



## INFORMATION TECHNOLOGIES

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### MODELING OF OPTIMAL PORTFOLIO OF CLIENTS OF CENTRALIZED PHARMACY NETWORK

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The research object identifies the risk management of a centralized pharmacy network related to marketing relationships between the network and different customer groups. The development of a competitive market leads to the need for pharmacy networks to engage the customer into a dialogue, giving him/her certain benefits, thereby reducing their own risks. The subject of the research is the modelling the optimal client portfolio of a centralized pharmacy network as one of the risk management tools.

Based on the fundamentals of Markowitz portfolio theory and multicriteria optimization, this paper builds a basic model of an optimal portfolio of clients of centralized pharmacy network, which takes into account three groups of customers – loyal, casual and online orders. In contrast to the classic two-criteria model (risk minimization while maximizing income), the model has been introduced to maximize entropy, which enhances the diversification effect. Four modifications of the basic model are also considered. The first of these deepens on the analysis of the portfolio of clients of the network to the individual pharmacies belonging to this network. The following three model different marketing strategies in which one customer group is preferred.

Matlab software has been developed to solve many of the Pareto-optimal client portfolios for solving multicriteria-based problem-solving models. Model verification was performed on real data provided by one of the Pharmacy network.

Modelling the optimal customer portfolios of a centralized pharmacy network eliminates the deficiencies in network management and selects the optimal combination of loyal, casual, and online client group distribution. This provides the opportunity to influence these consumer groups by implementing appropriate loyalty programs, which ultimately leads to higher profits. The simulation results will be useful for automating the business processes of any trading network, managing risk, analyzing loyalty programs to improve the effectiveness of their operations.

**Keywords:** pharmacy network, loyal customers, internet clients, optimal portfolio model, multicriteria task.

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### RESEARCH OF INFORMATION-ANALYTICAL ASPECTS FOR OPTIMIZATION OF THE HEALTH CARE INSTITUTIONS

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The health sector is a priority in the national dimension. The availability and quality of medical services depends on the effectiveness of the functioning of the network of health care

institutions. Optimization of the activities of health facilities in order to meet the needs of the population in medical services is an urgent task. The development and implementation of information technology in the processes of managerial decision-making in this case will increase their effectiveness.

The object of research is the processes of informational and analytical support for making managerial decisions on customer-oriented optimization of the activities of health care institutions in the face of uncertainty. Such support is necessary to ensure effective analysis of the available data, taking into account situational and informational uncertainty, and forming on the basis of this set of effective solutions. The peculiarity of this problem is that when solving it, it is necessary to analyze and draw conclusions based on data of various natures: both actual data on the activities of health care institutions in different periods of time, the results of personal data of representatives of various social groups, and the conclusions of experts.

General scientific methods, methods of mathematical modeling, as well as a systematic approach are used. To effectively solve the problem, it is proposed to consider the health care institution as an integrated system, which is characterized by internal connections and the influence of the external environment.

As a research result, an algorithm for analyzing the activities of health care institutions is developed, the implementation of which will allow calculating the needs for medical personnel in subsequent periods of time.

Data in accordance with their origin is systematized. It is noted that the results of expert surveys are an important source of data. A structural and functional scheme of information and analytical support for a decision maker in the process of optimizing the personnel of a health care institution is developed. The development and implementation of information and analytical support for the analysis of the personnel activities of a health care institution will increase the effectiveness of relevant management decisions

**Keywords:** quality medical services, information and analytical support, medical personnel, customer-oriented optimization.

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## REPORTS ON RESEARCH PROJECTS

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### THE DEVELOPMENT OF SECURED CONSOLIDATED INFORMATION RESOURCE OF ACTIVITY ANALYSIS OF THE POULTRY INDUSTRY IN UKRAINE

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The object of research is the process of consolidating business information. The paper considers the creation and use of a powerful

component of the business analytics system – a consolidated information resource that improves the understanding of the business process, analyzes activities and improves the process of managerial decision-making in the poultry market of Ukraine.

Methods and tools that are used in the process of building an information resource are substantiated. In particular, analysis and comparison methods are used to select a database management system, data warehouse model, and programming language. Also in the research process, a synthesis method is used to substantiate the requirements for the subject of study and a modeling method to create an ER model. As well as methods of induction and deduction – to form conclusions and a method of expert evaluation – to determine the economic feasibility of developing a consolidated information resource.

A goal tree is formed to create a consolidated information resource. An entity-relationship diagram is developed. And to systematize the information received and analyze it in detail, a database is designed. This process is implemented using DBMS (database management system) MS SQL and JavaScript. It is used as a means of accumulating data and a tool for analyzing the activities of both a single producer in the poultry market and the entire poultry industry together. Based on the results of the study, it is possible to prove the economic and functional feasibility of introducing and using a consolidated information resource. Since the proposed development significantly increases the level of leadership awareness of the performance indicators of both individual enterprises and the industry as a whole, for making high-quality and informed management decisions.

The introduction and use of a secure consolidated information resource significantly reduces the time to receive and process the necessary information and makes this process safe. In addition, this consolidated information resource has a high level of commercial potential and opportunities for further improvement, taking into account the influence of the rapidly changing external and internal environment of its functioning.

**Keywords:** secure consolidated information resource, data warehouse model, ER model, database, poultry market of Ukraine.

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#### METHODS FOR ENSURING THE NAVIGATION SAFETY OF UNMANNED SURFACE VESSEL

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When creating unmanned surface vehicles (USV), special attention is paid to the safety of navigation. One of the main threats at sea is the threat of collision. Two main directions of ensuring the safety of navigation can be distinguished. The first is legal regulation and a number of international documents that are binding on all ship-owners. The second is technical control systems and software, the purpose of which is ensuring the safety of navigation. This work is devoted to the issue of determining the level of collision danger and reaction to this danger from the system of automatic control of the course and speed of the USV, which acts as the object of study. The subject of research is management processes and algorithms. Given the significant danger that automatic mobile systems at sea can pose, maritime safety issues are a priority.

The analysis of effective control systems for autonomous mobile vehicles shows that their creation is based on relatively simple, but fairly accurate abstract models of interacting media (physical and informational). Such models are the starting point for the creation of automated and automatic systems, which include USV as well. Paying attention to the technical side of the problem, it should be noted that determining the level of danger and the reaction to it from the side of the USV control system also requires some formalization.

In this paper, a method is proposed for determining the danger of USV collision with other moving and stationary marine objects. The generalized algorithm of the control system for the course and speed of the USV is determined. The reaction of the propulsion (propulsive) system and the necessary composition of on-board equipment to ensure the safety of navigation are determined. It should be noted that in the work under the USV let's mean small-tonnage (up to 1 t) surface self-propelled floating craft of the boat or boat type.

The research results will be useful in constructing control systems based on fuzzy or neuro-fuzzy controllers.

**Keywords:** navigation safety, unmanned surface vessel, propulsion and steering complex, vessel heading control, vessel speed control, autopilot.

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## RESEARCH ON THE POSSIBILITIES OF SOLUTION OF THE MONITORING PROJECTS OF THE RAILWAY POWER SUPPLY SYSTEM

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The object of research is the monitoring parameters of the railway power supply system. PMUs power supply system recording devices are the basis of the WAMS transient monitoring system. An important aspect of WAMS elements is data synchronization, which is technologically ensured using satellite-based orientation systems.

The study used a system analysis, a systematic approach to the problem, as well as methods of synchronization and systematization of data.

Methods for solving problems of monitoring processes of the railway transport power supply system are investigated. Diagnostic functions, currently implemented using PMUs, WAMS, are actually concentrated and limited in the areas of power supply, and include monitoring of low-frequency fluctuations of system parameters. As well as identification of the emergency mode and determining the location of damage in the facilities of the power supply system. In addition, to use these functions, at the same time, even with the modern development of

systems, it is necessary to ensure diagnostic functions on the scale of power systems, with minimizing the participation and influence of a person in the formation of the results of the assessment of modes. This is due to the fact that there is a need to expand diagnostic functions according to the parameters of the objects of the power supply system, the monitoring systems used, which will solve the problems of operational dispatch control of these objects.

This ensures the resolution of operational dispatch tasks, assessing and predicting the state in the processing of information, its synchronization and systematization. As well as monitoring and synchronizing measurements over time, which significantly increases the level of operational dispatch control of the operating modes of objects of the power supply system. Compared with similar technologies, the new ones based on the use of PMU devices for data collection have an advantage over traditional SCADA technologies, which measured system objects without time synchronization.

**Keywords:** power supply system, railway transport, data synchronization, computer tools, man-machine interface settings.

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**DEVELOPMENT OF THE METHOD OF FORECASTING THE ATMOSPHERIC AIR POLLUTION PARAMETERS BASED ON ERROR CORRECTION BY NEURAL-LIKE STRUCTURES OF THE MODEL OF SUCCESSIVE GEOMETRIC TRANSFORMATIONS**

page 26–30

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The article describes the importance of improving existing and exploring new algorithms for predicting environmental parameters to improve the quality of environmental monitoring. Because the organization and management of production require the development of new approaches to the problem of control and management of industrial sources of harmful substances based on new information technologies. One of the most problematic places in industrial air quality control and management systems is the development of advanced prospective air pollution forecasting algorithms. These algorithms must take into account situational changes in data distribution and do not require retraining of atmospheric air pollution parameters. With the advent of neural-like structures, there is a need for their study, including the task of predicting the parameters of air pollution. The object of research is the neural-like structures of the Model of Successive Geometric Transformations. A method for predicting the parameters of atmospheric air pollution based on error correction with the help of a committee of different types of neural-like structures is proposed. In the course of the study, three methods for predicting the parameters of atmospheric air pollution were analyzed: a Generalized Regression Neural Network, a Radial Basis Function, and a neural-like structure of Sequential Geometric Transformations Model. A combination of these methods was performed and the results of the three methods were compared. It is experimentally determined that the prediction of atmospheric air pollution parameters based on the error correction using the committee of neural-like structures of the Sequential Geometric Transformations Model provides a prediction error reduction by 7 % of the General Regression Neural Network and by 2.6 % of the Radial Basis Function with extended General Regression Network. The obtained results increase the reliability and speed of forecasting of atmospheric air parameters to improve the quality of monitoring of emissions of harmful impurities in production and to make environmental management decisions.

**Keywords:** atmospheric air, neural-like structure, principal components, forecasting error correction.

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### STUDY OF THE INFLUENCE OF ROAD CONGESTION ON THE FATIGUE LEVEL OF A SANGUINE DRIVER

page 31–35

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The object of research is the process of the driver's labor activity on city roads in the city's transport system during the transportation of goods and passengers. The influence of traffic congestion on the functional state of a sanguine driver is studied, which is one of the most common types of temperament. The main hypothesis of the study is that the level of driver fatigue in traffic congestion, which affects the driver's reaction time and road safety, depends on the driver's condition and traffic congestion parameters. The driver's fatigue level is determined based on the concept of the cardiovascular system, as an indicator of the adaptive and adaptive activity of the body by measuring the electrocardiogram. In this case, the unevenness of the cardio intervals is analyzed, which is a universal response to any kind of load. Fatigue level is calculated in arbitrary units according to a special algorithm that takes into account statistical indicators, histogram indicators and data of spectral analysis of cardio intervals. Using a non-linear model of changing the functional state of a sanguine driver, the patterns of changes in the fatigue level under various conditions of stay in traffic congestion are obtained. It is revealed that the most significant factor that affects the final level of driver fatigue in traffic congestion is its initial value before traffic congestion. The second most important parameter affecting the change in the fatigue level of the sanguine driver is the duration of traffic congestion, which affects the initial function only together with the initial fatigue level. The influence of the age of the sanguine driver on the fatigue level in the traffic congestion is manifested to a lesser extent. However, the conditions of stay in traffic congestion most noticeably affect older drivers (sixty or more years) compared with young drivers of twenty years. Analysis of the research results shows that traffic congestions lasting more than twelve minutes lead to a significant increase in the fatigue level of a sanguine driver. This may increase the likelihood of a traffic accident. The trends in the fatigue level of sanguine driver in traffic congestions identified during the study allow to predict the driver's behavior after exiting a traffic congestion and evaluate possible patterns of road traffic development that directly affect road safety.

**Keywords:** traffic congestion, fatigue level, temperament, sanguine driver, road safety.

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### RISK ANALYSIS ON TECHNICAL SAFETY OF PRODUCTION OF WELDED STRUCTURES USING NON-DESTRUCTIVE TEST AND TECHNICAL DIAGNOSTICS

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The object of research is welded structures and their production.

There is always a risk, but it is obvious that making decisions to minimize and eliminate it requires a structured and systematic approach. For example, top, middle and line managers need to constantly analyze the risks associated with the dangers that arise in very difficult situations in the welding industry.

An algorithm for the formation of risk during the operation of welded structures is constructed. A process approach is proposed with the aim of analyzing deviations in the design, production and maintenance processes. The parameters of the ultimate state of the welded structure from mechanical stresses and the quality indicators of corrosion effects are determined. The calculated formulas for the speed (probability) of reaching limit states from mechanical stresses are selected. To analyze the combination of actions, it is recommended to use the Bayesian grid method. It has been established that one of the main tasks of the welding production quality management system according to DSTU ISO 9001:2015 is to ensure the identification of potential inconsistencies in the welding production system and to prevent their detection through risk management. Deviations of the processes of the management system are the reasons for the formation of a shortage of products and the risk of an emergency at work. The success of risk management will depend on the effectiveness of the management structure, which provides the rationale and measures that integrate it throughout the welding plant at all levels. The structure helps to implement effective risk management through the production of risk management processes and non-destructive testing and technical diagnostics at different levels and within the specific context of the enterprise. The structure ensures that the risk information obtained in the risk management process appropriately is used as the basis for making decisions and appointing those responsible for the result at all relevant levels of welding production.

**Keywords:** production conditions, technological documentation, control system, human factor, moral and psychological climate, risk-management, risk control.

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