ABSTRACT AND REFERENCES
CONTROL PROCESSES

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IMPROVEMENT OF TECHNOLOGY FOR MANAGEMENT OF FREIGHT ROLLING STOCK ON RAILWAY TRANSPORT (p. 4-11)

Tetiana Butko
Ukrainian State University of Railway Transport, Kharkiv, Ukraine
ORCID: http://orcid.org/0000-0002-6707-4552

Svitlana Prodashchuk
Ukrainian State University of Railway Transport, Kharkiv, Ukraine
ORCID: http://orcid.org/0000-0002-7673-3863

Ganna Bogomazova
Ukrainian State University of Railway Transport, Kharkiv, Ukraine
ORCID: http://orcid.org/0000-0002-8042-0624

Ganna Shelekhan
Ukrainian State University of Railway Transport, Kharkiv, Ukraine
ORCID: http://orcid.org/0000-0002-6640-6084

Mikola Prodashchuk
V. N. Karazin Kharkiv National University, Kharkiv, Ukraine
ORCID: http://orcid.org/0000-0002-3355-7767

Roman Purii
Regional Branch «Lviv railway», Senkevychivka, Ukraine
ORCID: http://orcid.org/0000-0003-0554-2477

We performed a statistical analysis of the time series of the volumes of cargo transportation. Studies have shown sufficiently high accuracy of prediction relative to the actual values of a railway transport system based on the mathematical apparatus of artificial neural network. The experiment revealed that the mean absolute percentage error for the volumes of transportation of grain and the products of flour mills amounted to 5.56 %. Given that railway transport is a fairly inert system, indicator of 5.56 % is sufficient for management decision making. By having predicted the level of cargo transportation, we determined the required number of wagons of a particular type, which would conform to the conditions of transportation of this particular cargo.

The optimal technology of organization of railway wagon flows implies minimization of operational costs for the transportation of cargo. In order to find the best variant to move the wagons, we proposed to take into account irregularity factor, or seasonality. The application on the railway network of the result of solution of the proposed model enables the dispatcher, the one who handles wagons, to make rational management decisions. Such technology makes it possible to take both long-term and operational decisions directly in the system of organization of railway wagon flows.

To automate management decision-making by operational personnel of railway transport, we simulated organization of wagon flows using the software. The simulation was carried out on a virtual polygon of railways. The procedure for obtaining rational decisions when managing freight rolling stock is universal and makes it possible to perform calculations for polygons of any size and at arbitrary time of planning.

Keywords: railway transport, artificial neural networks, irregularity factor, management of transportation.

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FORMATION OF SEPARATE OPTIMIZATION MODELS FOR THE ANALYSIS OF TRANSPORTATION-LOGISTICS SYSTEMS (p. 11-20)

Arkadii Bosov
Dnipropetrovsk National University of Railway Transport named after academician V. Lazaryan, Dnipro, Ukraine
ORCID: http://orcid.org/0000-0002-5348-2205

Nataliya Khalipova
University of Customs and Finance, Dnipro, Ukraine
ORCID: http://orcid.org/0000-0001-5605-6781

We proposed an algorithm and a procedure of a multi-criterion analysis of the objects of transportation-logistics systems using the vector optimization of functionals, which provide a more complete representation of the properties of objects and processes. The algorithm is based on a statistical analysis of empirical data, analysis of the influential factors and qualitative characteristics of the processes, which makes it possible to more reasonably define the form of a quality function and to form criteria.

The essence of the proposed procedure of a multi-criterion analysis is the vector optimization of functionals whose equations are introduced with the characteristics of rate of change in the examined processes. In contrast to the existing procedures that characterize a state of the system and separate elements, the given technique allows us to more fully and objectively estimate dynamic properties of the transportation and logistics processes.

Using the movement of cargo flows through the customs warehouse as an example, we have shown the statement of separate mathematical models for simultaneous and independent optimization of several parameters and functionals and the formation of a complete set of effective plans for subsequent analysis by a decision-maker.

Keywords: improvement of transportation-logistics systems, vector optimization, functional criteria, effective solutions.

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DEVELOPMENT OF THE MARKOV MODEL OF A PROJECT AS A SYSTEM OF ROLE COMMUNICATIONS IN A TEAM (p. 21-28)

Dmytro Lukianov
Belarusian State University, Minsk, Belarus
ORCID: http://orcid.org/0000-0001-8305-2217

Katsiaryna Bespanskaya-Paulenka
Belarusian State University, Minsk, Belarus
ORCID: http://orcid.org/0000-0001-7898-8969

Viktor Gogunskii
Odessa National Polytechnic University, Odessa, Ukraine
ORCID: http://orcid.org/0000-0002-9115-2346

Olexii Kolesnikov
Odessa National Polytechnic University, Odessa, Ukraine
ORCID: http://orcid.org/0000-0003-2366-1920

Andrii Moskaliuk
Odessa National Polytechnic University, Odessa, Ukraine
ORCID: http://orcid.org/0000-0003-0970-6280

Katerina Dmitrenko
Odessa National Polytechnic University, Odessa, Ukraine
ORCID: http://orcid.org/0000-0002-3307-6410

Known approaches to project team management typically rely on intuitive decisions of project managers, rather than regularities and laws of role interaction between project participants. To resolve this contradiction, it is necessary to generalize and develop applied aspects of the use of the Markov chains to represent and model the projects as a system of role communications in a project team. To construct a Markov chain, we used a well-known role model of a project team by R. Belbin, which represents the structure of project participants only qualitatively. We developed a graphical representation of the cognitive structure of the role model, which is similar to a directed graph with vertices – states of the project, and arcs that represent communication links between project participants. Construction of the graph enables us to create a matrix of transition probabilities for communications of a project. To finish the method of transformation of a role model, it is necessary to pass to the development of analytical stepwise method to solve the system of equations of the Markov chain with discrete states and time. It is shown that iterative solution of the system of equations of the Markov model forms a "trajectory" of development of virtual or actual projects based on the characteristics of role communications. The practical aspects of assessment of effectiveness of the "trajectory" of projects development were explored using the developed Markov model. Evaluation of results of change in the distribution of probabilities of states of a project in coordinates of probabilities of states of the system in steps revealed a significant effect on the progress and effectiveness of a project in the case of variation of competences of only one member of the team project. These results reflect the essential property of teamwork: effectiveness of projects depends on the coherence of roles of all project performers.

Keywords: role model, discrete states, transition probabilities, Markov chains, project trajectory.

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ECONOMIC-MATHEMATICAL TOOLS FOR BUILDING UP A PROJECT TEAM IN THE SYSTEM OF COMPANY'S KNOWLEDGE MANAGEMENT (p. 29-37)

Inna Chaikovska
Khmelnytsky University of Management and Law, Khmelnytsky, Ukraine
ORCID: http://orcid.org/0000-0001-7482-1010

Tetyana Fasolko
Khmelnytsky University of Management and Law, Khmelnytsky, Ukraine
ORCID: http://orcid.org/0000-0003-4718-2422

Ludmila Vaganova
His Beatitude Metropolitan Volodymyr of Kyiv and All Ukraine Khmelnitsky Institute of PJSC "HEI" Interregional Academy of Personnel Management", Khmelnytsky, Ukraine
ORCID: http://orcid.org/0000-0002-5812-4597

Olga Barabash
Teaching and Research Institute of Law and Psychology, Lviv Polytechnic National University, Lviv, Ukraine
ORCID: http://orcid.org/0000-0003-2666-9696

Economic-mathematical model for the formation of a group of employees (project team) for the generation of new organizational knowledge was created. The model implies construction of a integrated assessment for possible project teams and selection of the best one. The model allows taking into account both individual and group indicators of employees. Individual indicators include professional knowledge, education, working experience, intelligence, logical intellect, creative intelligence, self-organization and knowledge, interest and experience in solving similar tasks. The group indicators include social interaction in pairs between group members. The developed model allows taking into account both positive and negative synergistic effect of social interaction. Therefore, considering not only professional and intellectual components, but also synergic effect of social interaction of team members allows formation of the optimal composition of a project team. The specified feature distinguishes the present model from other analogues. The model includes seven stages: from determining the number and all the possible combinations of employees to formation of a project team. The model implies the application of elements of combinatorics to determine the number of possible combinations of groups. In addition, we used expert knowledge and the method of direct assessment for selecting indicators of integrated assessment and selection of weight coefficients. The Harrington scale enabled us to establish the level of experience and knowledge in solving similar tasks. A group of employees was considered as an additive system, so for each group, integral indicator was calculated. The model was implemented on the example, in which 3 employees were selected out of 10 employees of a department. Each of the employees had their indicators of professional, intellectual and social component. According to results of modeling, the highest effectiveness in generation of new organizational knowledge was demonstrated by the group, which has a positive synergistic effect of interaction between employees in a project team.

Keywords: project team, economic-mathematical modeling, weight coefficients, integrated assessment.

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MANAGING A PROJECT OF COMPETITIVE-INTEGRATIVE BENCHMARKING OF HIGHER EDUCATIONAL INSTITUTIONS (p. 38-46)

Lyudmyla Ganushchak-Yefimenko
Kyiv National University of Technologies and Design, Kyiv, Ukraine
ORCID: http://orcid.org/0000-0002-4458-2984

Valeriia Shcherbak
Kyiv National University of Technologies and Design, Kyiv, Ukraine
ORCID: http://orcid.org/0000-0002-7918-6033

Olena Nifatova
Kyiv National University of Technologies and Design, Kyiv, Ukraine
ORCID: http://orcid.org/0000-0001-9325-6176

The proposed approach to management of a project of competitive-integrative benchmarking makes it possibleh to increase competitiveness of Ukrainian higher educational institutions. Management of projects of HEI development of this type allows us to introduce the service ecosystem of provision for qualified personnel in industry, transport, without which it is impossible to implement high technologies. Ecosystem of benchmarking of HEI is an interaction of four components: functional marketing subsystems (personnel management (People), partnership (Partnership), process management (Processes), educational services (Products).

Competitive benchmarking allows us timely and clearly to identify weaknesses and shortcomings in the activity of an examined University. It is possible to develop a project of benchmarking implementation of successful experience of development and realization of competitive advantages and competencies of HEI-model, as well as to compare the activity of HEI with others.

Performed analysis of activity of 14 institutions of higher education in Ukraine allowed us to comprehend the situation in the market of educational services and the level of competition. Application of instruments of process-oriented approach of benchmarking makes it possible:

– to determine the best HEI for each of the proposed 4P component – marketing subsystems;

– to substantiate standard strategies in each benchmarking subsystem by comparison of competitive competences of the top universities.

Implementation of the proposed conceptual model of management of a project of competitive-integrative benchmarking allows adaptation of best practices of model HEIs based on partnership and cooperation.

Keywords: project management, competitive-integrative benchmarking, process-oriented approach, 4P-subsystems, higher education institutions (HEIs).

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METHOD OF TRAFFIC OPTIMIZATION OF URBAN PASSENGER TRANSPORT AT TRANSFER NODES (p. 47-53)

Volodymyr Vdovychenko
Kharkiv National Automobile and Highway University, Kharkiv, Ukraine
ORCID: http://orcid.org/0000-0003-2746-8175

Oleksandr Driuk
Kharkiv National University of Radio Electronics, Kharkiv, Ukraine
ORCID: http://orcid.org/0000-0002-1299-7616

Ganna Samchuk
Kharkiv National Automobile and Highway University, Kharkiv, Ukraine
ORCID: http://orcid.org/0000-0002-9890-6374

The method of optimization of traffic of urban passenger transport (UPT) at transportation hubs (TH) is proposed, which implies modeling of operation of a stop point, taking into account individual characteristics of traffic parameters and time of servicing the vehicles. Software implementation of the simulation model is created in the PyCharm environment. The algorithm of the program includes a procedure for the formation of all possible combinations of shifting of time of departure of vehicles from the starting stop point within the traffic interval on the UPT routes, which pass through TH. For every combination, calculation of waiting time and of the number of vehicles in a queue is performed. Employing the minimal values of these indicators, we choose a combination that provides optimal coordination of traffic at TH for each number of service places at a stop point. Efficiency of the algorithm in the lookup and assessment of all possible combinations of values of input factors, implied by the presented method of optimization, may be guaranteed if the following limitations are satisfied: the number of routes is up to 5, traffic interval is up to 30 min.

Based on results of the studies, it was established that it is possible to decrease unproductive downtime by up to 50 % even for a single service place if a change is made in the traffic schedule for the purpose of synchronization. In addition, when adding one service place, we observed a nonlinear decrease in the waiting time of vehicles in a queue.

Keywords: stop point, waiting time in queue, departure time, loading area.

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A PROCEDURE FOR MODELING THE DEPOSITS OF KAOLIN RAW MATERIALS BASED ON THE COMPREHENSIVE ANALYSIS OF QUALITY INDICATORS (p. 54-66)

Ruslan Sobolevskyi
Zhytomyr State Technological University, Zhytomir, Ukraine
ORCID: http://orcid.org/0000-0001-7489-8851

Aleksey Vaschuk
Zhytomyr State Technological University, Zhytomir, Ukraine
ORCID: http://orcid.org/0000-0003-3149-4317

Oleksandr Tolkach
Zhytomyr State Technological University, Zhytomir, Ukraine
ORCID: http://orcid.org/0000-0002-8722-6496

Valentyn Korobiichuk
Zhytomyr State Technological University, Zhytomir, Ukraine
ORCID: http://orcid.org/0000-0002-1576-4025

Volodymyr Levytskyi
Zhytomyr State Technological University, Zhytomir, Ukraine
ORCID: http://orcid.org/0000-0002-3892-5848

We studied approaches to determining the whiteness of different materials and developed a procedure for highly efficient determining of whiteness based on using a flatbed scanner with subsequent processing of color pixel coordinates, which combined high productivity, affordable price and acceptable accuracy, which, for the case of applying the flatbed scanner Epson Perfection V200 Photo (Japan), matches the accuracy of basic techniques. To enhance effectiveness of the implementation of the developed procedure, we created an algorithm and realized it in the software "Whiteness" for determining the whiteness of primary kaolins using a scanned image of the sample.

We established main types of correlation relationship between quality indicators of kaolins for Zhezhelivsky and Velyko-Gadominetsky deposit. The constructed models of correlation pairs provide a possibility to develop integrated indicators of deposit quality that will make it possible to simplify the process of building a model of geospatial variability of quality indicators and improve effectiveness of quality control at separate technological areas of a deposit.

We improved efficiency of mathematical modeling of geospatial variability of quality indicators to control technological processes of extraction and processing of primary kaolins, based on determining the optimal models of variograms for various areas of research using a devised plane criterion. We established directions that are characterized by maximal values of correlation degree and anisotropy indicators, and found the ranges of autocorrelation of data for selected quality indicators. We developed a procedure for a geostatistical calculation of reserves at Velyko-Gadominetsky deposit of primary kaolins taking into account the grade differentiation to improve effectiveness of quality control over raw materials. The main types of interrelations between quality indicators of kaolins are established. We determined the volume of kaolin field at Velyko-Gadominetsky deposit by industries and grades. A procedure is proposed to estimate an error in determining the volume of operations performed at a deposit to enhance efficiency of control processes in the exploration of deposits. The implementation of the developed procedures to determine the volume of Velyko Gadominetsky deposit of primary kaolins with respect to the grade differentiation using the proposed methodology is characterized by minimal values of relative mean-weighted error in determining the total amount of grade, which ranges from 0.001 % to 1.067 %.

Keywords: geometrization, geostatistical analysis, kaolins, whiteness of kaolins, grade differentiation, variogram analysis, Simpson method, management, quality control, technological processes.

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INFLUENCE OF DEMOGRAPHIC FACTORS AND FACTORS OF JOB SATISFACTION IN THE PROCESSES OF PERSONNEL MANAGEMENT: PREDICTION OF STAFF TURNOVER BASED ON LOGISTIC REGRESSION (p. 67-74)

Nataliia Manakova
O. M. Beketov National University of urban economy in Kharkiv, Kharkiv, Ukraine
ORCID: http://orcid.org/0000-0003-3645-7929

Inna Tsyhanenko
O. M. Beketov National University of urban economy in Kharkiv, Kharkiv, Ukraine
ORCID: http://orcid.org/0000-0002-9081-0378

Ganna Bielcheva
Kharkiv National University of Radio Electronics, Kharkiv, Ukraine
ORCID: http://orcid.org/ 0000-0002-1622-7635

Olga Shtelma
O. M. Beketov National University of urban economy in Kharkiv, Kharkiv, Ukraine
ORCID: http://orcid.org/0000-0002-0293-3504

Here a combined approach is considered to the prediction of intentions of an employee of a company to quit, on the basis of demographic factors and job satisfaction factors. The developed method includes preliminary assessment of reliability of data from staff survey, an analysis of correlation dependence, construction of a regression model and a nonlinear predictor to assess a probability of staff turnover. This method allows an expert not only to identify the employees who fall into a zone of probable turnover, but also to adjust the processes of human resource on the basis of the most critical factors. At the stages of the method, an employee of a company has a possibility to reduce the number of factors (by grouping, or discarding insignificant factors). Such a choice is made both on the basis of mathematical indicators and taking into account the experience of an expert from a human resource department. To preserve an expert component, authors of the present study refused applying the automated methods of reducing dimensionality, such as a Principal Component Analysis.

The developed method is implemented on the basis of a logistic regression analysis, which allowed us to select a group of individual factors and aspects of job satisfaction that affect staff turnover. In addition, it was found that salary level and marital status are significant predictors for the intentions of staff turnover.

Keywords: prediction, logistic regression, personnel management, staff turnover, job satisfaction.

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