac{2t}{T_0}\right)$	$P_{Бр}(t)=\exp\left\lfloor-\frac{2t}{T_0}\left(1+\frac{2t}{T_0}\right)\right\rfloor$
Normal	$f(t)=\frac{1}{\sigma\sqrt{2\pi}}\exp\left(-\frac{(t-T_0)^2}{2\sigma^2}\right)$	$P_{Бр}(t)=1-B\left(\frac{T_0-t}{\sigma}\right)$

As known from probability theory, the most complete characterization of a given random variable can be given by its distribution law. For analytical consideration of the random variable, the integral F(t) and the differential f(t) distribution function are used:

$$f(t)=\frac{df(t)}{dt} \qquad (1)$$



a) Exponential law Law

b) Law of Weibull

c) Normal law

d) Log-normal

Fig. 2. Graphic representation of the distribution laws

Type of the distribution law	Distribution density
Exponential	$f(t)=\lambda e^{-\lambda t}$
Weibull	$f(t)=b\lambda t^{b-1}e^{-\lambda t^{b}}$
Normal	$f(t)=\frac{1}{\sigma_t\sqrt{2\pi}}e^{-\frac{(t-m_t)^2}{2e_t^2}}$
Log normal	$f(t)=\frac{1}{t\sigma_{jn_t}\sqrt{2\pi}}e^{-\frac{(\ln t-m_{jnt})^2}{2\sigma_{lmt}^2}}$

The distribution of density *f(t)* of the truncated normal distributiona is one of the type [7]:

$$\overline{f(t)}=Cf(t)=C\frac{1}{\sqrt{2\pi}}e^{\frac{(t-m)^2}{2\sigma_t^2}} \qquad (2)$$

where m_t and σ_t are notations for mathematical expectation and root mean square deviation, respectively, and the normalizing factor C and is determined by the expression [6 pp. 135-156]:

$$C=\frac{1}{1/2+F_0\left(\frac{m_t}{\sigma_t}\right)} \qquad (3)$$

$$\frac{\partial^2 x}{\partial t^2}+Cx=0 \qquad (4)$$

In terms of operational success factors, the degree of adequacy of the economic-mathematical model used, its consistency with the source information, the number and importance of the restrictive conditions included in its design, its computational efficiency and the possibilities for easy application and interpretation of results come to the fore. It should be pointed out that these factors can be evaluated relatively objectively through various mathematical calculations. The possibilities for operationalization, including the choice of such particularizations of the variables involved, which express important features of the object and are accessible to measurement by various scientific methods, should also be considered. Weaknesses in the operationalization can lead to a low degree of adequacy of the algorithm and difficulties in its application. It is also necessary for the model to be characterized by heuristics, i.e. the proof or refutation of one or other hypotheses when solving it leads to the acquisition of new knowledge about the studied object. Otherwise, the model would have no value to the company. The development of adequate metrics for evaluating the results and their timely follow-up is also of great importance. This is because, despite the generally accepted need to 'tune' marketing behavior to key customer characteristics, there are also arguments against prioritizing customers. From the analysis we could draw the following conclusions:

1. The results testify to a positive effect on the satisfaction of priority customers and a negative one for non-priority customers, as well as the influence of factors such as information quality, the ability to calculate customer profitability, management and staff commitment, organizational structuring and the development of planning measures and control over the results of the practical realization in the prioritization of customers.

2. Under these circumstances, a statement can be presented that "the marketing toolkit should not be "absolutized" only and only on the vector of pragmatic financial interest (for example, the higher management and modeling of customer interests can be achieved by developing an adequate mathematical "form" for the various possible purposes before the post offices. In this way, managers themselves can choose the most appropriate goals (or a combination of goals) that meet the challenges facing the company for a given period and construct an economic-mathematical model for optimizing activities according to these goals. This impresses the emerging new content of planning processes in today's turbulent environment, which require flexibility in the design of business models.

The dynamic conditions of today's business environment require organizations to continuously update and improve their customer relationship management policy. The selection and use of models for optimal management of client portfolios can be considered as reasoned actions in this direction. This is because there are many different options available to organizations today. At the same time, not all of them lead to the achievement of the set business goals. In this regard, companies face the challenge of determining the various possible action scenarios, the expected results and making decisions as quickly, easily and efficiently as possible. As an answer to this, one can consider the evolution of client portfolio management models available in the literature, which have been continuously developed and refined over the last more than 40 years. This is an argument in the direction of their importance for practice and because of the possible positive effects of their application.

As a result of the performed analysis, the following more important conclusions can be drawn [10, pp. 457-464]:

• The interdisciplinary theoretical foundation of the "customer portfolio" concept, which is systematized, refined and analyzed in the exposition above, predetermines both the multitude of possibilities it provides for individual organizations and the variety of tools that can be used. In this context, there is a conception presented that each organization should design its marketing activities by analyzing and managing client portfolios according to factors from the external and internal environment. As a prerequisite for adequate and scientifically based solutions in the field, a comparative analysis of the possible

levels of analysis of client portfolios is presented, and the existing metrics are further developed and grouped, taking into account bilateral relations between the individual groups of indicators, which creates opportunities to dynamize the analysis. The proposed systematization of the metrics has a universal character, insofar as it allows to study client portfolios in different industries after some adaptation.

• The belief that customers are a strategic resource capable of generating value that can be measured, managed and maximized drives the undertaking of customer portfolio management activities. In general, they have the potential to positively impact the performance of organizations and the value they create. This is also a justification for the need to take targeted measures to manage client portfolios.

• The management of client portfolios is a continuous and non-stationary process that is associated with constant processing and analysis of information about clients and the environment in order to make decisions adequate to the situation. It can be carried out for different purposes, which predetermines the various possibilities for structuring the stages of the process, the selection of appropriate tools, the development of strategies, etc. An important part of the process is also the optimization of client portfolios, which is the search for an optimal portfolio for a given purpose and restrictive conditions.

• There are objective prerequisites for the application of economic-mathematical modeling in the management of client portfolios. The variety of possible goals and desired effects dictate the use of different classes of models, as well as their combination.

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