



# SCIENTIFIC RESEARCH OF THE SCO COUNTRIES: SYNERGY AND INTEGRATION

上合组织国家的科学研究：协同和一体化

Proceedings of the  
International Conference

Date:  
August 9

Beijing, China 2023



上合组织国家的科学研究：协同和一体化  
国际会议

参与者的英文报告

International Conference  
“Scientific research of the SCO  
countries: synergy and integration”

Part 1

2023 年 8 月 9 日。中国北京  
August 9, 2023. Beijing, PRC

Proceedings of the International Conference  
**“Scientific research of the SCO countries: synergy  
and integration”** - Reports in English

(August 9, 2023. Beijing, PRC)

ISBN 978-5-905695-82-7

这些会议文结合了会议的材料 – 研究论文和科学工作者的论文报告。它考察了职业化人格的技术和社会学问题。一些文章涉及人格职业化研究问题的理论和方法论方法和原则。

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DOI 10.34660/INF.2023.90.11.034

煤矿企业职工劳动活动的社会经济调控  
**SOCIO-ECONOMIC REGULATION OF LABOR ACTIVITY OF  
EMPLOYEES OF COAL MINING ENTERPRISES**

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抽象的。文章指出了在煤矿企业工作实践中实施职工劳动活动社会经济调节的现实意义。

煤矿企业现有的劳动力配给制度，再现了企业与职工所获得的利益与收益的等值、损失数额。员工未完成劳动标准和生产计划5-10%，其薪酬减少30-40%；员工超出劳动标准和生产计划1%，其薪酬增加0.3-0.5%。其结果是，劳动者不能满足其必要的社会经济利益和需要，用人单位不能满足所有者的利益和需要，企业整体不能满足国家和社会的利益。需要一个工具包来建立和规范员工和企业所获得的福利和福利的比例。

为了兼顾雇主和雇员的社会经济利益并确保其实施的可能性，有必要将劳动规范的目的从与劳动结果相关的评价性为主转变为监管性规范。保持雇主和雇员的利益和责任的平衡，并遵守共同商定的活动目标。

关键词：社会经济调节、劳动活动、煤矿企业。

**Abstract.** *The article indicates the relevance of the implementation in the practice of the work of coal mining enterprises of the socio-economic regulation of the labor activity of workers.*

*The existing system of labor rationing at coal-mining enterprises reproduces the unequal value of the benefits and benefits received by the enterprise and employees, the amount of losses. Non-fulfillment by an employee of labor standards and production plans by 5-10% causes a decrease in his remuneration by 30-40%, if an employee exceeds the labor standards and production plans by 1%, his remuneration increases by 0.3-0.5%. As a result, the employee cannot satisfy his social and economic interests and needs to the necessary extent, the employer cannot meet the interests and needs of the owners, and the enterprise as*

*a whole cannot satisfy the interests of the state and society. A toolkit is needed to establish and regulate the proportionality of the benefits and benefits received by the employee and the enterprise.*

*In order to take into account the socio-economic interests of the employer and employee and ensure the possibility of their implementation, it is necessary to change the purpose of the labor norm from a predominantly evaluative one in relation to the result of labor to a regulatory one that maintains a balance of interests and responsibilities of the employer and employees, and their compliance with mutually agreed goals of activity.*

**Keywords:** *socio-economic regulation, labor activity, coal mining enterprise.*

The main purpose of a coal mining enterprise as a socio-economic system is to satisfy the social and economic interests of its owners, management, employees, the state and society, which are the main criteria for the effectiveness of its functioning. The system that provides the satisfaction of these important interests for the subjects to a greater extent has the greatest efficiency [1]. The object of regulation is the labor activity of the personnel, since it contains a goal, the achievement of which allows to a certain extent satisfy the needs of the listed subjects [2].

The labor activity of employees is understood by the author as a conscious and expedient participation of employees of an enterprise in the production of material goods and services of market value, and includes the following components: social and economic goals determined by the interests and needs of the enterprise's stakeholders; objects, means and working conditions; technologies for obtaining results; labor functions; social and economic results. The nature, conditions and culture of work have a significant impact on the relationship between the employer and the employee, between employees in the workplace. Therefore, these factors should be taken into account when rationing labor activity.

The current situation, in terms of satisfying the interests of the employer and employee, at Russian coal mining enterprises can be characterized as a stalemate: the employer has more than 2 times the cost of foreign competitors, and the employee earns 4 times less than his foreign counterpart - competitor. Taking into account the difference in the purchasing power of money, this gap is 2.-2.5 times. At the same time, the specific wage costs of Russian enterprises (per 1 ton of coal products) exceed the costs of competitors. The reason for this situation is uncompetitive labor productivity as a result of insufficient efficiency and labor safety, which have become a natural result of the delay in the evolution of labor rationing in relation to the dynamics of the economic development of coal industry enterprises.

Labor efficiency, by analogy with the definition of economic efficiency by P. Samuelson and W. Nordhaus, is getting the maximum benefit: the quantity, qual-

ity and value of the product from the use of labor. Occupational safety is the state of protection of an employee from the impact of hazardous and harmful factors.

Studies of the labor efficiency of excavator drivers and dump truck drivers (operators who operate this powerful equipment) have shown that these and other categories of workers have significant reserves in using their labor potential (Table 1).

But these reserves are not obvious, they are «linked» by unproductive work arising from the improper organization of labor processes.

**Table 1**  
*The results of the study of the use of working time by operators [3]*

Categories of operators	Enterprises			
	Coal mine No. 1 (2008-2009)	Coal mine No. 2 (2009-2012)	Coal mine No. 3 (2013-2018)	MC** (2008)
Excavator drivers, h/month*	95–100	65–96	–	70–75
Mining dump truck drivers, h/month*	110-120	78–110	105-115	87–90
Reserves in the use of working time***:				
- excavator drivers, %	80–84	87–176	–	140–157
- dump truck drivers, %	60–65	63–130	56–71	100–104

\* - productive time of the operator

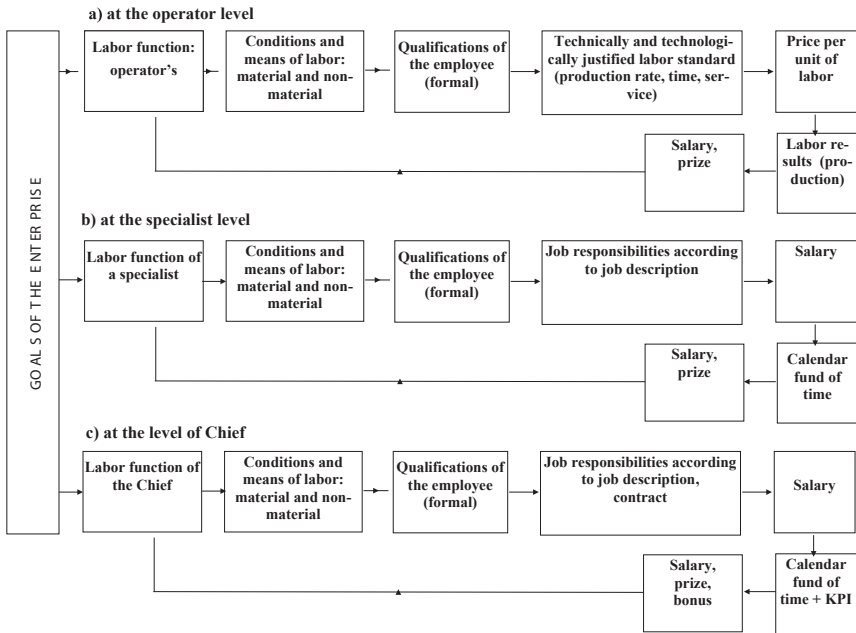
\*\* MC - mining company;

\*\*\* - reserves in the use of working time were determined as the ratio of the calendar time of the operator to the productive time

According to expert estimates of foremen, heads of production departments, managers and specialists of coal mines of the Kuzbassrazrezugol company, performed in 2007, unproductive work is about 50%. Unproductive work - work, at the output of which there is no product: a product or service. It is noteworthy that the results of the study with the definition of productive time and expert assessments of employees are close in terms of labor efficiency.

Even more significant reserves are for specialists and managers at various levels of enterprise management, whose labor function is very «blurred» by their official duties and who receive payment not for their specific results, but for the «general» result - the fulfillment of planned production volumes by an enterprise or production unit, which predetermined by the traditional methodology of labor rationing (Fig. 1). In the traditional methodology, the labor function of the operator for controlling machines and mechanisms, as well as the operator for servicing this equipment, is normalized (Fig. 1, a). At the same time, as practice has shown,

the efficiency of the use of labor is low. Managers and specialists have irregular work, irregular working hours, which are fixed in their official duties (Fig. 1, b, c).



The labor function is work according to the position, which is indicated in the staff list, in accordance with the profession, specialty, qualification; specific type of work assigned to the employee (according to article 57 of the Labor Code of the Russian Federation)

**Figure 1.** Mechanisms for determining the norm and remuneration of employees of the enterprise according to traditional methodology [3].

Irregular work in the organization of activities came after the «strong leader» model. This model allowed the state to withstand the conditions of civil war, industrialization, the Great Patriotic War, and the post-war restoration of the national economy. It proved to be effective in extremely difficult circumstances, requiring the mobilization of all resources. At the same time, the possibilities of this model in other conditions are less significant. Its application replaces the functions of planning, organizing and controlling labor with the function of stimulating it, i.e. stimulating employees becomes dominant, which negatively affects labor processes.

Each employee has personal and labor potential, labor capital, which are used and developed in cooperation with the employer.



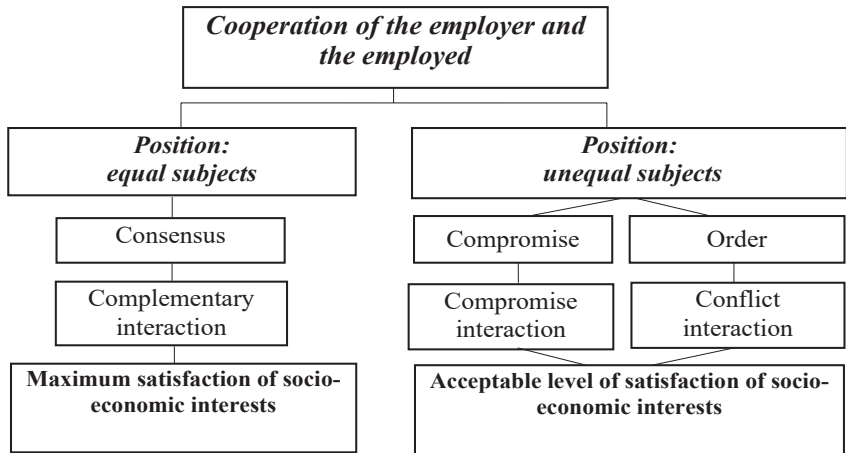
The personal potential of an employee is professionally significant personality traits that ensure the successful implementation of his labor activity. This potential includes the following components:

- psychophysiological: health, performance, stress resistance, etc.;
- social: consciousness and legal awareness, spiritual and social maturity, etc.;
- qualification: the ability to comprehend and use what has been learned in one's activity, to learn and master new skills and abilities.

The labor potential of an employee is the labor capacity, the resource capabilities of a person in the field of labor. The possibilities and limits of his participation in labor activity, which depend on his motivation and ability to work.

The labor capital of an employee is a system of his skills that can bring him income.

An important role in the development and use of the employee's potential can be played by the employer. The organization of interaction between these parties can be carried out on the basis of different positions: equal or unequal subjects. The position of equal subjects makes it possible to reach a consensus in the main areas of activity and, on this basis, to build their complementary interaction, thereby providing the prerequisites for maximum satisfaction of mutually significant socio-economic interests. The position of unequal subjects, at best, makes it possible to reach a compromise interaction of subjects on the basis of mutual concessions, at worst, through administrative levers, pressure is put on the employee to force him to achieve results that provide an acceptable level for the parties to satisfy their socio-economic interests (Fig. 2).



**Figure 2.** The scheme of interaction between the employer and the employee [3]

Because of this, the development and use of the potential of employees is hindered, labor processes are carried out with significant deviations in the parameters of efficiency, safety and labor productivity, which is confirmed by the results of research [3]

The wage-forming function of the labor rationing system also makes its “contribution” to this state of processes. This «contribution» lies in the fact that operators have, as a rule, unequally stressed shift production rates. An analysis of the output rates for the transportation of rock mass at one of the mining enterprises in Yakutia showed that the intensity of the output rates differs by 20-30% (Table 2).

**Table 2**  
*Characteristics of transportation conditions in overburden operations (2008) [3]*

Excavator no.	Distance, km		Number of flights				The ratio of the actual and equally stressed norms	
	physical	reduced*	Actual rate		Equally stressed norm		BelAZ 75145	BelAZ 7555
			BelAZ 75145	BelAZ 7555	BelAZ 75145	BelAZ 7555		
Hitachi 1900 No.3	1,3	1,6	36	42	37	45	0,97	0,93
RH No.4	1,4	1,7	32	40	36	44	0,89	0,91
Hitachi 1200 No.2	1,4	1,8	29	36	30	38	0,97	0,95
EKG-10 No.27	1,4	1,9	32	40	34	41	0,94	0,98
ECG 8I No.28	1,7	2,6	30	36	27	33	1,11	1,09
RH No.33	1,3	1,7	33	40	37	44	0,89	0,91

  “Light” norm;     
   «Heavy» norm

\*The reduced transportation distance is the estimated distance, taking into account the profile and other characteristics of the road in the quarry [5]

This situation gives rise to the emergence of «profitable» and «unprofitable» transportation routes for both operators and the enterprise (employer), which is accompanied by the desire or unwillingness of operators to comply with such norms. A “favorable” norm for an employee is a lighter norm in terms of the time spent on its implementation. In this example, this is the output rate from excavators RH No. 4 and RH No.33. But this norm is “unprofitable” for the enterprise - labor and technical potentials are largely underutilized. A “unprofitable” norm for an

employee is a more difficult norm in terms of execution time. In the example, this is the production rate from the excavator EKG-8I No. 28. It is «profitable» for the enterprise, because involves a more complete use of labor and technical potential. Employees prefer to keep the “easy” norm, not to advertise it, while the “heavy” norm is either avoided by all possible means, or signaled by available methods to management that it is impossible to fulfill it. A direct economic loss for both employees and the enterprise is the underutilization of the working time of personnel and equipment, which leads to a decrease in labor efficiency and, as a result, to a decrease in its productivity, and insufficient wages. The considered example is typical and is largely present in the activities of coal mining enterprises. There is an imbalance of benefits, and, consequently, the interests of the employee and the employer.

The long-term dominance of the state and employers in social and labor relations has led to unequal benefits and benefits received by the enterprise and employees, as well as the amount of losses. Non-fulfillment by an employee of labor standards and production plans by 5-10% causes a decrease in his remuneration by 30-40%, if the employee exceeds the labor standards and production plans by 1%, the remuneration of labor increases by 0.3-0.5%. As a result, the employee cannot satisfy his social and economic interests and needs to the necessary extent, the employer cannot meet the interests and needs of the owners, and the enterprise as a whole cannot satisfy the interests of the state and society. Logic suggests that, based on the interests of the parties (employer and employee), it is necessary to determine and agree on the goals of production activities and labor activities of specific employees and, on this basis, form and implement their labor functions, provide appropriate conditions for their implementation. For the effective implementation of labor functions by employees, the employer must determine the parameters of labor products - goods or services, their cost (remuneration), norms of costs and results of labor, standards for the organization of labor, relationships and interaction of employees, which ensure the possibility of achieving the established parameters [3 ].

The formation of the internal market environment (within the enterprise) with the help of socio-economic regulation makes it possible to increase the level of responsibility (subjectivity) of employees in cooperation with other employees, with the heads of the enterprise, who are representatives of the employer [1]. This, in turn, increases the level and dynamics of labor productivity - the basis of the enterprise's competitiveness and satisfaction of the socio-economic interests of the enterprise's subjects.

The need to preserve the targeting of norms as specific functional laws was also pointed out by V.D. Plakhov: “... norms have their own address - a certain social subject and object - certain aspects of subjective life activity, this manifests

the functional nature of norms. While maintaining the system of social and labor relations of the administrative-command economy at the enterprise, the norms are addressed not to individuals, but to the aggregate entity. The individualities in the norms are “redeemed”, “blocked” [6]. Thus, the norms “ignore” the individual vital needs of workers. Thus, one of the main reasons for the rejection of labor standards is that they are not subjective enough.

Insufficient subjectivity is disadvantageous neither to employees, nor to management, nor to the owners of the enterprise, nor to the state, since it does not allow to increase labor efficiency, which is the source of: workers’ dissatisfaction with the quality of working life and income; labor conflicts; low growth rates of labor productivity; low level of labor safety, insufficient growth of tax revenues to the state budget [7].

These circumstances indicate the need to develop the theory and methodology of labor rationing of employees of coal mining enterprises, aimed at increasing the professional subjectivity of each employee of the enterprise through the socio-economic regulation of his labor activity, which allows the employee to satisfy his socio-economic needs, and the enterprise to carry out socio-economic development as one of the conditions for effective functioning in a market environment [7].

To do this, when rationing labor, the conjugation of labor and production activities should be ensured and the proportionality of the benefits and benefits of the enterprise and the employee should be achieved. Consequently, the socio-economic regulation of labor activity is the definition, establishment and maintenance of the conjugation of the socio-economic components of the labor activity of employees and the production activity of the enterprise in order to achieve proportionality of the benefits and benefits taught by employees and the enterprise.

Thus, socio-economic regulation is mainly intended to ensure a balance of interests and responsibilities of employees and the employer, the achievement of which increases the activity of the employee in the development of reserves in the organization of his activities on the basis of improving the content of the labor function, prevents destructive forms of behavior of employees and creates an opportunity for satisfaction the needs of employees, and the enterprise - the required dynamics of increasing competitiveness [8].

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确定税务犯罪意图的程序

**PROCEDURE FOR DETERMINING INTENT IN TAX CRIMES**

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**摘要。**考虑了确定税务犯罪意图的程序。因过失而实施的税务犯罪与故意实施税务犯罪之间的界限已经确定。对故意实施税务犯罪的例子进行调查。提出了一种确定逃税经典方案的方法。本文的目的是对税务犯罪进行分析和评估。故意犯罪与过失犯罪概念的区别。该研究采用系统方法来评估税务犯罪的机制。事实证明，所提出的检测逃税的经典系统有助于证明在实施税务犯罪时指控性论文的提名是合理的。

**关键词：**税收、意图、税务犯罪、相互依赖、虚幻交易对手、虚幻操作、相互依赖、业务分散、正式文件流。

**Annotation.** *The procedure for determining intent in tax crimes is considered. The line between a tax offense committed by negligence and the intentional commission of a tax crime has been determined. Examples of tax offenses committed with intent are investigated. A method for determining the classical scheme of tax evasion is proposed. The purpose of the article is the analysis and assessment of tax crimes. Differentiation of the concepts of intentional commission of crimes and commission of offenses by negligence. The study uses methods of a systematic approach to assessing the mechanisms of tax crimes. It is proved that the proposed classical system for detecting tax evasion helps to justify the nomination of an accusatory thesis in the commission of a tax crime.*

**Keywords:** *tax, intent, tax crime, interdependence, unreal counterparty, unreal operation, interdependence, business fragmentation, formal document flow.*

**Introduction**

Despite numerous decisions of the highest judicial instances, legislative acts of the Russian Federation, letters of recommendation from the Federal Tax Service of the Russian Federation, theoretical and practical studies of theorists in the field of law, the issue of tax crimes has not been fully studied at present. The problem

of law enforcement in distinguishing between legal and illegal ways to reduce the tax burden, as well as the definition of a fine line between a tax offense committed through negligence and the intentional commission of a tax crime, is an occasion for discussions and discussions among specialists in the field of law and scientists in the field of economics and jurisprudence.

### **Literature review**

Intent is one of the forms of guilt (as opposed to negligence) - the preparation of a crime and awareness of its socially dangerous consequences.<sup>1</sup> According to Art. 25 of the Criminal Code, an act committed with direct or indirect intent is recognized as a crime committed intentionally.

Article 106 of the Tax Code of the Russian Federation defines a tax offense. “A tax offense is a guilty illegal (in violation of the legislation on taxes and fees) act (action or inaction) of a taxpayer, payer of insurance premiums, a tax agent and other persons, for which liability is established by this Code.”<sup>2</sup>

In his research in the field of tax crimes, I.M. Sereda determines responsibility for tax crimes, M.I. Voronin. explores topical issues of proof in criminal cases in the field of crimes in the field of taxation. E.V. Sheredko and V.N. Simin conduct theoretical research and define the concepts and problems of bringing to responsibility for tax evasion and fees in accordance with the legislation of the Russian Federation. However, in our opinion, insufficient attention has been paid to the issue of distinguishing between a tax offense committed through negligence and the intentional commission of a tax crime. The relevance of this topic is primarily due to the fact that the same actions to create a financial and economic scheme for the work of an organization, as well as the procedure for calculating real tax liabilities, receive different assessments within the framework of tax, administrative and criminal law procedures.

### **Theory and methods.**

The main subjects for the detection of tax crimes are currently the Federal Tax Service of the Russian Federation, the unit for combating economic crimes of the Ministry of Internal Affairs of Russia and the Federal Security Service of Russia. The bulk of criminal cases, as practice shows, are initiated on the basis of conducted tax authorities. The Investigative Committee of the Russian Federation, in turn, is investigating criminal cases on tax crimes. It should be noted that the tax authorities in the context of increasing digitalization use quite original methods to detect tax crimes committed with the intention of evading taxes and contributions. Investigative feed performing investigative actions. It applies such procedures as seizing financial documentation, computer equipment and servers, appoints forensic accounting, forensic technical expertise on the seized material, interrogates witnesses, employees of the audited organization or a group of economically related organizations. The most difficult final stage, based on the evidence base

collected, is to determine whether a tax crime has been committed with intent, or as a result of negligence, an unintentional arithmetic or technical error. Due to numerous disputes, including in the Supreme Courts of the Russian Federation, the procedure for proving a deliberately committed crime is becoming increasingly difficult. In this regard, on July 13, 2017, the Federal Tax Service Control Department for investigating and proving the facts of intentional non-payment or incomplete payment of the amount of the tax (fee) issued guidelines that allow the study of evidence of willful non-payment or incomplete payment of the tax (fee).<sup>3</sup>

The above methodological recommendations provide a definition and the possibility of correct qualification of a tax offense committed through negligence and the determination of the intentional commission of a tax offense. Thus, an act is considered a tax offense committed through negligence if the person who committed it did not realize the illegal nature of his actions (inaction) or the harmful nature of the consequences that arose as a result of these actions (inaction), although he should have and could be aware of it.<sup>4</sup> An example is the lack of qualifications of the manager and chief accountant, temporary disability of officials, arithmetic errors as a result of computer program failure, technical errors caused by settings failure and the use of calculation formulas. It should be noted that the personal and professional qualities of the employees of the organization cannot be a legitimate basis for the innocence of the organization, therefore, as a result, the organization is subject to tax liability in the form of a fine of 20% of the unpaid amounts, provided for in paragraph 1 of Article 122 of the Code.<sup>5</sup>

According to the above methodological recommendations, evidence of intent to commit a tax crime is a combination of taxpayer actions aimed at concealing real tax liabilities, namely imaginary contractual relations, imitation of the taxpayer's real activities, the use of "one-day firms" in the chain of business operations, artificial "fragmentation" of business, the use of imaginary or sham transactions in the activities of the organization, the creation of a formal workflow. For the application of these tax offenses by an organization, it entails the application to tax liability in the form of a fine of 40% of the unpaid amounts, provided for in paragraph 3 of Article and 122 of the Code.<sup>6</sup>

The methodological recommendations we are studying contain seven examples that show how the courts prove the guilt of the taxpayer when deciding to prosecute an organization that has committed a tax offense. We believe it is necessary to pay attention to each example in order to develop an individual methodology for determining the classical scheme of tax evasion.

Example 1. An organization is prosecuted for the intent of evasion if the tax authority collected evidence of the use of fiscal checks, unregistered cash registers in the activities of the taxpayer, bills of exchange and cash in large volumes were used as payment to counterparties, signing of primary documentation by an un-



authorized official, temporary difference in acceptance primary documents (older date than the date of state registration of the counterparty organization).<sup>7</sup>

Example 2. An organization submitted documents to the tax authority on behalf of counterparties, and they were drawn up by the audited organization, or the founder or director of the audited organization, was at the same time the head or employee of the organization of the counterparty of the “one-day firm”. At the same time, investigative measures in the form of interrogation showed that the nominal directors in the “one-day firm” were not engaged in actual management, they only signed documents.

Example 3. The tax authority has established circumstances that testify to the consistency of the actions of the organization and its counterparties aimed at creating the appearance of compliance with the requirements of the Code. For this purpose, unreasonable amounts of VAT were accepted for deducting value added tax, and professional tax deductions were classified as buried, without confirming the facts of a real business transaction.

Example 4. A taxpaying organization, together with other organizations, in order to apply a 0% income tax rate, created a group of companies in a special economic zone. In order to create activities, the buildings, structures, land plots, machinery and equipment necessary for production were transferred to the parent company. Regulated on favorable terms for themselves the amount of rent. The goal is to create a single property controlled center. A large amount of money, in the form of paid dividends, was withdrawn abroad. The court qualified the actions of the group of companies as concerted actions aimed at obtaining unjustified tax benefits.

Example 5. A taxpaying organization, in order to cash out funds, has created a formal workflow. So the funds were transferred for construction and installation work, under the guise of payment for subcontracting work, to the accounts of organizations that actually do not carry out financial and economic activities. The court concluded that there was a formal document flow in order to obtain an unreasonable tax benefit.<sup>8</sup>

Example 6. A taxpayer applied a business split system. These activities were carried out jointly with controlled organizations that were deprived of economic independence. The purpose of splitting the business is aimed at preventing the excess of the maximum amount of revenue, for the application and preservation of the right to apply a special taxation regime in the form of a simplified taxation system. The taxpayer pursued the goal of obtaining unjustified tax benefits in the form of non-payment of value added tax and income tax applied under the general taxation system.<sup>9</sup>

Example 7. A taxpayer, being the owner of a property complex, in order to underestimate the real market value of real estate, entered into transactions for the

sale of property with interdependent organizations, and a fictitious document flow was created for the implementation of current repairs, without real business transactions. The court determined that the organization deliberately underestimated the taxable base for income tax and value added tax.<sup>10</sup>

The examples given in the guidelines are of great practical importance in the process of determining the intent of organizations to avoid paying real tax liabilities to the budget.

Taxes and contributions form the basis of the state budget of any state, and the collection of taxes in full is the guarantor of the stable functioning of the state economy. Therefore, an important task of the government is to organize a strong system of tax administration. In fairness, it should be noted that the state policy of the Russian Federation is aimed at large-scale digitalization of tax control. A breakthrough in the digitalization of tax administration is the information system AIS «TAX-3». This system provides full automation of the activities of the Federal Tax Service of Russia. The AIS «TAX-3» system allows you to automatically calculate errors associated with incorrect calculation of taxes, including schemes used by the taxpayer for deliberate tax evasion. Identification of a violation is carried out instantly, but the moment of proof of intent sometimes takes a large amount of time, and does not always end in success. In the process of proving the intentional commission of a tax crime, we propose to use the methodology for determining the classical scheme of tax evasion to the budget.

Methodology for determining the classical scheme of tax evasion to the budget.

To develop this methodology, we analyzed the actions that organizations carry out with the aim of tax evasion, the types of taxes for which tax offenses are most often applied. A system of ongoing measures aimed at identifying cases of unlawful understatement of the tax base. The analysis was carried out using a systematic approach. The object of the tax offense was considered as an integral complex of interrelated elements, namely, all relations and actions, as well as financial and business operations of the organization, were considered in aggregate. The empirical data of the researcher and the current legislative framework of the Russian Federation were used.

**Table 1**  
*«Methodology for determining the classical scheme of tax evasion to the budget»*

Actions of the taxpayer	The purpose pursued by the taxpayer	Suggested control measures
<p><b>1. Economically unsound transactions</b> The use of fictitious transactions in order to increase the cost of the purchased goods or the cost of manufacturing the final product. Overestimation of the expenditure side or reduction of the revenue side. Fictitious transactions can be concluded both with unscrupulous counterparties - a one-day firm, and with an affiliated organization.</p>	<p>VAT and income tax evasion</p>	<ol style="list-style-type: none"> <li>1. to identify inconsistencies of counterparty organizations (identify and interview employees of the organization, identify inconsistencies);</li> <li>2. analysis of used firms «one-day» and identification of accountability;</li> <li>3. determination of the real supplier of raw materials, goods, services;</li> <li>4. Inspection and seizure of the premises (attracting an evidence base in the form of documents confirming the fictitiousness of the transaction);</li> <li>5. identification of inconsistencies in the volumes of the mass of goods (establishing the actual volumes of transportation, comparing these volumes with the data of trucks, with the volumes of the warehouse where the goods were stored);</li> <li>6. testimonies of dismissed employees about the facts of deliberate tax evasion</li> </ol>
<p><b>2. Business fragmentation</b> Use in the activities of a group of companies that apply special tax regimes or STS (simplified taxation system), registration of a new organization and the application of STS (simplified taxation system) to it, at the threshold of exceeding the maximum revenue of the previous organization.</p>	<p>VAT and income tax evasion</p>	<ol style="list-style-type: none"> <li>1. determination of the type of activity of all members of the group of companies. Recording similar activities;</li> <li>2. revealing the facts of expenses incurred by the participants of the scheme for each other;</li> <li>3. determination of the affiliation of the participants in the business splitting scheme</li> <li>4. revealing the facts of the use by the participants of the scheme of the same signs, telephone contacts, website, banks, addresses of the actual location.</li> <li>5. fixing the lack of funds and personnel resources from controlled persons;</li> <li>6. identification of single suppliers and buyers</li> </ol>

*Source:* developed by the author during a scientific study

When developing the classical methodology, we grouped the popular actions of taxpayer organizations, which, if supported by the necessary evidence base, can be qualified as deliberate actions in order to conceal real tax liabilities. In our

methodology, we offer six control measures in each block, the positive result of which will help to draw a conclusion about the deliberate actions of the taxpayer, as well as to provide a qualitative assessment of the evidence base.

We propose to use the assessment of the degree of proof of the taxpayer's intent as follows:

- Number of positive findings:
  - from 0 to 2 as the minimum;
  - from 3 to 4, as an average;
  - 5 to 6 as high.

The next stage after determining the degree of proof of intent, in our opinion, is the formation of a documentary dossier as an evidence base for the application of tax evasion schemes. The dossier will be required in the presence of circumstances of medium and high degree of proof.

### **Main results.**

At present, the fulfillment of the requirements regarding the establishment and reflection in the materials of tax control of signs of the absence of a business purpose (the use of economically unjustified transactions) and the identification of facts of business splitting is a natural filter and improves the prospect of materials sent to the Russian Investigative Committee on initiating a criminal case in the field of tax rights under articles 198.199, 199.1, 199.2 of the Criminal Code of the Russian Federation. But despite the fact that tax crimes are a real threat to economic security, determining the fine line between a tax offense committed through negligence and the intentional commission of a tax crime is a difficult task that requires careful proof. Using our methodology for detecting facts of deliberate tax evasion, assessing the degree of proof and compiling the evidence base in the form of a documentary dossier will help reduce the time for investigating a tax offense, approach the evidence base qualitatively and draw fairer conclusions.

### **Conclusion**

Thus, when analyzing and evaluating tax crimes, it is first necessary to distinguish between the concept of intentional commission of crimes and the commission of offenses through negligence. Forming conclusions, it is necessary to be guided by the current regulatory framework, the tax code of the Russian Federation, the Criminal Code of the Russian Federation, the practice of the Supreme Arbitration Court of the Russian Federation, the methodological recommendations "On the study and proof of facts of intentional non-payment or incomplete payment of tax (fee) of 13.07.2017. When investigating a criminal case on facts of violation of tax laws, it is necessary to have an evidence base and documentary evidence. The method proposed by us for determining the classical scheme for assessing a tax offense will reduce the time for collecting evidence, make the right decision when qualifying a tax offense. If a tax offense is qualified as intentional,

accrue real tax liabilities, accrue interest and penalties, with subsequent transfer of materials to the court to initiate a criminal case in the field of a tax offense.

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根据俄罗斯联邦现行刑事立法, 死者的尸体是社会记忆的载体  
**THE BODIES OF THE DECEASED AS OBJECTS-CARRIERS  
OF SOCIAL MEMORY UNDER THE CURRENT CRIMINAL  
LEGISLATION OF THE RUSSIAN FEDERATION**

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摘要。俄罗斯联邦宪法法院在 2003 年 12 月 4 日第 459-0 号决定中解释说, 人死后受到尊严对待的权利源于人身不受侵犯的权利(俄罗斯联邦宪法第 22 条)。联邦), 排除对个人身心的非法影响, 以及国家保护个人尊严的权利(俄罗斯联邦宪法第 21 条第 1 部分)。在这方面, 国家有义务在既定法律秩序的框架内建立这样一种制度, 使每个人确信在其死后, 国家将保护其身体不受侵犯的权利。在这方面, 本文探讨了死者尸体作为俄罗斯联邦社会记忆的客体载体的法律地位。对一个人的出生和死亡时刻、其组成部分以及死后生理状态的特殊性进行分析, 这与根据俄罗斯联邦现行立法确定死者的正确资格有关。因此, 研究结果不仅可以用于理论部分, 还可以用于执法活动。

关键词: 尸体, 社会记忆, 无名尸体, 头躯干, 尸体鉴定, 年龄与腐烂变化

**Annotation.** *The Constitutional Court of the Russian Federation in its Decision No. 459-O<sup>1</sup> of 4 December 2003 explained that the right of a person to be treated with dignity after death is derived from the right to personal inviolability (Article 22 of the Constitution of the Russian Federation), which excludes unlawful influence on a person both in the physical and mental sense, and the right to state protection of personal dignity (Part 1 of Article 21 of the Constitution of the Russian Federation). In this connection, the State is obliged to create, within the framework of the established legal order, such a regime that would allow each person to be sure that after his death the State will protect the right to inviolability*

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<sup>1</sup> Definition of the Constitutional Court of the Russian Federation “On refusal to accept for consideration the request of the Saratov Regional Court to check the constitutionality of Article 8 of the Law of the Russian Federation “On Transplantation of Human Organs and (or) Tissues” of 4 December 2003 №459-O // Bulletin of the Constitutional Court of the Russian Federation. 2004 №3.

*of his body. In this regard, the article investigates the legal status of the body of a deceased person as an object-carrier of social memory in the Russian Federation. The analysis of the moment of birth and death of a person, its components, as well as the peculiarities of his physiological state after death, relevant for the correct qualification of the deceased under the current legislation of the Russian Federation. Thus, the results of the study can be used not only in the theoretical part, but also in law enforcement activities.*

**Keywords:** *dead body, social memory, unidentified corpse, head and torso, corpse identification, age and putrefactive changes*

Social memory is a system of storage, processing and transmission of essentially significant (relevant) information necessary for the functioning of society.<sup>2</sup> The purpose of the existence of social memory is to preserve the accumulated and theoretically generalised collective experience and to transmit it from generation to generation, i.e. its reproduction (value-symbolic reconstruction) by means of traditions<sup>3</sup>. The content of the social memory of the dead, which is a type of social memory, in general, is the collective experience of cognitive and practical activity of mankind, with regard to respectful and dignified treatment of a person after his death.

Protection of the social memory of the dead by criminal-legal means is the purpose of the criminal-legal prescription provided by Article 244 of the Criminal Code of the Russian Federation, which establishes liability for abuse of the bodies of the dead.

The subject of the offence is defined in part 1 of article 244 of the Criminal Code of the Russian Federation as “bodies of the dead”. In this regard, it should be noted that in the Interstate Standard “Domestic Services, Ritual Services: Terms and Definitions” (hereinafter - Interstate Standard), approved by Order of the Federal Agency for Technical Regulation and Metrology of 11 June 2014 № 551-st (GOST 32609 - 2014),<sup>4</sup> ***the body of the deceased (deceased) and (or) its fragments are distinguished, combining into the concept of remains of the deceased.***

***The body of a deceased person is considered to be the postmortem anatomical complex of human organs and tissues.***<sup>5</sup> According to the Decree of the Govern-

<sup>2</sup> Philosophical Dictionary / Edited by I.T. Frolov. M.: Respublika Sovremennik, 2009. - p.487

<sup>3</sup> See: Encyclopaedic Sociological Dictionary / Edited by G.V.Osipov. M: PUBLISHING HOUSE OF ISP RAS, 1995. - P.520-522; Papanina Y.A. Theoretical foundations of the concept of “social memory” // Bulletin of St. Petersburg State University 2010. Ser.12. Vol.1. pp.395-396

<sup>4</sup> Interstate Standard “Household Services, Ritual Services. Terms and definitions”, approved by the Order of the Federal Agency for Technical Regulation and Metrology of 11 June 2014 № 551-st (GOST 32609-2014) // [Electronic resource] - Access mode. – <http://drive.google.com> (Circulation date 25/07/2017.).

<sup>5</sup> Forensic medical examination of corpses: lecture // Forensic Medicine: a course of lectures / V.B. Kan, I.E. Belikov. - Ekaterinburg: Publ. house of Ural Law Institute of the Ministry of Internal

ment of the Russian Federation “On approval of the rules for determining the moment of death of a person, including the criteria and procedure for determining the death of a person, the rules for terminating resuscitation measures and the form of the protocol for determining death” of September 20, 2012, № 950,<sup>6</sup> the death of a person is established from the moment of **brain death** or **biological death**.

In the course of a questionnaire survey of religious ministers - representatives of such religions as Orthodoxy, Catholicism and Islam, it was established that, according to the religious understanding, the body of the deceased is a set of such parts as the torso, head and limbs. However, from the legal point of view, it is thought that the absence of limbs cannot be considered a circumstance excluding the possibility of recognising the head and (or) torso of the deceased as the body of the deceased.

Thus, the body of the deceased as a postmortem anatomical complex of human organs and tissues must jointly or alternatively include body parts that inevitably testify to the death of a person (i.e. vital parts of the body) - the head and the torso. Other fragments of the body of the deceased (separate organs and tissues, limbs, hair, nails, etc.) are to a much lesser extent carriers of the social memory of the deceased, and therefore should not entail equal legal protection with the protection of the body of the deceased. Firstly, dismembered fragments of a person’s body are not always in themselves indicators of his or her death (for example, an arm or leg leg legally amputated in a medical institution, etc.). Secondly, dismembered fragments of a person’s body are not capable of evoking an emotional reaction similar to the reaction to the body of a deceased person. Thus, the results of the conducted questionnaire confirm that citizens do not perceive fragments of the human body as emotionally similar to the body itself (including the head and (or) torso).

Turning to the issue of the quality of the legislative formulation of the subject of the offence in part 1 of Article 244 of the Criminal Code of the RF, it should be noted that according to the 1st law of logic - the law of identity, the content of any thought in the process of reasoning must be the same, constant, identical to itself<sup>7</sup>. In the field of lawmaking, the compliance of the text with this law implies, in particular, that the indication of an object in the plural requires such an object in reality. However, the legislative wording of part 1 of Article 244 of the Criminal Code of the RF is “Mutilation of dead bodies...”, which raises the question of what should be the number of dead bodies as the subject of the offence. It seems that the answer to this question should be that the body of one deceased person is sufficient. Otherwise, law enforcement practice under Art. 244 of the Criminal Code of the Russian Federation will be brought to absurdity due to the

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Affairs of Russia, 2002;

<sup>6</sup> See: Rossiyskaya Gazeta. - 2012. - № 220

<sup>7</sup> Ivanov E.A. Logic: Textbook. M.: 1996. p.3



impossibility of instituting criminal proceedings for the commission of abuse of only one body of the deceased. It is not by chance that many authors, commenting on the provisions of part 1 of article 244 of the Criminal Code of the Russian Federation, under the abuse of dead bodies understand “mockery of the human body”, “exposure or dismemberment of the corpse”, “removal of the corpse from the grave”, “introduction of various objects into the body of the deceased”, etc.<sup>8</sup> Thus, representatives of criminal law science actually demonstrate in the process of legal interpretation that in order to bring a person to criminal responsibility under Article 244 of the Criminal Code of the Russian Federation, they believe that the commission of abuse of one body is sufficient. The analysis of 305 sentences in criminal cases involving the issues of abuse of dead bodies, conducted for the period from 2010-2017 in the Russian Federation also leads to the conclusion that in law enforcement practice there is a clear position on the qualification of abuse of dead bodies, in accordance with which a person is held criminally liable for committing unlawful acts against the body of one deceased person.

Thus, in the process of legal interpretation and law enforcement based on it of the criminal-legal prescription contained in Part 1 of Article 244 of the Criminal Code of the Russian Federation, the logical legal and technical error of the legislator, consisting in the use of synecdoche (a type of metonymy based on the transfer of meaning from one phenomenon to another on the basis of the quantitative relationship between them - the use of the plural of nouns in the meaning of the singular number, i.e. the naming of a single object in the plural) was corrected.<sup>9</sup>

A.S. Shokel, believes that since in investigative and judicial practice there are no difficulties in the qualification of this act, there is no need to bring the criminal legislation of the Russian Federation into compliance with the rules of legislative technique<sup>10</sup>. We believe that we can agree with this opinion only partially. The deviation from the laws of logic in the construction of the criminal-law provisions under consideration can be transmitted to other, newly introduced criminal-law provisions, acting as a kind of example for subsequent lawmaking activity. In this

<sup>8</sup> Criminal Law. Special Part: Textbook for Bachelors / Edited by A.I. Chuchaev, - 3rd ed., revision and addendum. M: Prospect, 2018. - P.340-341; Criminal Law of Russia. Parts General and Particular: Textbook / Edited by A.I. Rarog. A.I. Rarog. - 2nd ed., revision and additions - M.: Prospect, 2018. - P. 508; Criminal Law of Russia. Parts General and Particular: Textbook / Edited by A.I. Rarog. - 9th ed., revision and addendum - Moscow: Prospect, 2018. - 697; Criminal Law of Russia. Parts General and Particular: Textbook / Edited by A.V. Brilliantov. - 2nd ed., revision and addendum - Moscow: Prospect, 2018. - P.789; Criminal Law. In two-volume Special Part: Textbook / Editor-in-Chief A.V. Naumov, A.G. Kibalnik - 5th ed. revision and addendum - Moscow: Yurait, 2017. Vol. 2. P.318 et al.

<sup>9</sup> Legal technique in criminal law: A course of lectures / S.S. Tikhonova. - Nizhny Novgorod, 2008. - p.116

<sup>10</sup> Shokel A.S. Prevention of crimes connected with abuse of dead bodies and places of their burial: Cand. of juridical sciences: 12.00.08. - M., 2001. p.56

regard, in order to improve the criminal legislation, it is advisable to eliminate the legislative defect in question, but with a possible delay in time - only when making further significant changes to Article 244 of the Criminal Code of the RF.

Considering the question of how the degree of preservation of the body of the deceased should affect the criminal law protection, it should be concluded that the body of the deceased, subject to putrefactive changes or skeletonised, should equally be the subject of an offence under Part 1 of Article 244 of the Criminal Code of the RF. Thus, according to the results of a questionnaire, 98 per cent of the persons interviewed agreed that skeletonised and putrefied human remains should be subject to equal legal protection on an equal footing with the preserved ones. Judicial practice has also revealed cases of abuse of skeletonised and putrefied human corpses. One such example is the case of A. Moskvina, a resident of Nizhny Novgorod, who, on the territory of Nizhny Novgorod and Moscow regions, dug up the graves of little girls aged three to twelve, removed the bodies from the graves, and made mummies of them<sup>11</sup>.

The age of the deceased should also have no legal significance for the protection of the social memory of the deceased, this follows from the constitutional principle of equality, and should not detract from the dignified treatment of the body of the deceased regardless of his or her age. At the same time, if a person has not been born, i.e. has not passed into the status of a human being, the deceased is not a person, but a foetus, which has a different legal status. In order to resolve the question of whether in a particular case a person was born, it is necessary to refer to Part 1 Article 53 of the Federal Law "On the Fundamentals of Health Protection of Citizens in the Russian Federation" of 21 November 2011 No. 323-FL,<sup>12</sup> according to which the moment of birth is considered to be the moment of separation of the foetus from the mother's body through labour. In addition, it is necessary to take into account the provisions of paragraphs 2, 3, 5 of Annex N1 to the Order of the Ministry of Health and Social Development of the Russian Federation "On medical criteria for birth, the form of the birth document and the procedure for its issuance" of 27 December 2011 N1687n,<sup>13</sup> defining medical criteria for birth: 1) gestational age; 2) birth weight; 3) birth length, etc.

Live birth is the moment of separation of the foetus from the mother's body through labour when the gestational age is 22 weeks or more and the newborn's body weight is 500 grams or more (or less than 500 grams in case of multiple births) or if the baby's body weight at birth is unknown, If the length of the newborn's body is 25 cm or more and the newborn shows signs of live birth (breathing, heartbeat, pulsation of the umbilical cord or voluntary muscle movements,

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<sup>11</sup> Anatoly Moskvina - "puppeteer" from Nizhny Novgorod // [Electronic resource] - Mode of access. <https://ribalych.ru/2015/10/30/anatolij-moskvina> Date of circulation 15/04/2017).

<sup>12</sup> Rossiyskaya Gazeta. 2011. № 263.

<sup>13</sup> Rossiyskaya Gazeta. 2012. № 64

regardless of whether the umbilical cord has been cut or whether the placenta has separated) (paragraph 4 of Annex No. 1 to the Order).

A stillbirth is the moment of separation of the foetus from the mother's body through labour when the gestational age is 22 weeks or more and the newborn's body weight is 500 grams or more (or less than 500 grams in the case of multiple births) or, if the child's body weight at birth is unknown, when the newborn's body length is 25 cm or more and the newborn shows no signs of live birth (paragraph 5 of Annex No. 1 to the Order). However, it seems that the legislative construction is built in such a way that creates uncertainty regarding a stillborn child, since the meaning implies that it is necessary not to die as a foetus, but to die as a human being. This is a rather complex criterion that can only be identified from a medical point of view. Thus, Federal Law No. 323-FL "On the Fundamentals of Health Protection of Citizens in the Russian Federation" enshrines the provision that all stillborns are subject to a pathological anatomical autopsy, the main task of which is to determine the age of intrauterine death of the foetus<sup>14</sup>. Thus, if a medical examination establishes that the stillborn has lost its viability in the process of intrauterine development as a foetus, then under the current legislation of the Russian Federation there is no criminal liability for unlawful influence on the foetus. However, if death occurs in the process of childbirth (strangulation by the umbilical cord, other physiological condition - absence of breathing, heartbeat, pulsation of the umbilical cord, etc.), then this child should be considered as a stillborn person and equated to subjects protected by criminal law.

Body (remains) of a deceased person, whose identity at the time of discovery of the body (remains) has not been established, according to the Federal Law "On State Genomic Registration in the Russian Federation" dated 03 December 2008 №242-FL<sup>15</sup> is considered an **unidentified corpse**. According to the note to clause 2.1.16 of the *Interstate Standard*, in cases where the identity of the deceased (deceased) is not established, the body of the deceased may be unclaimed for burial. In such cases, the burial procedure is regulated by local acts of local self-government bodies (see, for example, p. 3.2. - 3.4 of the Resolution of the Administration of Surgut, Khanty-Mansi Autonomous Okrug - Yugra "On Approval of the Regulations on the organisation of funeral services, the Procedure for the activities of a specialised funeral service in the city of Surgut" dated 8 September 2014 No. 6176.<sup>16</sup>). Thus, the **identification of the deceased** is incidental (situational) in

<sup>14</sup> Shchegolev A.I., Tumanova U.N., Lyapin V.M. "Pathological and anatomical assessment of the age of intrauterine fetal death" // Archives of Pathology., 2017; 76 (6), P.60-65

<sup>15</sup> Rossiyskaya Gazeta. - 2008. - № 251

<sup>16</sup> Resolution of the Administration of the city of Surgut "On Approval of the Regulations on the organisation of funeral business, the Procedure for the activities of the specialised service for funeral matters in the city of Surgut" // [Electronic resource] - Mode of access. <http://admsurgut.ru>. (Circulation date 18/07/2017).

nature and therefore should not have legal significance for the protection of the memory of the deceased, although it can influence the legal burial procedure applied to the deceased.

Thus, the body of the deceased as an object-carrier of social memory under the current criminal legislation of the Russian Federation is understood as a postmortem anatomical complex of human organs and tissues. The death of a person is established from the moment of *brain death* or *biological death*.

The body of the deceased as a postmortem anatomical complex of human organs and tissues must jointly or alternatively include the parts of the body that inevitably testify to the death of a person (i.e., vital parts of the body) - the head and the torso

The degree of preservation of the body of the deceased, subject to putrefactive changes or skeletonised, must equally be the subject of an offence under part 1 of article 244 of the Criminal Code of the Russian Federation

The age of the deceased should also have no legal significance for the protection of the social memory of the deceased. The exception is the case when the person was not born, i.e. has not passed into the status of a person, the deceased is not a person, but a foetus, which has a different legal status, and is not protected by the criminal law of the Russian Federation.

The identification of the deceased is of an accidental (situational) nature, therefore it should not have legal significance for the protection of the memory of the deceased, although it can influence the legal burial procedure applied to him/her.

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DOI 10.34660/INF.2023.89.25.037

青少年跆拳道运动员体能训练阶段特点  
**CHARACTERISTICS OF THE STAGE OF PHYSICAL TRAINING  
 OF KICKBOXERS-YOUNG MEN**

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摘要。文章对青少年跆拳道运动员体能训练阶段的训练负荷和状态进行了分析。

关键词：运动训练，综合监测。

**Annotation.** *The article provides an analysis of the training load and the condition of young kickboxers at the stage of physical training.*

**Keywords:** *Sports training, integrated monitoring.*

INTRODUCTION. Sports training management is related to the analysis and evaluation of sports training indicators and the athlete’s condition. A special role in this process is given to comprehensive control, as a tool that allows you to identify the main directions in the further training of an athlete [11, 4].

ORGANIZATION AND METHODOLOGY OF THE STUDY. In the pedagogical experiment, studies of kickboxers-young men (11-12, 13-15 years old) at the general preparatory stage (PE) were carried out, taking into account the values of the parameters of training loads and the degree of their impact on the condition of athletes. The structure and content of training loads within the framework was studied according to the methodology of the authors A.V. Chernyak, G.I. Mokeev, Yu.B. Nikiforov, 1977-1986 [1].

**Table 1**

*The amount of training load at the general preparatory stage n = 20*

Exercise groups	Training load indicators			
	a group of boys aged 11-12		a group of boys aged 13-15	
	Volume, min, %	UOI, %	Volume, min, %	UOI, %
<i>OFFP</i>	630, 77	64	630, 77	63
<i>SPU</i>	130, 16	71	130, 16	70
<i>US</i>	-	-	-	-
<i>STTM</i>	60, 1	82	60, 1	80

UB	-	-	-	-
VBS	-	-	-	-
SP	190, 23	76	190, 23	74
Total volume	820	66	820	64

Symbols: OFP – general physical training; SPU – special preparatory exercises; US - exercises on shells; STTM – improvement of technical and tactical skills; UB – conditional fights; VBS - free-style fights, sparring; SP – special training; UOI – average relative intensity.

According to this methodology, the training load is represented by two main indicators - the volume and intensity of physical exercises. The amount of load is calculated by the “net time” spent only on performing physical exercises. The total amount of loads performed per stage, microcycles, and training sessions are taken into account. The intensity of the training load according to this technique is evaluated quantitatively, according to the developed intensity scale based on the registration of heart rate (table 1).

The training was built in the form of training camps lasting 10 days. The PE included two microcycles (table 2). In the first microcycle, training sessions are aimed at fostering aerobic endurance, increasing the functional capabilities of the body, and developing physical qualities. In these microcycles, the volumes of training loads with a predominance of high intensity were planned (4th intensity zone, 160-170 beats/min).

**Table 2**  
*Distribution of training load indicators by microcycles*

Microcycles	Training load indicators			
	a group of boys aged 11-12		a group of boys aged 13-15	
	Volume, min, %	UOI, %	Volume, min, %	UOI, %
1 (5 days)	62	63	62	61
2 (5 days)	38	65	38	63

The microcycles consisted of four training days and one recovery day with three classes a day – morning, main and auxiliary. The main tasks were solved at the main (more often daytime) training. During the auxiliary lesson, athletes performed secondary tasks. In the second microcycle, preference in the main classes was given to the education of special (high-speed) endurance. In this microcycle, the volume of training sessions was reduced, and the intensity of exercises was increased. The trainings were distinguished by a wide variety of OFP tools using interval and repeated training methods [2].

The ratio of general physical training (OFP) to special training (SP) was 77% to 23% (Table 1). The group of exercises of general physical orientation mainly



included sports games, cross-country, speed-force exercises. In the special part of the process, special preparatory exercises prevailed (imitation, shadow fighting, jumping rope, with weights, etc.). In a small volume (2-4%), specialized exercises to improve technical and tactical skills with a partner with a partner were used to assess the level of special preparedness.

Analysis of the training load in groups (Table. 3) showed that the largest volume of the stage took place in the 3rd and 4th intensity zones. In the zone of maximum intensity, only 7-8% of the load volume was performed. About 1/3% of the load volume was aerobic (heart rate up to 150 beats/min).

**Table 3**  
*Distribution of TN volume by intensity zones (%) n=20*

Зоны интенсивности	Объем тренировочной нагрузки, %	
	a group of boys aged 11-12	a group of boys aged 13-15
1st (up to 139 beats/min)	11	9
2nd (140-149 beats/min)	17	18
3rd (150-159 beats/min)	33	38
4th (160-169 beats/min)	31	28
5th (over 170 beats/min)	8	7

To assess the fitness of kickboxers at the beginning of the stage and at its completion, a stage control was carried out [3]. The athletes' fitness was assessed according to the following indicators (Table 4): speed (running, 30 m), speed-strength (push-ups in 1 min, pull-ups, dynamometry of the right and left hands), endurance (running, 2000 m), functional state (Genchi test, functional test with a rope), psychophysical qualities (Schult's table), questionnaire of physical condition, activity and mood (FSAN, Matesius, 1972).

**Table 4**  
*Comparative characteristics of the average indicators of kickboxers' fitness at the general preparatory stage, n=20*

№ n/n	Tests	a group of boys aged 11-12			a group of boys aged 13-15		
		the beginning of the stage	end of the stage	changes in indicators, %	the beginning of the stage	end of the stage	changes in indicators, %
1	Running 30 m, s	6,1	6,1	0	5,7	5,6	+1,0
2	Push-up for 1 m, count	28,2	27,7	-1,0	34,3	34,3	0
3	Running 2000 m, min	16,01	14,8	+7,6	14,02	12,5	+10,8
4	Test with a rope (2 min), heart rate in 3 min	275,5	249,5	+9,4	237,5	225,7	+5,0

5	Gencha sample, s	17,7	20,3	+12,3	23,7	26,7	+11,2
6	Schulte table, s	48,0	53,7	-10,6	36,5	32,7	+ 10,4
7	Pull-up, count	4,8	5,5	+12,7	6,8	7,8	+12,8
9	Dynamometry with the right/left brush, daN	20,0/ 16,5	18,7/ 15,5	+0,1/ -0,1	22,2/ 22,5	26,0/ 22,7	+0,17,1/ +0,01

At the morning session, the heart rate (HR) of athletes was measured (Fig.1). By the end of the stage, the dynamics of heart rate reduction was obvious.

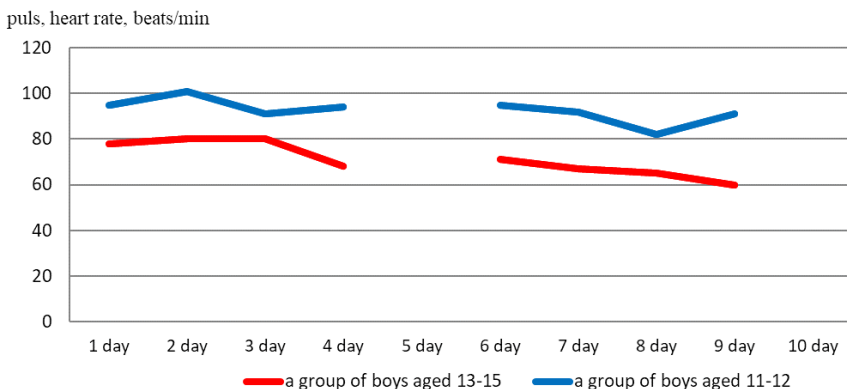


Figure 1. Change in athletes' heart rate

The FSAN method was used as an assessment of subjective feelings of athletes (R. Mattesius, 1972).

THE RESULTS OF THE STUDY. The results of a comprehensive control conducted after the completion of the PE allowed us to identify the degree of influence of training loads on the indicators of kickboxers of different ages. It was revealed that the training effects of the stage allowed to increase the indicators of endurance, speed and strength abilities, psychophysical qualities and functional state of young athletes [4]. The decrease in the indicators characterizing the speed qualities, in our opinion, is associated with the timing of the training effect, depending on the large total volume of loads. Improvement of these indicators in kickboxers was noted after 2 weeks of subsequent training with reduced amounts of training load.

**Conclusions**

1. Stage-by-stage control in sports training allows you to assess the condition of an athlete and give an opportunity to answer the question about the compliance of the training effects used with the condition of the athlete.

2. Large-volume training loads of a general nature (large in volume and increased in intensity), first of all, increase endurance and strength abilities. Increasing the indicators of speed and speed abilities require more time (up to 2 weeks) of recovery and adaptation.
3. The body of boys aged 11-12 years is more sensitive to training load, in comparison with boys aged 13-15 years. The heart rate in the training process is higher in boys 11-12 years old than in boys 13-15 years old. In addition, 11-12-year-olds showed a faster recovery after a training load.
4. The test according to the Schult tables is sensitive to the state of physical and mental fatigue of athletes. The use of this test is advisable to assess the adequacy of training loads to the athlete's fitness level.

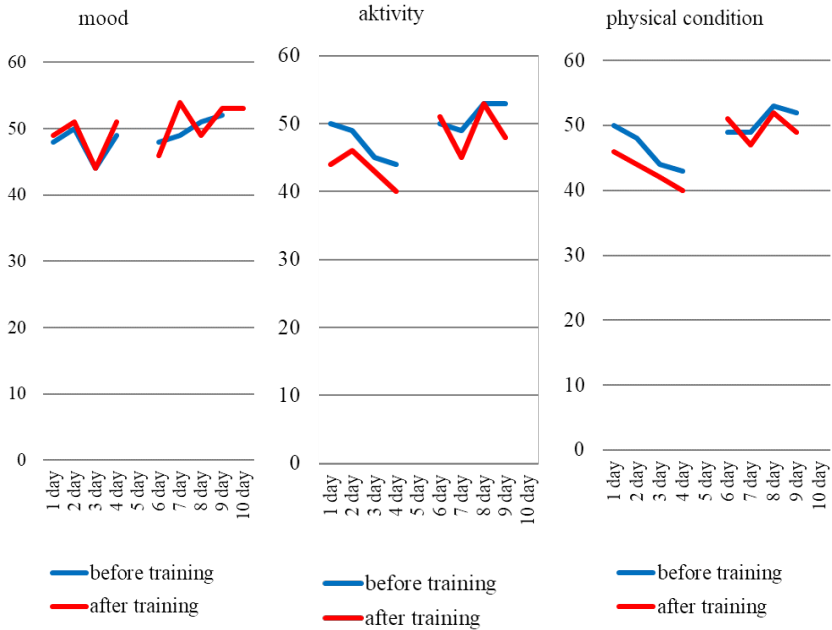


Figure 2. FSAN indicators

5. The test “Gencha Test” allows you to assess the functional state of the cardiovascular and respiratory systems of the body. But, there is not always a positive correlation of the indicators for the “Gencha Test” with the indicators of endurance.
6. The method of assessing subjective feelings is important for monitoring the conditions of athletes. Indicators of ACTIVITY, MOOD and PHYSI-

CAL CONDITION “before” and “after” training allow you to determine the degree of training impact on a particular athlete, and rationally plan further training loads. With large TN, the indicators “A” and “FS” decrease. The indicator “H” depends on the parameters of the load, and on the content of the workout.

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DOI 10.34660/INF.2023.10.92.038

莫斯科人文大学专业区域中文课程体系概述与分析  
**REVIEW AND ANALYSIS OF THE PROFESSIONAL REGIONAL  
SYSTEM OF TEACHING CHINESE AT THE MOSCOW  
UNIVERSITY OF THE HUMANITIES**

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**摘要。**区域国别研究与语言学习关系密切，俄罗斯莫斯科人文大学将语言学习纳入区域国别研究课程框架，并要求学生在学习区域国别研究专业知识与技能的过程中掌握相关区域国别的语言。本文以俄罗斯莫斯科人文大学专业区域语言（中文）课程作为研究对象，对其课程体系的设置、构建和特征进行比较分析，探讨其中存在的问题和发展趋势，并针对问题提出相应的优化方案，从而提升专业人才的培养质量。

**关键词：**莫斯科人文大学，区域国别研究，专业区域中文，专业技能

**Annotation.** *Regional country research is closely related to language learning. Moscow University for the Humanities in Russia incorporates language learning into the framework of regional country research curriculum and requires students to master relevant regional and national languages in the process of learning regional country research expertise and skills. This paper takes the professional regional language (Chinese) course of Moscow University for the Humanities in Russia as the research object, and compares and analyzes the setting, construction, and characteristics of its curriculum system, discusses the existing problems and development trends, and proposes corresponding optimization plans for the problems, so as to improve the quality of professional training.*

**Keywords:** *Moscow University for the Humanities, Regional Country Studies, Professional regional Chinese, Professional skills*

随着俄罗斯与亚洲国家之间经济和政治关系的日益发展，培养精通亚洲语言和广泛能力的合格专家显得尤为重要。这些专家能够将他们的语言知识和当代欧亚口语应用于不同阶层之间的经济、政治和社会文化交流，为促进各国之间的合作与理解做出积极贡献。

在欧亚大陆，俄罗斯所面临的挑战促使我们积极开发新的概念方法，以培养更优秀的学士和硕士生。为此，我们需要进一步加强跨学科联系，不断更新课程内

容,探索新的教学形式,以便给予学生更多独立工作的机会。作为亚洲研究专业的学生,他们必须深入了解各个国家的情况,掌握先进的研究方法及当代区域研究相关概念和范畴,提高自身的学术素养和研究能力。这样他们才能够应对多样化的挑战,成为在俄罗斯与亚洲之间搭建桥梁的重要人才,为两个地区的合作搭建坚实的基础。

近年来,“区域国别研究”领域的高等教育课程在俄罗斯一些顶尖大学中越来越受追捧,其中包括莫斯科国立大学、高等经济学院、莫斯科国立国际关系大学、俄罗斯总统国民经济与公共行政学院及俄罗斯人民友谊大学等。

莫斯科国立国际关系大学的区域国别研究学科是一门具有广泛理论和方法框架的跨学科领域,注重实践导向。该学科拥有独特的教科书,它详尽描述了区域国别化的规律以及全球区域和区域子系统发展的多个方面,洞察了世界区域变化的趋势。莫斯科国立国际关系大学以价值论的方法论为基础,表明“教育是一种公共的、社会的和个人的价值”。

俄罗斯人民友谊大学是俄罗斯历史最悠久的国际学生大学之一。该大学的人文与社会科学院提供区域国别研究硕士学位,其中包括几个领域的专业研究,如中东、中国、俄罗斯及周边地区以及法语国家。

高等经济学院也推出俄罗斯区域国别研究双学位项目:“亚洲经济与政治”。通过此项目,学生们可以获得韩国庆熙大学和高等经济学院两所知名学府颁发的学士学位,同时还可获得(中国/韩国/日本研究)的学士学位,这为他们的未来职业发展提供了广阔的机遇。

受不同地缘政治、经济、民族文化、民族地理和历史因素的影响,当代欧亚交往空间具有复杂的多层次结构。了解区域的传播实践和策略的主要规则和特殊性是区域国别研究专家必备的重要专业能力。

在中俄两国建立了新时代中俄战略协作伙伴关系的背景下,越来越多的俄罗斯大学生选择将中文作为他们的第二外语学习。他们希望通过学习中文以便更好地了解中国国情。对于大部分学习者来说,学习中文是实现个人目标和开阔视野的重要机会。因此区域国别研究(中国研究方向)备受学习者的青睐。

区域国别研究是一门涉及地理、人文、政治、经济、社会、文化等领域的交叉学科。聚焦国际区域,主要以区域整体为分析对象,综合分析构成国际区域的要素、要素关系和运行机制。在进行区域国别研究时,应奉行语言先行的策略,因为语言关乃是国别与区域研究的首要挑战。确立良好的语言基础对区域国别研究成果的信度和效度至关重要。语言是区域国别研究的重要工具,在进行区域国别研究时,必须全方位发挥语言的作用,尤其是目标国家语言的作用。同时也要加强语言研究,避免同质化倾向。区域国别研究主要依托于外国语言文学、政治学和历史学等学科,这些学科为区域国别研究提供了坚实的研究基础。通过语言学习与历史、地理、自然、气候、政治和社会现象以及文化身份等语言世界观中所代表的概念之间的有效互动,能够更好地理解所研究的语言和区域社区。俄罗斯亚洲学者常常强调研究亚洲国家:“没有亚洲文本与亚洲研究无关”,“亚洲研究是一个复杂的领域,或者更准确地说,是研究亚洲国家的不同领域的综合体”。一般来说,从事区域国别研究的人才应该具备语言、专业和实践三方面的能力。其中精通目标国家的语言是从事区域国别研究的必备条件,多学科的专业知识储备是基础,而实践则

是能力的保障。

通过深入学习专业区域语言，学习者得以对具体的国际地区展开研究，深刻掌握地区要素，从而为研究该区域的具体领域提供更大的优势。正因如此，专业区域语言已成为当今不可或缺的专业学科。

### 一，课程基本情况

在区域国别研究方向，要求学生深入系统地了解中文、文化、社会、历史等领域的知识和研究方法，紧跟学科前沿的最新研究动态。该专业方向关注中国地区文化领域的发展变化、中俄人文交流、中国地区大众传媒生态以及涉华舆情等内容。在教学和研究过程中注重培养学生的文献阅读与综合分析能力，让他们能够从语言学、传播学、社会学等跨学科视角对文化现象进行深入分析和探讨。

莫斯科人文大学学习者可以根据自身兴趣选择将区域国别研究作为自己的研究方向。在获得专业技能的过程中，学习者必须掌握相关专业区域语言（即中文）。区域国别研究与专业区域语言有着密切的关系，学习者在区域国别研究的专业框架内学习专业区域语言（即中文）。

专业区域中文是一门必修综合课，适合初级学习者。它包含了最基本和最主要的中文知识。这门课程和其他的中文课程紧密联系，如中文视听说、中国国情、商务汉语、商务汉语写作以及中文报刊阅读等。这些课程极大地提升了学习者的学习效果，加深了对中国的了解，使他们生动地感受当代中国人的真实生活、工作状况和精神风貌。课程内容大多围绕实用性课文与日常生活相关的话题展开，有效地提高了学习者的语言水平。

大学教师更加注重汉语理论的教学，致力于让学生系统地掌握词法、语法、句法等方面，从而深入了解汉语乃至中国的文化。通过逐步培养学生的语言语法习惯实现汉语教学目的。

### 二，课程教学方案

专业区域语言以具体教学方法培养学习者的专业技能。该教学方案由理论与实践两方面组成，其核心在于将理论和实践相结合。

“以学生为中心，教师为主导”这一原则是针对教与学的关系所提出的：结合书本教学与多媒体手段运用。以时间表示法为例，大学课堂教学会为学生提供半个小时的时间进行问答互动和翻译。事实上，语言交际能力可以通过课堂教学有效培养。

在初级和中级阶段的汉语教学中，词汇学习是一个重要的组成部分，然而学习者常常面临词汇学习的困难。为了解决这一问题，教师需要还原词汇的真实意义，用直观释义的教学方法为学习者留下坚实的词汇基础和深刻的词汇印象。随着网络媒体技术的快速发展，多媒体技术，视频资料，图文资料等都能被引入到课堂教学中。通过形象生动的表现方式将汉语词汇有效转化为学习者现实生活中的客观事物，让学生对这种词汇教学方法产生兴趣。在一些抽象的词汇或其他词性的词汇教学中，教师可以通过还原语境来加深学习者对词汇的理解，并通过逻辑思维将已学过的词汇进行分类整理和合理关联，如同义词，近义词，褒义词，贬义词等，逐步形成以常用词汇为核心的词汇集合，更好地拓展学习者对词汇的掌握数量和质量。

随着词汇量的不断增加，学习者越来越感受到词汇的记忆成为学习汉语的最



大障碍。这种情况可能导致他们对学习汉语产生厌烦情绪。为了激发学习者的兴趣和动力,教师在教学过程中可以促进学习者的词汇习得,并培养他们的学习技能。

学习者必须掌握中文,以应对日常生活和专业交际的需求。重点是掌握表达工具和检验手段,例如掌握研究过程、研究基本方法、构建分析模型、文献检索或索引分类、学术阅读、实用知识等。学习者都必须经历从不懂到懂的艰难过程,并克服许多学习汉语的难题。然而,随着课程难度的增加,学习者会对学习汉语产生厌学情绪,这种心态会成为学汉语的障碍,导致学生失去兴趣并自暴自弃。因此,实践证明,兴趣在学习过程中起着至关重要的作用,它是最好的学习动力,能够帮助学习者更好地开拓视野。在保持学习者的兴趣和动力方面,选择适合的教学路径至关重要,它强调了教学方法的重要性。通过兴趣和动力,教学方法应该适用于每一个学习者,同时要根据学习者的特点,创造性地使用教学方法,塑造个性和独特的教学策略。这样可以将课堂内容以生动形象的方式呈现,有效地转化为学习者现实生活中的客观事物,帮助学习者实现知识的更新和个性的发展,从而排除所存在的交流障碍并克服交际中的困难,大大提升教学效果。

在很大程度上,学习过程对学习者具有深远的教育意义。综合教学法能够帮助教师在教育过程中实现教学目标。并为学习者设定目标,以便其能够熟练地运用中文进行文化交流和业务沟通。

在中高级汉语教学中,词汇所蕴含的文化含义是学习者不可忽视的重要组成部分,也是帮助学习者更有效掌握词汇意义的关键方法。文化教学法是跨文化交际语境中被放大的一个有效教学途径,它强调了文化教学对语言教学的重要意义。通过对词汇中的文化解读、文化惯用语词汇的学习、以及学习文化资料中的词汇等方式,实现语言词汇和文化认知的同步提升。通过提升跨文化交际能力,进一步提高词汇教学的效果。在汉语词汇教学中,教师可以借助互联网技术、多媒体技术、信息技术等先进手段,促进学习者在词汇交际应用中的训练和实践。词汇的学习在不同的语言和文化主体之间搭建成了一个相互理解和交流的桥梁。

为实现设定的教学目标,进而提出以下几个任务:

一、以汉语为媒介进行文化交流,深入了解中国文化。学习者需达到HSK4级及以上的汉语水平。

二、在职业和社会导向的交叉下,把沟通视为对本科毕业生的要求。

三、以文化知识为基础,培养学习者的专业技能。把学习中文资料作为分析与比较实际国别情况的基础,使用中文进行交际。

四、关注学生个体差异,通过使用中文提高其认知和研究能力。

五、鼓励学生在学习过程中积极自学,培养学习者对中文的浓厚兴趣。

六、强调提高学习者独立思考的能力,培养其分析中文资料的技巧。

七、强调学习者所掌握的技能对解决实际问题具有实用价值。

八、强调思想道德教育对人才培养的重要性。

如完成以上任务,实现设定的目标必定会取得正面效果。

在学习的过程中,学习者渴望提升自己在跨文化交际方面的能力以及展现自己的专长。为此,必须先掌握基本技能,明确自己的职业发展方向。同时,积极参与实习和实践活动以便将所学专业与未来职业需求紧密结合,为学习者在未来职业生涯中运用专业技能从事某项具体工作提供有力支持。此外,这样的实习和实践



经历也将帮助学习者全面了解中国的政策、社会科学和民俗文化。

### 三、课程教学内容

专业区域语言(中文)课程包括以下三个教学大纲:普通用途汉语、学术汉语、专业技能用途汉语。

普通用途汉语教学大纲着重于提升初中级学习者的中文水平,帮助他们在日常生活中更加熟练地进行交际。通过学习中文日常对话,学生们能够有效地提高自己的语言水平,同时还能解决日常生活中可能遇到的中文知识不足问题。这样的学习过程大大增强了学习者的中文交流的能力,从而帮助他们更好地融入中文社交环境。

这段学习的时间,将专注于汉语拼音的学习,同时也会涉及一些简单的日常生活会话和课堂用语。每堂课都包含精心编写的短文和对话,通过阅读短文,掌握一些基本的汉语语法知识。会话部分主要帮助学习者掌握一些常见的会话模式和语言表达功能。除了词汇表之外,课堂上的词汇学习还包括词组的读写。此外每课课文的讨论、介绍和练习环节都会引入常用事物,并配有图片,以增强趣味性和进行发音练习。学习者可以边听边学,更好地吸收所学知识。掌握汉语拼音的基础后,阅读课程的重要性逐渐凸显,精读和泛读的作用也愈发重要。对学习者来说,发音是学习汉语的难点,特别是声调。为了加强发音训练,达到准确发音的目的,学习短文和会话的汉字上全都注了汉语拼音。学习者阅读课文的次数越多,记忆效果也会越好,这将为他们学习中文带来益处。通过结合背诵词汇和提前用手写的汉字,同时注意学生语素、音节、声调和汉字形式的细节,激发学生的学习兴趣。这样一来,通过短文和对话中的汉字拼音,学习者将获得良好的技能培养,包括认读和书写汉字,从而提高语言修养。而对于汉语语法的练习,本教材主要通过句型来掌握。这样,学习者在初学汉语时就能初步掌握汉语基本句型,清晰地发音。随着学习的深入将进一步巩固、扩大并深化语法句型和词汇应用,加深对汉语的理解。

学术汉语的目标在于培养学习者运用汉语进行专业学习和学术活动的能力。这一课程大纲使学习者受益匪浅,并努力引导他们掌握的知识应用于学术研究。这些活动不仅有助于学习者提升的学术研究水平,而且在拓展他们的思维方式和视野上起到了重要的积极作用。

学术汉语的课程是从提高学生从事学术交流汉语能力的角度出发,在对汉语教材和相关学术资料进行深入研究的基础上,经过细致、周密的考虑而制定的。汉语课程紧密围绕专业设置,选用的文章都是某一专业领域的文章,其是否具有代表性是入选教材的重要标准。学术级汉语强调课程的专业导向性,每门课程都有明确的专业要求和范围,根据专业选择学习汉语的内容,专业处于教学的核心位置,语言则是与专业培训相配合。专业培训通过汉语教学实现,学生通过学习汉语加深对专业知识的了解。四年级的学生选修学术汉语课程,即意味着他在某一专业方面接受了相对严格,系统的专业汉语培训,初步接触了该领域内著名学者、有代表性的学术论文和有影响力的学术观点。同时借此了解了该领域常用汉语词汇、某些专门术语和常见概念,初步具备了在这一专业领域与中国人进行一般学术交流的能力。

专业技能用途汉语是指用于某种专业领域,特定范围和固定场合汉语。它包括与学科密切相关的专业汉语,如文史哲专业汉语,跨文化语言生活,报刊中文阅

读, 语言交际密切相关的业务汉语, 以及具有广泛需求的商务汉语, 经贸汉语等。随着中国作为世界经济大国崛起, 专业技能用途汉语课程的需求日益突显。学习者需要具备多种技能, 其中深厚的专业基础知识至关重要。因此, 教学的根本目标是让学习者掌握好汉语这一交际工具, 以满足他们在专业领域中的需求。

经过一段时间的学习, 四年级的学习者已经达到一定水平, 他们希望进一步了解中国的历史文化和社会发展情况, 并以中文为主介绍中国社会和历史文化, 这样的学习具有重要的价值。基于上述经验和成果, 简要介绍中国历史文化和社会发展概况变得非常重要。特别是为了帮助学习者更好地阅读和理解中国, 便于在相关的教学中应用所学知识, 特别有助于提高学习者在跨文化沟通中用汉语陈述和讨论中国社会和历史文化话题的能力。业技能用途汉语大纲的内容涵盖了对学习者来说既重要而有趣的主题。比如中国社会发展的特点、中国历史文化的特质、中国传统思想的传承和革新、中国人生活的变化等等。在围绕这些主题展开叙述时, 学习者能够深入领略中国历史文化精神, 观览中国社会发展的整体概况, 并开始对中国社会有所理解。学习者在进入主题和正文之前一定要先掌握内容提要 and 导入进行读前思考。内容提要以简短的句子介绍了内容要点, 帮助学习者明确学习重点。通过背景知识介绍, 引起学习者的学习兴趣。在正文学习之前, 对即将学习的内容进行预热性的思考, 激活相关知识记忆, 为进一步学习做好准备。讲课时使用真实形象的图片, 并配以简单的中文说明, 帮助学习者直观地理解学习内容, 通过串联关键词来练习写作, 使学习者进行复习, 并提高书面表达能力。通过小组活动形式, 鼓励学生在课堂上使用中文进行互助沟通, 共同完成任务型练习。这种学习方式旨在帮助学习者跳出课堂的限制, 融入社会, 让他们能够主动积极地学习, 并进一步了解中国文化, 同时也能够运用所学知识进行专业科目的研究。

随着学习者学习阶段的演进, 每个大纲在不同情况、条件和要求下都能发挥作用。课程教学大纲旨在以教学目标为基础, 为具体的主题提供指导, 指出语言手段强调学习者直接参与话语活动, 并提高其中文学习研究能力。该课程的主要大纲内容包括: 交际活动领域、中文交际演讲的主题和情境、信息材料、国情知识、专业知识、理解和运用中文材料的技能、中文口头和书面交流能力、学习技能等方面。

这些大纲涵盖以下具体题目, 这些题目相互联系、相互依存, 形成了一个完整的本科教学体系, 旨在提高学生的中文交际能力。

第一题: 日常生活交际

第二题: 教育和认知领域的交际

第三题: 社会文化交流领域

第四题: 商务沟通

第五题: 专业传播领域

每个题目都设定了具体的交流话题, 包括沟通情况、中文交际手段、言语活动的类型、沟通礼仪以及中文课文研究。课程考核方式涵盖考试、学生独立完成作业、以及能力形成阶段所需的能力清单, 如试题集和教学资料等。

根据该教育方案, 学习者将获得与相关专业技能相关的知识, 掌握通用性技能, 为未来的职业发展做好准备, 并掌握该学科必需的基本研究技能。

四, 莫斯科人文大学与北京联合大学教育合作

莫斯科人文大学与北京联合大学于2005年开始合作，十八年来两校互派师生百余人次，交流密切，成果丰富。目前，莫斯科人文大学有六名学生在北京联合大学旅游学院攻读旅游管理专业2+2学校项目。此外，两所大学的学生经常举行线上交流研讨会，共同探讨旅游和文化方面的新使命和新课题，以此推动俄中友谊的发展。两国学习者在交流活动中畅所欲言，分享彼此的经历和观点，增进了相互理解，加强了互鉴互学。通过俄中教育合作，培养了一批“中文通”的人才。他们是俄中友好往来的使者，必将在科技合作、教育交流、经贸往来等领域做出重要贡献。值得一提的是，在俄中建立战略伙伴关系的情况下，与俄罗斯高校的交流水平和教育合作规模将进一步扩大和提高。

#### 结束语

通过学习专业区域中文，学习者能对具体的区域进行探索研究，全面了解研究中国的基本国情，深入掌握国家政策、人文和知识、社会科学和民俗文化。这将为学生的学习生涯打下坚实基础，提升其跨文化交流和业务沟通能力，为就业或继续深造奠定基石，协助他们攻读硕士学位。

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2. 莫斯科人文大学专业区域语言(中文)课程教学大纲
3. 莫斯科人文大学区域国别研究(中国研究方向)专业发展大纲

学习实践中的现代教育

**MODERN EDUCATION IN THE PRACTICE OF LEARNING**

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**摘要。**文章作者旨在寻找最有效的教学方法，探讨教育技术在教学过程中的实际问题。对媒体上发表的有关远程教育和传统教育的世界实践的现代出版物进行了分析。新信息和教育技术的引入、教育过程组织的渐进形式和积极的教学方法的使用使得扩展教育实践的方法成为可能。通过回顾国内外媒体提供的材料，我们可以对现代条件下最有效的学生教学机会做出真实的结论。

**关键词：**远程教育、互联网资源、信息技术、数字技术。

**Annotation.** *The authors of the article aim to find the most effective teaching methods, exploring the actual problem of using educational technologies in the process of teaching students. The analysis of modern publications on distance and traditional education in the world practice, presented in the press, is made. The introduction of new information and educational technologies, the use of progressive forms of organization of the educational process and active teaching methods make it possible to expand the methodology of educational practices. A review of the materials presented in the domestic and foreign press allows us to make real conclusions about the most effective opportunities for teaching students in modern conditions.*

**Keywords:** *Distance education, Internet resources, information technology, digital technology.*

**Introduction.** Modern teaching technologies allow to apply various approaches for teaching students. The current situation with the spread of the corona virus and the start of the quarantine mobilized university teachers to create the necessary

and safe conditions for teaching students, as well as usage of Internet resources more actively. This problem is quite relevant for teachers and students of foreign countries and Russia.

Goal: to analyze the experience of teaching higher education students and university teachers of the Northern State Medical University and present the main forms of traditional and distance education technologies, their problems and solutions.

The learning technologies, which are commonly used by modern specialists, are presented by a set of teaching methods and knowledge acquisition. They include also technical and information learning tools to make content and methods interrelated and interdependent. According to M.V. Plaksina, “Since the mid-1950s, a new technological approach to the construction of the educational process has appeared. A new term of “teaching technology” was created in the pedagogical field. It was associated with the use of technical teaching equipment. Along with the expression of “learning technology”, such phrases as “pedagogical technology” and “educational technology” are also used. Moreover, a clear distinction between them has not yet been established.” [9, p.10].

Teaching technologies are quite relevant in connection with the current conditions. The pandemic has had a strong impact on higher education, universities have switched to distance learning, and, as a result, the use of distance learning technologies has been developed. In Russia, teaching platforms have been created for distance learning and the digital educational environment as a part of the national project “Education”, on which the information and communicative competences of students are formed. Social networks allow to bring together a huge number of people from different countries and different parts of the world. The implementation of new information and educational technologies, the use of progressive forms of organization of the educational process and active teaching methods are now considered as the criteria for education in the 21st century.

New computer tools in education are reflected in the works of local and foreign researchers. In William G. Bowen’s “Higher Education in the Digital Age”, many important criteria for digital education were identified: a need for reliable platforms, a new way of thinking and fresh ideas [1, p.36]. An analysis of the current situation has shown that the availability of effective online platforms and their accessibility is one of the important aspects of online learning.

The volume and dynamics of the online education market indicate that the development of information technology has a large impact on the education system, for which there is a significant demand that keeps growing. As practice shows, many countries are actively introducing new digital educational systems into their work. In Russia, according to various estimates, the volume of the online education market is 17–25%. In 2016, it was valued at 20.7 billion rubles (slightly

more than 1% of the entire Russian education market), by 2021 it was predicted to increase its share to 2.6%, and in absolute terms, the market volume is forecast to grow to 53.3 billion rubles [6, p. 412]. In this regard, work with foreign students is quite relevant for universities.

Chinese experts analyzed the statistics of the country's universities and found that traditional teaching methods have become a problem that needs to be solved in order for China's higher education to remain competitive. They identified student's weak independent work skills due to the pandemic distant education and concluded that maintaining competitiveness in the current situation makes a combination of online and offline learning the norm [9, p.202].

The problems of adjusting learning to new conditions are shown in the publications of many specialists. "A big problem is the inability of teachers to adapt the ordinary education to the future, which is already there, especially with drastic climate changes and pandemics." University professors who work on online courses, according to Giancarlo De Agostini, have been found to face a significant "dilemma" of transferring and extrapolating different curricula, programs, teaching ideas, messages, collaborative activities and concepts from face-to-face learning.

In Cuba, distance education is part of the educational strategy. In an online environment, the question of education becomes more complex as learning and knowledge generation are carried out in different ways due to a variety in level of training of students, the conditions of classes, the availability of computers. As online professors build relationships between students and engage in non-traditional but authentic learning, according to Maylen Dumenigo Rodriguez and her colleagues, they must take a high responsibility for learning outcomes and stimulate the process. Studies have shown the following results of distance learning: reading comprehension is 38.7%, vocabulary acquisition is 50.3%, and reading motivation is 8.2%. [7, p.2].

One of the factors influencing the successful solution to this problem is the ability and readiness of teachers to work in a crisis. This concerns the methods and techniques of teaching, the manner of communication, explanation, features of the applied design technologies. To work successfully, advanced training courses were needed. This was necessary to solve a number of problems: search and selection of Internet resources for educational purposes; evaluation of the selected information; the use of information and reference materials and Web technologies in the learning process; online tests and Internet services to monitor the progress of students. The creation of online training programs was meant to solve professional problems in accordance with the profile orientation of the university. The use of information and communication technologies in the educational process of foreign students led to the development of new areas and forms of education [2, p.86].



A necessary condition for distance learning is access to the Internet, with which there were difficulties in some regions, primarily due to a lack of reliable internet connection and access to digital devices. The experience of teachers at the Northern State Medical University has shown that the quality of the equipment that hosts information resources and the amount of transmitted information are the weakest parts in the online learning at the present time. In accordance with the concept of the Federal Program, the Northern State Medical University began to actively implement information and communication technologies (ICT) into the practice of working with Russian and foreign students on the main platforms, when a large number of foreign students left Russia and stayed at home [3, p.5].

Analysis of the content of the questionnaires of teachers revealed the following position: the organization of remote and independent work of students causes great difficulties. In addition, attention should be paid to the peculiarities of student's adaptation to new working conditions, to the formation of motivation. With the help of information technology, students solve various problems: intellectual development, self-expression, interpersonal communication, satisfaction of emotional needs. Teachers should introduce various information resources into their practice, develop distance courses and create an effective learning environment. At the same time, it should be remembered that most students have extensive experience in using digital technologies, however, with wide access to gadgets, they experience difficulties in using digital technologies in an educational context, since they often do not have high-quality equipment and high-quality Internet. Empirical research shows that the emphasis should be on discursive learning, a culture of using social media that creates and provides opportunities for success and facilitates effective learning in the digital era.

The development of distant education, the formation of ICT competencies of students requires the solution of several tasks. Significant difficulties are presented by the need to adapt students to the conditions of organizing the educational process. Working in a pandemic has shown that many students are not ready for distance learning. Some of them don't have a sufficient level of basic training, motivation, individual learning ability, some of them don't have a comfortable place to study at home, don't have a fast Internet connection, don't have stationary computers or laptops, some can communicate with the teacher only by phone. Students from India and Thailand struggled to adapt to learning for new and unusual conditions for them. For communication, it is especially important to pay attention to linguistic information and knowledge of the cultural background, understanding the laws of communication at the cognitive level of consciousness. Building a communicative dialogue based on interest and respect for the established norms of language and speech culture will help ensure a high level of knowledge and enable representatives of different nationalities to successfully adapt to the environ-

ment, adequately respond to changes taking place in the world. The formation of standard rules of conduct has a deep socio-cultural meaning. These rules take into account not individual, but general, historically established, cultural trends, their ignorance violates traditional norms and forms of communication. [4, p. 84]. In a difficult situation, the university managed to solve the problems of technological equipment and training of teachers for online learning.

The productivity of teachers is determined by many factors. Nigerian researchers conducted a survey of school teachers with 643 respondents from three senatorial districts in Oyo State. The results showed that the level of teacher productivity has always been high, however, in order to improve the efficiency and quality of work, particular attention should be paid to active learning in digital technologies and the implementation of digital leadership [10, p.3].

Teachers emphasize that the organization of remote and independent work of students causes great difficulties. In addition, attention should be paid to the peculiarities of student's adaptation to new working conditions, to the formation of motivation. By using information technology, students solve various problems: intellectual development, self-expression, interpersonal communication, satisfaction of emotive needs. [4, p. 83]. Teachers should implement various information resources into their work practice, develop distance courses and create an effective learning environment. At the same time, it should be remembered that most students have extensive experience in the use of digital technologies, however, with wide access to gadgets, they experience difficulties in using digital technologies in an educational context, as they often do not have high-quality equipment and high-quality Internet connection. Empirical research shows that there should be an emphasis on discursive learning, a culture of using social networks that create and provide opportunities for successful work and promote effective learning in the digital age. The education system should contribute to the desire of students for professional activities, sustainable professional interest. Young people are very actively using gadgets and Internet. Mastering the digital space of communication should be interesting and exciting for them.

The productivity of teachers is determined by many factors. Nigerian researchers conducted a survey of school teachers with 643 respondents from three senatorial districts in Oyo State. The results showed that the level of teacher productivity has always been high, however, in order to improve the efficiency and quality of work, particular attention should be paid to active learning with digital technologies and the implementation of digital leadership [11, p.3].

Digital forms of work help to rethink the basic principles of the organization of education. They allow to establish more trusting relationships for cooperation, find creative solutions to a number of problems. The teachers should be encouraged to master the new forms of work, while actively helping them and stimulating the



desire to learn and try new tools, based on the fact that the colleagues actively cooperate between themselves. In «Questionable Assumptions About ‘Moving Online’ in Response to COVID19 and Some Practical Advice», colleagues from the University of Edinburgh offered valuable practical advice on online learning:

Think about what you are trying to achieve, what tools and resources are available, and how you can get students to engage with them as simply as possible.

At the same time, try to keep things simple. Where possible, use the tools that are already familiar to you and students.

Go low-tech where possible and allow alternative ways of working when not connected.

Do not assume all students will have stable connectivity, access to good quality or large screen devices, or even a quiet environment for study.

It’s possible to produce short workbooks that support the completion of an assignment and can be downloaded and printed [10, p. 83].

Massachusetts Institute of Technology has developed specialized online courses in various disciplines (medicine, geography, mathematics, chemistry, information technology), including English, with a large collection of videos, interactive tasks, forums, chats for discussion, and implemented distance learning in all disciplines depending on the native language of foreign students.

Teachers provide methodological support to each other in the use of digital technologies, post current training courses on various platforms for free, use electronic presentations that allow to reveal the essence of the studied topics more clearly through diagrams, graphs, drawings and multimedia models, post video lectures on the Internet that will be in demand for individual work.

According to Euronews, students are affected by a lack of face-to-face interaction, and lecturers find it difficult to teach without feedback from students. As a result, the higher education system is experiencing serious difficulties. The participants feel demoralized [8].

The survey results show that students are particularly affected by loneliness and stress. Students believe that online learning is not the only part of the problem. Mostly depressing is the lack of communication, especially since bars, restaurants and clubs have been closed. They can’t even play sports together. According to students, life becomes boring, they are not motivated to follow the curriculum. The classroom lectures feel more productive. The lecturers read more enthusiastically when there are real people in front of them.

The results of the work carried out at the Northern State Medical University confirm the general trends identified in the publications of specialists, based on answers to an online survey. It was made at the Northern State Medical University and performed among teachers and foreign students. Two hundred respondents were interviewed. The following results were obtained. 84% indicated problems

with the Internet, 75% of students noted that they were stressed because of the new conditions of study at the university. 93% of students admitted that they feel uncomfortable with online learning, noting that the quality of education is significantly improved when combining classroom and online classes. 39% noted the inability to study by phone. Students miss teachers and familiar learning environments, face-to-face classes with real teachers and fellow students. 67% pointed to the restriction of communication. One of the most important components of university life, in their opinion, are social activities. It should be concluded that digital and interactive activities should be introduced into the educational process, but should not replace traditional forms of education. At the same time, it was found that not only students suffer.

The survey showed that 82% of teachers suffer from overwork, 74% struggle to maintain a healthy lifestyle due to lack of time, 66% indicate an exacerbation of occupational diseases, 86% miss real classes and feel depressed by worsening financial situation.

The most successful universities have formed online communities for students, faculty and administrators, which have contributed by improving the quality of education and reducing the stress of social isolation. European universities have created a specialized fund to support poor students and stimulate the work of teachers.

The results of the work carried out at the Northern State Medical University confirm the general trends identified in the publications of specialists and the opinions of students presented in Internet messages. A survey conducted at the Northern State Medical University among teachers and foreign students (200 respondents were interviewed) revealed the same problems. 84% indicated problems with the Internet, 75% of students noted that they experienced stress due to the new conditions of study at the university. 93% of students admitted that they feel uncomfortable studying online, noting that the quality of education is significantly improved when combining classroom and online classes. 39% noted the inability to study by phone. Students miss teachers and familiar learning environments, face-to-face classes with real teachers and student friends. 67% indicated the restriction of communication. One of the most important components of university life, in their opinion, is meetings and social activity. It should be concluded that digital and interactive mechanics must be implemented into the educational process, but they shouldn't replace traditional forms of education. At the same time, it was found that not only students are affected.

A survey showed that 82% of teachers suffer from exhaustion, 74% struggle to maintain a healthy lifestyle due to lack of time, 66% indicated an exacerbation of occupational diseases, 86% miss real classes and note depression, worsening financial situation [12, p. 8].

The most successful universities have formed online communities for students, teachers, and administrators, which has contributed to improving the quality of education and reducing the stress of social isolation. European universities have created a specialized fund to support poor students and stimulate the work of teachers.

The conclusion. The educational process in modern society has changed significantly. In a short time, university teachers learned how to use modern Internet technologies and moved to a new level of teaching. As a result, it should be concluded that the high-quality distance learning can provide effective search, analysis, processing and transmission of the necessary information using information technology, including the solution of professional problems when combining classroom and online classes. It can be assumed that due to the current situation, quality online courses will attract more attention. In order to compete successfully for national students, and even more for the international students, universities have to constantly improve the quality of their education.

Governments of countries today pay more attention to health care, economic and social policy. Their efforts are aimed at training specialists in the field of medicine and other demanded areas. The international organizations report that they will consolidate efforts to help the field of higher education, without stopping scholarships and grant competitions for scientific research. The most successful universities have created an online community of students, teachers, administrators in order to improve performance, which contributes to changes in quality of education.

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模块化技术和数字化是开发适应性教育过程的最现代、最有效的方式  
**MODULAR TECHNOLOGIES AND DIGITALISATION ARE THE MOST MODERN AND EFFECTIVE WAY TO DEVELOP ADAPTIVE EDUCATIONAL PROCESS**

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**摘要。**本文介绍了基于信息和通信技术、数字化和人工智能的使用的模块化方法在职业培训组织中的优势的研究结果。这项研究的相关性取决于有必要培训所有专业的专家，这些专家是动态和灵活的劳动力市场所需要的，如果不广泛应用适应性培训，这是不可能的。

**关键词：**信息通信技术、适应性教育技术、模块化技术、专业领域模型、培训个性化、教育体系、“劳动能力模块”概念、活动方法。

**Annotation.** *The paper presents the results of research on the advantages of the modular approach in the organisation of vocational training, based on the use of information and communication technologies, digitalisation and the use of artificial intelligence. The relevance of the research is conditioned by the necessity to train specialists of all specialties, who are in demand in the dynamic and flexible labour market, which is impossible without a wide application of adaptive training.*

**Keywords:** *infocommunication technologies, adaptive educational technologies, modular technologies, model of professional field, individualisation of training, education system, concept “Modules of labour competences”, activity approach.*

One of the most important trends in the development of education in the modern world [1] is the orientation on the learner’s personality in order to fully develop his/her abilities and meet his/her educational needs. The opportunity to implement this trend is provided only by the organisation and use of adaptive educational process.

Historical studies indicate that the first attempts to adapt the process of knowledge accumulation, or the process of learning, both to the capabilities of those who were learning and to the needs for this knowledge, were made already in the first century BC [2], as evidenced by the ancient Greek, Jewish and Chinese treatises of that era. The pedagogical foundation of adaptive learning was laid by Jan Amos Comenius [3], in the Middle Ages AD. The great pedagogue of the Middle Ages brilliantly formulated the pedagogical principles of the classroom-lesson system of learning, which are, in fact, the basis of adaptive learning systems [4].

The relevance of the tasks solved in the process of adaptive learning is continuously increasing nowadays. This is due to the fact that informatisation, digitalisation and application of artificial intelligence, actively penetrating into all spheres of human activity, significantly facilitate the implementation of adaptive educational process at all levels of its using, namely:

- pre-school education,
- general secondary education,
- vocational education,
- specialised secondary education,
- as well as higher education.

The creation of a modern system of adaptive learning, at any of these levels, implies the solution of a priority task:

- determine **what, to what, and how to adapt.**

In order to successfully resolve the above, inherently multi-stage task, it is necessary to develop:

- a model of the system,
- and, on its basis, an algorithm that allows implementing adaptive learning [4].

It should be taken into account that the essence of any professional training, traditional or adaptive, is ultimately reduced to:

- to the formation of the necessary amount of educational material - i.e., the creation of the content of vocational training;
- the learner's assimilation of this material, consolidation of the acquired knowledge, and formation of competences necessary for future professional activity.

Speaking in modern info-communicative language, **the task of the created adaptive learning system**, or, more precisely, the system model and the algorithm implementing this model, is reduced to: **the use and optimal interaction of two data sources:**

- training content (**occupational domain model**);

- data on the capabilities and needs of the learner (**learner model**). The needs of the learner, in turn, depend on the specialities demanded by a dynamic and flexible labour market

Based on the above, we can draw an unambiguous conclusion:

- Quality professional learning is **IMPOSSIBLE** without the necessary completeness and quality of learning content, for modern adaptive learning this sounds like - **without a highly effective model of the professional field.**

In order to create a model of a professional field, i.e. to form the content of professional training, it is possible to use two alternative ways: *traditional and activity-based* [4].

In the first case, the formation of learning content is based on the subject-lesson (lecture-seminar) approach. The obtained learning material is a set of subjects or disciplines. However, even a deep and complete assimilation and knowledge of the material of academic disciplines does not always lead the learner to the effective use of this knowledge in practice.

More effective is the activity-based approach based on the modular technology developed by ILO experts in the crisis years of the 1980s and widely known in the world as the concept of “Modules of Labour Competencies” (ILO MLC-concept). The main principles underlying the creation of modern educational systems and the formation of vocational training content under the activity-based approach are the following principles [4]:

- responsiveness and flexibility;
- continuity and openness;
- democratisation;
- accessibility;
- modularity;
- efficiency and quality;
- standardisation;
- individualisation of the learning process;
- result-orientation;
- activation;
- pluralisation, etc.

This approach, also called *functional* approach, is based on the predictive analysis of the future specialist’s activity. The analysis is carried out by a group of experts in order to identify all labour functions within this activity; identification of objects and means of labour. According to the results of the analysis, an exhaustive description of the specialist’s activity is drawn up, with a list of all tasks to be solved by the future specialist. Based on the consideration of these tasks, the content, structure and sequence of material study are determined.

The use of educational and methodological materials developed in this way allows the individualisation of training, implementation of flexible training programmes or educational standards. All this contributes to increasing the motivation of the learning and cognitive process of students. As a consequence, the quality of education is increased and cost is reduced.

Implementation of individualisation of training is possible in two variants:

- by regulating the rate of learning of educational material for individual students, with the same amount of material for all;
- by choosing the amount of learning material by the students themselves, in accordance with their wishes and capabilities, to study in a given period of time.

All the above mentioned here promotes self-learning and thus increases the responsibility of the learner for the results of his/her work. The role of the teacher changes significantly - the main functions of the teacher become management and control of the cognitive activity of students. The teacher does not become the only source of learning information, but rather a counsellor; and his/her qualifications have less influence on the results of learning. As a result, learning time can be significantly reduced without affecting the completeness and depth of learning.

In the educational system implemented in this way, the learner can use the capabilities of modern information and communication technologies (ICT) independently (or under the guidance of a teacher) to work with an individual package of educational and methodological support, which should contain [4]:

- target programme of actions;
- a bank of educational information;
- methodological guidance for achieving the set learning objectives;
- means of control or self-control over the quality of training;
- ways to adjust the level of training.

Let us consider in detail the main provisions of the ILO MLC-concept [5]. As already mentioned, the basis for the development of the programme and the formation of the content of professional training is the description and analysis of the specialist's activity. Such description is obtained on the basis of using:

- professional standards (existing);
- qualification characteristics;
- employers' production tasks;
- job descriptions for professions;
- as well as taking into account the professional knowledge and experience of the developers of these materials themselves.

The description of a specialist's activity obtained in this way is divided into separate logically completed parts - the so-called modular units (MU) [5].



***MU - is a logically completed and acceptable part of work within a work assignment, profession or field of activity with a clearly defined beginning and end, which is usually not further subdivided into smaller parts.***

MUs grouped for a specific type of work form the so-called *module of labour competences* (MLC).

***The MLC represents a job description expressed in the form of MUs (the MLC describes in the form of MUs the work performed within a specific production task).***

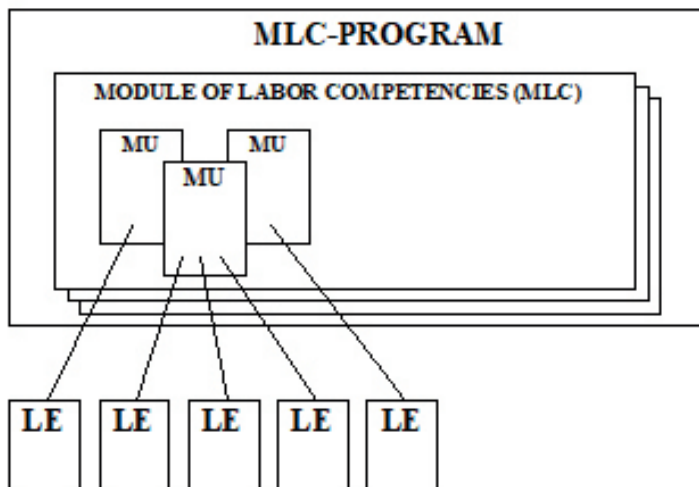
The work within each mu must be broken down into smaller, clearly defined steps (*operations*) that must be performed in a certain logical sequence. In order for a learner to be able to perform these operations, he/she needs to acquire certain knowledge, skills, abilities and competences (psychomotor, intellectual and emotional).

Analysing the steps of work in each MU, as well as the skills and competences required to perform them, allows determining the necessary and sufficient amount and content of learning material to prepare the learner to perform step-by-step work within the entire MLC.

The training material is subdivided and structured in the form of individual learning elements (LE). Each of the LE is dedicated to the formation of a specific type of knowledge, skills or competencies in the learner.

***LE is an independent learning booklet (learning element in electronic format) designed for learning, oriented to both independent work of the learner and work under the guidance of a teacher. Each LE is designed for certain practical competences or theoretical knowledge, i.e. it contains the whole volume of learning material necessary for the learner to form these competences or acquire these theoretical knowledge.***

The logical interrelation of MLC, MU and LE within the framework of MLC programmes is shown in Figure 1.



*Figure 1. Schematic structure of MLC programmes*

The prepared LE bases are the content of vocational training and are the main source of learning information for students. Such databases can be created both for a particular profession and for an entire professional area. The accessibility of the professional learning content (*model of the professional field*) formed in this way is ensured thanks to the possibilities of ICT and, especially, the use of cloud technologies.

The above review of the main provisions of the ILO's MLC concept, the results of the pilot implementation of MLC programmes created within the framework of the ILO project "Development of the modular system of education in the Republic of Belarus" [5], as well as long-term experience accumulated by Belarusian, Russian and Ukrainian colleagues, convincingly confirm the possibilities of achieving higher efficiency of the adaptive educational process on the basis of using the model of professional field, formed with the use of the modular activity approach, as compared to the traditional approach.

Modern highly effective adaptive learning systems can be created only on the basis of the modular approach and the wide application of information and communication technologies, digitalisation and artificial intelligence. Therefore, adaptive learning is very labour-intensive and expensive, but it pays off in terms of high efficiency and shorter learning times.

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未来教师专业培训中义务论能力的资源潜力  
**RESOURCE POTENTIAL OF DEONTOLOGICAL COMPETENCE  
IN THE PROFESSIONAL TRAINING OF A FUTURE TEACHER**

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抽象的。如今，由于现代社会的趋势，雇主对教育系统的专家提出了很高的要求，并关注新形成的学生，他们按照数字社会的步伐经历社会发展的各个阶段。在这方面，未来的教师在以专业实践为导向的培训过程中掌握了整个专业能力，其中道义能力占有重要地位，它是现代教师专业和个人形象的一个组成部分，也是一种资源。较高的教育和培养潜力。为了有意识地掌握教师职业并进一步成功地组织教学过程，有必要确定未来教师义务论能力的基本特征，这就是我们“教师义务论能力的形成”这一主题的研究主题。未来的老师”。

关键词：专业培训、教育义务论、义务论能力、未来教师、资源潜力、专业活动、教育义务。

***Abstract.** Today, employers place high demands on the specialists of the education system, due to the trends of modern society and focused on the student of a new formation, who goes through all stages of social development in accordance with the pace of the digital society. In this regard, the future teacher in the process of professional practice-oriented training masters the entire spectrum of professional competence, in which deontological competence occupies a significant place as an integral part of the professional and personal portrait of a modern teacher and a resource with a high educational and upbringing potential. For conscious mastery of the teaching profession and further successful organization of the pedagogical process, it is necessary to determine the essential characteristics of the deontological competence of the future teacher, which is the subject of our study on the topic “Formation of the deontological competence of the future teacher”.*

***Keywords:** professional training, pedagogical deontology, deontological competence, future teacher, resource potential, professional activity, pedagogical duty.*

**Introduction.** The challenges of modern society dictate the requirements for the training of teachers associated with the diversification of the labor market, where the training of mobile, informationally socialized specialists who quickly adapt to the personal characteristics of modern students is at the forefront. Particularly emphasized is the need to form a consciously positive attitude towards professional activity in a modern teacher based on national and universal values, the fulfillment of pedagogical duty in accordance with regulatory documents [1, p.47].

In this regard, the priority of professional training becomes the development of interdisciplinary critical thinking in the student, adapting to the requirements of scientific and technological progress and the internationalization of higher education [4]. At the same time, the issue of forming a consciously positive attitude towards professional activity in a modern teacher based on national and universal values is relevant. In this regard, higher education faces extremely responsible tasks related to the training of teachers of a new formation, which is reflected in the regulatory documents regulating educational activities.

Issues of pedagogical interaction based on duty are dealt with by pedagogical deontology, in the plane of which lies the topic of our dissertation research devoted to the study of the deontological competence of a future teacher. The logic of the study sends us to the analysis of approaches to the concept of «deontological competence of the future teacher». K.M. Levitan turned to the issues of pedagogical deontology in 1994, where he dwelled in detail on the characterization of deontology as a science of proper behavior, emphasizing the importance of the teacher's awareness of the categories of duty in the framework of professional activities. The researcher defines the deontological competence of a lawyer as “an integral characteristic that determines his personal ability and readiness to successfully perform legal activities based on compliance with all norms of professional behavior” [9 p.110]. G.M. Kertaeva pays attention to the following issues in her book “Fundamentals of Pedagogical Deontology”: she characterizes the concept of “deontology”, explains the prerequisites for the emergence of pedagogical deontology, describes the functions, tasks and principles of pedagogical deontology, considers the structure and content of the deontological readiness of future teachers. A.K. Kablanova in the manual «Pedagogical Deontology» (2015) notes the importance of this aspect as a link with other disciplines in the system of training undergraduates. In our opinion, on the one hand, this course offers an independent model for understanding professional activity in all forms of its manifestation, on the other hand, it acts as a “prologue” to those disciplines of the training cycle, where each of the problems will be considered in more depth and detail. The modern researcher E. V. Neumoeva-Kolchedantseva in the textbook for undergraduate and graduate students «Pedagogical Deontology: Modern Interpretation» (2019) deals with the issues of the deontological orientation of the teaching profession.

**Methodology and research methods.** The interdisciplinary approach in our study ensures that the socio-political, ethno-psychological and historical-cultural contexts are taken into account in the study of the category of «deontological competence», and the plurality of ontological ideas about the subject of research will provide a basis for the methodological substantiation of its essence.

in modern pedagogical research, the development of ontological, methodological and axiological foundations for interdisciplinary synthesis within the framework of a holistic pedagogical research are important, relevant and unresolved problems in the field of pedagogy methodology” [6]. The application of the axiological approach for the operationalization of deontological competence will make it possible to assess its value potential, understand its conceptuality and basis in the training of future teachers, their awareness of their unconditional role in shaping the value orientations of students, the transfer by future specialists of norms and rules that are pleasant in society. The main aspects of the activity approach will provide scientific support and social-role activity of future teachers throughout the entire period of study, focusing on the training of the future teacher of an integral wide-profile type, scientific support of the student’s social-role activity. The competence-based approach determines the content and components of the deontological competence of the future teacher, directs the vector of developing a methodology for the formation of the deontological competence of the future teacher. Summarizing the above methodological approaches to the study of the essence of the deontological competence of a future teacher, we note that their functional dependence, correlation and subordination will make it possible to structure the desired concept and fill it with meanings.

The discussion of the results. In the process of working on a scientific topic, we analyzed dissertations, scientific articles, scientific and methodological manuals of the problem field «deontology», where we were convinced of the relevance of the study and, using an interdisciplinary approach for analysis, synthesizing a variety of meanings, identified the most characteristic features of deontological competence reflected in three directions:

I. *Professional and personal qualities*: integrative quality of personality, epistemological abilities that lie in the plane of professional and personal communication based on moral standards in professional activities based on the category of obligation; a system of political, ethical, normative knowledge about the requirements in professional activity, including professional and personal qualities, regulating the behavior of a specialist, based on professional duty.

II. *Knowledge, skills and abilities in the field of professional and ethical knowledge*: a dynamic component of the level of knowledge, skills and abilities in the field of ethics and deontology, which orients the implementation of the norms of professional ethics from the position of professional duty and is realized

in the deontological competence of a specialist; the ability of a specialist to act according to formalized and non-formalized norms in professional activities in a deontologically determined situation; level of knowledge and skills in the field of professional ethics and deontology.

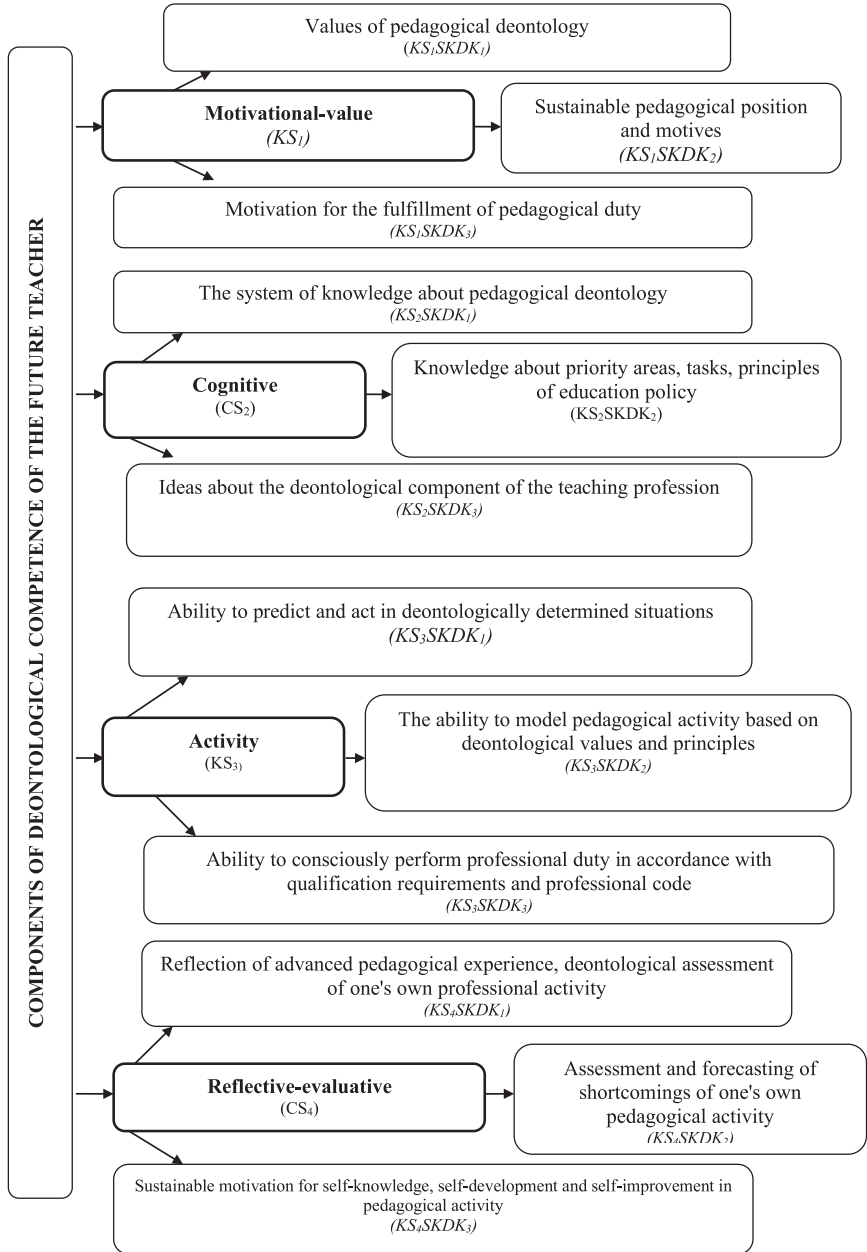
III. *The ability to implement the norms of professional ethics based on humanity*: responsibility for the result of activity, justice in relation to all subjects of professional activity, faith in goodness, a sense of duty to the state, society, family, as a constant; orientation of professional activity to participation in the fate of another person, authority in front of colleagues, responsibility for the result of professional activity in accordance with the system of norms and requirements and professional duty; interaction of professional competence, which consists of regulatory, social, psychological, personal, communicative qualities that will help the teacher navigate in difficult socio-cultural circumstances and act in them based on the category of duty [3].

Summarizing the studied approaches, we note that the deontological competence of a future teacher is a meta-level of professional competence, which consists of regulatory, social, psychological, personal, and communicative qualities that will help a specialist navigate complex sociocultural circumstances and act in them based on categories obligation, where duty is a meaning-bearing and meaning-forming category. Duty determines and dictates the requirements for the teacher from the standpoint of due, where the norms of personal morality strictly coincide with social obligations, based on certain formalized and authoritative requirements, among which one can single out “rules-boundaries” that strictly regulate the behavioral reactions of a specialist in the present and “norms -ideals”, predicting the most successful models of behavior in the future [3, p. 63]. Next, let us dwell on the component composition of deontological competence. Analyzing the structural units of the deontological competence of specialists from various fields, we concluded that the component composition of deontological competence presented in the studies is similar in meaning to the components proposed by scientists in various fields of knowledge, and at the same time has significant differences, both in the name and content of the components. Thus, the motivational component is represented by the motivational-value, motivational-personal component in studies devoted to the deontological competence of medical workers and future education managers. The cognitive component is presented in the description of the structural units of deontological competence of both medical students and teachers by the cognitive activity component, and its meaning is seen as a gnostic ability. I.P. Slyusareva, O.D. Agamova, G.A. Karakhanova and others, operationalizing the category of “deontological competence”, along with the reflexive component, which they single out as a system-forming one, include a creative and semantic component in its composition, combining it with the pres-

ence of professionally important deontological qualities in a future specialist of a professional and moral orientation. S.S. Bykova, defining the essence of the deontological competence of future teachers in the system of vocational education, saturates it with the following components: cognitive, activity, reproductive components.

The analysis of the content side of the concept of “deontological competence” we are studying and its components served as the basis for stating the following: in scientific research there is no single approach to filling the desired concept with structural units. However, we note that the interdisciplinary synthesis of understanding deontological competence based on systemic morphology made it possible to trace the methodological support that is the basis for understanding the essence of deontological competence and further operationalization of the construct of deontological competence of the future teacher we are looking for and present it as a complex of interdependent components: motivational-value (value priorities, including ideals, meanings, guidelines, categories of duty, attitudes that are laid in the course of training, socialization, which are the basis for the future teacher to choose the path of mastering and realizing his professional activity, the values of pedagogical deontology); cognitive (synthesis of knowledge about pedagogical deontology, as a constantly developing component of a professional in the field of pedagogical sciences with a high level of knowledge, skills and abilities in the field of deontological vector); activity (we consider through the category of duty in relation to the state and society, our own professional activity and its subject); reflexive (the ability of the future teacher to manage himself, his behavior in deontologically conditioned pedagogical situations, evaluate his own professional readiness). Figure 1.





### Conclusions.

The material presented in the article gives us the opportunity to conclude that deontological competence is the subject of research in numerous branches of science, and most of them agree on the relevance of its study in the context of professional training. This is due not only to the socio-cultural situation and the humanization of the educational space, but also to the understanding that this aspect is little covered in theory and is not reflected in the regulatory documents regulating the activities of a teacher [2, p. 8].

The theoretical and methodological analysis of the problem field of our study allowed us to determine further directions for studying the phenomenon of deontological competence of the future teacher and delve into the subject of research, to determine the essential characteristics of the deontological competence of the future teacher as a norm of professional activity, approaches to the structural analysis of the components of deontological competence and the patterns of its formation as an important component professional competence; to develop a model for the formation of deontological competence of a future teacher.

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DOI 10.34660/INF.2023.95.17.042

俄中创意教育领域合作的限制因素  
**LIMITING FACTORS OF RUSSIAN-CHINESE COOPERATION IN  
THE FIELD OF CREATIVE EDUCATION**

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抽象的。当前国际形势下，俄中人道主义合作领域的研究日益受到关注，因为需要为政治和经济领域合作的发展奠定理论和方法基础。俄中创意教育领域合作是跨文化人道主义合作的重要组成部分。这项工作的目的是找出俄中创意教育领域合作的制约因素。研究对象是俄中人道主义合作，研究对象是俄中创意教育领域合作的制约因素。确定这些因素是俄罗斯联邦缺乏适当的方法来资助国际创意活动、声誉因素、对跨文化互动可能风险后果的恐惧、缺乏单方面投资的愿望（尤其是中方）、沟通因素、国际形势不稳定。这些因素可分为系统性因素、组织性因素和操作性因素，也可分为创造性导向的俄中教育组织互动中所有参与者所特有的因素和私人因素。

关键词：国际人道主义合作、俄中创意教育领域合作、俄中合作制约因素。

**Abstract.** *In the current international situation, research in the field of humanitarian cooperation between Russia and China is gaining more interest due to the need to prepare theoretical and methodological foundations for the development of cooperation in the political and economic spheres. Russian-Chinese cooperation in the field of creative education is an important part of intercultural humanitarian cooperation. The purpose of this work was to identify the constraining factors of Russian-Chinese cooperation in the field of creative education. The object of the research is Russian-Chinese humanitarian cooperation, the subject is the constraining factors of Russian-Chinese cooperation in the field of creative education. It was determined that such factors are the lack of a proper approach in the Russian Federation to the financing of international creative events, the reputational factor, the fear of the consequences of possible risks of intercultural interaction, the lack of desire for one-sided investment (especially for the Chinese side), the communication factor, and the unstable international situation. These factors can be divided into systemic, organizational*

*and operational ones, into those characteristic of all participants in the Russian-Chinese interaction of educational organizations of a creative orientation and private ones.*

**Keywords:** *international humanitarian cooperation, Russian-Chinese cooperation in the field of creative education, constraining factors of Russian-Chinese cooperation.*

International cooperation can be viewed as a manifestation of intercultural interaction [3]. The concept of «intercultural interaction» was introduced by G. Treiger and E. Hall, who defined it as an ideal goal that a person should strive for in his desire to adapt to the world around him as best and as efficiently as possible [9].

E.I. Sabanenکو defines intercultural interaction as a way of existence of social reality, expressed by a set of heterogeneous, multi-level connections, relationships, processes of functioning of large, open social systems (cultures) that influence each other and characterizes it as an integral element of social life, a way of coexistence of large social structures systemic order, characterized by an intensive exchange of information, values, performance results, etc. [7, pp. 816 - 819].

In this paper, intercultural interaction is considered as interstate, which requires further clarification of the definition. Under the intercultural interaction of states in the humanitarian sphere, we mean an active, organized, manageable, goal- and value-oriented process of mutual influence and interaction of states and their social institutions, aimed at realizing the interests of states and their citizens in the humanitarian sphere, influencing all spheres of life of subjects interactions.

Factors of Russian-Chinese intercultural humanitarian interaction are regulatory, intellectual, financial, material and technical, socio-demographic, moral and ethical, informational and methodological [1, p. 21]. These factors can be considered as refinements (deepening) of the action of political, socio-economic, cultural factors [4, p. 24]. These factors ensure the implementation of the main directions of Russian-Chinese intercultural humanitarian cooperation, enshrined in regulatory documents and at the level of interstate agreements.

Intercultural interaction is built with the help of appropriate tools. J. Lenzowski [8, pp. 82–86] offers the following tools:

- 1) Demonstration of various types of art, including both high and popular culture (paintings, sculptures, architecture, theater, films, music).
- 2) Exhibition activity. (art exhibitions, scientific and technical, commercial, ethnic and others). Differences in scale, levels of organization, topics.
- 3) Exchanges (educational and scientific exchanges, exchanges of artistic groups).

4) Educational programs: opening branches of universities abroad; grant and scholarship support for youth for education.

5) Distribution of books and periodicals to foreign audiences; opening of national libraries abroad.

6) Learning foreign languages: promoting the learning of the national language among foreigners; learning foreign languages [8, C. 82–86].

From the point of view of the theory of socio-cultural activity, the latter acts as a tool for building international relations and includes several areas: cultural exchanges (both products of activity: performances, films, etc., and groups, individual performers, delegations), protection of cultural values, joint activities to create cultural values and conduct scientific research, organization of international festivals, competitions, holidays; export-import activities in relation to works of culture on the basis of international treaties [5, p.260].

The practice of Russian-Chinese intercultural interaction at the federal and regional levels is represented by cultural exchanges, cross years of language and culture [6, p. 43], the most important goal of which, among other things, is the formation of a positive image of one state in the eyes of another.

In the line of educational institutions of culture, the following areas are relevant: getting education abroad, academic exchanges, in which teachers of creative disciplines participate, who give master classes in creative areas of training, students of preparatory departments who will subsequently study in foreign universities, students who realize their educational trajectory under the double degree program, as well as internships in their specialty.

The directions of Russian-Chinese intercultural humanitarian cooperation are: in the field of education and career development - this is education abroad, academic exchanges, internships, joint research, implementation of joint educational programs with the possibility of obtaining double diplomas, joint research centers and universities [1, P. 18].

In the field of culture and art: cultural exchanges, protection of cultural values, joint activities to create cultural values and conduct scientific research, organization of international festivals, competitions, holidays; export-import activities in relation to works of culture on the basis of international agreements. In addition, there is interaction within the framework of the activities of the Russian-Chinese and Chinese-Russian friendship societies, Confucius institutes and schools, cultural centers, cross years, as well as interaction at the level of organizations of various forms. [1, p. 18].

The directions of Russian-Chinese intercultural humanitarian cooperation in the field of creative education are: education abroad, academic exchanges, joint creative activities, implementation of joint educational programs, creative and research centers.

These areas are implemented mainly within the framework of interuniversity cooperation. The process of preparing and implementing projects of Russian-Chinese interuniversity cooperation in the field of creative education is associated with certain difficulties and risks that must be taken into account. Yu.P. Vetrov and S.S. Zengin identifies the following risks of Russian-Chinese integration interaction in education, which can be taken into account in the framework of the implementation of interaction in the training of creative personnel: “loss of cultural identity, commercialization, declining quality of education, neo-colonization, orientation to status and ratings, increase in fake documents, risk economic rationality, reputational risk, the risk of «drain of brains and talents», the risk of social and cultural adaptation of Chinese students, reducing the quality of training of foreign students, increasing inequality» [2].

In accordance with the experience of implementing joint activities of the author, the following constraining factors should be noted. The main difficulty in the preparation and implementation of Russian-Chinese projects is the lack of a proper approach to financing international creative events. The grant approach in financing international humanitarian projects does not fully meet the realities. This is due to the need for financial justification, budgeting.

Creative international events refer to the tools of cultural diplomacy, which refers to the use of culture and its elements to influence foreign politicians, opinion leaders and youth in foreign studies of the impact of culture on international relations is understood as cultural diplomacy, [8, P. 77] and , respectively, their results have delayed and long-term consequences.

Another important feature - international events involve sending their teams or employees abroad or inviting foreign teams, delegations, which include a significant, often the largest expense item - transportation costs. The problem is not only the high cost, but also the change in cost during the period of preparation of documentation, project approval, and so on. The preparation time for an international creative event can take a year or more. Consequently, there is a risk of problems with the regulatory authorities associated with a discrepancy between the project budget and its financing.

Another deterrent is a reputational (stereotypical) factor, namely, Russian educational organizations often, when participating in negotiations with Chinese partners, overestimate the ability of their organizations to implement major events and their social significance, expressed in media coverage, admission of foreign students, availability the proper number of teachers, the provision of social and household resources, etc. Or, for various reasons, organizations underestimate the complexity and high level of responsibility for the implementation of international creative events of this level.

In addition, among the employees of Russian universities there is an incorrect attitude towards the implementation of bilateral agreements between the universities of the two countries, which is expressed in a frivolous attitude towards international treaties.

Having received a negative experience, Chinese educational institutions are wary of interacting with other Russian organizations in the future.

The next important aspect is poor communication, due to the fact that there are few specialists in Russian and Chinese creative universities who speak Chinese and Russian, respectively.

The current constraining factor is the international situation, which leads to an unstable currency situation, financial difficulties, the emergence of fears and uncertainty among project participants.

Thus, the limiting factors of Russian-Chinese cooperation in the field of creative education are the lack of a proper approach to financing international creative events, the reputational factor, the fear of the consequences of possible risks of intercultural interaction, the lack of desire for one-sided investment (for the Chinese side), the communication factor (knowledge of languages, knowledge of modern communication channels), an unstable international environment.

These factors can be divided into systemic, organizational and operational ones, into those characteristic of all participants in the Russian-Chinese interaction of educational organizations of a creative orientation and private ones.

In the context of international pressure on Russia and China, it is important to timely identify the constraining factors for the development of bilateral cooperation in the field of creative education in order to increase the effectiveness of Russian-Chinese humanitarian cooperation.

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DOI 10.34660/INF.2023.25.66.043

丹尼尔·凯斯小说《献给阿尔吉农的鲜花》中主人公查理·戈登的形象  
**THE IMAGE OF THE MAIN CHARACTER CHARLIE GORDON IN  
THE NOVEL BY DANIEL KEYES «FLOWERS FOR ALGERNON»**

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**摘要。**本文关注的主题是对丹尼尔·凯斯的小说《献给阿尔杰农的鲜花》中主人公查理·戈登形象的描述，以及对小说主人公作为语言人格的发展的决定因素的识别。以及其他个人意义的形成。

**关键词：**丹尼尔·凯斯，《献给阿尔吉农的鲜花》，语言个性

**Annotation.** *The subject of attention in this article is the description of the image of the main character Charlie Gordon in the novel «Flowers for Algernon» by Daniel Keyes and the identification of factors that determine the development of the main character of the novel as a linguistic personality and the formation of his personal meanings.*

**Keywords:** *Daniel Keyes, «Flowers for Algernon», language personality*

Daniel Keyes - American prose writer, philologist and professor of fiction at Ohio University, wrote the story «Flowers for Algernon» in 1959 and a year later the author received the Hugo Literary Award for it, and in 1966 reworked the story into a novel of the same name, for which he also received the prestigious Nebula Award.

«Flowers for Algernon» is a touching story of mentally retarded Charlie Gordon, whose intelligence was brought to the level of genius as a result of scientific experiments and surgery, and then also rapidly dropped to its previous state. The main character is 32 years old and, having a severe mental retardation, Charlie attends a special college where he learns to write and read «... at the beekmin collidge center for retarded adults ...» [2, 3]. And he gets a chance to voluntarily participate in the experiment and contribute to science. This artificial enhancement of intellectual abilities through surgery is the original discovery of two scientists: Dr. Strauss and Dr. Nemur.

After a successful operation on a mouse named Algernon, scientists decide to perform a similar operation on a human. The choice falls on Charlie, as he shows

a desire to learn to read, write better and become smarter “I hope they use me because Miss Kinnian saya maybe they can make me smart. I want to be smart” [2, 3]. In our time, this does not seem so unrealistic, and given the latest scientific discoveries in the field of DNA, it even becomes relevant. So, the main character will have to overcome many trials, both physical and emotional, in a short period of time.

In literature, there are two main ways to create an artistic image of a hero: direct, when the reader is informed about certain properties and qualities of a character, and indirect, when the image of a character is revealed through a demonstration in action [1, 41]. In the direct way of characterizing a character, the message can come from the character himself, from other actors, or from the author. So, a direct characterization of a character is a statement of fact. The author or character denotes the qualities of the hero (“stubborn as a donkey”, “golden hands”, “swarty man”, “timid girl”). And the reader in this case must believe in the word. In the indirect way, the reader himself thinks the hero is cowardly or brave, honest or deceitful - the reader is given the opportunity to decide for himself. In the novel, preference is given to the second way of characterizing the protagonist.

It is worth noting that the narration of the novel «Flowers for Algernon» is made in the form of reports about what is happening in life on behalf of Charlie himself, and as frankly as possible, since this is a kind of personal diary. Thus, the reader looks at all events through the eyes of the main character, which in turn greatly affects the perception and helps to create a certain opinion about the main character. Through the records of the hero, we are provided with all the necessary information. Let's start with the fact that the image of the main character Charlie Gordon is presented through his actions and the actions of the people around him.

We can draw some conclusions about his character by analyzing his actions. We see how childishly, as an adult man, he perceives the world around him and how he expresses this in his written speech “Nobody ever tells me about the babys...”; “I don't know what eating got to do with getting smart and Im hungry Prof Nemur took away my choklate cake. That Prof Nemur is a growch” [2, 15]. With an increase in his intellectual abilities, numerous spelling and punctuation errors gradually disappear in the text, vocabulary and style become more complicated.

Charlie is very superstitious and wears various charms with him “I am very strong and I always do good and beside I got my luky rabbits foot and I never breakd a mirrir in my life. I droppd some dishis once but that don't count for bad luk»; “I was very skared even tho I had my rabbits foot in my pockit because when I was a kid I always faled tests in school and I spilled in to...”; «mabey I shodnt of let them operate on my branes like she said if its agenst god. I don't want to make

god angry»; “I think I know why I was having bad luck. Because I lost my rabbits foot and my horseshoe” [2, 17].

Charlie is a simple and frank person, he says everything the way he sees and feels, even when it comes to his weaknesses: “I dint know mice were so smart”; “I toll dr Strauss and perfesser Nemur I cant rite good...”; “He said I had good motorvation. I never even knew I had that»; «It had funny smel like old garbidge» [2, 23]. He does not understand hints and most of the situations are also obscure and inaccessible to him “Then she got something in her eye and she had to run out to the ladys room” [2,32].

As for the mental limitation and inability for sound reasoning of the protagonist, he does not seem so stupid to the reader, and the reader considers his thoughts and actions naive. For example: “Then Joe Carp said I shoud show the girls how I mop out the toilet in the bakery and he got me a mop. I showed them and everyone laffed when I told them that Mr Donner said I was the best janiter and errand boy he ever had because I like my job and do it good and never come late or miss a day except for my operashun. I said Miss Kinnian always told me Charlie be proud of the work you do because you do your job good» [2, 32].

It is worth noting that at every opportunity, Charlie tries to learn something new in order to become at least a little smarter: “The nice lady who give it to me tolld me the name and I askd her how do you spell it so I can put it down rite in my progis report»; « Anyway I hope I get smart soon because I want to lern everything there is in the world like the collidge boys know. All about art and politiks and god” [2, ]. He really wants to be like everyone else: to have many friends, to keep up a conversation on politics and religion, to meet a girl

«Then when I am smart they will talk to me and I can sit with them and listen like Joe Carp and Frank and Gimpy do when they talk and have a discussen about importent things. While their werking they start talking about things like about god or about the truble with all the mony the presedint is spending or about the r-publicans and demicrats. And they get all excited like their gonna have a fite so Mr Donner got to come in and tell them to get back to baking or theyll all get canned union or no union. I want to talk about things like that. If your smart you can have lots of fiends to talk to and you never get lonley by yourself all the time» [2, 39].

Despite all the difficulties in life, Charlie remains a very kind person, able to sympathize with others, whether it be a little mouse, a character from a book he read, or bakery workers who mock him «...Algernon is so smart he has to solve a problem with a lock that changes every time he goes in to eat so he has to lem something new to get his food. That made me sad because if he couldnt lern he woudnt be able to eat and he would be hungry. »; «Only I feel sorry for him because hes all alone and he has no frends. But I think their must be somebody else on the island because theres a picture of him with his funny umbrella looking at

footprints. I hope he gets a friend and not be so lonely. »; « They were gonna tell Mr Donner to fire him. I told them I dint think he should be fired and have to find another job because he had a wife and a kid. And besides he said he was sorry for what he did to me. And I remember how sad I was when I had to get fired from the bakery and go away» [2,51].

Along with the improvement of his intellectual abilities, his attitude and relationship with the people around him changes. Such rapid change is difficult to handle, and he has conflicts, both internal and external. “I don’t feel as if I’m accomplishing anything. I don’t understand about myself or my past» [2, 19]. This is a state of mental discomfort of the protagonist, caused by a clash in his mind of conflicting ideas: values, beliefs, ideas and emotional reactions.»Oh, no! That’s no answer.» I insisted. «Even in the world of make-believe there have to be rules. The parts have to be consistent and belong together. This kind of picture is a lie. Things are forced to fit because the writer or the director or somebody wanted something in that didn’t belong. And it doesn’t feel right.» [2, 43].

In a matter of months, Charlie not only gets rid of inferiority, but also, with the help of the latest programs, becomes a unique owner of a broad outlook and knowledge of “The moral aspects of the military blockade as a weapon in times of peace had been bothering me. I asked him what he thought of the suggestion by some senators that we begin using such tactics as «blacklisting» and reinforcement of the navicert controls that had been used in World Wars I and II, against some of the smaller nations which now oppose us» [2, 97]. The reader unfolds the painful and ultra-fast formation of Man. Kindness is replaced by cynicism, naivety by critical thinking, and happiness is on the grief of the protagonist. Charlie remembers and comprehends his past, he is hurt, ashamed and lonely. He has a regression, which has replaced the rapid path of knowledge, but he is happy, because he has known true love and made friends.

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DOI 10.34660/INF.2023.11.73.044

交际法是外语教学方法的主导趋势

## COMMUNICATIVE APPROACH AS A LEADING TREND IN THE METHODOLOGY OF TEACHING FOREIGN LANGUAGES

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**摘要。**本文讨论了一种基于信息、建模和反思的沟通方法。学习过程本身就是对沟通过程的模拟，其主要参数与真实的沟通过程相似。

**关键词：**交际方法、交际能力、语言能力、外语教育、言语思维活动。

**Annotation.** *This article discusses a communicative approach based on work with information, modeling, reflection. The learning process itself is a simulation of the communication process, which is similar in its main parameters to the real communication process.*

**Keywords:** *communicative approach, communicative competence, language competence, foreign language education, speech-thinking activity.*

A large explanatory dictionary defines an approach as “a set of techniques, methods in considering something, in influencing someone, something. [1]” The dictionary of methodological terms calls the approach “the basic category of methodology that determines the strategy for teaching the language and the choice of the teaching method that implements such a strategy; represents a point of view on the essence of the subject to be taught [2].

In modern conditions of globalization, the role of foreign languages in human life is increasing. The purpose of learning a foreign language is the formation and development of a communicative culture, the development of practical skills to communicate in a foreign language. The practical mastering of foreign languages increases the importance of specialists in the labor market, especially in the context of the intensification of economic and socio-cultural cooperation between states.

According to the Common European Framework of Reference for Languages developed by the Council of Europe [3], language must be used for communication purposes. To do this, it is necessary to master certain knowledge and skills and master communicative competence.

The concept of “communicative competence” arose under the influence of the concept of language competence of N. Chomsky, which refers to the ability of the speaker to generate grammatically correct statements.

**Communicative competence includes in its structure:**

- language competence (possession of language material for its use in the form of speech statements);
- sociolinguistic competence (use of language units in accordance with communication situations);
- discursive competence (the ability to understand and achieve coherence in the perception and generation of individual statements within the framework of communicatively significant speech formations);
- the so-called “strategic” competence (acquaintance with the socio-cultural context of the functioning of the language);
- social competence (willingness to communicate with others).

“Knowledge of a foreign language is the basis of communicative competence, which is understood

as the ability to solve vital extralinguistic tasks by means of a foreign language. Communicative competence is based on speech competence - the ability to understand and produce oral and written statements at the level of a sentence, superphrasal unity, text. Speech competence, in turn, is based on the possession of the necessary minimum of lexical and grammatical means, that is, on linguistic competence [4].

The communicative approach involves the creation of such a learning model that is “communicative” in terms of learning objectives (aimed at the formation of communicative competence) and active in terms of the methods of learning actions and interactions that a person performs.

The communicative approach determines the need to build the process of foreign language education as a model of the communication process. The essential features of the communicative approach to foreign language education, according to E.I. Passov, it is anthropocentricity, cultural conformity, integrativity, dynamism [5].

The purpose of a foreign language as an educational discipline is to develop the individuality of the student in order to prepare him for the dialogue of cultures (dialogical anthropocentrism). Each language reflects a portrait of national culture; language helps to know the culture of an ethnic group, to understand its features. In intercultural interaction there are representatives of different cultures with their own mentality. The purpose of intercultural dialogue is to achieve mutual understanding - this means understanding the position of the interlocutor and respect for it.

The principles of communicativeness in teaching a foreign language were formulated by the Lipetsk methodological school at the I MAPRYAL Congress in Moscow back in 1969 [6].

According to Passov, in a foreign language culture (as the content of a foreign language education) everything that a person studying a foreign language masters in all four aspects of education is integrated. So, for example, a student acquires knowledge about the language as part of the culture of the people (cognitive aspect); develops his speech and general abilities (developing aspect); assimilates ethical, moral norms (pedagogical aspect); forms speech skills (social aspect of foreign language education).

The scientist also offers a model of the culture of foreign language education. The content of the proposed model consists of representations, concepts and judgments (as types of knowledge) drawn from various sources. Let us dwell in more detail on the last component, which is directly related to linguistics. It examines the role of a foreign language as “an integral component of culture, its accumulator, carrier and exponent” [7].

This section provides knowledge on:

- about the language system, which are used in the process of mastering speech skills in the form of rules-instructions, explanations, structural and functional generalizations, formulated patterns;
- about the functions of the language as a means of communication - speech skills;
- about norms of speech relations (about ethics);
- about the so-called background knowledge that all members of this national-cultural linguistic community have (toponymy, proper names, folklore, phraseological units, idioms, realities of everyday life);
- about non-verbal means of communication;
- about the status, history and development of the language, its role in the world.

E.I. Passov comes to the logical conclusion: “All this knowledge, firstly, is necessary for the conscious mastery and possession of speech units (educational aspect); secondly, they contribute to the development of the individual (developing aspect), education (educational aspect); thirdly, they help to solve educational problems - they expand the linguistic horizons of students [8].

At each segment of the educational process (class or part of it), some fact of culture is first presented. Then tasks are performed, the purpose of which is the perception of this fact of culture;

“extraction” of knowledge about him, analysis of knowledge from the standpoint of development and education; correlation of the assimilated fact of Russian culture with similar facts of native culture (memorable places). Great importance

is attached to the expression of various feelings, readiness to evaluate the facts of native and other cultures, to find their relationship.

In the process of completing tasks, the student participates in all four types of speech activity: listens to statements about the fact of culture, reads microtexts that reveal different aspects of the new fact of culture, speaks about what he heard and read both orally and in writing.

Communicativeness has a whole range of its inherent characteristics, namely: the student's motivation, that is, the performance of an action from an internal impulse, and not external stimulation; purposefulness of any action and any activity; personal meaning in all the work of the student; contact during discussion (emotional, semantic, personal); verbal activity; expressiveness in the use of verbal and non-verbal means of communication; situationality and novelty as a constant variability of all components of the educational process. Only the observance of all the listed parameters and their optimal use gives the right to call the educational process communicative [8].

So, the communicative method consists in likening the process of learning to the process of communication. It is based on the fact that the learning process is a model of the communication process, similar in its main parameters to the real communication process. The subject of training in this case is speech activity in a foreign language. With the communicative approach, the allocation of speech skills and abilities is clearly traced, exercises are offered for their consistent formation.

Many modern methodologists are confident that the communicative approach to teaching Russian as a foreign language, which is associated with active learning, will remain the leading one in the methodology, since the main function of the language is communicative and people learn languages in order to communicate in them.

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英美文学研究中的文学经典与读者偏好的关系  
**RELATION OF THE LITERARY CANON AND READERS'  
PREFERENCES IN STUDYING ENGLISH AND AMERICAN  
LITERATURE**

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抽象的。本文讨论了在大学学科文学研究的框架内定义文学经典的问题。现阶段，根据俄罗斯文学批评的科学传统和批评思潮形成的英美文学经典作品目录，往往与学生的趣味和阅读偏好发生冲突。为了了解学生的阅读偏好，进行了一项调查，文章给出了调查结果。

关键词：文学经典；英美文学；读者的喜好。

**Abstract.** *The article deals with the problem of defining the literary canon in the framework of the study of literature as a university discipline. At the present stage, the canonical list of works of British and American literature, formed on the basis of scientific traditions and critical trends in Russian literary criticism, often comes into conflict with the tastes and reading preferences of students. In order to study the reading preferences of students, a survey was conducted, the results of which are given in the article.*

**Keywords:** *literary canon; British and American Literature; readers' preferences.*

Each year, students who start studying Literature at University get acquainted with a list of literary works mandatory for reading (in this article we speak only about British and American ones). During the semester they look into and discuss these works at lectures and seminars. At some point the students face the problem of literary canon, quite often having never heard of such. Sometimes, consciously or intuitively, they challenge a list of mandatory books. "Who has compiled this list and why should I read these very books?" These questions can be heard more and more often of late.

Nowadays Literature study within curriculum framework sometimes comes up against students' reading preferences. Actually most students possess a certain reading experience formed before the beginning of their university study and have their own opinions concerning different literature phenomena. The canon list is conditioned by selection which the professor carries out on the basis of literature experts' and critics' opinion, expressed in numerous textbooks. A famous literature sociologist B. Dubin defines literary canon as "a national corpora of nationwide and world authors along with their interpretation standards" [1, p, 67]. As a rule, the syllabus includes works of literature classics, i.e. works possessing doubtless moral and artistic value, significant for the global literary space, involved in transhistorical dialogical relations and of interest to many generations of readers. One should remember that literature study in our country is specific as firstly it has profound history and traditions; secondly one can find various translations of the same works. What's more, quite a number of classic literature works have become inseparable from Russian cultural context and are no longer viewed as alien. Our traditions sometimes transform into a steadfast perception stereotype which manifests itself, for instance, in relation to English literature, in "Shakespearecentricity" or "Dickenscentricity" [3] at the expense of many remarkable writers deemed "secondary".

Readers' tastes and preferences are rather unstable and depend on a large number of heterogeneous factors such as personality, reading experience, literature teaching methods and a school teacher's individuality, importance of reading books for the family, trends, number and quality of screen adaptations, so on. The key factor that guides students when making a list of reader's preferences is determined purely by their choice, dependant on the artistic competence and understanding of the reading as a cultural prerequisite. Readers' preferences are currently the objects of dynamic multidisciplinary studies. Even in spite of the diminished interest in reading observed by professors and scholars, literature remains a significant factor in shaping people's worldviews and what the psychologists call "subjective view of individual's life course" [2, p. 30].

This article presents the results of the survey conducted among full-time and part-time bachelor students of the Faculty of History and Philology (Teacher training, specialization in English and German languages), Transbaikal State University, Chita, in academic year 2022-23.

The survey was performed after studying the disciplines which were a part of a general studies curriculum and called *History of English Literature* and *Contemporary English Prose*. The great majority of books were read in translation. The respondents were asked to compile anonymously two lists of literature works (3-10 titles). The first list was to include British and American literary works which, in students' opinion, are **mandatory** to study in school and university to gain in-

sight into literature and culture of the English-speaking countries. The second list was to consist of the works which excited students' interest, their **favourite** books, which had impressed them, the books to reread.

The survey aimed at, firstly, taking a closer look at students' reading preferences and, secondly, tracking whether there exist any discrepancies between a syllabus list, based on a literary canon, and personal dispositions, and if any, how significant they seem. Finding a certain "point of convergence" between syllabus and personal preferences lists is of acute importance.

16 students took part in the English literature survey. They named 34 works in the mandatory list and 37 ones in the favourite books list (the same book could be mentioned twice). The survey results containing the books mentioned more than three times are presented below:

**Table 1**  
*English literature: mandatory and favourite literary works rating.*  
*Books, named 3 times and more*

	<b>Most popular mandatory books (number of references)</b>		<b>Most popular favourite books (number of references)</b>
1	William Shakespeare <i>Romeo and Juliet</i> (9)	1	Charlotte Brontë <i>Jane Eyre</i> (7)
2	William Shakespeare <i>Hamlet</i> (7)	2	<i>Beowulf</i> (5)
3	<i>Beowulf</i> (6)	3	J. R. R. Tolkien <i>The Lord of the Rings</i> (5)
4	Oscar Wilde <i>The Picture of Dorian Gray</i> (6)	4	Julian Barnes <i>A History of the World in 10½ Chapters</i> (4)
5	Charlotte Brontë <i>Jane Eyre</i> (4)	5	Daniel Defoe <i>Robinson Crusoe</i> (4)
6	John Galsworthy <i>The Forsyte Saga</i> (4)	6	Jane Austen <i>Pride and Prejudice</i> (4)
7	Daniel Defoe <i>Robinson Crusoe</i> (4)	7	Oscar Wilde <i>The Picture of Dorian Gray</i> (4)
8	Charles Dickens <i>Oliver Twist</i> (4)	8	Charles Dickens <i>Oliver Twist</i> (3)
9	Jonathan Swift <i>Gulliver's Travels</i> (4)	9	Jonathan Swift <i>Gulliver's Travels</i> (3)
10	William Makepeace Thackeray <i>Vanity Fair</i> (4)	10	Robert Louis Stevenson <i>Treasure Island</i> (3)
	6 points of convergence		

15 students took part in the American literature survey. They named 40 works in the mandatory list and 50 ones in the favourite books list (the same book could be mentioned twice). The survey results are presented below:

**Table 2**  
*American literature: mandatory and favourite literary works rating.*  
*Books, named 3 times and more*

	<b>Most popular mandatory books (number of references)</b>		<b>Most popular favourite books (number of references)</b>
1	J. D. Salinger <i>The Catcher in the Rye</i> (7)	1	F. Scott Fitzgerald <i>The Great Gatsby</i> (5)
2	F. Scott Fitzgerald <i>The Great Gatsby</i> (6)	2	Edgar Allan Poe 'Stories' (4)
3	Kurt Vonnegut <i>Slaughterhouse-Five,</i> <i>or The Children's Crusade</i> (4)	3	Daniel Keys <i>Flowers for Algernon</i> (4)
4	Jack London <i>Martin Eden</i> (4)	4	Mark Twain <i>The Adventures of Tom</i> <i>Sawyer</i> (3)
5	Edgar Allan Poe 'Stories' (4)	5	Stephenie Meyer <i>Twilight Saga</i> (3)
6	Mark Twain <i>The Adventures of Tom</i> <i>Sawyer</i> (4)	6	Chuck Palahniuk <i>Fight Club</i> (3)
7	Harriet Beecher Stowe <i>Uncle Tom's Cabin</i> (3)	7	J. D. Salinger <i>The Catcher in the Rye</i> (3)
8	Nathaniel Hawthorne <i>The Scarlet Letter</i> (3)	8	Ernest Hemingway <i>A Farewell to Arms</i> (3)
9	Theodore Dreiser <i>An American Tragedy</i> (3)		
10	Ernest Hemingway <i>A Farewell to Arms</i> (3)		
11	Margaret Mitchell <i>Gone with the Wind</i> (3)		
6 points of convergence			

#### Survey results commentaries

1. Novel remains a favourite genre among the respondents. This signals of its major role in the current-time literary process. Although in the rating list of mandatory literature William Shakespeare's plays win leading positions (thus reinforcing the thesis on "Shakespearecentricity" of official Russian literature studies), in the favourite books list they are mentioned but once. The knowledge of English poetry is practically superficial; only the names of most famous classic poets (all American) were mentioned by the students: Henry Wadsworth Longfellow, Walt Whitman, and Emily Dickinson. Notably, when mentioning the works

of writers, famous as authors of both fiction and poetry, the students focused on their prose works (Edgar Allan Poe, Robert Louis Stevenson, Rudyard Kipling).

2. When compiling the mandatory list, the students tried to explain their choices theoretically, evoking, e.g., literary historical approach or mentioning moral and artistic merits of the works as well as their educational value. When compiling a list of favourite books, the motivation was determined by personal tastes. They explained the discrepancies in the lists in the following way: “Others won’t understand”. “It is better to study well-known literary works”, “It is my personal opinion, it is of no interest to others.”

3. Nevertheless, the lists of most popular works in both categories have the largest number of convergences, which is a telltale sign that the established, though not always acknowledged, visions of the canon in English literature determine personal preferences. This fact confirms canon viability, in spite of some students treating the necessity to study classic literary works skeptically and even nihilistically. Such works top mandatory and favourite books lists; the majority of the most popular among the students books (mentioned three times or more) belong to the 19<sup>th</sup> of first half of the 20<sup>th</sup> centuries and had been profoundly interpreted by critics. Frankly speaking, we have expected more new books.

4. Especially it concerns British literature. Both the lists of “mandatory” and “favourite” literary works mentioned less than three times include the titles of the books traditionally presented in the established Russian textbooks and manuals on English literature (Geoffrey Chaucer’s *The Canterbury Tales*; Lord Byron’s *Childe Harold’s Pilgrimage*; Robert Burns’ *Poems*; Thomas Hardy’s *Tess of the d’Urbervilles*; Rudyard Kipling’s *The Jungle Book*, H.G. Wells’ *The War of the Worlds*, W. Somerset Maugham’s *The Moon and Sixpence*, William Shakespeare’s *Plays*, etc.). The list of the British writers of the second half of 20<sup>th</sup> century and the beginning of the 21<sup>st</sup> century is less representative (Anthony Burgess, William Golding, Julian Barnes, John Fowles, J.R.R. Tolkien, C.S. Lewis, J. K. Rowling are mentioned in the list). Students were unfamiliar with, or did not mention many highly acclaimed contemporary writers.

5. The lists of American books, mentioned less than 3 times, is more diverse in genre, temporal and hierarchical aspects; along with classical literature there are works belonging to popular fiction, though most students understand quite well questionable artistic merits of some of them. Readers mentioned more contemporary works, so, they know better contemporary American literature than British one; both in the mandatory and favorite books lists, mentioned less than three times, there are names of modern writers, popular among the young: Stephen King, Michael Cunningham, Dan Simmons, George R. R. Martin, Cormac McCarthy, Stephenie Meyer, Chuck Palahniuk, Stephen Chbosky, Jack Kerouac, Paul Auster, Ann Catherin Porter, Hunter S. Thompson, Mitchel Willison, Dan

Brown, and others. Among the classical American books there are Washington Irving's *Rip Van Winkle*, Nathaniel Hawthorn's *The Scarlet Letter*, Theodor Dreiser's, *An American Tragedy*, the short stories by O. Henry.

6. Sometimes the respondents name American writers as British ones (Sidney Sheldon, James Fenimore Cooper, Stephenie Meyer, Ernest Hemingway, Edgar Allan Poe, Ken Kesey, Winston Francis Groom, Jr.). As a rule, these students are not active readers and perceive English literature as a homogeneous space both in language as well as value and content aspects.

7. We did not set a special task to see how readers' literary tastes depend on age (the age of the responders varied from the late teens till the early forties), but there was an obvious tendency: the older students were more ready to perceive and appreciate 'difficult' books, though, as some of them said, without much time for reading. What the intramural younger students took as 'boring', or 'too long', or 'unclear' (e.g. *A History of the World in 10½ Chapters*, or *The Sound and the Fury*) was treated with greater interest by extramural grown-up students.

In conclusion, it is necessary to say that despite an opinion that reading is becoming less popular with people, even with Arts students, the majority of the surveyed consider literary works reading as a compulsory component of education and self-development and recognize literature value for future professional life. The given results are not intended to describe the whole picture of young people's literary tastes, even within a single University, but we consider them rather thought-provoking, especially for those who teach subjects related to English Literature and Culture.

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初级对俄汉语教材语音要素教学对比浅析——以《实用汉语新编》《实用汉语教科书》为例

**A COMPARATIVE ANALYSIS OF THE TEACHING OF  
PHONOLOGICAL ELEMENTS IN ELEMENTARY RUSSIAN  
CHINESE TEXTBOOKS: USING “PRACTICAL CHINESE COURSE:  
NEW EDITION” AND “PRACTICAL CHINESE TEXTBOOK” AS  
THE EXAMPLES**

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**摘要:** 随着中俄关系的快速利好发展, 中国综合国力和国际地位的迅速腾飞, 在俄罗斯和以俄语为第二官方语的部分国家逐渐出现“汉语热”的现象。这样的大背景, 自然会推动对俄汉语教学的进一步发展。在对外汉语教学中, 语音教学是整个语言教学的起点、重点、更是难点; 教材又作为教师授课和学生学习重要工具, 当下需要迫切重视起来。

本文选取俄罗斯目前使用最广泛最具代表性的两套对俄汉语初级综合教材《实用汉语新编》(以下简称《新编》)和《实用汉语教科书》(以下简称《教科书》)两套对俄汉语初级综合教材为研究对象, 由点及面, 使用统计法、对比分析法和归纳法等, 综合国内外语言学相关研究成果, 并参考《国际中文教育中文水平等级标准(2021年版)》(以下简称《标准》)和《国际汉语教学通用课程大纲(2014年修订版)》(以下简称《大纲》)的相关要求, 对教材语言项目的语音要素进行对比分析, 并对二者的编写内容、编写形式和编写理念等进行评估, 找出可能存在的问题。针对相应问题, 从多角度, 对相关内容编写发展提供思考和建议。

**关键词:** 对外汉语语音教学、对俄汉语初级教材、《实用汉语新编》、《实用汉语教科书》

**Abstract.** *With the rapid and favorable development of Sino-Russian relations and the speedy enhancement of China's Comprehensive National Power and international status, the phenomenon of "Chinese language fever" has gradually appeared in Russia and in some countries where Russian is the second official language. Against this backdrop, it is only natural to promote the development of Teaching Chinese as a Foreign Language (TCFL) to Russian-speakers. In teaching Chinese as a foreign language, phonetics is the starting point, the focus, and even more difficult point of the whole language teaching. As the main*



*teaching tool and learning guide for teachers and students, “Chinese textbooks for Russian-speakers”, need urgent attention at present.*

*In this article, the two most widely used and representative sets of elementary comprehensive Chinese textbooks in Russia, «Practical Chinese Course: New Edition» and «Practical Chinese Textbook», are selected as the research objects. By adopting statistical research, comparative analysis and inductive methods, combining the relevant contemporary research results in domestic and foreign linguistics, with reference to «Chinese Proficiency Grading Standards for International Chinese Language Education (2021 Edition)» and «International Curriculum for Chinese Language Education (2014 Revised Edition)», the linguistic elements (pronunciation) of the research objects were compared and analyzed from the particular to the general. Based on the results of the study, the writing content, writing form and writing concept of the two sets of the textbooks were evaluated, and the possible problems were found out. With the aim of solving the corresponding problems from different approaches, the article provides some related thoughts and suggestions on the compilation of elementary comprehensive Chinese textbooks for Russian-speakers*

**Keywords:** *Teaching Chinese phonetics to foreigners, Elementary Chinese Textbooks for Russian-speakers, «Practical Chinese Course: New Edition», «Practical Chinese Textbook»*

任何综合类语言教材的教学目的和目标，就是使学习者掌握其教材所设定的教学内容，即，教材中所包含的语言项目。根据索绪尔的《普通语言学教程》中对于语言和言语、言语活动的定义，“任何交流方式和手段不可缺少语音要素”<sup>1</sup>。莫斯科国立大学名誉教授M. K. Rumyantsev也曾指出，“在第二语言习得中，标准的发音是发展和提高所有语言技能的基本基础和前提，也是初级阶段时学习者首先接收的语言知识”。从牙牙学语到行文成章，从最初通过简单的音节表达心理活动到语言规则排列组合以表达具体或整体的思想内容。在人成长的过程中，语言交流的方式是需要经过“音—字—词—句—文”一系列结构化和系统化的进化过程的。在对外汉语教学中，语音教学是整个语言教学的开始，也是重中之重。语音的不标准，可能产生交流上的误解或根本无法交流的问题。因此，下文笔者将参照《标准》（图1）的语言量化指标，对《新编》和《教科书》的语言项目中的语音要素进行对比分析并评估。

<sup>1</sup> М·К·Румянцев. Фонетика и фонология китайского языка[M]. Москва: АСТ, 2007: 2.

语言量化指标 Quantitative criteria

学习者达到每一级中文水平应掌握的音节、汉字、词汇、语法的内容和数量。(见下表)

《国际中文教育中文水平等级标准》语言量化指标总表

等次	级别	音节	汉字	词汇	语法
初等	一级	269	300	500	48
	二级	199/468	300/600	772/1272	81/129
	三级	140/608	300/900	973/2245	81/210
等次	级别	音节	汉字	词汇	语法
中等	四级	116/724	300/1200	1000/3245	76/286
	五级	98/822	300/1500	1071/4316	71/357
	六级	86/908	300/1800	1140/5456	67/424
高等	七—九级	202/1110	1200/3000	5636/11092	148/572
总计		1110	3000	11092	572

注：表格中“/”前后两个数字，前面的数字表示本级新增的语言要素数量，后面的数字表示截至本级累积的语言要素数量。高等语言量化指标不再按级细分。

图1 《标准》<sup>2</sup>  
两套教材音节量对比分析

在初级阶段中，语音系统的基础教学需要在一定体量的音节数量支持下，尽快形成科学的系统化概念，为后续汉字和词汇系统的构筑发挥应有的作用。

两套教材音节教学内容以语音练习形式编排在教材开始课时中，《新编》为前14课时（图2）、《教科书》为前12课时（图3），笔者对《新编》和《教科书》中音节数量分类统计见表1。

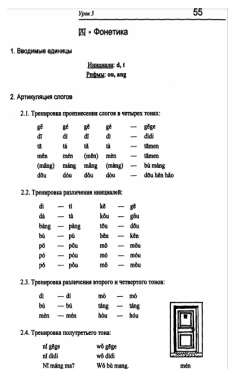


图2 《新编》

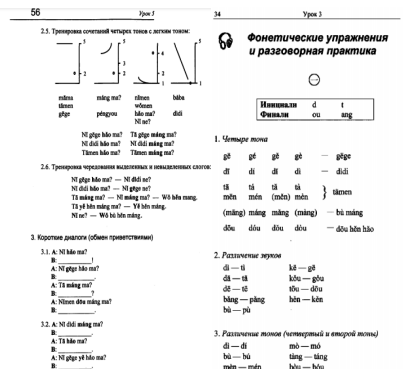
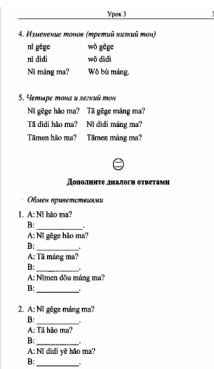


图3 《教科书》



<sup>2</sup> 中华人民共和国教育部国家语言文字工作委员会. 国际中文教育中文水平等级标准[M]. 北京: 北京语言大学出版社, 2021: 254.

表1  
两教材音节数量统计

声调	教材	
	《新编》	《教科书》
第一声	168	148
第二声	188	125
第三声	159	106
第四声	177	132
轻声	29	23
总数量	721	534

上表中，两本教科书中出现的唯一值的音节总数量为，《新编》共721音节、《教科书》共534音节。参照《标准》中对音节的量化指标为：初等一级269音节、初等二级468音节、初等三级608音节、中等四级724音节。

《新编》完全达到并超过初等最高等级三级指标，甚至几乎达标中等四级要求，而《教科书》处于初等二级和三级指标之间，音节量远远低于《新编》。《新编》为帮助学习者构造语音系统基础而设计了大量汉语语音知识，但由此也带来的基础语音内容过于庞大的问题，可能在初级阶段使学生产生对音节把握混淆、偏误的情况；《教科书》对语音教学的较低要求，虽然可以相对简化音节教学，降低初级阶段语音教学的复杂性，但在一定程度上，可能会影响后续教学内容的开展，并可能出现“洋腔洋调”一类的汉语发音规范化问题。

从整体来看，音节是语音的基本结构单位，在对外汉语教学中占很重要的地位，是帮助学习者识字的一种工具，而“识字”是阅读和写作的基础。因此，音节量在对外汉语教科书中的作用不容低估，它对“听说读写”技能培养起到“奠基石”的作用。就音节量的设置来说，《新编》无疑更胜一筹。

### 1. 两套教材语音教学理念对比分析

笔者根据《新编》和《教科书》对语音单位的编排形式与教学顺序，做出下列统计：

表2  
两套教材语音单位教学情况

课时	《新编》	《教科书》
一	汉语语音系统和音节结构	汉语语音系统和音节结构 声母:b, p, g, k, h, l, n 韵母:a, o, i, u, ao, an 声调:第一声 第二声 第三声 第四声; 声调符号标注

二	声母:b-p, g-k, h 韵母:a, o, i, u 声调:第一声 第二声 第三 声 第四声; 声调符号标注	声母:m 韵母:e, uo, ie, en
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续表2  
两套教材语音单位教学情况

三	声母:l, n 韵母:ao, an	声母:d, t 韵母:ou, ang
四	声母:m 韵母:e, en, ie, uo	声母:zh, sh 韵母:i, iou, eng
五	声母:d-t 韵母:ou, ang	声母:(zh), ch, (sh), f 韵母:ai
六	声母:zh-sh 韵母:iou, eng	声母:(zh, ch, sh), r 韵母:ü, ei, ong
七	声母:ch, f 韵母:ai	声母:j 韵母:ing, iang, uang
八	声母:r 韵母:ü, ei, ong	声母:(j), q, x 韵母:in, ian, uan
九	声母:j 韵母:ia, iang, uang, ing	声母:(j, q, x) 韵母:iao, uei (-ui), uai, uen (-un), üe, üan, ün
十	声母:q, x 韵母:in, ian, uan	声母:z, c, s 韵母:i, er
十一	韵母:iao, uei (ui), uen (un), üe, üan, ün	声母:(z, c, s) 韵母:ua, ia, iong
十二	声母:z, c, s 韵母:i, er	发音规则总结
十三	韵母:ua, iong, yong	
十四	发音规则总结	

如上表中所示《新编》和《教科书》语音教学项目的编排形式与设计顺序:

在辅音与声母教学理念和讲解方法上,《新编》和《教科书》都运用“对比法”。例如,讲解普通话中相近音的发音规则(如,不送气塞音-送气塞音: b-p, g-k, d-t; 边音-鼻音: l-n; 塞擦音-擦音: zh-sh, q-x, ch-f等)。这样的教学方式有助于学习者对声母发音方法特征对照,发音时口腔和鼻腔节制气流的方式和状况由易入手,掌握正确发音,先听辨,再进行模仿和对比练习。

两教材都针对学习难点进行了重点讲解编写，总结了辅音发音规则，都采用了“表格归类+文字表述”的形式，讲解发音部位和发音方法相似、且在俄语中没有对应发音的辅音，例如，图4、5中所示，普通话中三组声母：舌尖前音（z、c、s）、舌尖后音（zh、ch、sh）、舌面前音（j、q、x）。两套教材在讲解声母发音规则时，都针对俄语为母语的初级学习者在声母发音时常出现的代表性混淆现象，讲解发音时气流受到阻碍的位置，指导学生尽快掌握语音知识。侧面也反映出，《新编》的表格讲解相对简单，便于学习；《教科书》表格统计形式虽然更细致化，但对语音知识刚刚起步的学习者，稍显繁杂，接受难度较高。

инициали	смычные	придыхательные	щелевые
переднеязычные			
сложные	z	c	s
ретрофлексные	zh	ch	sh
среднеязычные	j	q	x

图4 《新编》（第14课）

По звучанию			Шипящие и свистящие		
По месту образования			Язычные		
По способу образования			Среднеязычные (свистящие-шипящие)	Переднеязычные (шипящие)	Среднеязычные (свистящие)
Группы	Смычные (внутри и фронтальные)	Исходные	j	zh	z
		Придыхательные	q	ch	c
	Спиранты (щелевые)		x	sh	s

图5 《教科书》（第12课）

其次，在元音与韵母教学编排和讲解方法上，两教材也基本相同，二者都按韵母发音的共同点（舌位、开头元音的发音口型、响亮度、鼻音特征）采用“过渡法”进行教学。例如，先讲解学生比较容易发的韵母（舌面单元音韵母：a, o, i, u, e；开口呼韵母：a-ao-an, e-en；前响复韵母：ao；后响复韵母：uo, ie；前鼻尾韵母：an, en等）起到带动作用，然后，“以旧带新”语音教学原则解决俄语为母语的初级学习者的发音难点（齐齿呼、合口呼、撮口呼韵母；中响复韵母；后鼻尾韵母）。

但之后，在归纳其语音知识方面，两教材出现了很大的差别（图6、图7）。《新编》按普通话韵母的结构（韵头和韵身中的韵腹、韵尾）总结发音规则，而《教科书》则根据韵母的组成成分（单元音韵母、复元音韵母、带鼻音韵母）总结发音规则。虽然《新编》提供了相对更具有科学性的解释方式，更专业地把握了汉语语音的规律原则，但是对初级学习者来说，过度的系统化和细致化，反而会使教学内容的呈现缺失一定的直观性。而《教科书》采用的韵母分类方式，在一定程度上也遵循了汉语语音的规律性，但这样的分类形式相对过于简化，可能会直接或间接地导致学习者出现发音不标准情况，影响其语音知识系统的自我构建。

2. Система рифм

основной гласный	полу-гласный	окончание нулевое	гласные окончания		носовые окончания	
			переднее, заднее	заднее	переднее, заднее	заднее
а-образный	0	a	ai	ao	an	ang
	i	ia	—	iao	ian	iang
	u	ua	uai	—	uan	—
	u	—	—	—	uan	—
э-образный	0	e	ei	ou	en	eng
	i	ie	—	io u	in	ing
	u	uo	u e i	—	un	ong
	u	ue	—	—	un	iong

图6 《新编》 (第14课)

● Краткое обобщение. Инициалы и финалы

Финалы	Простые финалы							
	a	o/e	i	u	ü	i	[l] [r]	
	er	ai	ei	ao	ou			
Финалы	Сложные финалы							
	ia	ie	iao	iu	(iou)	ua	uo	uai
	ui	(uei)	üe					
Финалы	Носовые финалы							
	an	en	ang	eng	ong (ueng)			
	ian	in (ien)	iang	ing (ieng)	iong (uiong)			
	üan	ün (uen)						

图7 《教科书》 (第12课)

再者, 在声调教学理念和讲解方法上, 两教材都采用“五度标记法”标记调值相对音高(图8、图9), 把人普遍性音高范围, 从低音到高音, 分为五个等级讲解普通话四个声调的调型。通过线性表示形式讲解起音和收音, 给学生提供了训练要领, 声调的视觉印象。

但是, 《教科书》的五度声调调型图上出现了偏误(如, 图9上红线标记处: 第三声的调值原标记4-1-2, 应该改为2-1-4)。区别于汉语, 在俄语中声调没有区别意义的作用, 语音教学过程势必会出现“母语的干扰影响”的情况, 所以教材必须保证语音知识准确性, 否则会导致相关知识系统的构建出现严重偏差。

3. Схема четырех тонов



4. Обозначения тонов

- Первый тон (5-5) — ā
- Второй тон (3-5) — á
- Третий тон (2-1-4) — ǎ
- Четвертый тон (5-1) — à

图8 《新编》 (第2课)

1-й тон 2-й тон 3-й тон 4-й тон

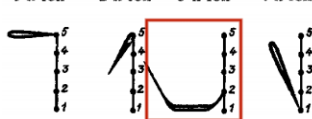


Рис. 1. Конфигурация китайских тонов

- : 第一声 первый тон
- ↗ : 第二声 второй тон
- ↘ : 第三声 третий тон
- ↘ : 第四声 четвертый тон

图9 《教科书》 (第1课)

最后, 在课时安排上, 两套教材对“语音单位”(声母、韵母、声调)部分的编排主要集中在教材的前部课程(《新编》前十四课, 《教科书》前十二课), 后续未再对语音知识进行过多的复述。两套教材都尽量保持了每课知识量的合理性、教学内容的系统性、教学方式的科学性。对于初级阶段的学习者来说, 这样的安排会减少学习难度; 但同时带来的是, 对外汉语教学区别于国内语文课程的教学, 在海外缺少汉语语音氛围的大环境下, 语音知识复习的缺失, 可能对学习者汉语语音的准确性长久保持产生较大影响。

### 1. 语音编写建议

赵元任在《语言问题》中曾指出，语言“发音的部分最难，也最要紧，语言的本身，语言的质地就是发音不对，文法就不对，词汇就不对”<sup>3</sup>。在《大纲》（图10）语音教学目标中，也明确提出了“语音”项目知识对于掌握“词汇”和“语法”项目的重要作用。

语音	<ol style="list-style-type: none"> <li>1. 对汉语拼音知识有一定的了解；</li> <li>2. 能根据拼音拼读出不熟悉的生词和句子；</li> <li>3. 在日常会话中能听懂带有连读、变调等语流音变因素的话语；</li> <li>4. 在日常会话中做到语音、语调基本正确。</li> </ol>
----	---

图10 《大纲》（三级）4

对外汉语教材中语音项目编排，必须根据语音教学其自身的特点，注意“语音知识”和“语音技能”的教学。“语音知识”是指学习者对汉语中各种音节的性质、特点和规律的认知，语音知识是对外汉语教学的关键要素之一，是语音感知、声韵辨析、词汇和语法的基础，培养“听说读写”技能的前提，是语言交际基础的先决条件；“语音技能”是指学习者在日常生活中运用语音的能力，是汉语交际的基本能力之一。对外汉语教学中的“知识”和“技能”教学都离不开“汉语拼音”的奠基。

在音节数量设计方面应遵循“以音节为单元”“以听觉系统训练为重点”的原则。在符合标准的足量音节支持上，理解汉语“声韵调”配合规律和具体组合。通过大量系统化不同特点的音节编排，让初级阶段的学生做到语音项目的“多听—多说—多练”，发展自我规范化的声母、韵母、声调的发音，并掌握汉语音节规律。

在语音音素的教学编排和讲解方法上，应遵循“科学性”、“针对性”、“差异性”和“直观性”的编写原则。针对汉语语音音素发音特点和俄语地区第二语言习得规律，将语音音素进行对照分类教学：根据声母中发音部位的差异性，例如：送气音与不送气音“b-t、b-p”；根据韵母分类的差异性，例如：韵母结构分类中的“a-ao-an-ang”。并在对比教学过程中，搭配相应“发音器官图”（图11）使音素“图像化”。从语音学和音系学角度，对比不同的音素差异性。了解其语言的语音物理属性，掌握汉语的发音基础，避免母语感染、洋腔洋调现象的出现。

<sup>3</sup> 赵元任. 语言问题[M]. 北京：商务印书馆，1980：06.

<sup>4</sup> 孔子学院总部，国家汉办. 国际汉语教学通用课程大纲（修订版）[M]. 北京：北京语言大学出版社，2014：218-260.





图11 发音器官图

在语音音节的教材编排上，应保证课程与复习的“持续性”和教学内容的“准确性”。《标准》中对汉语拼音作有解释，“汉语拼音是以汉语拼音字母为拼写和注音符号，帮助汉语学习者读准音节，认识声母、韵母和声调的一种拼写符号”。在语音学习方面，应在保证音节标注“准确性”的前提下，尽量扩大拼音在初级教科书中的覆盖范围。对外汉语教学的音节习得后，学习者事实上依旧并可能较长时间仍处于汉语学习的初始阶段，此时的汉语发音正确习惯急需巩固，应在后续课程内容进入后，继续对音节内容的复习，增加语音纠正教学内容，针对描述汉语语音系统特征的发音现象和俄罗斯学生遇到的语音困难，尽可能地在词汇表、课文甚至练习等必需的位置标注“拼音”，以此提高汉语语音学习的水平，形成准确的“语音肌肉记忆”。

总结：《新编》和《教科书》语音单位教学体系基本一致。二者在这部分内容的教学理念和讲解方法上，都遵循由易到难、循序渐进的教学原则，用合理的语音教学方法（对比法、图示法、过渡法、五度标记法）讲解汉语语音基础，基本符合了第二语言习得的客观规律；但在语音音素教学理论上略有不同，《新编》辅音与声母讲解相对简单，元音与韵母讲解更细致、更系统，而《教科书》则反之。但对于时下日益紧密的跨语言交流环境，两套教材语音部分在当代对俄汉语教学活动中，相对无法满足时代性、针对性，存在一定程度的局限性。时下对于新教材中语音音素的教材编排，应在音节数量设计方面遵循“以音节为单元”、“以听觉系统训练为重点”的原则；使语音音素的教学编排和讲解方法，更具有“科学性”、“针对性”、“差异性”和“直观性”；在此之上尽可能保证语音学习的“持续性”和“准确性”，并扩大拼音的标注范围。

每套教材的编撰，都凝聚了无数专家学者和相关人员的心血，都是以推动对俄汉语教育事业、提供更好的教学材料为目标。笔者希望“观一素而知沧海”，通过以上的研究成果，尽可能地去发现现有对俄汉语初级教材中语音音素编排可能需要改进的方面；还希望本文的研究能够有助于日后相应教材的改进和完善，并提供一定的参考价值。



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情感词汇在俄罗斯古典诗歌 阿.阿.费特

## THE EMOTIVE VOCABULARY IN RUSSIAN POETRY OF A.A. FET

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简评: 文章研究了案例有用情感词汇在俄罗斯古典诗歌阿.阿.费特。情感词汇分类的例子。对阿.阿.费特的作品进行了分析、情感词被标记、阿.阿.费特的文本中有一些情感词汇的例子。

关键词: 情感、感受、情感词汇。

**Annotation.** *The article studies cases of using emotive vocabulary in the works of A.A. Feta. Classifications of emotive vocabulary are given. The analysis of the works of A.A. Fet, several groups of emotional words are identified, specific examples of emotive vocabulary from the texts of A.A. Feta.*

**Keywords:** *emotions, feelings, emotional vocabulary.*

人的一生中、会经历很多情绪。情绪伴随着一个人在交流、思考某件事时、也是对刺激源的反应。在科学文献中、命名情感的词被称为“情感词汇”。在当今世界、沟通的过程需要情感的表达、因为没有情感、沟通的过程就不会富有成效。

情感词汇术语作为表达情感的手段、表达积极情绪和消极情绪。例如: “爱”这个词有积极的含义。“恨”这个词表达了负面含义。

为了理解什么是情感词汇、你需要能够区分情感词汇和其他类似的概念: 情绪词汇(语言中的客观情绪)和 情感词汇用于表达说话者的情感、评价言语对象(表达功能和语用功能)。

这些概念之间的差异很难找到、因此一些科学家将它们彼此分开、而另一些科学家则认为它们具有相同的含义。让我们转向语言术语和概念的百科全书词典参考书。其中、“情感词汇”的概念有几层含义:

1. 通过语言手段表达情感色彩的词语(小乖、小宝贝、一个多么好、闷得慌)。
2. 脏话(坏蛋、寄生虫)。

叹字:(该死的、天哪、哇塞) [11].

E. M. Galkina-Fedoruk 指的是表达当前经历的经历、感受的情感词汇、以及表达情感评估的手段的词汇（恶意、粗鲁、厌恶、仇恨、恐惧、悲伤；讨厌、令人讨厌的、卑鄙的、卑鄙的、无价值的；心爱的、光荣的、美妙的、深情的）[2、p. 78]。

如果我们谈论情绪驱除，那么在科学文献中给出了以下概念：情绪驱除是命名和描述情感的词汇，在其语义中包含情感的思想[9、p. 1]。 20]。

情感词汇不同于情绪词汇、也不同于情绪驱除。 它包括表达精神情感体验及其表现的词语[3、p. 1]。 84]。

许多研究人员将这两个概念结合起来、因为。 它们包括表达一个人的情绪状态的词语。因此、有人认为“情绪词汇”和“情感词汇”的概念是同义词。

情感词汇有多种分类。 例如，V. I. Shakhovsky 将情感词汇分为三组：

- 具有情绪状态含义的词汇（愤怒；激怒）；
- 具有情感态度含义的词汇（去爱、不去爱）。
- 具有情感表征意义的词汇（白痴、孩子、婴儿、小鬼）[10、第 10 页] 29]。

L.M. Vasiliev 就像 V.I. Shakhovsky将情感词汇分为三组：

- 具有情绪状态含义的词汇（生气、高兴）；
- 具有情感态度含义的词汇（爱、恨）；
- 具有情感冲击意义的词汇（愤怒、抽泣）[1、p. 104]。

阿。阿。费特在其作品中使用情感词汇来描述人物的感受和情绪。 每个角色都有自己的生活、所有角色都是不同的、他们表达不同的情感。借助词典可以在作品中找到情感词汇。使用《俄语语义词典》N.Y. Shvedova。 什维多娃、我们可以分析情感词汇。N. Y. Shvedova 将情感词汇分为几组：

- 一般标记：
  - 感受、情绪状态；
  - 性格特征、人格特征、心理特征及其在行动、行为中的表现。
- 不同的感觉、情绪状态及其表现：
  - 感受本身、情绪状态；
  - 与明显或高度表达情感相关的状态、以及与缺乏情感表达或缺乏情感表达相关的状态。
- 不同的性格特征、个性特征；精神属性及其表现形式；可以用这些特征、属性来表征的动作、行为。
- 与特定心理属性、性格特征、本性仓库无关的行为、行动：
  - 有目的的行为、具有社会意义的行为；
  - 与对社会具有重要意义的剧烈活动无关的行为、行动[4]。

通过分析阿。阿。费特的作品、我们发现了以下几组情感词：

1. 感受本身、情绪状态：

a) 绝望、悲伤和沮丧的感觉：

“可是我多年来梦想的快乐在哪里呢？她走了！我的心里一点也不高兴、甚至深感悲伤……” [6, p. 29]。

“最近、她的道德明显下降、一旦停止体力工作、她就陷入了某种沉闷的绝望、接近精神错乱” [8, p. 22]。

b) 无聊、忧郁的感觉：

“当然，阿法纳西伊万诺维奇遇到这样一个新人纯属偶然；其余时间他向伟大的作家寻求帮助。另一方面、当他坐上马车或马车时、他感觉自己就像一个受苦的行李、并且感到难以忍受的无聊” [5, p. 4]。

“无聊的博戈亚夫伦斯基显然对戈尔茨感到高兴” [8, p. 10]。

c) 恐惧、焦虑、不耐烦的感觉：

路易莎亚历山德罗芙娜激动得浑身颤抖、打开了她的小包” [8, p. 13]

。

“在新米尔哥罗德、我们被拦截、直至另行通知。我们期待着这个订单” [6, p. 1]。

“回到房间后、母亲发现路易丝浑身发抖、趴在绣框上抽泣” [8, p. 2]。

d) 怨恨、烦恼、不满的情绪：

“即使是这样的回忆、费奥多尔费奥多罗维奇也感到愤怒和恼怒、这些回忆显然对他来说很愉快” [8, p. 16]。

“在路上没有遇到任何新的东西、他试图从熟悉的物体中寻找真相、并且通过比较大多数人与这些物体相关的概念和判断的混乱、在很大程度上加剧了他的愤怒” [5, p. 4]。

e) 愉悦、快乐、有趣的感觉；知足、平安

“当一个事实、无论多么小、成为他世界观的新确认时、他感到高兴、但当他在某个特定时刻不知道如何为它找到合适的位置时、他一点也不感到尴尬” [5, p. 2]。

她清新的脸上绽放出愉快的笑容。我的可能表达了惊讶和高兴、因为丽莎看着我、笑得更开心了” [6, p. 11]。

f) 爱、温柔、地点、感情的感觉；谢谢：

“我胆怯地看着妈妈；她看着我。那眼神里蕴藏着多少温柔、多少炽热的爱意” [6, p. 12]。

“科瓦连科热情地爱着他的妻子、并没有否认她的世俗乐趣、她在没有孩子的情况下、以青春的热情沉迷于这种乐趣、害怕孤独？” [8, p. 2]

。

g) 厌恶、蔑视、嫉妒、敌意的感觉：

“他的脸上沾满了灰尘、平淡无奇的五官表现出疲倦和冷漠、他的棕色小眼睛漠然地看着向后倾斜的青翠谷物笔扇” [5, p. 1]。

“一张宽阔、厚颜无耻的脸，黑色下垂的眉毛、纽扣鼻子、宽而平坦的嘴唇、紧闭的嘴和刮得很差的下巴、不断地表达出某种轻蔑的不满” [8, p. 17]。

2. 与清晰或高度的情感相关的状况，以及与没有情感表现或情感克制相关的情况：

a) 兴奋、兴奋、热情、冲动的感觉：

“事实是、格特纳上校的悲剧丝毫没有影响、相反、不断地在听众中引起无法控制的、不可避免的笑声” [8、p. 16]。

“我看了看：可以肯定的是、卡莱尼克、我们离他至少一俄里、正在兴奋地挥舞着他的经典卡托西斯” [7、p. 4]。

b) 冷静、保守、平静的感觉：

“她松了口气，告诉丽莎她要去寻找洋葱” [8、p. 23]。

因此，作者通过描写人物灵魂中汹涌而爆发的情感，描绘了艰难的生活处境，揭示了人物心理状态的特殊性。阿。阿。费特的创新品质体现在作品中——能够借助语言创造的抒情风格向读者传达一个人内心世界的秘密。

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参加特种军事行动官兵家属心理状况调查

**INVESTIGATION OF THE PSYCHOLOGICAL STATE OF  
FAMILIES OF OFFICERS AND CONTRACT SERVICEMEN  
PARTICIPATING IN A SPECIAL MILITARY OPERATION**

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摘要。本文致力于研究受伤和死亡军官家属以及受伤和死亡合同军人家属的 PTSD 参数和人格变化的表征。该研究的目的是研究参加特种军事行动的军官和合同兵家属的心理状态组成部分。研究实证对象为已故军官家属 (124人)；阵亡合同军人家属 (564人)；受伤军官家属 (72人)；受伤的合同军人家属 (275人)。研究的方法学工具：“创伤后应激障碍反应指数”方法与临床对话相结合。

关键词：特种军事行动、合同军人家属、军官家属、创伤后应激障碍。

**Annotation.** *This article is devoted to the study of the representation of PTSD parameters and personality changes in family members of wounded and deceased officers, as well as family members of wounded and deceased servicemen under contract. The purpose of the study is to study the components of the psychological state of families of officers and contract servicemen participating in a special military operation. The empirical object of the study is the family members of the deceased officers (124 people); family members of the deceased servicemen under contract (564 people); family members of officers with wounds (in the number of 72 people); family members of contract servicemen with wounds (in the number of 275 people). Methodological tools of the study: The method “Index of reactions in PTSD” in combination with clinical conversation.*

**Keywords:** *special military operation, family members of military personnel under contract, family members of officers, post-traumatic stress disorder.*

**Introduction**

Now we can say with confidence that the special operation has become another important turn in the new history of not only Russia, but also other states. The

consequences of any such event are a source of research and scientific developments in various fields, including psychologists. Today, an important turn in the life of any state is the health of its citizens, so all the practical experience of the psychological community is aimed at maintaining the psychological health of the individual and health care.

In the conditions of a special military operation, military psychologists work with newly arrived servicemen to form their appropriate adaptive potential, as well as to eliminate psychological traumas resulting from participation in a special military operation. There is a fairly large number of works related to the description of the activities of psychologists in the context of post-traumatic stress disorder in military personnel [3,4,5].

However, there is a clear shortage of work related to the psychological support of family members of the dead and wounded. There are practically no works describing the specifics of psychological assistance to families in conditions of special military operations due to the specificity and uniqueness of the events taking place [5]. Most psychologists focus on comprehensive support for the families of dead and wounded servicemen during a special military operation. It is important to understand here that in most cases parents and wives are left alone with their loss, so in addition to psychological support, it is important to take into account social support measures [4].

Thus, the relevance, novelty and uniqueness of this study lies in the presentation of generalized empirical data on the psychological state of families of officers and contract servicemen participating in a special military operation.

### **Materials and methods of research**

The purpose of the study is to study the components of the psychological state of families of officers and contract servicemen participating in a special military operation.

The empirical object of the study is the family members of the deceased officers (124 people); family members of the deceased servicemen under contract (564 people); family members of officers with wounds (72 people); family members of servicemen under contract with wounds (275 people).

The subject of the study is to study the differences in the specifics of the psychological state of family members of officers (wounded and dead) and family members of contract servicemen (wounded and dead) participating in a special military operation.

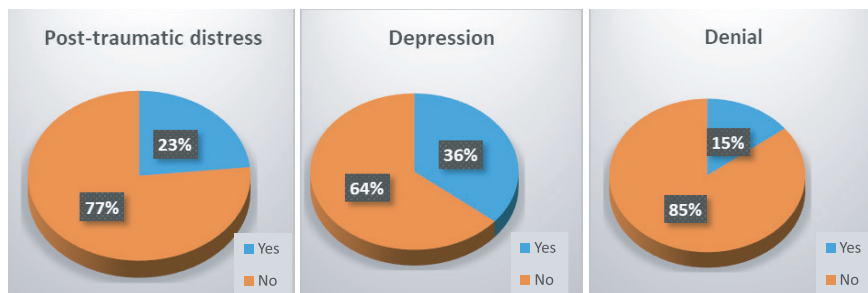
Methodological tools of the study: The method “Index of reactions in PTSD” in combination with clinical conversation.

The research procedure. From the very beginning of the special military operation, psychologists of the Regional Center for Psychological Work of the Southern Military District have been working in the “Center for the reception, processing

and dispatch of the dead”. This work is being carried out in several directions at once: 1) accompanying the relatives of the deceased during identification procedures, taking biomaterial for DNA testing, farewell and search for the dead; 2) psychological examination and rehabilitation activities of the staff of the CPOP; 3) individual counseling of military personnel taking part in the identification, processing and dispatch of the dead. This study will present only the results for the closest family members of wounded and deceased officers and family members of wounded and deceased contract servicemen participating in a special military operation. The sample includes the following categories of kinship - wife, mother, father. All empirical measurements were carried out by clinical psychologists 1-3 months after the traumatic event.

### Research results

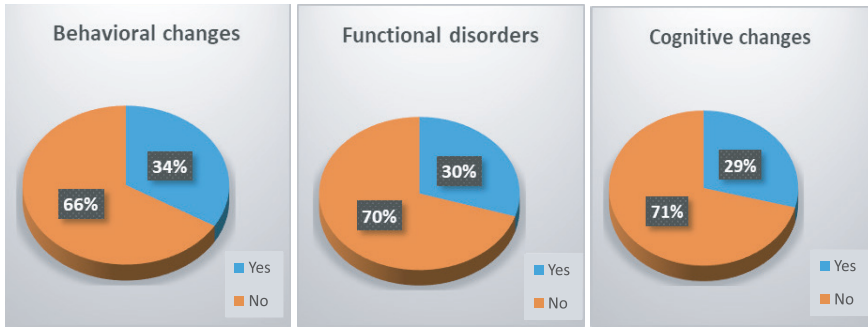
During the empirical study, family members of deceased officers were diagnosed; family members of deceased military personnel under contract; family members of officers with wounds; family members of military personnel under contract with wounds. Based on the described specifics, we will present empirical results.



*Picture 1. Representation of PTSD parameters among family members of deceased officers*

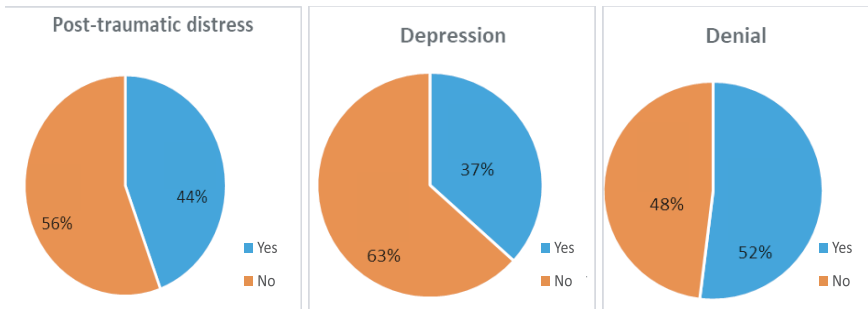
Among all the family members of the deceased officers studied by us during a special military operation (124 people), 23% of relatives experience post-traumatic distress, depressive manifestations are characteristic of 36% of relatives. The reaction of denial is characteristic of only 15% of the examined relatives.





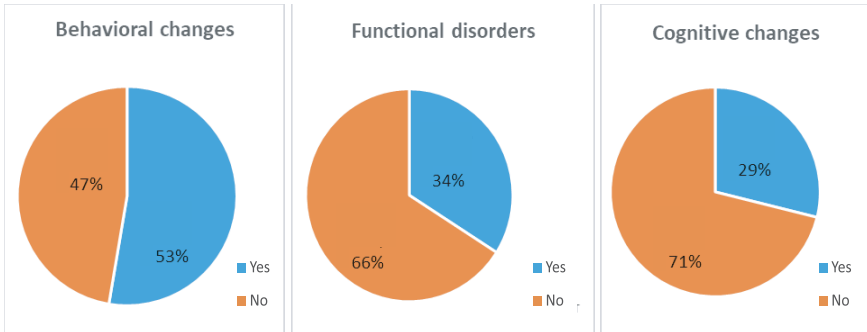
**Picture 2.** Representation of features of personality changes among family members of deceased officers

Among the family members of the deceased officers, various behavioral changes were recorded in 34% of relatives, functional changes are characteristic of 30% of relatives, and cognitive changes are characteristic of 29% of relatives.



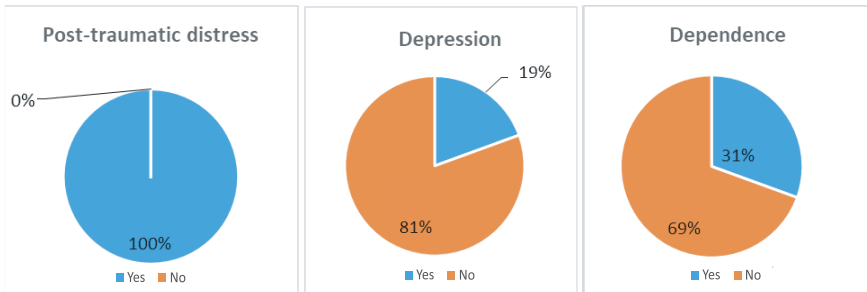
**Picture 3.** Representation of PTSD parameters among family members of deceased servicemen under contract

Among the family members of the deceased servicemen under contract, 44% of relatives experience post-traumatic distress, depressive manifestations - 37%. The reaction of denial is characteristic of 52% of the examined relatives.



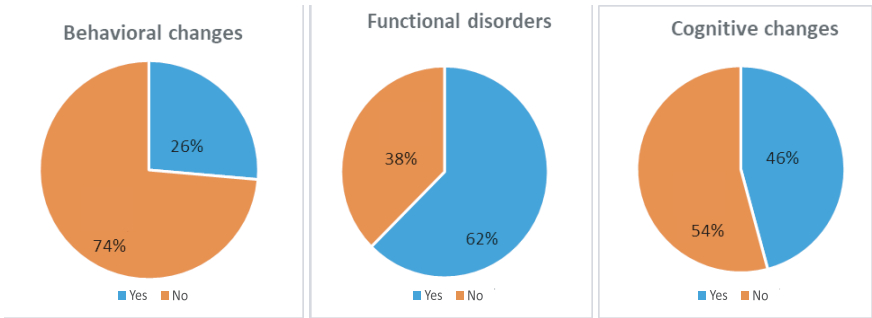
**Picture 4.** Representation of the peculiarities of personality changes among family members of deceased servicemen under contract

Among the family members of the deceased servicemen under contract, various changes in behavioral characteristics were recorded in 53% of relatives, functional changes are characteristic of 34% of relatives, and cognitive changes are characteristic of 29% of relatives.



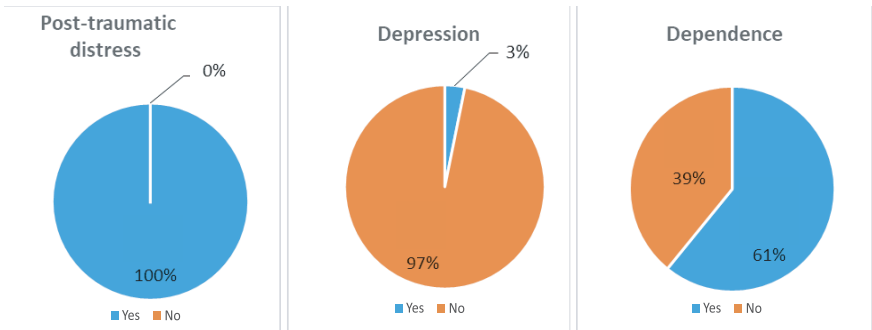
**Picture 5.** Representation of PTSD parameters among family members of wounded officers

Among the family members of wounded officers, 100% of relatives experience post-traumatic distress, depressive manifestations - 19%. Various forms of dependent behavior are characteristic of 31% of the examined relatives.



**Picture 6.** Representation of the peculiarities of personality changes among family members of wounded officers

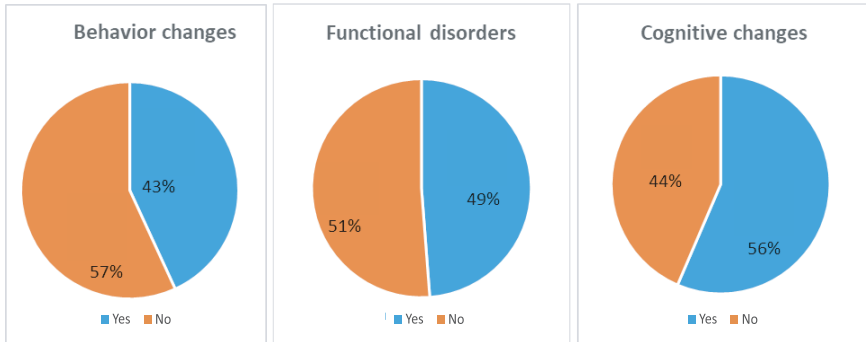
Among the family members of wounded officers, various changes in behavioral characteristics were recorded in 26% of relatives, functional changes are characteristic of 62% of relatives, and cognitive changes are characteristic of 46% of relatives.



**Picture 7.** Representation of PTSD parameters among family members of wounded contract servicemen

Among the family members of wounded servicemen under contract, 100% of relatives experience post-traumatic distress, depressive manifestations - 3%. Various forms of dependent behavior are characteristic of 61% of the examined relatives.

Figure 8 shows the features of personality changes among family members of wounded servicemen under contract. Among the family members of wounded officers, various changes in behavioral characteristics were recorded in 43% of relatives, various functional changes are characteristic of 49% of relatives, and cognitive changes are characteristic of 56% of relatives.



**Picture 8.** Representation of the peculiarities of personality changes among family members of wounded servicemen under contract

Summarizing the results of the conducted research on the study of the psychological state of families of officers and contract servicemen participating in a special military operation, it can be concluded that family members of wounded officers and contract servicemen are more characterized by the manifestation of post-traumatic distress, which indicates the presence of repetitive, involuntary and obsessive disturbing memories; traumatic nightmares in which the content of and/or the affect of sleep is related to events; intense or prolonged distress after encountering traumatic reminders; dissociative reactions — for example, vivid memories of trauma (relatives feel or act as if the event is repeating itself); pronounced psychological reactivity after encountering stimuli associated with trauma. Also, a fairly large number of relatives of wounded officers and military personnel under contract have various forms of dependent behavior.

If we consider the peculiarities of personality changes among family members of wounded officers and military personnel under contract, then more than half of their relatives have functional changes that manifest themselves through sleep disorders, digestive tract disorders, nervous system disorders, etc. Also revealed are various cognitive changes manifested in the inability to recall key moments of a traumatic event; constant (and often distorted) negative judgments and expectations about oneself or the world around; constant negative traumatic emotions; a decrease in interest in activities that a person liked before the event; a feeling of alienation from other people; flattening of the emotional sphere: inability to experience positive feelings — for example, happiness, satisfaction or love.

For family members of deceased officers and military personnel under contract, changes in the psychological sphere mainly affect behavioral features that are revealed through irritable or aggressive behavior: outbursts of anger — with or without a little provocation — are usually expressed in the form of verbal or phys-

ical aggression towards people or objects; self-destructive or risky behavior; hyper-alertness; hypertrophied withtart reflex: exaggerated reaction to fright; problems with concentration; sleep disorders (for example, difficulty falling asleep or sleeping, restless sleep).

Post-traumatic distress and depressive manifestations are characteristic of family members of deceased officers and military personnel under contract in part. In most cases, relatives have a negative reaction to the situation of losing a loved one during a special military operation.

### **Discussion of the results of the study**

A separate vector of the direction in psychocorrective work is assistance to the families of the wounded who found themselves in the most difficult psychological state. Often, loved ones experience feelings of guilt, fear, shame and powerlessness. Most psychologists note high anxiety, internal tension and the presence of panic attacks in relatives of servicemen who have fallen into a difficult life situation.

Psychologists have been working with relatives since the beginning of the special operation on a daily basis. Psychological support is provided throughout the entire stay of the serviceman on treatment and includes: individual psychoanalytic counseling, cognitive behavioral counseling, gestalt techniques, autogenic training. At the same time, the level of understanding, empathy and emotional feedback allows the relatives and friends of the wounded to survive the traumatic event.

Work with the families of the victims begins from the moment the death is reported and is then monitored with constant verbalization. It is very important to help realize the loss and accept it. This does not always happen at the time of the identification procedure, or farewell. In moments of loss, the reaction to grief, as experts cite, is completely different and can range from hysteria to complete apathy [6].

The present study is only a fragment from a set of empirical data obtained by us during the psychological support of military personnel during a special military operation. Other works of the claimed authors consecrate various aspects of psychological diagnosis and support of military personnel and their families.

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DOI 10.34660/INF.2023.75.80.048

插图中的神话图像曼达尔乌斯

**MYTHOLOGICAL IMAGES IN ILLUSTRATIONS BY  
MANDAR UUS**

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摘要。神话不仅是某一民族文化传统的一部分，也是全人类神话传统的一部分。本文试图从神圣绘画的角度理解鲍里斯·费奥多罗维奇·纽斯特罗耶夫-曼达尔·乌斯的插图作品，确定插图中神话图像的含义，并将其用于教学目的。目前，区域科学家还没有对Mandar Uus插图中的神话图像进行详细分析的研究，这无疑强调了这个问题的相关性。

关键词：民间价值观、雅库特文化、插图、神话形象。

**Annotation.** *Mythology is not only part of the cultural tradition of a certain people, but also part of the mythological traditions of all mankind. This article presents an attempt to comprehend the illustrative works of Boris Fedorovich Neustroev - Mandar Uus in the aspect of sacred painting, determine the meaning of mythological images in illustrations, and use them for pedagogical purposes. Currently, regional scientists do not have studies of a detailed analysis of mythological images in the illustrations of Mandar Uus, which undoubtedly emphasizes the relevance of this problem.*

**Keywords:** *folk values, Yakut culture, illustrations, mythological image.*

Introduction. One of the urgent tasks of pedagogical research was the definition of scientific, theoretical, practical approaches to organizing the interaction of the main structures responsible for the education of young people on folk traditional values. The 21st century is becoming the century of visual culture. Drawings, diagrams, maps have seriously crowded out the text. It is no coincidence that many modern authors attach great importance to the visual accompaniment of their texts, creating by non-verbal means not only informational, but also emotional content.

Analysis of the works of Mandar Uus, their culturological comparison in the context of his biography constitutes the content of the monograph “Mandar kyhatyn” culturologialyy toruttere” (Russian: Culturological foundations of the Mandar doctrine). Ethnopedagogical developments of the heritage of the original master are presented in the works of N.D. Neustroeva, E.I. Khatylayeva[8], K.A. Belolyubskaya[14], M.A. Manasytova, V.V. Khatylaeva, A.A. Neustroev[1].

Religious worldview attitudes, motivations, orientations and world outlook are the subject of philosophy of culture and religious studies. Foreign scientific research on semiotics and philosophy of culture (R. Barth, M. Heidegger, H.-G. Gadamer) made it possible to extrapolate the general theoretical provisions and conclusions of various scientific schools and concepts to the problematic field of illustration semantics Mandaar Uus. The sacred, artistic, creative, spiritual and moral functions of religious art are studied by domestic culturologists, philosophers and religious scholars: V.V. Bychkov, I.L. Buseva-Davydova, G.I. Vzdor-nov, L.M. Vorontsov, N.K. Gavryushin, V.S. Glagolev, O.A. Lavrenova, S.N. Petrov and others.

Having considered the works of regional authors, we came to the conclusion that until recently no attempts were made to study the artistic creativity of Mandar Uus precisely in the aspect of sacred painting, and this is extremely promising in scientific terms and takes research beyond the limits of space and time of regional culture. Currently, there are no studies by regional researchers of a detailed analysis of mythological images in the illustrations of Mandar Uus.

The object of our study was the mythological images of the Sakha people; The subject of the research is the processes of visualization of mythological images in the works of Mandaar Uus.

The purpose of the proposed study is to determine the meaning of mythological images in the illustrations of Mandar Uus, their use for pedagogical purposes. This goal requires the solution of the following tasks: clarify the concepts of “image” and “myth”; study illustrative materials for the works of Mandar Uus; to argue the position on the sacred nature of the illustrations of Mandar Uus.

The theoretical and methodological foundations of the study are the principles of dialectics, historicism and consistency. The methodology of representatives of the symbolic cultural-philosophical school was applied: “the concept of culture as a symbolic universe” by the German philosopher E. Cassirer, the concepts of the semiosphere and culture as a semiotic, sign system introduced by Yu.M. Lotman, which makes it possible to trace the dynamics of the formation of religious, moral, spiritual values and traditions of the Sakha people. This issue was developed by A.A. Aronov, K. Levi-Strauss, D.S. Likhachev, Yu.M. Lotman, V.M. Mezhuhev, T.N. Suminova, L. White, A.Ya. Flier, S.S. Khoruzhy, A. Schweitzer and others.



Such general scientific and special methods were used as semiotic, which made it possible to interpret the sign-symbolic nature of sacred images and plots, semantic analysis, which contributed to the consideration of a cultural object as a “text”, comparative, which served to identify universal concepts, comparative historical, the method of sociocultural observations and sociocultural reflections.

### **Presentation of the main material of the article**

In translation from Greek the word “myth” (mythos) means “story”. It appeared in ancient times. In a broad sense, myth as an integral part of mythology is a special way of relating to the world, generalizing the tasks of primitive religion, art and science. Our distant ancestors were characterized by the so-called mythological thinking, when the history of mankind was considered as a change of generations of gods, heroes and people, and animated natural elements intervened in the fate of mortals.

Myth as a type of worldview has a number of distinctive features:

- arbitrary plot; zoomorphism; an attempt to explain natural and social phenomena; - the repetition of images and plots among different peoples.

Mythology is not only part of the cultural tradition of a certain people or tribe, but also part of the mythological tradition of all mankind. Comparing the mythologies of different peoples, we constantly meet similar images, recurring plots and situations. We will consider mythological images as a special specific form of symbolic reflection of objective reality, including events of a metaphysical nature[2].

The mythological theme is widely represented in various genres of art, including sacred painting. Under this definition, icons, hand-written miniatures, wall paintings, ornaments, as well as magic scrolls are distinguished.

The end of the 20th - the beginning of the 21st century is a unique time in many respects, when an educated person has access not only to the latest technologies, but also to the search for sacred values. The word “sacred” comes from the Latin *sacralis*, which means “sacred”. Over time, the religious consciousness deepened the understanding of the term, now the sacred is not just separated from the profane world, but separated with a special purpose, as intended for a special higher service or use in connection with cult practices. Accordingly, any object dedicated to God is endowed with the quality of sacredness, that is, sacredness.

Just such, going beyond the limits of everyday life, are the works of Neustroev Boris Fedorovich in the field of illustration. Being the custodian of the material and spiritual knowledge of the Sakha people, he created many bright works for the books of leading masters of the word, such as A.E. Kulakovskiy, A.I. Krivoshekin - Aiyana, Sayyana, Unaar Uybaan and others.

It should be noted that his illustrations visualize the religious, philosophical and spiritual views of the Sakha people. The works are characterized by ordinary

viewers as “philosophically meaningful. Experts and connoisseurs distinguish five levels of being of a sacred image

1. didactic (utilitarian and illustrative aspect, literal understanding of the image);
2. symbolic (analytical, rational perception of the mythological image);
3. sacral-mystical (perception of the image as a sacred relic, incomprehensibly and mysteriously associated with the ancient religion of the Sakha people, with the archetype),
4. liturgical (drawing as a conductor of the Upper World to the Middle World)
5. artistic (emotional and aesthetic perception of the image).

The author himself did not comment or explain the meaning of his works. The thoughts and judgments expressed in the article are based on the author’s personal attempt to decipher and interpret the mythological images of B.F. Neustroeva-Mandar Uus from his book “Oyuu rear Aiyu rear” [7].

Aiyysyt. In this illustration, we can assume that this is the goddess Aiyysyt (Aiyysyt (Yakut. Aiyhyt), or Aiyysyt, is the common name of the patron goddesses, givers of children and offspring of domestic animals among the Yakuts [6]). She lived on the eastern side of the sky and descended from there, all surrounded by a halo of light, seemed to be a richly dressed elderly woman or a mare. E.K. Pekarsky wrote that “Aiyysyt is a creator, a creator, an intercessor for the conception of children, a patroness of children who lives on the eastern side of the sky.” She, in his opinion, gives the newborn a “kut” (soul), that is, it connects the elements of kut embedded in the earth, air and woman. According to other sources, “Aiyysyt” itself could not create a “kut” of a child, she asked for it from the most important deity of the ancient Yakut pantheon of light deities “Yuryung Aiyu toyon” (White Aiyu Lord) and introduced it into the crown of a man. From there, “kut” during conception passed into a woman [4]. As V.M. Ionov, “kut” was given to the child by Yuryung Aiyu Toyon himself, and “Aiyysyt” was created by the child himself [12].

“Kut” by the definition of many authors such as V. F. Troshchansky, A. A. Popov, G. V. Ksenofontov, A. E. Kulakovskiy, Sehen Bolo, N. A. Alekseev, A. I. Gogolev, L. A. Afanasiev, R. I. Bravina is explained as a “soul”. P. A. Oyunsky wrote: “The word kut defines the concept of being. Moreover, kut has three elements: iye kut, buor kut, salgyn kut. The totality of these elements gives the completeness of the concept of being - kut”, further adds: “... the concept of being is closely connected with the life of a living organism, outside the body there is no life for kut” [10].

First, by the external outlines we can see a woman. This is hinted at by the parting on her head and thin eyebrows and gracefully twisted edges of the eyes. Yes, in general, the shape of her body, resembling an egg, is most often used to

describe the figure of women. A radiance emanates from her head, which hints at her divinity. Also, her hands are gracefully folded together and pass something in the form of a drop with a radiance inside to the other hands from below. It can be assumed that this is how the process of transferring the soul is depicted. A small sprout below from the hands can be interpreted as the beginning of a new life. So, for example, a flower already in the religious picture of the world acts as a symbol of a whole person - in Christianity, a rose symbolizes Jesus Christ, a lily - the Virgin Mary; In Buddhism, a lotus with a thousand petals symbolizes the Buddha.

### **Ai uonna Jai (Ai and Jai)**

Inside the circle are two opposites. Ai and Jai, light and dark. Ai is depicted as a sun with a face whose hands send light energy to the middle world, which is in the middle and is painted with floral patterns.

Jai is made in black and depicted as a one-eyed monster. His hands seem to be trying to grab the middle world. And the patterns in his side are dark in color. Sparks in the form of lightning emanate from the place where their forces meet.

As for the meaning of these two concepts, in the dictionary of E.K. Pekarsky gave the following definition: “To create what, to give life, to create, to create (a person), to arrange, to establish, to erect, to produce” [11]. In many words of the Yakut language, all verbs that make sense to create have the horse of the word “Ai”. The same Aiyy deities have the same basis.

The author himself claims that “Ai” is the beginning of all beginnings in the person of “Urung Aiyy Toyon” (Supreme Lord Aiyy). E.K. Pekarsky gives such a definition to the word “Jai” “rubbish, dirt, evil spirits (in the spiritual sense), black evil spirits (filth)” [11]. Also, many words that have a bad meaning have the root “day”, such as “djaaby - disorderliness”. It also means “influencing, influencing.” The author himself writes that it is opposite to the concept of “Ai”. And that with the help of it there is a cycle of life in the world. Both concepts are equal in strength to each other, and one cannot exist without the other. Otherwise, the balance of the world is disturbed.

### **The deities of Aiyy bless the child.**

In this illustration, you can see a white silhouette resembling a baby in a fetal position, from which undulating circles emanate. Inside the figure itself, there are two objects with many rays. By location, they are in those places where the heart and brain are located. They are united by dotted lines that come from a cruciform object of five points, reminiscent of the amulet “Bies harah - five eyes, five-eyed.” The amulet consists of five equilateral rhombuses forming a cross.

Based on everything described, it can be assumed that these are the deities “Aiyy” or the spirits “ichchi” transmit vitality or bless the child, the future representative of the Sakha people.

Deity-aiyy is the general name of higher supernatural beings, personifying the principles of goodness [5]. More A.E. Kulakovsky defines the functions of deities. Aiyg deities are defined as powerful beings with great magical abilities.

The concept of “ichchi” in the broadest and deepest sense of the word in the Yakut language means “essence”, nature, content of things, phenomena of the surrounding reality. It is the inner essence, nature, content of anything that determines all its possible connections and relations with all other things. In Yakut mythology, this irrational, self-willed, active, ideal essence of a thing is the sovereign ruler, master, ichchi of all its external visible manifestations. Every living thing contains ichchi within itself. Therefore, the concept of “ichchiteh” in the Yakut language means inner emptiness, the absence of ichchi. Consequently, the concept of “ichchi” is a figurative designation, an expression of the abstract concept of “essence”. In Yakut mythology and the heroic epic olonkho, some ichchi were represented as anthropomorphic, zoomorphic and other creatures. These creatures endowed with reason and abilities for various emotions, conscious actions and actions. It is these creatures in the Yakut mythology and olonkho that form a special kind of creatures that definitely cannot be attributed to the kind of good or to the kind of evil beings. These, most often, anthropomorphic and zoomorphic creatures in the literature are designated by the concept of “master spirits” or “ichchi” of things, phenomena, certain places.

#### **Tyl ichchite (Spirit of the word)**

In front of us is a circle, inside which is a sun with zigzag rays and three silhouettes of men. Each is inside the other according to the principle of nesting dolls. And each one is distinguished by light, from the lightest smaller one to the darkest larger one. It is assumed that these are the souls of a person (Us kut): Buor Kut - the earth of the soul, Iie Kut - the mother of the soul, Salgyn Kut - the air of the soul. Below is the figure of a bird. According to Sakha belief, the spirit of the words “Tyl ichchite” had the shape of a bird. And the spoken words flew away in the form of a small bird, and thus reached their addressee. Based on this, we can say that the “rear of ichchite” is drawn here. The author himself in the book “Oyuu rear, Aiyg rear” The language of drawings, the language of Aiyg calls it “Tyl Tordo Ytyk Chyybystaan” (The basis of words is sacred Chyybystaan) [7].

At the same time, the head and tail of the bird are raised up, thus resembling a crescent in shape, as if something is singing. Also, the figure of a bird is on the forehead of each soul. All of them are connected by dotted lines, which come from the beak of the lower bird. It can be concluded that the deities “Aiyg” bless every soul of a person with the help of “Tyl ichchite”.

#### **The deities of Aiyg are watching from above.**

In this illustration, a man with a choron is seen inside the circle. His hand is brought to his ear, usually in this position they describe the narrators of the olonk-

ho (epos of the Sakha people). Next to him are three serge (tethering posts). And to his head are lines twisting into a spiral. Outside the general image, a luminous circle is drawn, from which a dotted line goes to the head of the olonkhosut (olonkho storyteller). From which we can conclude that the upper deities of “Aiyy” send a blessing to him. The deity “Aiyy” is shown in the form of a shining circle, and the line is the connection between them.

Outstanding olonkhosut storytellers believed that when they narrate and sing olonkho, the words of the text flow in a continuous stream from somewhere above or from within, from the heart, as if someone prompts them, and they only have time to express. They should definitely speak out, otherwise they feel unwell, they may even get sick.

It is also possible to make an assumption that the lines leading to the head of the olonkhosut may be the “reins of the aiyy”. In olonkho, most often the human race is described as follows, “argahytan tehiinneeh kun ogoloro” - with solar reins behind the back. It is assumed that the aiyy deities lead a person with these reins.

#### **Tyl ichchite (Spirit of the word)**

In the illustration, the figure of a bird is noticeable inside a drop-shaped dark figure that flies towards the luminous circle. According to the belief of the Sakha people, everything in the world has its own spirit “ichchi”, and words can have their own “ichchi”. He was described as a small bird. Based on this, we can make the assumption that the “rear of the ichchite-spirit of words” is described here, which flies towards the circle-Aiyy. And a man is chasing him, who is trying to grab his wings, which are twisted in a spiral.

So, for example, in the olonkho of P.P. Yadrikhinskiy - Bedzhelele “Girl-hero Dzhyrybyna Dzhyry-lyatta”, the ichchi of words takes the form of a sonorous bird-jiereng (dhierzh) [3]. In the Yakut text of the olonkho by V. M. Novikov - Kyunnyuk Uurastyrap “The Mighty Dzhagaryma”, the ichchi of words takes the form of a crossbill songbird (ymyy chyychaakh) [9]. In the olonkho of P. A. Oyunsky “Nyurgun Bootur the Swift,” ichchi of the words of the song of the radiant Tuyaarum, Kuo takes the form of a white crane [9]. And about the ichchi of the tongue and jaw, Aan Alakhchyn Khotun is sung in the same olonkho:

From the limits of the wide earth, Surrounded by mountain ranges, Cutting through the air with a ringing arrow, Aan Alakhchyn’s Voice, the Spirit of her jaw and tongue, flew up to the sky, sparkling; And turning into a small cuckoo, Shining with wings, Circled over the roof of the golden Vastly beautiful house-palace, Where Yuryung Aar Toyon of Heaven lives, the gray-haired master, ... [9].

**The transfer of the soul of a child by the goddess Aiyysyt to the people of the middle world.**

Here is the plot of the transfer by the goddess Aiyysyt of the soul “kut” of the child to the inhabitants of the middle earth. The goddess herself is shown rather

schematically, the main female features are conveyed. Since Aiyysyt is interpreted as the goddess of fertility and the middle earth, she has three-dimensional forms. This description of the female figure is found in many cultures. The same Venus of the Paleolithic.

With both hands, she carefully conveys the soul of the boy, who is drawn inside the shining circle, which hints to us that this is the soul of the “kut”. Three lines are directed from the goddess Aiyysyt to the child, which can be explained as a blessing and strengthening of the boy’s three souls. Or the connection of his souls with the goddess Aiyysyt. Below are men building the salaries of a house to illustrate our world.

Mythology has become the original form of human thinking, the source of subsequent, more developed forms of thinking: religious, artistic, philosophical, scientific. All of them consist of “bricks” of mythological thinking. Hegel called myths the pedagogy of the human race. Myths or fairy tales educate each of us in childhood, they serve as a source of inspiration for artists and scientists, and even the most rational theories contain elements of mythological thinking. Myths are a kind of matter of spiritual culture.

### **Conclusions**

Neustroev Boris Fedorovich created a number of landmark works of great importance for science on the semantic content, key ideological representations of the traditional Sakha culture, both in the field of the spiritual heritage of the Sakha people and in the field of applied art. His talent as an illustrator of his own books and works of the classics of Yakut literature is also known outside the republic, as is the master of blacksmithing. Drawings made by B.F. Neustroev to his ethno-philosophical works, are images of the Yakut traditional mythology, a kind of visualization of individual philosophical and ethno-cultural positions of the master.

2. As a working definition in our article, we adopted the definition: a mythological image is a special specific form of symbolic reflection of objective reality, including events of a metaphysical nature. The original semantics of the word “sacred” - “separated, protected” - deepened over time. Today, experts define the sacred not as simply separated from the profane world, but as separated for a special purpose, as destined for higher service or use in connection with cultic practices.

3. The mythological images created by Mandar Uus as illustrations for his works and books by well-known authors of the RS(Y) can be attributed to examples of modern sacred art, whose goal is to convey sacred knowledge. The sacredness of this or that visual drawing of Mandar Uus is determined by the degree of its difference from the profane, that is, guided by the instinctive and emotional principles of the world. At the same time, this separation can arise and be expressed both in the external world and in the internal.

4. In the 21st century, huge masses of people live in a state of spiritual emptiness, engaged in the consumption of material and household goods. According to numerous expert studies, violence on the TV screen (certain visual images) has a devastating effect on the psyche of viewers, causing a desire for aggression. It is necessary to actively popularize and introduce into the mass consciousness positive visual images that will orient to Truth, Goodness and Beauty. The mythological images in the illustrations of Mandar Uus, the wise lines of his books set readers up for positive reflections on the meaning of life, and his social and pedagogical activities show an example of true service to the people of his republic.

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中国作曲家汪立三钢琴作品中的社会现实主义发展浅析  
**REFLECTIONS OF SOCIAL REALISM TENDENCIES IN THE  
PIANO WORKS OF CHINESE COMPOSER WANG LISAN**

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**摘要:** 20世纪中叶,抗日战争结束和新中国成立后,中国的音乐创作迎来了新时代,作曲家加强了对西方音乐成果的学习,推行中西音乐融合进程。特别是在前苏联和中国当时社会主义思想影响下出现的社会现实主义音乐,逐渐占据中国国内音乐文化主流。本文以中国著名作曲家汪立三先生钢琴代表作之一《我们走在大路上》为例,探索中国社会现实主义在钢琴音乐作品中的映射,运用美学思想和风格流派技巧特点,与同时期苏联作曲家音乐作品进行对比分析,并在研究基础上阐述相应结论。汪立三作品中的社会现实主义倾向与苏联作曲家作品基本相同,其表现形式也趋于同一——以鼓舞人民斗争或生产等社会行为的主题(战争主题、革命主题、英雄主题、劳动人民主题和爱国主义主题等);通过音乐语言(庄严地、进行曲、群众性大众性劳动歌曲等)宣传国家意识形态和人民群众进步思想。

**关键词:** 社会现实主义、汪立三、《我们走在大路上》、钢琴作品、中国音乐

**Annotation.** *In the early 1950s, after the end of the Sino-Japanese war and the founding of the People's Republic of China, China's creative environment entered a new period of development: composers began to actively master Western musical achievements, which led to an accelerated passage along the evolutionary path of European music. Social realism, the ideological content of which China adopted from the USSR, became one of the popular styles of the country's musical culture at that time. This article uses one of the representative works of the famous Chinese composer Wang Lisan, "Walking Along the Broad Road" (《我们走在大路上》), to study the peculiarities of the "Chinese variant" of Social Realism and the reflection of its tendencies in piano art. The author examines the aesthetic principles and stylistic techniques of the mentioned work and compares it with the works of the Soviet authors of the middle of the 20th century. On the basis of*



*the analysis, it is concluded that the tendencies of social realism in Wang Lisan's works are largely identical with the "Soviet examples" and are expressed in following a single installation - to attract people's attention to significant social phenomena (themes of war, revolution, heroic labour, patriotism and heroism), to spread the actual state ideology by means of musical language (solemnity, marching rhythms, mass song intonations, etc.).*

**Keywords:** *social realism, Wang Lisan, "Walking Along the Broad Road", piano work, Chinese music*

The Chinese musical culture of the twentieth century, as well as the general state of affairs and political attitudes, in many respects inherited the trends that had formed in the Soviet Union a little earlier. In art, the main trend that met the needs of the times in both countries was social realism - the style that encapsulated the ideological and aesthetic attitudes of the socialist system. In China, as in the USSR, virtually no artist who publicly proclaimed his work escaped the influence of social realism. Wang Lisan's works directly implementing the ideas of this trend are few, but they are interesting as examples typical of their time, reflecting both an affinity with Soviet art and an original national implementation of ideas borrowed from the USSR.

The need to recreate the artistic style of socialist realism on "Chinese soil" was dictated by ideological reasons. As T.E. Kudryavtseva writes: "Artistic creativity in all spheres of its existence became the main means of propaganda of political ideas, introducing the idea of 'socialist existence' into the public consciousness" [3, p. 20]. Initially, the main factor in the imposition of socialist realism on Soviet art was the possibility of influencing mass consciousness through a special pathos of a heroic-romantic character. The ideologist of Soviet musical socialist realism, V.M. Gorodinsky, formulates the status of social realism in comparison with previous artistic movements as follows: "Reality, which has greatly expanded the ideological horizons of musicians, dictates to us themes which, in their grandiosity and depth of coverage unrivaled in the entire history of social consciousness" [2, c. 6].

The Chinese version of social realism is almost identical to the Soviet version. The similarity is observed both in the ideological and figurative spheres - patriotic themes, revolutionary pathos, optimistic resolution of the conflict between the "old" and the "new" world in favour of the victory of transformation, connection with historical events of the present or the recent heroic past - and in the stylistic aspect: songfulness, folkness (reliance on folklore roots), accessibility (use of common, memorised, intonated clichés) (for more: [5, pp. 53]). The main purpose of creating works within the aesthetics of social realism is "to convey to the masses not specifically artistic but mythological content", so that "both the pic-

torial system and the system of means of expression must ultimately lead human consciousness beyond the limits of the artistic text proper and connect it to the 'hypertext' of state mythology and aesthetics. In order to achieve this intertextual transition, a system of canons characteristic of each art form was used, according to which this or that image, this or that artistic technique, was assigned a *stable function*". [1, c. 46].

Socialist realism has been the main artistic trend in China since the founding of the People's Republic of China in 1949 (cited in [6, p. 94]). Several of Wang Lisan's works respond to this trend, such as "Walking Along the Broad Road" (《我们走在大路上》), Ballade "Song of the Guerrillas" (叙事曲《游击队》), "Brother and Sister Reclaiming the Wastelands" (钢琴曲《兄妹开荒》), etc. They contain all the above-mentioned characteristics of the art of social realism: "songfulness" (use of songs as a basis), "folkness" (use of melodies that are widely known among the people), "narrativity" (through explicit programme, images), "accessibility" (deliberate simplification of language and form), "inclusiveness" (explicit reliance on the mass genre of the march), "partisanship" (the composer uses well-known songs by popular and politically significant composers that were created "for the occasion" and "for the people"), "mythologisation" or "ritualisation" (a certain "system of canons" for depicting the idea of a heroic struggle that always culminates in a crushing victory and a general people's celebration), reliance on the Western European tradition of musical romanticism (using of the ballad genre, common in the art of romanticism, which makes it possible to combine all of the above qualities of social realism) (for more: [7, 86]).

The connection with the Romantic tradition - in its most effective, heroic and rebellious hypostasis - is quite in keeping with the spirit of Social Realism, despite the apparent contradictions (the individualism of Romanticism - and the reflection of the mass consciousness of Social Realism). Explaining this paradox was already done in the early stages of forming the socialist realist tendency in the USSR. V.M. Goroditsky's article quoted above - in fact the aesthetic manifesto of musical socialist realism - says: "Does the demand for socialist realism exclude revolutionary romanticism? Not at all. Realism is historically and logically opposed to Romanticism, as a direction and a method of creativity. But romanticism and romance should not be confused, they are not the same. Marx hated romanticism, which created reactionary phantoms rather than images of actual reality. But nowhere and never did he act as an apostle of *sober* (the authors' italics) respectability in art or politics. Lenin said that a Revolutionist must be able to dream, but he never considered dreaming to be the essential quality of a Revolutionist". And further: "Revolutionary romance as a way of artistically reflecting the creative enthusiasm of the masses, the all-consuming pathos of struggle and construction, must naturally be an element of an artistic revolutionary work. We would not be

true realists if we did not feel the enormous enthusiasm of the working class in its approach to the tasks of struggle and construction". [2, c. 17].

In music, of course, social realism matured as the most important art form in terms of its hypnotic effect on a large audience, on the ground already prepared by works of literature, theatre and, above all, cinema. This was the case in the USSR, where "the social demand of Soviet society for cinematography was so great that cultural cinematographic values caused an increase in the general social need to 'go to the cinema' five or more times, to look closely at the faces of heroes, to take from them the example of the Komsomol and the Party, to build their present and future with the help of valuable screen experience" [4, c. 97]. In this context, Soviet films such as "Chapaev" (directed by the Vasilyev brothers, 1934), "Alexander Nevsky" (directed by S. M. Eisenstein, 1938), "Baltic Deputy" (directed by I. Kheifitz, N. Zarkhi, 1934), "We are from Kronstadt" (director: E. Dzigal, 1936), "Seven Brave Men" (director: S. Gerasimov, 1936), "The Thirteen" (director: M. Romm, 1936) were a great success.

In China we can observe similar forms of continuity of artistic trends. The works of Wang Lisan have a close relationship with the famous Chinese films of the second half of the twentieth century, made during the period of revolutionary transformation and the establishment of the new socialist nation, and dedicated to the revolutionary and independence struggle. These include films such as "The White-haired Girl" (《白毛女》, 1950), "The Red Detachment of Women" (《红色娘子军》, 1961) and "Lei Feng" (《雷锋》, 1965). The popularity of these films was so great that operas and later ballets were written and performed based on them<sup>1</sup>. The films focus on belief in the coming victory of the "Kingdom of Justice" and the people over the oppressors. The latter in art always seem to be the personification of all the vices of the past society, and all these vices must be completely eradicated and swept away by the builders of socialism. The struggling heroes experience personal feelings (there are short lyrical fragments in the films), but the lyricism in such films is always subordinated to the main heroic idea, and the suffering of the heroes, tormented by oppressors, is expressed in an emphatically dark form, but is necessarily replaced by a final jubilation, which the heroes anticipate throughout the film as a dream of a bright future.

The ideological attitudes characteristic of socialist realist cinema were also reflected in piano music, both in the USSR and in China. The style of Wang Lisan's works is characterised by a deliberate simplification of the musical language, a

<sup>1</sup> "The White-haired Girl" is the first Chinese national opera, composed in January-April 1945 by the team of authors of the Lu Xin Academy and declared "exemplary" by the CCP. A ballet based on the opera was performed in 1965 (see: [8]). "The Red Detachment of Women" is a film made in 1960. In 1964 a ballet of the same name was staged by a group of authors: Wu Quqiang, Du Minxin, Dai Hongwei, Shi Wanchong, Wang Yanchao, with choreography by Li Chenxiang, Jiang Zuhu and direction by Ma Yunhong. (for details: [8]).

reliance on European principles of harmonic thinking based on a tendency to tonicity, an emphasis on optimism and festive imagery, which are linked to patriotic and national liberation themes and close to the aesthetics of social realism. If we talk about the stylistic origins of this direction, the leading one is undoubtedly the piano style of late Romanticism with its colourful variety, imagery, colourful use of the pedal, virtuoso passages, powerful chords, scattering of octaves, scattering of chords in different registers, as well as the use of certain elements of 20th century musical language: dissonances too sharp for 19th century Romanticism, polytonality.

However, such insertions are very brief and have almost no effect on the main style of the work. In this respect, Wang Lisan's approach was fully in line with that of the representatives of Soviet Socialist Realism, who, as V. Orlov writes, were essentially concerned with copying the style of late Romanticism: "The truth is that the essence of social realism was the restoration of the late romantic style, which was most evident in music. Thus, only the instruction to create a 'high style' in this statement was true; the other statements-both 'nationality' and 'guidance of new feelings' - were mere 'whims' that had nothing to do with reality. It was precisely the imitation of the style of nineteenth-century romantic composers that was the real requirement for Soviet composers" [5, c. 56].

One of Wang Lisan's works in this vein, "Walking Along the Broad Road" (《我们走在大路上》), is a brilliant piano arrangement of a famous song by Li Jiefu (李劫夫, 1913-1976), a Chinese educator and composer of over two thousand songs. Li Jiefu was the first dean of the Shenyang Conservatory of Music and helped found many music schools in China. He was known as the "People's Musician" because he used his works to portray the lives of ordinary people and the country he lived in. Many of his songs are dedicated to the Second Sino-Japanese War. During the Cultural Revolution, he also contributed greatly to the dissemination of Mao Zedong's ideas by composing more than two hundred songs based on his poems. Li Jiefu's work has always been a response to the events taking place in society. For example, when an earthquake unexpectedly struck Hubei Province in May 1966, he went there to lift people's spirits and thus contribute to disaster relief (he composed thirty-one songs during his thirteen days there). Li Jiefu himself wrote about his creative credo: "Art is a tool for the illumination of history and the reflection of reality. The most valuable quality of art will be lost if it is separated from the time of its creation" (quoted in [9, p. 55]).

The song "We Walk on the Great Road" (《我们走在大路上》) was composed by Li Jiefu in 1962 (Fig. 1) after a tour of Shenyang by Premier Zhou Enlai and other leaders of the central ministries. After the inspection, the Premier invited Li Jiefu and Bo An (1915-1965), Minister of Cultural Work of Liaoning Province, to a meeting at the Zhou residence to discuss the current economic situation. He

assured those present that the Communist Party government would lead the country into a bright future from the severe crisis caused by China's recent famine. This meeting made a deep impression on the composer and he wrote several songs intended to raise people's morale, including "We Walk on the Great Road".

## 我们走在大路上

行进速度

劫夫词曲  
吉律制谱

1. 我们走在大路上，意气  
2. 革命红旗迎风飘扬，中华  
3. 我们的道路洒满阳光，我们的  
4. 我们的道路多么宽广，我们的

风发斗志昂扬，共产党领导革命队伍，披荆斩棘奔向前  
儿女奋发图强，勤建设锦绣河山，誓把祖国变成天  
前歌声传四方，我们的朋友遍及全球，五洲架起友谊桥  
程无比辉煌，我们献身这壮丽的事业，无限幸福无上荣

方。向前进！向前进！伎俩气势不可阻挡，向前  
堂。梁。光。

进！向前进！朝着胜利的方向。胜利的方向。

向。

Figure 1. Li Jiefu. "We Walk on the Great Road"<sup>2</sup>.

<sup>2</sup> 《中国歌曲选》. 上海：人民音乐出版社，2014. 页数：109.

Just two years later, in 1964, Wang Lisan composed his concert piece “Walking Along the Broad Road” based on a melody by Li Jiefu (Fig. 2).

李劫夫作词

作于1964年5月.

**Moderato**

\*根据李劫夫同名歌曲改编。  
After a song of same title by Li jiefu.

Figure 2. Wang Lisan “Walking Along the Broad Road”<sup>3</sup>.

The main emotion of the piece is rejoicing, expressed both in the celebratory structure and in the use of elevated tones: II, IV, V. Wang Lisan prefaces this composition with original lyrics from Li Jiefu’s song of the same name, which

<sup>3</sup> 童道锦, 王秦雁. 汪立三钢琴作品选. 上海: 上海音乐出版社, 2013. 页数: 245.

translates as follows<sup>4</sup>: “*How wide is our path. Our future is glorious. We dedicate ourselves to this magnificent cause. We’ll run forward through thick and thin!*”

Wang Lisan transforms the melody of the song into a brilliant concert piece in which he uses both typically Romantic structures (wide range, throwing the melody from one register to another, Lisztian trills in the bass imitating the beating of drums, bell-like sound, typical Romantic polyrhythmic combinations of duo and trio figures, alternation of solemn and singsong fragments) and elements of 20th century musical language (bold and unexpected tonal juxtapositions, polytonal and polyharmonic combinations). In addition, the use of national elements in the music is noticeable: although the melody itself is written in F-Dur, the first half uses a pentatonic scale, which is emphasised at certain moments in the accompaniment (for example, in the first half of the second variation (mm. 23-30), the singing second voice in the right hand plays a pentatonic motif (tones f g a c d), which gives rise to non-tert (quarto-quinto, second) combinations in the music. The same effect occurs in the second variation, which performs the function of the middle section (mm. 50-51), but in the key of E-Dur.

The piece is written in a form that combines a variation (as always, in free form, with elements of variation and development) and three parts. The theme and the first variation follow the classical canon of varying form. In the third variation, the theme develops without suspense, relying on two sudden and unexpected key changes, but maintaining the melodic line. Beginning at m.38 in the key of Des-Dur, the theme suddenly shifts to E-Dur at m.49. Then, at m. 52, the composer, using polytonality, immediately moves the melody to F-dur and triumphantly ends the variation in this key. Later, however, as if unable to contain its exultation, the music moves sharply up half a tone to Fis-dur (mm. 54-56). At m.56, the rhythm changes only once (by two quarters instead of four, creating a ‘failure effect’), and the theme, returning to the key of F-Dur, is repeated, with a melodic line in Fis-dur in the basses at the same time as the key of the melody in the accompaniment at mm.66-67. The piece ends in F-Dur key, with a final upward movement of the melody by an octave and a half and a pentatonic final consonance.

In this work, in the tradition of socialist realism, Wang Lisan presents the image of the liberation and revolutionary struggle as a celebration, which, although sometimes disturbed by life’s dramas and tragedies and interspersed with moments of lyricism.

A comparison of Wang Lisan’s piano piece “We Walk on the Broad Road” with the works of Soviet authors of the mid-twentieth century leads to the conclusion that Chinese social realism and the corresponding artistic method of Soviet art are related. In both cases, the aesthetic principles of musical composition are the same: adherence to Party ideological guidelines in content, and simplicity, bright-

<sup>4</sup> Translated from Chinese by Zhao Zehua.



ness and accessibility in style. The latter requires aspects such as programme, reliance on folk intonations and clichés of mass singing, simplicity and clarity of structure, and variation as the main method of development. The use of the stylistic techniques of the Romantic piano style (virtuosity, density of texture, breadth of range, harmonic colour) is part of the artistic task, as it gives musical works an infectious, inspiring character, an acoustic beauty accessible to the perception of a mass audience.

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DOI 10.34660/INF.2023.13.11.050

三维成像在腹腔镜根治性前列腺切除术中的效率  
**EFFICIENCY OF THREE-DIMENSIONAL IMAGING ON  
PERFORMING LAPAROSCOPIC RADICAL PROSTATECTOMY**

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**摘要。**腹腔镜介入治疗期间的三维成像是显著提高此类手术质量的因素。然而，值得注意的是，只有单一的著作致力于研究 3D 术中导航在腹腔镜手术（包括泌尿科疾病的手术治疗）中的潜在益处。

该研究的目的是比较 2D 和 3D 成像方面腹腔镜根治性前列腺切除术的围手术期结果。

**研究材料和方法：**对146名局限性前列腺癌患者进行了为期6年的观察。他们每个人都接受了带有 2D 和 3D 成像控制的腹腔镜根治性前列腺切除术（RP）。干预过程中是否采用保留前列腺神经血管束的技术。至此，4个研究组成立。第1组和第2组中，LRP采用二维术中导航，52例患者（第1组）使用神经保留技术，46例患者（第2组）未使用神经保留技术。第3组和第4组（n = 23 和 n = 25）在手术过程中使用了三维成像。第3组使用神经血管束保留技术，第4组未使用。分析以下围手术期参数：总干预时间、失血量、膀胱引流时间、手术切缘阳性频率、住院时间尿失禁的停留时间和频率以及勃起功能的恢复。

**研究结果：**第 1、2、3 和 4 组的总干预时间为  $171,35 \pm 21,08$ 、 $168,25 \pm 23,16$ 、 $98,72 \pm 17,34$  和  $92,18 \pm 22,21$  分钟术中失血量分别为  $294,16 \pm 62,13$ 、 $281,24 \pm 53,23$ 、 $144,22 \pm 31,67$  和  $148,53 \pm 33,04$  ml。第 1 组和第 2 组的手术切缘阳性率为  $1,92 \pm 0,11\%$ 、 $2,17 \pm 0,04\%$  的患者检测到阳性手术切缘，但在第 3 组和第 4 组的参与者中未观察到阳性手术切缘。第 1 组的膀胱导

尿时间、2、3、4是术后5-7天。接受 2D 成像手术的患者干预后的卧床天数为 8-10 天,接受 3D 引导手术治疗的患者为 8-9 天。在第 1、2、3 和 4 组中使用 2D 和 3D 成像,100% 的患者在术后第 6 个月和第 12 个月末记录到 RP 后尿失禁功能完全一致。腹腔镜 RP 后 3 个月,每组中约有  $\frac{1}{3}$  名患者观察到勃起功能恢复,12 个月后,来自 1、2、1、2 组的参与者分别为 59.62%、41.30%、82.61% 和 56.00%。分别为3组和4组。

结论。根据我们的研究,与2D导航进行RP的类似测量结果相比,以3D可视化方式进行RP具有统计学意义,手术时间减少了42-45%,术中失血量减少了47-51%干预后的 12 个月内,患者的住院时间减少了 1-2 天,勃起功能恢复的频率大约增加了 1.3-1.4 倍。使用保留前列腺神经血管束的技术显著有助于勃起功能的正常化。

关键词: 腹腔镜手术中的成像格式、3D 成像、3D 成像根治性前列腺切除术。

**Annotation.** *Three-dimensional imaging during laparoscopic interventions is the factor significantly improving the quality of such operations. However, it is worth noting that there are only single works devoted to studying potential benefits of 3D intraoperative navigation in laparoscopic surgery, including surgical treatment of urology diseases.*

**The aim of the research** is to compare the perioperative results of laparoscopic radical prostatectomy performed in terms of 2D and 3D imaging.

**Materials and methods of the research:** 146 patients with localized prostate cancer were observed for 6 years. Each of them underwent a laparoscopic radical prostatectomy (RP) with 2D and 3D imaging control. During the intervention, the technique of preserving the neurovascular bundles of the prostate was whether used or not. Thus, 4 research groups were formed. In groups 1 and 2, LRP was performed in terms of two-dimensional intraoperative navigation, nerve-preserving technique was used in 52 patients (group 1), and was not used in 46 patients (group 2). In groups 3 and 4 ( $n = 23$  and  $n = 25$ ), three-dimensional imaging was used during the operation. The technique for neurovascular bundle preservation was used in group 3 and was not used in group 4. The following perioperative parameters were analyzed: total intervention time, volume of blood loss, time of bladder draining, frequency of a positive surgical margin, length of hospital stay, and frequency of urine continence and erectile function restoration.

**Results of the research:** in groups 1, 2, 3 and 4 the total time of intervention was  $171,35 \pm 21,08$ ,  $168,25 \pm 23,16$ ,  $98,72 \pm 17,34$  and  $92,18 \pm 22,21$  minutes, respectively, the volume of intraoperative blood loss was  $294,16 \pm 62,13$ ,  $281,24 \pm 53,23$ ,  $144,22 \pm 31,67$  and  $148,53 \pm 33,04$  ml, respectively. Positive surgical margin in groups 1 and 2 was detected in  $1,92 \pm 0,11\%$  and in  $2,17 \pm 0,04\%$  of patients, was not observed in participants from groups 3 and 4. Time of bladder catheterization in groups 1, 2, 3 and 4 was 5-7 days after surgery. The number of bed-days after the intervention in patients operated on in terms of 2D imaging was 8-10, in those undergoing 3D-guided surgical treatment - 8-9 days. Using 2D and 3D imaging in groups 1, 2, 3 and 4, complete consistency of urine continence

*function after RP was recorded at the end of the sixth and twelfth postoperative months in 100% of patients. Restoration of erectile function 3 months after laparoscopic RP in each group was observed in about 1/3 patients, after 12 months - in 59,62%, 41,30%, 82,61% and 56,00% of participants from 1, 2, 3 and 4 groups, respectively.*

**Conclusion.** *According to our study, performing RP in terms of 3D visualization is statistically significant compared to the results of similar measurements for RP with 2D navigation, the surgery time reduced by 42-45%, the volume of intraoperative blood loss decreased by 47-51%, the length of the patient's hospital stay became 1-2 days less, erectile function regained approximately by 1,3-1,4 times more often in 12 months after the intervention. Using the technique of preserving prostate neurovascular bundles significantly contributed to the normalization of erectile function.*

**Keywords:** *imaging format in laparoscopic surgery, 3D imaging, radical prostatectomy with 3D imaging.*

The first three-dimensional (3D) imaging models for laparoscopic surgeries were developed in the 1990s, further on, these systems were improved, and nowadays they are an advanced technology of visual control while performing endo-surgical interventions.

Regardless the technical aspects of the issue, there are principal differences between images in 2D- and 3D-formats. In the first ones, besides the exterior of the anatomical structures and the instruments, it is possible to assess only linear sizes and interlocations of these objects on the plane. In the second ones, due to three dimensions of imaging, there is a volume visual image with the perception effect "closer-farther". In 2011 Starkov Y.G. et al. noted that using 3D-navigation "... allows a surgeon to orientate precisely in the area during the surgical intervention, to assess not only the organ size, but the depth of its location, which facilitates the coordination of the instruments, increases the accuracy of the movements...".

Visualizing 3D-models are a mandatory component of DaVinci robotic complex [Talamini M.A. et al., 2003]. As Panchenkov D.N. et al. emphasize, this fact is related to the main advantages of robot-assisted surgery against the technology of ordinary laparoscopic intervention with two-dimensional image format: stereoscopic visualizing of operative movement zone allows to grade such common difficulties of intraoperative 2D-navigation as "... absence of binocular visualization of topographic-anatomical interrelations in the operation area, limited facilities for intraoperative inspection, orientation in the operation field, manipulating the instruments ...". However, implementing robotic operating models is greatly restricted by their high costs. For instance, the costs of buying and applying DaVinci complex are about 1,0-2,3 million and 180 thousand dollars, respectively [Rao G. et al., 2013]. Besides, during robot-assisted interventions there is no tactile feedback and opportunity to change the patient's position on the operation table. The

logic solution of this problem is performing laparoscopic operations with three-dimensional imaging control [Nezhat C., 2009].

In the late XX and early XXI centuries, 3D-imaging models were not widely used in traditional (non-robotic) laparoscopic surgery. Researchers mention several reasons of this fact. Some of them are technical and ergonomic drawbacks of 3D-screens [Kozlov Y.A. et al., 2015], high costs of the equipment [Goh P. et al., 1993], deterioration of the surgeon's health during the operation (headache and dizziness, nausea, blurry and double vision, eye fatigue) [Taffinder N. et al., 1999].

Nevertheless, in 2018 H. Liang et al. published the results of cumulative meta-analysis of 23 investigations comparing the efficiency of using 2D- and 3D-imaging models and emphasized that 3D-intraoperative navigation is more preferable in laparoscopic interventions. The authors also underline the necessity of further improvement of 3D-facilities intended to reduce side effects and cost of the equipment [Liang H. et al., 2018].

In Russia and abroad, during comparative studies of the efficiency of 2D- and 3D-imaging models, the following parameters are considered: time of the laparoscopic intervention, volume of blood loss, time of bladder draining, number of post-operative bed-days, as well as surgeon's work efficiency and others. According to the finding of the cumulative meta-analysis performed by H. Liang et al. (mentioned above), basing on such criteria as operation time, volume of blood loss, length of hospital stay and surgeon's work efficiency in laparoscopic interventions, the best results were obtained in cases of using 3D-imaging [Byrn J.C. et al., 2007; Wagner O.J. et al., 2012; Bilgen K. et al., 2013; Liang H. et al., 2018].

In 2019 A. Arezzo et al. presented a systemic literature review (n=9967) devoted to using three-dimensional visualization in laparoscopic surgery and it was registered in the database of National Center of Biotechnology Information (NCBI), the USA (database PubMed) and biomedical literature database Embase. Basing on the results of the literature analysis, the authors, firstly, marked that using three-dimensional imaging models in laparoscopic interventions really promotes reducing the operation time and intraoperative traumatism; secondly, highly recommended to continue the investigations aimed at studying "... the potential benefits of 3D-laparoscopic model..." (cited by A. Arezzo et al., 2019). Topicality of further investigations was also emphasized by R. Smith et al. (2014), M.O. Watson et al. (2016) and others. [Panchenkov D.N. et al., 2012; Kozlov Y.A. et al., 2015; Smith R. et al., 2014; Watson M.O. et al., 2016].

The aim of the cited investigations was a comparative study of perioperative results of laparoscopic radical prostatectomy in terms of 3D- and 2D-imaging.

#### **Materials and methods of the research**

The research was carried out in the Urology department of St. Luke's Clinical Hospital (St. Petersburg) from March 2014 to August 2020. To achieve the aim

there was performed a retrospective analysis of perioperative results of radical surgery for localized prostate cancer (PC) (T1c-T2c) in terms of two- and three-dimensional imaging control.

All the participants were diagnosed localized PC on base of histological study of prostate biopsy. The indication for PC biopsy was high serum PSA level up to 4 ng/ml and higher and/or signs of prostate structure impairment revealed on digital rectal examination.

While selecting the research materials (medical records), the following exclusion criteria were taken into account: 1) previous radiation and/or hormonal therapy, abdominal and pelvic surgeries; 2) history of small pelvis traumatic injuries, central nervous system damage, severe cardiovascular diseases, diabetes mellitus, alcohol abuse; 3) prostate volume more than 100 cm<sup>3</sup>; 4) urinary incontinence before the intervention.

Thus, 146 medical records were selected. The age of the patient-participants varied from 59 to 74 years old (median – 66 years old).

Allocation of the patients into the research groups was performed according to the following parameters: 1) using / not using the technique for neurovascular bundle preservation during the intervention (TNVBP); 2) using 2D or 3D imaging format. According to this, four groups of participants were formed. In groups 1 and 2, radical surgical treatment for localized PC was performed in terms of 2D-imaging control, nerve-sparing technique was applied in 52 patients (group 1), was not applied in 46 patients (group 2). In groups 3 and 4 (n=23 and n=25), the operation was performed in terms of 3D-imaging, TNVBP was used in group 3 and was not used in group 4.

Comparison of the male patients from the research groups (1, 2, 3 and 4) by sex, body mass index, PSA level, Gleason score and prostate volume is presented in Table 1. The results of statistical analysis testify of full compatibility of the parameters in all the groups.

**Table 1**  
*Common characteristics of the patients before radical surgery for prostate cancer*

Parameters	Group				p
	№1 (n=52)	№2 (n=46)	№3 (n=23)	№4 (n=25)	
	M±σ				
Age (years)	64,24±3,32	66,32±4,28	65,08±4,52	67,41±3,09	0,362
Body mass index (kg/m <sup>2</sup> )	27,18±1,36	26,12±1,08	27,78±2,06	26,53±1,23	0,123
PSA (ng/ml, serum)	13,37±1,41	14,34±1,45	13,92±1,44	14,62±1,68	0,258
Gleason score	6,27±0,32	6,06±0,24	6,36±0,23	6,18±0,17	0,098
Prostate volume (cm <sup>3</sup> )	54,65±4,16	53,36±4,62	52,89±3,57	51,72±3,39	0,492

where: M – mean value of the parameters; σ – standard deviation β

All the steps of radical surgery for localized PC (prostatectomy, bladder neck exposure and applying urethrovesical anastomosis) were performed in endotracheal anesthesia, the patient was in supine position with adducted legs 30° (as for open prostatectomy), the operating table was placed in a 30 – 35° Trendelenburg.

First a transumbilical incision about 2,5 cm is made. Then abdominal access is performed in layers, a laparoscope is inserted after arranging a standard 10-mm trocar, and insufflation with CO<sub>2</sub> up to 12 mmHg is carried out. The abdomen is inspected. Stepping aside 2 cm medial from anterosuperior spine of iliac crest, under visual control two ports are arranged bilaterally – the left one is 10 mm in diameter, the right one – 5 mm. Two 5-mm trocars are inserted for the working instruments of the operator and the assistant, along the lateral margin of the anterior abdomen muscle, bilaterally at the level of the umbilicus under visual control. The anterior wall of the bladder is exposed. Bilaterally from the prostate, pelvic fascia is incised and lateral prostatic walls are exposed. Next, puboprostatic ligaments are dissected, the dorsal vein complex is ligated by a continuous stitch using a V-Loc suture. The prostate is divided from seminal vesicles. Seminal ducts are dissected. Subfascially the prostate is exposed up to the apex with blunt and sharp dissection. Now the prostate is completely mobilized. The prostate is distally freed from the urethra and divided from Denonvilliers' fascia. The prostate and seminal vesicles are extracted as a whole block in a bag through the central port access. A urethrovesical anastomosis is applied by six interrupted stitches using a monofilament suture. The profiled Foley catheter 18Ch is inserted. The balloon is inflated to 10 ml. Water tightness of anastomosis is checked. Hemostasis control is made – dry. Anastomosis and small pelvis drains are placed. Stitches are put on the skin. Aseptic dressing.

The same technique is used in standard radical prostatectomy.

Intraoperative two-dimensional visual control (groups 1 and 2) was performed using a 2D video processor EVIS EXERA III CV-190 and a LED block EVIS EXERA CLV-190. Three-dimensional imaging (groups 3 and 4) was provided by the video system EXERA III CLV-190. However, in such cases two video centers CLV-190 and the block 3DV-190 were required.

The following perioperative parameters were comparatively assessed: intervention time (min), volume of intraoperative blood loss (ml), time of bladder draining after the intervention (days), frequency of a positive surgical margin (PSM, %), length of hospital stay after surgery (days). Urine continence function (6 and 12 months after the surgery) and erectile function (3 and 12 months after the surgery) were studied in all the patients.

Urine continence function (UCF) was considered to be restored in case if a patient had no need of using even a single incontinence pad a day.

Normal erectile function (EF) was considered to be the ability to obtain and maintain an erection enough for a sexual intercourse.

Statistical analysis of the findings was performed using the following computer applied programs: a) “Microsoft Excel 2010”; 6) “IBM SPSS Statistics-19”. To make a comparative statistic evaluation of the quantative continuous independent variables (age, body mass index, serum PSA level, Gleason score, prostate volume, blood loss, intervention time, time of bladder draining after the intervention, frequency of a positive surgical margin, length of a hospital stay after the surgery) there was used a one-dimensional statistical analysis with paired two-sample t-test; to compare category variables (erectile function restore) – the method for contingency tables with  $\chi^2$  Pearson criterion.

**The results of the research**

Table 2 demonstrates that in radical surgery for localized PC in groups 1 and 2, where 2D imaging control was used, intervention time was 171,35±21,08 and 168,25±23,16 minutes, respectively. In groups 3 and 4 (in terms of 3D imaging) this parameter decreased by 42-45%. The volume of intraoperative blood loss in the patients from groups 1 and 2 was 47-51% more than that of the patients from group 3 and 4 (p>0,05). Bladder catheterization period after the intervention didn’t exceed 5-7 days in all the patients from groups 1, 2, 3 and 4. Frequency of a positive surgical margin in groups 1 and 2 had no statistically significant differences and was 1,92±0,11% and 2,17±0,04%, respectively. In groups 3 and 4 there weren’t a single case of PSM. After the surgery, the patients from groups 1 and 2 stayed in hospital for about 8-10 days, and in groups 3 and 4 – for 8-9 days. For all the considered parameters, there was no relation between their values and using/not using TNVBP. After 6 and 12 months after the intervention, all the patients from groups 1, 2, 3 and 4 were registered with full consistency of urine continence function.

Ability to obtain and maintain an erection enough for a sexual intercourse after 3 months after laparoscopic RP was confirmed in 1/3 of all the patients: 38,46% of men from group 1; 28,26% - from group 2; 34,78% - from group 3 and 30,43% - from group 4 (as shown in Figure 1).

**Table 2**  
*Perioperative results in groups 1, 2, 3 and 4*

Parameters	Groups			
	№1 (n=52)	№2 (n=46)	№3 (n=23)	№4 (n=25)
	M±σ			
Intervention time (min)	171,35 ±21,08	168,25# ±23,16	98,72 <sup>12</sup> ±17,34	92,18* <sup>12</sup> ±22,21
Volume of intraoperative blood loss (ml)	294,16 ±62,13	281,24# ±53,23	144,22 <sup>12</sup> ±31,67	148,53* <sup>12</sup> ±33,04



Time of bladder draining (days)	6,00 ±1,00	6,00# ±1,00	6,00 ±1,00	6,00* ±1,00
Frequency of a positive surgical margin (%)	1,92 ±0,11	2,17# ±0,04	0	0
Length of hospital stay (bed days)	9,09 ±1,00	9,75 ±1,00	8,50 ±1,00	8,75 ±1,00

where: n – number of observations; M – mean value of the parameters;  $\sigma$  – standard deviation  $\beta$ . Symbols: # and \* - no statistically significant differences between the parameters in groups 1 and 2 and in groups 3 and 4; 1 – statistically significant differences from the results in group 1; 2 – in group 2.

According to the results of  $\chi^2$ -Yate’s testing presented in Table 3, there is no relation of the considered parameter to the imaging model and using/not using TNVBP.

**Table 3**

*Frequency of erectile function restoration 3 and 12 months after surgery*

Groups (№, n)	Urine continence function		Results of $\chi^2$ – Yate’s testing	
	Restored	Not restored		
	Absolute number of patients			
3 months after the intervention				
1 (n=52)	20	32	df=1	$\chi^2=1,1921$
2 (n=46)	13	33	$\chi^2_{cr}=3,841$	p=0,2749
1 (n=52)	20	32	df=1	$\chi^2=0,1747$
3 (n=23)	8	15	$\chi^2_{cr}=3,841$	p=0,6760
2 (n=46)	13	33	df=1	$\chi^2=0,3449$
3 (n=23)	8	15	$\chi^2_{cr}=3,841$	p=0,5570
1 (n=52)	20	32	df=1	$\chi^2=0,9247$
4 (n=25)	7	18	$\chi^2_{cr}=3,841$	p=0,3363
2 (n=46)	13	33	df=1	$\chi^2=0,2573$
4 (n=25)	7	18	$\chi^2_{cr}=3,841$	p=0,6120
3 (n=23)	8	15	df=1	$\chi^2=0,3487$
4 (n=25)	7	18	$\chi^2_{cr}=3,841$	p=0,5548
12 months after the intervention				
1 (n=52)	31	21	df=1	$\chi^2=3,3150$
2 (n=46)	19	27	$\chi^2_{cr}=3,841$	p=0,0687
1 (n=52)	31	21	df=1	$\chi^2=3,9978$
3 (n=23)	19	4	$\chi^2_{cr}=3,841$	p=0,0456
2 (n=46)	19	27	df=1	$\chi^2=10,6949$
3 (n=23)	19	4	$\chi^2_{cr}=6,635$	p=0,0011
1 (n=52)	31	21	df=1	$\chi^2=0,1430$
4 (n=25)	14	11	$\chi^2_{cr}=3,841$	p=0,7053



2 (n=46)	19	27	df=1	$\chi^2=1,4559$
4 (n=25)	14	11	$\chi^2_{cr}=3,841$	p=0,2276
3 (n=23)	19	4	df=1	$\chi^2=4,0643$
4 (n=25)	14	11	$\chi^2_{cr}=3,841$	p=0,0438

where: n – number of variants in each sample; df – number of degrees of freedom; p – significance level;  $\chi^2_{cr}=3,841$  – critical value  $\chi^2$  at p=0,05;  $\chi^2_{cr}=6,635$  – critical value  $\chi^2$  at p=0,01

12 months after the intervention, relevant number of men with normalized EF increased by 1,6 times (up to 59,62%) in group 1; in group 2 – by 1,5 times (up to 41,30%); in group 3 - by 2,4 times (up to 82,61%); in group 4 – by 1,8 times (up to 56,0%) (Fig. 1). The results of  $\chi^2$ -analysis justify of a statistically significant positive role of three-dimensional visual control combined with TNVBP in order to restore erectile function after laparoscopic RP (Table 3).

### Conclusion

In 2009 in Russia there were registered 68,1 patients with prostate cancer per 100 000 population. Annually this index steadily increases by 7,5-10,5% and in 2019 it has reached 176,3 patients [Kaprin A.D. et al., 2019]. At the same time, there is a rising need for specialized aid and a “golden standard” for localized PC is radical prostatectomy. By oncological findings, so-called “open” and laparoscopic RP are fully equitable. However, the latter technology is less traumatic. The factor prone to improve the quality of laparoscopic interventions is three-dimensional model of intraoperative visualization.

According to our research findings, performing RP in terms of 3D-imaging is statistically significant compared to the results of RP with 2D navigation: operation time reduces by 42-45%; volume of intraoperative blood loss decreases by 47-51%; length of hospital stay is 1-2 days less; 12 months after the intervention erectile function restores by 1,3-1,4 times more often. Normalization of the erectile function is significantly facilitated by using the technique for neurovascular bundle preservation.

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急性破坏性胰腺炎的综合治疗

**COMPLEX TREATMENT OF ACUTE DESTRUCTIVE  
PANCREATITIS**

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抽象的。作者介绍了针对急诊手术中紧迫问题之一的科学研究结果：优化急性破坏性胰腺炎患者的手术治疗方法。该研究是在哈萨克斯坦共和国阿斯塔纳市第二综合医院国家临床公共医疗机构基地进行的。作者开发并提出了一种在外科诊所实施的急性破坏性胰腺炎综合治疗方案：视频内手术干预与药物治疗相结合，包括使用蛋白酶抑制剂“乌抑菌素”和细胞介质（以下简称 CM），取决于疾病的严重程度。

关键词：急性胰腺炎；乌司他丁；细胞介质，复杂的治疗。

**Abstract.** *The authors present the results of scientific research dedicated to one of the pressing issues in emergency surgery: optimizing surgical treatment methods for patients with acute destructive pancreatitis. The research was conducted in the Republic of Kazakhstan at the base of the State Clinical Public Healthcare Institution at the City Multidisciplinary Hospital No. 2 in Astana. The authors*

*have developed and proposed for implementation in surgical clinics an algorithm for the comprehensive treatment of acute destructive pancreatitis: endovideo surgical interventions in combination with medical treatment, including the use of the protease inhibitor “Ulinostatin” and cellular mediators (hereinafter referred to as CM), depending on the severity of the disease.*

**Keywords:** acute pancreatitis; ulinostatin; cellular mediators, complex treatment.

**Research objective:** To improve the outcomes of the endovideosurgical treatment method for patients with acute destructive pancreatitis.

**Materials and Methods:** The study was conducted at the State Clinical Public Healthcare Institution at the City Hospital No. 2 in Astana, Republic of Kazakhstan. The research protocol was approved at a meeting of the ethical commission of the Non-Profit Joint Stock Company “Astana Medical University” (No. 4 of 02.01.2020). The research utilized various medical imaging techniques such as CT, MRI, the “ZORING” system, “Karl Stors” endoscopic stand, “Karl Stors” argon-plasma coagulator, GelPort (Applied Medical), X-ray of the abdominal cavity organs, abdominal ultrasound (US), and esophagogastroduodenoscopy (ERCP). Clinical and laboratory investigations were also performed. Statistical analysis of the results was conducted using variational statistical methods with calculation of  $M \pm SD$ . Differences between the comparison groups were analyzed using the Wilcoxon-Mann-Whitney test and considered statistically significant at  $p \leq 0.05$ . Between 2017 and 2021, 70 patients with acute destructive pancreatitis were treated according to the developed and implemented treatment algorithm, including: 10 patients with Acute Pancreatitis (AP) without organ failure and local and/or systemic complications, 60 patients with moderate and severe forms of AP. There was one case with a fatal outcome, and the average duration of hospitalization was  $18.4 \pm 1.1$  days. Among the patients, 41 (58.6%) were male and 29 (41.4%) were female. The average age was  $43.3 \pm 1.2$  years. The control group consisted of 112 patients treated for moderate and severe acute biliary pancreatitis without the use of ulinostatin (US). Eight cases had a fatal outcome, and the average duration of hospitalization was  $24.5 \pm 1.2$  days.

**Results:** Out of 70 patients, 10 were treated conservatively, while 60 underwent surgical treatment combined with the administration of ulinostatin and cellular mediators according to the developed scheme. Among the 60 patients, endoscopic procedures were performed in 60 cases, while only 4 patients underwent surgery using laparotomy. The average duration of hospitalization in the main group was  $6.0 \pm 0.1$  days less than in the control group.

**Conclusions:** The research results demonstrated the high effectiveness of the developed algorithm of endovideosurgical treatment for acute pancreatitis in combination with the use of the protease inhibitor ulinostatin and cellular mediators.

**Introduction:** Despite the progressive development of modern medicine, the relevance of treating patients with acute pancreatitis remains high, as the mortality rate associated with this condition steadily increases. It is a significant problem that requires considerable attention. Numerous publications on endovideosurgical treatment methods for acute pancreatitis, in combination with medical therapy, indicate a constant search by surgeons for an optimal comprehensive approach to treating this severe surgical condition. The implementation of new medications and technologies is necessary to improve treatment outcomes. The incidence of acute pancreatitis, both abroad and in Kazakhstan, has been on the rise. The proportion of patients with destructive pancreatitis is around 15-20%, with a mortality rate of 20% or higher, depending on the extent and severity of the disease. Since 2000, acute pancreatitis has become the leading surgical condition in the Russian Federation, accounting for 35-45% of acute surgical diseases of the abdominal organs. The trend of increasing the number of cases continues. Approximately 15-20% of cases of acute pancreatitis develop into a destructive form. The demographic distribution of acute pancreatitis patients shows that males constitute 55-75% and females 25-45%. The majority of cases occur in individuals of working age, between 21 and 60 years old (65%). Among patients under 45 years old, the majority are males, often linked to alcohol abuse. Among women over 60 years old, the incidence of acute pancreatitis is notably high, primarily due to a history of frequently recurring cholecystitis, a manifestation of gallstone disease. The rise in the number of acute pancreatitis patients has led to an increase in the frequency of its destructive forms and their complications, such as infected pancreatic necrosis in almost 60% of cases, parapancreatitis in over 45%, and omentobursitis in nearly 30%. The foundation of surgical treatment for complications of acute pancreatitis is the creation of favorable conditions for pancreatic juice drainage and prevention of further progression of destructive processes within the gland. Endovideosurgical methods have been proposed to prevent the spread of the inflammatory process, such as ERCP for blocked pancreatic ducts or laparoscopic abdominal cavity drainage in cases of total pancreatic necrosis with peritonitis and multiorgan failure. The search for and implementation of new medications, in combination with endovideosurgical techniques, are necessary to improve treatment outcomes and increase the effectiveness of managing severe complications of acute pancreatitis. Various studies have been directed towards finding new surgical approaches to treating biliary pancreatitis and severe forms of pancreatic necrosis, which are common complications of gallstone disease. Other studies have explored the use of TRO40303, a medication that prevents loss of

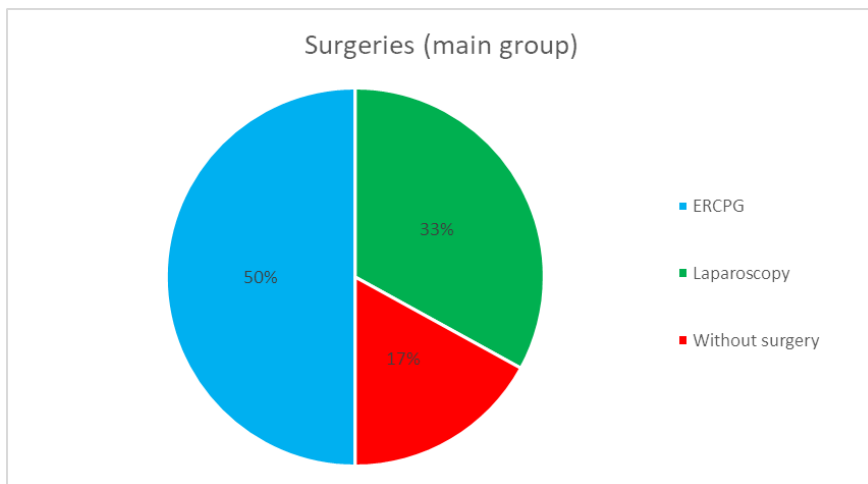
membrane potential and necrosis in alcohol-related acute pancreatitis. Additionally, investigations on supplementing ATP through high-calorie dietary additives have been conducted in a multicenter study of acute pancreatitis. Research has also been carried out to reduce endogenous intoxication levels in acute pancreatitis through peritoneal lavage, although results have been inconclusive. On the other hand, hemofiltration has been shown to lower endogenous intoxication levels and prevent cytokine storms, leading to improved patient survival.

**Scientific novelty:** For the first time in Kazakhstan, scientific research was conducted at the State Clinical Public Healthcare Institution at City Hospital No. 2 in Astana to investigate the application of the infusion solution “Ulinostatin” in combination with a developed algorithm for endovideosurgical interventions in the comprehensive medical treatment of acute destructive pancreatitis. The research aimed to improve the outcomes of the endovideosurgical treatment method for patients with this condition.

**Materials and Methods:** The study was conducted at City Hospital No. 2 in Astana, Kazakhstan. The research protocol was approved at a meeting of the ethical commission of the Non-Profit Joint Stock Company “Astana Medical University” (No. 4 of 02.01.2020). Various medical imaging techniques such as CT, MRI, “ZORING” system, “Karl Stors” endoscopic stand, “Karl Stors” argon-plasma coagulator, GelPort (Applied Medical), X-ray of the abdominal cavity organs, abdominal ultrasound (US), and endoscopic retrograde cholangiopancreatography (ERCP) were used. The research design was a comparative prospective non-randomized study. The inclusion criteria for the study were patients under 50 years old with increased erythrocyte sedimentation rate (ESR), leukocyte count, and other indicators in blood biochemistry, such as elevated levels of trypsin, amylase, and lipase; changes in elastase levels in feces in coprogram; and detection of amylase in urine. Clinical signs of moderate and severe biliary-induced destructive pancreatitis were also considered. The statistical analysis of the results was performed using variational statistical methods with standard deviation calculation. The treatment of patients followed the clinical protocol “Acute Pancreatitis” No. 60 of the Ministry of Health of Kazakhstan dated March 29, 2019. The research topic was approved at the meeting of the Local Ethical Committee of the National Medical University of Astana on February 12, 2020. From 2017 to 2021, 70 patients with acute destructive pancreatitis were treated, among them: 10 with acute pancreatitis without organ failure and local and/or systemic complications, and 60 with moderate and severe forms. There were 41 male patients (58.6%) and 29 female patients (41.4%), with an average age of  $43.3 \pm 1.2$  years.

The control group consisted of 112 patients with moderate and severe acute biliary pancreatitis who did not receive ulinostatin (US) and cellular mediators (CM) in their treatment. The control group had 8 fatalities, and the average du-

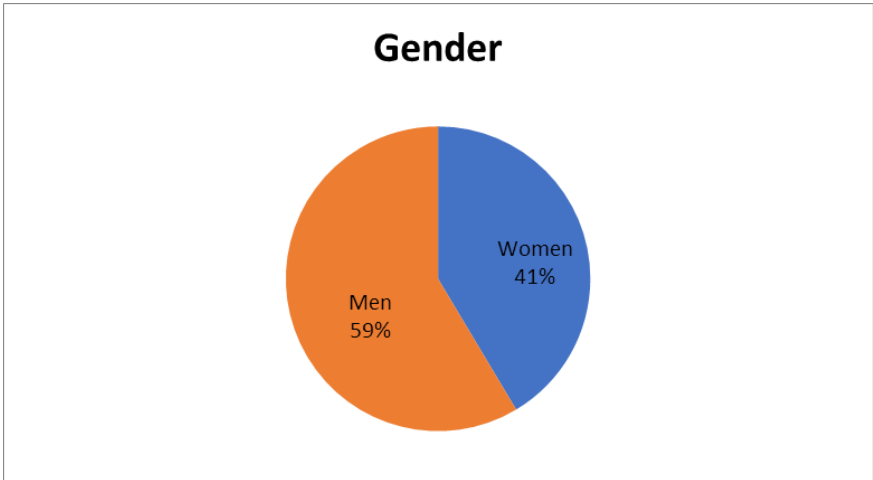
ration of hospitalization was  $24.5 \pm 1.2$  days. The main group included patients with moderate and severe acute biliary pancreatitis who received treatment with the protease inhibitor “Ulinostatin” and cellular mediators (CM). The main group had 1 fatality, and the average duration of hospitalization was  $18.4 \pm 1.1$  days. In the main group, according to the developed algorithm, in addition to traditional therapy, patients received ulinostatin (US) twice a day at 10:00 and 22:00, at a dose of 100,000 IU, for 5 days, no later than 48 hours after admission. On the third day after determining the patient’s initial immune status, cellular mediators were administered (10.0 mL of CM intramuscularly once a day for 5 days). Among the patients in the main group, in 33% of cases, endoscopic retrograde pancreatocolangiography (ERCP) was performed in 20 patients, 17% (10 patients) underwent surgery (laparoscopy or open surgery), and in 50% (30 patients), treatment was limited to conservative measures, such as medical treatment and endoscopic papillosphincterotomy (EPS). (Fig. 1)



*Figure 1. Main group*

**Results:** According to the developed algorithm, 60 patients with moderate and severe acute biliary pancreatitis were treated. Among them, 29 were female and 41 were male (Figure 2). The average age of the patients was  $43.3 \pm 1.2$  years. All patients received therapy in accordance with the approved clinical protocols “Acute Pancreatitis” (dated March 29, 2019, Protocol No. 60, Ministry of Health of Kazakhstan) and “Chronic Pancreatitis” (dated December 14, 2017, Protocol No. 35, Ministry of Health of Kazakhstan).

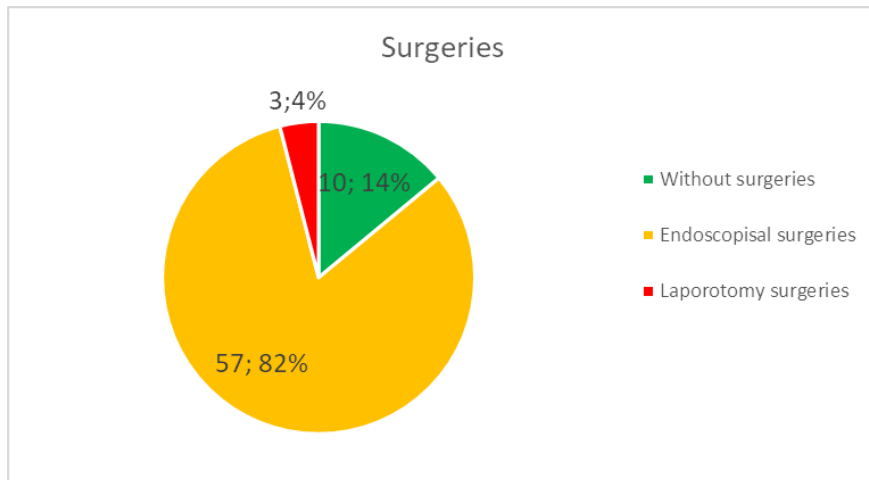




*Figure 2. Distribution of patients by gender*

#### Operations and Procedures:

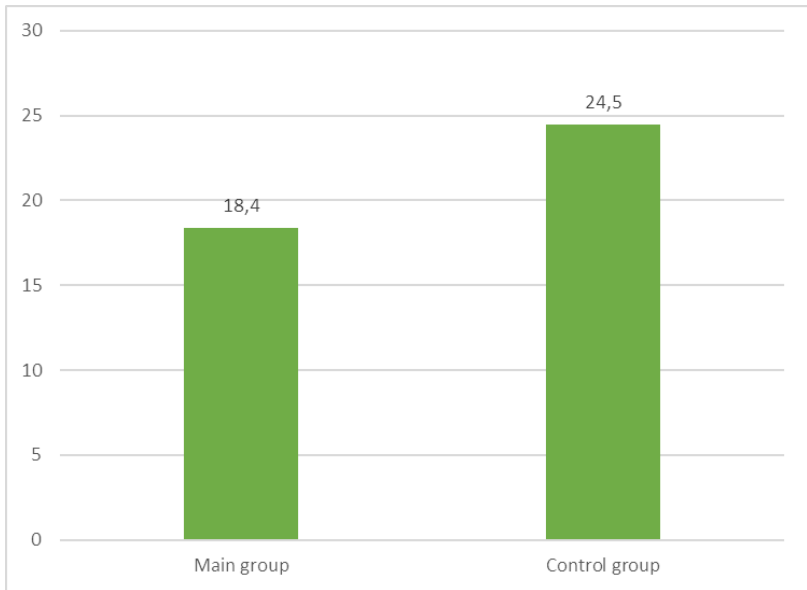
After studying the patient's complaints, medical history, and clinical-laboratory indicators, it was collectively decided to choose a conservative treatment method for 10 patients (14.3%). The cases of 60 patients were also discussed collectively, for whom surgical treatment was chosen in combination with the administration of the protease inhibitor "Ulinostatin" and cellular mediators following the developed scheme. Among the aforementioned 60 patients, the surgical approach varied, and in the vast majority, preference was given to minimally invasive surgical methods, such as endoscopic operations, performed in 57 patients, accounting for 81.4% of the total control group. Only 3 patients, i.e., 4.2%, were selected for open surgical access, i.e., laparotomy, based on life indications (Figure 3).



*Figure 3. Types of treatment*

All incoming patients underwent several tests in addition to general clinical analyses, including: Complete blood count with 12 parameters, Urinalysis, Blood gas analysis, Immunofluorescence assay for antibodies to HIV, hepatitis B, and hepatitis C, Microreactive test

At least three sets of extended biochemical blood tests: upon admission, 1 day after the start of treatment, and control tests before discharge. The indicative indicators for assessing the dynamics of the hepatobiliary area were chosen as the gold standard: the levels of total bilirubin and total amylase. Based on the results, the average value of total bilirubin decreased from 65  $\mu\text{mol/L}$  upon admission to 35  $\mu\text{mol/L}$  after treatment with statistically significant deviation. Similarly, the average level of amylase decreased from 65 U/L upon admission to 63 U/L after treatment. The combination of protease inhibitors and cellular mediators demonstrated its efficacy, especially in patients who underwent endoscopic retrograde pancreatography (ERPHG) and endoscopic papillosphincterotomy (EPST). The average duration of hospitalization in the main group was  $18.4 \pm 1.1$  days, while in the control group, it was  $24.5 \pm 1.2$  days. (Figure 4). This indicates that the main group had a shorter hospital stay by  $6.0 \pm 0.1$  days compared to the control group, which correlates with the dynamics of the biochemical blood analysis indicators.



*Figure 4. Length of stay in the hospital*

#### Algorithm for the Use of Ulinostatin Depending on the Severity of Destructive Pancreatitis

Ulinostatin has proven itself as an active inhibitor of pancreatic proteases, and its highest efficacy was observed after performing endoscopic retrograde pancreatocholangiography (ERCP) and endoscopic papillosphincterotomy (EPT) in patients. Our clinical studies revealed the following recommendations for ulinostatin administration based on the severity of pancreatitis. Moderate Pancreatitis: Ulinostatin should be administered intravenously at a dose of 100,000 units, dissolved in either a physiological saline solution or a 5% glucose solution, twice daily for a duration of 3 days. Severe Pancreatitis: For patients with severe pancreatitis, ulinostatin should be administered intra-arterially, selectively, at a dose of 200,000 units twice daily, with each dose administered on 100.0 ml of a physiological saline solution or a 5% glucose solution. The treatment duration should be 5 to 7 days, combined with endovideosurgical interventions in the hepatopancreaticoduodenal region.

It is known that destructive processes in the pancreas itself lead to the release into the bloodstream of a large number of proteolytic enzymes, oxygen free radicals and cytokines that can destroy cells and attract new leukocytes, including monocytes. Monocytes then turn into active macrophages, which begin to produce a large amount of pro-inflammatory mediators (IL-6, IL-8, etc.) and soluble recep-

tor proteins. The release of a significant amount of pro-inflammatory cytokines can activate leukocytes in the systemic circulation, including microvasculature of the liver, kidneys, lungs and other organs, which again induces the synthesis of inflammatory mediators (cytokine cascade) [18]. It leads to a sepsis-like state characterized by fever, leukocytosis, and release of acute phase proteins such as CRP, iferritin complement components, and ferritin. In a study by a number of authors, it was found that severe OP is associated with overexpression of pro-inflammatory cytokines, and IL-6 is one of the markers of differential diagnosis between mild and severe acute pancreatitis [23, 24]. The inclusion of cellular technologies in the complex treatment of acute destructive pancreatitis: cellular mediators of fetal hepatocytes is aimed at stabilizing the cytokine cascade that occurs in acute destructive pancreatitis. Fetal cell mediator transplantation is a unique mediator substance transplantation operation, which is an adjunct treatment. Cellular mediators are an extracellular fraction of cryopreserved fetal tissues obtained from aborted material (fetus) at 16-21 weeks of gestation. [25]. The positive results of the use of cellular mediators in the syndrome of multiple organ failure in surgical patients (Doskaliyev Zh.A., Baigenzhin A.K., Asabaev A.Sh. et al., Moscow, 2006) were described in the materials of the International Conference “Biotechnology and Medicine” [26]. They developed a guideline “The use of fetal cellular mediators in intensive care. Indications and contraindications” [27], which was used by us in the development of an algorithm for the introduction of CM in patients with acute destructive pancreatitis of moderate and severe degree.

In addition to ulinostatin, patients should receive cell mediators (KM) starting on the 3rd day after determining their baseline immune status. Cell mediators should be administered intramuscularly, once daily, at a dose of 10.0 ml for 5 days, following the guidelines provided by Clinical Protocol No. 10 of the Ministry of Health of the Republic of Kazakhstan from 2015. A retrospective analysis of hemograms and immune status of patients with Acute Pancreatitis, treated using the developed algorithm, demonstrated the appropriateness of including cell mediators, significantly improving treatment outcomes for this category of patients.

**Discussion:** The results of our studies showed a high efficacy of the developed algorithm, combining endovideosurgical methods of treating acute pancreatitis with the use of ulinostatin and cell mediators. Although we initially relied on biochemical analyses, which can be widely applied in all hospitals of our country, such as amylase, bilirubin, glucose levels, and indicators of kidney and liver function, it is undeniable that there are more sensitive and specific indicators that can help determine the severity of pancreatitis. For example, the use of interleukin-6 (IL-6) as an indicator of pancreatitis severity has been investigated. On the 3rd day, IL-6 was found to predict severe pancreatitis with 81.8% sensitivity and 77.7% specificity. The infusion of IL-6 inhibited endotoxin-induced TNF- $\alpha$

increase in humans and prolonged infusion resulted in anemia but not systemic damage. It was also shown that IL6 and TNF-a play a protective role in acute pancreatitis, and targeting only these cytokines may not improve outcomes in severe pancreatitis [21,22]. The authors raised an important question of the economic feasibility of the widespread use of this algorithm for the complex treatment of acute destructive pancreatitis, which combines protease inhibitors, cellular mediators with endoscopic methods of surgical treatment. The results of the study eloquently testified to the clinical effectiveness of such an integrated approach in the treatment of this complex surgical pathology, which is a serious problem in modern surgery of the hepatopancreatobiliary zone. The authors received titles of protection: AS No. 14704 dated 01.27.2021 (www.kazpatent.kz; AS No. 18079 dated 05.27.2021 (www.kazpatent.kz) ; AS No.-29024 dated 09.26.2022 (www.kazpatent.kz).

### Conclusions:

1. The developed algorithm for the complex treatment of acute pancreatitis, including the combination of the protease inhibitor ulinastatin with cell technology: cell mediators can be used in practical healthcare in surgical departments.

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共病患者 PIC 综合症的病程和康复预测因素: 临床观察

**THE COURSE OF PIC SYNDROME IN COMORBID PATIENTS  
AND PREDICTORS OF RECOVERY: CLINICAL OBSERVATIONS**

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**摘要。**重症监护后综合症 (PIC综合症) 是目前影响所有重症监护策略的一个问题。了解 PIC 综合症的发生机制有助于呼吸功能、神经肌肉传递和认知过程受损且需要长期保护重要功能的患者预防该疾病。作为机体个体反应的全身炎症反应的严重程度对PIC综合症的形成及其严重程度具有重要影响,它预先决定了神经和心理缺陷的程度。背景躯体疾病的存在,例如糖尿病(包括代谢综合征),会显著加重 PIC 综合症的病程,并导致恢复过程的延迟。在重症监护病房的基础上尽早开始被动和主动的康复和恢复措施,并随后在专门部门的基础上扩大个人康复计划,不仅有助于在康复过程中实现最有利的预后重要功能,还包括认知、运动、情感领域新出现的疾病,从而减少患者的住院时间并提高出院后的生活质量。该文章描述了不同年龄段患者强化治疗后果的临床案例。对所介绍患者的综合征动态的观察和实验室数据的分析使我们得出结论,炎症过程的过程和严重程度影响受损功能的恢复。

**Annotation.** *Post-intensive care syndrome (PIC syndrome) is currently a problem affecting the strategy of all intensive care. Knowledge of the mechanisms of PIC syndrome development contributes to the prevention of the disease in patients with impaired respiratory function, neuromuscular transmission and cognitive processes requiring long-term protection of vital functions. Significant influence on the formation of PIC syndrome and its severity is exerted by the degree of severity of systemic inflammatory response as an individual reaction of the organism, which predetermines the degree of neurological and psychological deficit. The presence of background somatic diseases, such as diabetes mellitus (including metabolic syndrome), significantly aggravates the course of PIC*



*syndrome and contributes to the delay in the recovery process. The earliest possible start of passive and active rehabilitation and recovery measures on the basis of the intensive care unit with the subsequent expansion of the individual rehabilitation programme on the basis of a specialised department contributes to the most favourable prognosis in the recovery not only of the disturbed vital functions, but also of the emerging disorders of the cognitive, motor, affective spheres, thus reducing the patient's hospital stay and improving the quality of life after discharge. The article describes clinical cases of the consequences of intensive therapy in patients of different age categories. Observation of the syndrome dynamics and analysis of laboratory data in the presented patients allowed us to conclude that the course and severity of the inflammatory process influence the recovery of disturbed functions.*

#### ACTUALITY

The provision of medical care in the profile of “anaesthesiology and intensive care” has changed significantly over the last 15 years due to the development of innovative technologies, standardisation of assisted circulation and respiratory equipment in intensive care units (ICU), as well as standardisation and improvement of educational programmes. The short-term outcomes of ICU patients, including mortality and 28-day survival rates, have improved significantly, but there is no evidence of a significant impact of the techniques used in the long term, including improvements in patient quality of life [1-3]. In the 21st century, The Society of Critical Care Medicine (SCCM) held a stakeholder conference to address subacute/chronic physical and psychological problems after discharge from ICU, where the term “post-intensive care syndrome” (PIC syndrome) was proposed [1, 3, 4]. Currently, PIC syndrome is understood as a set of somatic, neurological, and socio-psychological consequences of the patient's daily life limiting the patient's stay in the ICU [1, 4, 5]. In different combinations, they influence the increase in the length of stay in intensive care units and decrease the quality of life of patients years after their return to normal life. The acute period of critical condition requiring treatment in ICU is the lowest point of patient's personal independence in the complex of defence-adaptive mechanisms aimed at restoration of disturbed self-regulation, because intensive care technologies in the form of hardware monitoring, partial or complete replacement of vital functions, along with the course of the underlying disease, create for the patient the status of limited or complete loss of autonomous existence [1]. If the intensive phase of treatment is successful, the patient is expected to regain independence in everyday life, which may reach the premorbid level or decrease depending on individual reparative processes [5]. The paradox of the complex of life-saving intensive care technologies is that it simultaneously aggravates the patient's condition, creating the status of limited

or complete loss of autonomy due to hardware monitoring with the formation of PIC syndrome, which is the reason for the decrease in the quality of life of patients after discharge from hospital [1, 3, 6]. According to statistical data, PIC syndrome forms in 20-40% of patients discharged from ICU [7]. Patients may be unable to work for a long time and need help from others, and some patients become permanently disabled [2, 3].

The high social significance of PIC syndrome necessitates the search for ways to prevent and treat it. In order to ensure the patient's quality of life starting from his/her stay in the ICU, specialists of the Federation of Anaesthesiologists and Resuscitators of the Russian Federation, the Association of Neuroanesthesiologists and Neuroresuscitators, and the Union of Rehabilitation Therapists of Russia have developed clinical recommendations "Rehabilitation in Intensive Care" (RehabIT, 2021). The accumulated experience set out in the clinical recommendations and scientific evidence prove that early initiation of preventive treatment, despite the depressed level of consciousness, is more likely to restore the patient's quality of life, improving short-term prognosis (weaning from artificial ventilation, early transfer of the patient from ICU to a specialised department), as well as long-term prognosis (patient discharge and quality of life after hospitalisation). In 1985, K. Girard and T.A. Girard first described the formation of PIC syndrome in patients with prolonged stay in ICU. Girard and T.A. Raffi n, who called them "chronically critically ill patients" (chronically critically ill).

In 1991, B.J. Daly proposed to organise special care units for this category of patients. In 1998 G. Vanden Berghe proposed the terms "prolonged critical illness" and "protracted critical illness", which meant "prolonged", "prolonged" or "protracted" critical condition" [8]. [8].

At the beginning of the 21st century, the term "PIC syndrome" was first voiced in the proceedings of a conference on "multidisciplinary interaction between intensive care and rehabilitation specialists" [3, 5]. [3, 5].

At present, the concept of PIC syndrome is formed by A.A. Belkin, Doctor of Medical Sciences, Professor of the Department of Nervous Diseases and Anaesthesiology-Reanimatology of the Ural State Medical Academy, Chairman of the Supervisory Board of the autonomous non-profit organisation.

The formation of PIC syndrome, according to A.A. Belkin, includes several stages. The first stage is characterised by the impact of such factors as sedation, artificial ventilation, paralysis, dysproteinaemia, which together with the severity of the patient's condition, requiring a stay in the ICU, leads to prolonged immobilisation of the patient. Within 3-7 days (the second stage of PIC syndrome formation) the patient develops physical disorders such as critical state polyneuromyopathy, disorders of gravitational gradient and circadian rhythms. In case of prolonged immobilisation and absence of early rehabilitation and recovery measures, 8-30

days later the patient develops PIC syndrome with the development of neurological deficit.

The main factor of PIC syndrome formation is bed rest, i.e. the method of patient's positioning during the stay in ICU [1, 6, 7], described for the first time in the XIX century by English surgeon J. Hilton as the main therapeutic strategy. Hilton as the main therapeutic strategy for the treatment of severe patients [6, 9]. In the 20th century, this method received the term "immobilisation syndrome" or "nonuse phenomenon" due to the limitation of the patient's motor and cognitive activity [1, 4, 6]. According to the literature, the incidence of immobilisation syndrome in patients staying in ICU for more than 48 h reaches 55-98% [6]. Immobilisation syndrome is divided [4] into primary immobilisation (as a result of forced motor restriction due to disease) and secondary or therapeutic immobilisation due to medical interventions (bed rest, sedation, myorelaxation, artificial ventilation, etc.).

The causes of immobilisation syndrome are:

- acute cerebral insufficiency (stroke, craniocerebral and spinal trauma, infections and intoxications of the central nervous system, etc.) - 65-80% [7];
- acute lesions of the neuromuscular system (polyradiculoneuropathies, myopathies, myasthenic crisis) - 60-75% [10];
- complications of medical effects (bed rest, sedation, myorelaxation, artificial ventilation, etc.) - 45-50% [11].

Clinically, PIC syndrome is manifested by disorders in four domains: physical, autonomic, cognitive, and mental [12]. Physical impairments include the following neural and muscular disorders.

1. Polymyoneuropathy of critical states: an acquired syndrome of neuromuscular disorders of the polyneuropathy and/or myopathy type, clinically manifested by muscle weakness due to a decrease in the volume of muscle mass and strength, resulting in motor disorders - paresis, symmetrical in character, with predominance in both proximal and distal parts of the limbs. Foot flexion may be formed [3, 13, 14].

2. Respiratory neuropathy as a subtype of polyneuromyopathy of critical conditions, due to which respiratory failure develops with prolongation of the terms of transferring the patient to spontaneous breathing. According to the literature, respiratory neuropathy is formed in 59% of all cases [7].

3. Inactivity dysphagia (dysphagia acquired in ICU): a clinical symptom of swallowing dysfunction that makes it difficult to transfer to full enteral nutrition and decannulation due to the risk of aspiration complications [5, 6]. Mechanisms of inactivity dysphagia development: (a) postintubation dysphagia as a complication of prolonged standing of the intubation tube; (b) dysphagia due to loss of sub-

clavian pressure during prolonged cannulation; (c) dysphagia as a manifestation of the syndrome of acquired weakness in ICU [1, 3-5].

Autonomic factors include the following disorders.

1. orthostatic insufficiency: a sharp decrease in blood pressure (up to the onset of syncope) during the transition of the body position from horizontal to vertical, leading to a decrease in the gravitational gradient. The gravitational gradient is the maximum angle of elevation of the patient, corresponding to 90°, which prevents the development of signs of orthostatic failure and helps to keep vital functions such as blood pressure, heart rate stable [13].

2. Circadian rhythm disorder: one variant of sleep disorder in which there is an imbalance between the internal sleep-wake cycle and the external day-night cycle. Circadian rhythm is a physiological process responsible for the production of hormones and the alternation of the sleep-wake cycle. The conditions of the patient's stay in ICU lead to their changes and the development of remote consequences of postresuscitation dyssomnia [14, 15].

Cognitive disorders include:

(a) Cognitive afferent dissonance: a human condition with artificially reduced inflow of sensory impulses from sensory organs and peripheral organs on the background of sedation. It can be the cause of pain syndrome, disorders of perception of body parts and other disorders of proprioception. The essence of this phenomenon lies in the fact that due to the absence of habitual sensations (smells, touches, sounds of voices of loved ones), which are replaced by other stimuli, which are often negative and even aggressive in nature (alarm monitors, moans of patients, rude tone of staff, etc.), the patient upon awakening has a failure in the associative sphere and develops a state of derealisation and depersonalisation. The most severe manifestation of cognitive afferent dissonance is delirium [1];

b) affective disorders:

- depression (a disorder accompanied by persistent depressed mood, negative thinking and slowed reactions);
- anxiety (emotional reaction to factors that are related to external circumstances or internal pathological processes);
- post-traumatic stress disorder (severe condition of a patient resulting from a single or repeated events that have a negative impact on him/her) [16].

These clinical manifestations occur against the background of repeated exposure to physical pain and discomfort, as well as episodes of disorientation and confusion on the background of prolonged sedation. Factors that increase the probability of PIC syndrome development are: • time of stay in ICU; • presence of foreign bodies in the body (drains, catheters, probes); - stress from staying in ICU (constant noise, ward lighting); • aggravated premorbid condition (presence of chronic somatic and psychiatric diseases, addictions); • advanced age.

We present a clinical case analysis of a patient with established PIC syndrome.

## DESCRIPTION OF CLINICAL CASES

### Clinical Case 1

About the patient. Patient A., 29 years old, was admitted to the pulmonology department of a medical institution on 23.01.2022 and was placed in the Department of Anaesthesiology, Reanimation and Intensive Care (DARIC) No. 2 according to the severity of her condition. From the anamnesis: she became acutely ill on 13.01.2022, when general weakness, hyperthermia up to 39.6°C, cough, lymphoma, chills, headache appeared. She was treated on her own. On 20.01.2022 due to increasing weakness and dyspnoea she was taken by an ambulance brigade to a medical institution at the place of her attachment. On admission, her condition was severe due to pronounced respiratory failure (desaturation 75%, tachypnoea up to 24/min). Investigations on admission. According to the laboratory control data, there was an increase in the level of inflammatory markers: C-reactive protein (CRP) up to 24.4 mg/l, procalcitonin concentration up to 1.2 ng/ml; in the general blood analysis leukocytosis up to  $14.5 \times 10^9/l$  with neutrophil shift up to 85.0%. According to multispiral computed tomography (MSCT) of the chest organs: subtotal consolidation of both lungs, probably within the framework of respiratory distress syndrome, inflammatory infiltration may occur on this background. Diagnosis: “Consequences of COVID-19. Bilateral subtotal viral-bacterial pneumonia of severe course”. History: diabetes mellitus, type 2; target glycosylated haemoglobin level <7.0%.

Taking into account the necessity of long-term protection of respiratory function with the help of artificial ventilation, percutaneous dilatation-puncture tracheostomy was performed (on the 4th day). Dynamics of the condition. On 23.01.2022 due to increasing phenomena of respiratory failure (hypoxaemia, PaO<sub>2</sub>, 48.7 mm Hg; desaturation, SaO<sub>2</sub>, 58%; tachypnoea up to 35/min) she was transferred to extracorporeal membrane oxygenation, where she was kept until 05.03.2022 (for 43 days).

On the background of intensive therapy and forced prolonged immobilisation on the 21st day the patient was verified by a neurologist as having PIC Syndrome with the development of polyneuromyopathy in the form of flaccid tetraparesis with a decrease in muscle strength up to 4 points in the upper limbs and 2 points in the lower limbs (Rivermead mobility index - 1; Berg balance scale - 0; modified Rankin mRS scale - 4; Barthel index - 40; Rivermead daily activity scale - 41; functional independence scale, FIM, - 76; rehabilitation routing scale, RRS, - 5); inactivity dysphagia (positive three-glottic test, laryngoscopy data), cognitive (Montreal Cognitive Assessment Scale, MoCA, - 23 points) and affective (Beck scale - 22 points, Spielberger - 48 points) disorders. Electroneuromyography re-

vealed reduced amplitude of M-response from both motor and sensory fibres, wide muscle denervation.

Principal diagnosis. Polyneuromyopathy of mixed genesis (critical conditions, dysmetabolic). Tetraparesis to gross in the lower limbs. Background disease. Consequences of COVID-19: bilateral polysegmental viral-bacterial pneumonia of severe course. CT4. Extracorporeal membrane oxygenation from 23.01.2022 to 05.03.2022. Type 2 diabetes mellitus, target level of glycated haemoglobin target level of glycated haemoglobin <7.0%

On the 14th day the patient showed positive dynamics in the form of reduction of inflammatory markers: CRP to 9.3 mg/l, fibrinogen to 2.727 g/l, procalcitonin to 0.19 ng/ml; decrease of leukocytosis to  $6.7 \times 10^9/l$  with decrease of neutrophil concentration to 75.2%. According to MSCT of chest organs: resolution of part of inflammatory changes in the lungs. On the 28th day from the beginning of the disease, despite massive antibacterial, nutritive, metabolic therapy, the patient had a fever spiral with repeated increase of inflammatory markers: CRP up to 67.7 mg/l, fibrinogen up to 0.813 g/l, procalcitonin up to 2.9 ng/ml, leukocytosis up to  $4.6 \times 10^9/l$  with neutrophil shift up to 85.5%. According to the repeated MSCT of the chest organs negative dynamics was revealed: in the upper lobe on the left there appeared areas of infiltration of lung tissue on the type of frosted glass over a large length, in the lower lobe on the left - areas of infiltration of lung tissue on the type of frosted glass in combination with areas of consolidation, while the lower lobe was totally affected; in the lower lobe on the right, the previously observed consolidation zone has increased, against this background a small air cavity up to 5 mm in size can be traced, possibly an area of destruction; in the upper and middle lobes on the right, areas of frosted glass-like infiltration have appeared, while the previously observed consolidation areas have no dynamics. The patient was re-examined by specialised specialists, including a clinical pharmacologist; therapy was adjusted. On the 43rd day of stay in ICU, when the inflammatory process regressed (according to the laboratory control data: CRP 7.6 mg/l, fibrinogen 4.854 g/l, leukocytes  $3.0 \times 10^9/l$ ; neutrophils 39.2%) and respiratory failure partially regressed, the patient was transferred to assisted ventilation. On the 54th day of the stay, the patient was transferred to independent breathing.

After stabilisation of the condition, in addition to complex drug therapy, rehabilitation and recovery measures were started - intermittent compression of the lower limbs, magnetic therapy on the lower limbs, passive verticalization up to 30° with subsequent expansion of the motor regime. On the 61st day of the disease, the respiratory insufficiency phenomena resolved on the background of rehabilitation and recovery measures.

For further rehabilitation treatment the patient was transferred to a specialised department (neurological department for treatment of patients with acute cerebral

circulatory failure). Rehabilitation and recovery measures. The patient was examined by members of the multidisciplinary rehabilitation team, and an individual programme of rehabilitation and recovery measures was developed to correct physical, cognitive and affective disorders. On the 64th day of her stay in the specialised department, her motor activity was increased: the patient was active within the bed and began to sit up with unilateral support. Taking into account vegetative tests, she started sitting up in a chair with her legs down and feet supported, and individual active physical therapy sessions were expanded. In order to train and restore independent swallowing under the supervision of a speech therapist and aphasiologist, sessions were held to strengthen the muscles of the pharynx. Decanalised on the 68th day of stay. In order to correct cognitive disorders, individual sessions with a neuropsychologist were carried out, against the background of which positive dynamics was noted on the 68th day of the illness: 27 points at the repeated screening of cognitive disorders by MoCA. On day 71, the patient's motor activity increased: she walked up to 20 metres with minimal support.

Outcome. On the 81st day of the disease, the patient was discharged for outpatient treatment in a condition of moderate severity, close to relatively satisfactory. In the neurological status there was an increase in strength in the extremities, proximal muscle groups of the upper extremities up to 4.5 points, in the proximal muscle groups of the lower extremities up to 4 points, in the distal: on the right in dorsal flexors up to 3 points, in extensors up to 4 points; on the left: up to 4 points (Rivermead mobility index - 7; Rankin disability scale - 4; Barthel index - 55; Rivermead activities of daily living scale - 52; FIM - 86; RRS - 4). Motor activity was increased: 4-5 times a day within the ward with minimal support the patient moved up to 50 m.

## DISCUSSION

The presented cases describe the formation of the syndrome of intensive care consequences with the development of polyneuropathy, dysphagia, cognitive and affective disorders in patients with both primary somatic (pulmonological) and central neurological disorders.

According to the literature, three mechanisms of polyneuropathy development are distinguished [7, 13]:

- An increase in glycaemia, naturally occurring in patients in critical state;
- formation of a systemic inflammatory response;
- use of corticosteroids and drugs blocking neuromuscular transmission, widely used in intensive care.

There are also 3 factors in the formation of muscle weakness, which are based on disorders of microcirculation, metabolism, reversible canalopathies and bioenergetic dysfunction:



- Atrophy and necrosis of muscle fibres (loss of actin and myosin, loss of the ability of muscle fibres to contract, which is characteristic of the chronic phase of muscle weakness);
- loss of the ability to generate action potentials, which is characteristic of the acute phase of muscle weakness [3, 7, 13];
- degeneration of sensory and motor axons.

The main changes at the microvascular level are associated with increased expression of E-selectin, increased capillary permeability, decreased blood oxygen content, increased cytokine production, ion channel dysfunction, increased reactive oxygen species, mitochondrial dysfunction, activation of proteolytic enzymes, and apoptosis mechanisms. Proteolytic and lysosomal enzymes (transforming growth factor  $\beta$  and mitogen-activated protein kinase) are major factors in inflammation and stress, which further

leads to the breakdown of actin and myosin. Activation of the proteolysis mechanism promotes protein loss at the expense of myosin heavy chains, which reduces muscle volume in critically ill humans by an average of 1.6-2% per day. Proteolysis of structural proteins explains the long course of polyneuromyopathy and slow recovery in the chronic critical patient. The pathogenesis of mitochondrial dysfunction causes primary axonal degeneration, mainly in the distal parts of the nerve, where high-energy-dependent axonal transport systems of structural proteins are implemented, which explains the rapid axonal regeneration and early recovery of some patients with distal nerve damage [17, 18]. Summarising the data of the described clinical cases, we have identified the following unfavourable factors that aggravate the course of PIC syndrome and delay recovery of impaired functions (Table 1).

## CONCLUSION

Thus, according to the results of the analysis of the presented clinical cases, we have established the following direct correlation: the formation of PIC syndrome with vivid neurological and psychological deficit, difficulties in weaning from artificial ventilation and restoration of full-fledged spontaneous breathing is more expected in case of a pronounced systemic-inflammatory response and organism reaction to the provoking pathogenic agent against the background of prolonged forced immobilisation. The earliest possible start of passive and active rehabilitation and recovery measures on the basis of the intensive care unit with the subsequent expansion of the individual rehabilitation programme in a specialised department contributes to the most favourable prognosis for the recovery of impaired vital functions, as well as emerging disorders of the cognitive, motor, affective spheres, thus reducing the patient's hospital stay and improving the patient's quality of life after discharge from hospital. The presence of background



somatic diseases, such as diabetes mellitus (including metabolic syndrome), significantly aggravates the course of PIC syndrome and contributes to the slowing down of the recovery process. Undoubtedly, this topic requires further in-depth study in order to identify the gradation of biological markers in comparison with clinical manifestations of PIC syndrome severity and the formation of predictors of recovery of impaired functions in the long term.

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**Table 1**  
*Dynamics of the main clinical and laboratory parameters in comparison with the severity of PIC syndrome manifestation*

Main indicators	Upon admission	7th day	28th day	43d day	50th day	60th day
CRP, mg/l	24,4	7,6	67,7	7,6	140,4	18,1
Fibrinogen, g/l	1,87	1,17	0,813	4,854	3,6	4,854
Procalcitonin, ng/ml	1,2	0,56	2,9	<0,12	<0,12	<0,12
Leukocytes, 10 <sup>9</sup> /l	14,5	13,3	4,6	3,0	6,7	6,70
Neutrophils, %	85,0	77,2	85,5	39,2	78,3	49,5
Prothrombin index, sec	12,7	13,5	14,5	13,6	11	13,6
Tetraparesis: A - 5 points B - 4 points C - 3 points D - 2 points E - 1 point	в/к — B н/к — D	в/к — B н/к — D	в/к — B н/к — D	в/к — B н/к: пр — B д (с) — C (р) — C	в/к — B н/к: пр — B д (с) — C (р) — B	в/к — B н/к: пр — B д (с) — C (р) — B
Dysphagia of inactivity	+	+	+	+	+	-
Affective disorders (Berg scale; Spielberger scale)	+	+	+	+	+	-
Cognitive impairment (MoCA)	<23	<23	<23	<23	<23	>23

Note: Cl 1-3 — clinical cases 1-3; CRP — C-reactive protein; u/l — upper limb; l/l — lower limb; pr - proximal d — distal; d (fl) — distal/flexors; (ext) — extensors.

体力活动可降低心血管疾病的发展风险因素并改善器官移植患者的生活质量  
**PHYSICAL ACTIVITY AS A WAY TO REDUCE DEVELOPMENT  
RISK FACTOR OF CARDIOVASCULAR DISEASES AND  
IMPROVING THE QUALITY OF LIFE AMONG PEOPLE WITH  
TRANSPLANTED ORGANS**

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关键词: 移植学、器官捐献、身体康复、体育教育、运动、康复、移植运动比赛、生活质量、心血管疾病。

**Keywords:** *transplantology, organ donation, physical rehabilitation, physical education, sports, rehabilitation, transplant sports games, quality of life, cardiovascular diseases.*

**Introduction and Purpose:**

Determining the relationship between quality of life (QOL) and health has become an important criterion for both assessing morbidity and mortality, and assessing the health of the population in modern clinical trials [1]. QoL indicators are standardized and well tested using questionnaires that have physical, emotional, mental, social and behavioral components [2]. QOL analysis determines the need for transplantation, provides medical professionals with information about the psychosocial and physical impact after transplantation. Physical activity plays an important role in the formation of physical and psychological health of a person [3]. An active lifestyle reduces the risk of

developing cardiovascular diseases (CVD), and also has a beneficial effect on the quality of life of both healthy people and those with transplanted organs [4,5]. After organ transplantation, you can live an active lifestyle, and do sports. From July 29 to July 31, 2022, the First All-Russian Transplant Games were held in Moscow, in which 70 patients with transplanted organs from all over Russia. The purpose of the study was to study the quality of life and identify risk factors for the development of CVD in recipients of donor organs and those on dialysis who participated in the First All-Russian Transplant Games. Tasks: to conduct a QoL survey using the SF36 questionnaire; examine the sports history of recipients; to identify risk factors for the development of CVD in recipients, to determine the need for people with transplanted organs to hold sports events with their participation.

#### Materials and methods:

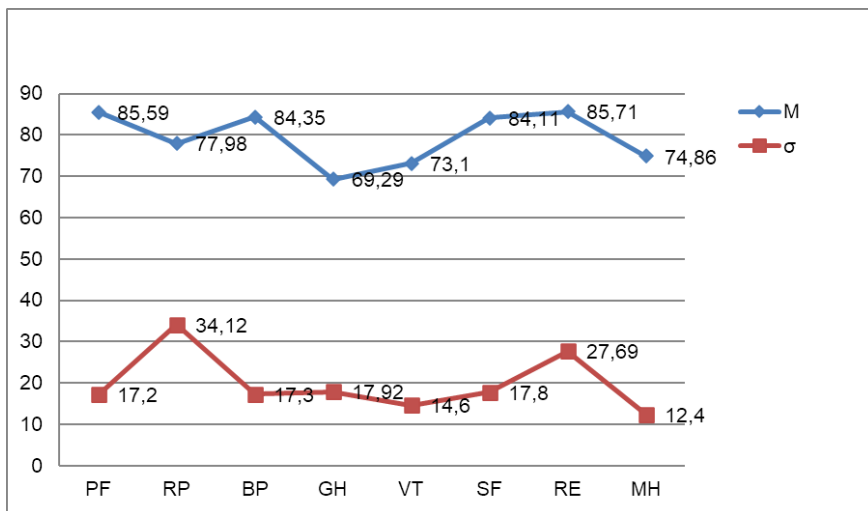
This study was approved by the Expert Council of the First Moscow Medical State University named after I.M. Sechenov of the Ministry of Health of Russia (First Moscow State Medical University named after I.M. Sechenov of the Ministry of Health of Russia). All participants receive advance notification of participation in the trial.

The competition was attended by 70 people who underwent organ transplantation with satisfactory graft function from 18 regions of Russia. All participants lived active lifestyle before and after surgery. The survey was conducted in 42 patients, including 19 men and 23 women. The average age was 42.6+12.09 years. At the time of the competition, the recipients had a minimum of 6 months after kidney transplantation and a maximum of 18-19 years also after kidney transplantation (3 people), dialysis periods ranged from 3 to 19 years. All participants were surveyed using the questionnaire developed by us and the SF 36 questionnaire (QoL assessment). The SF-36 quality of life questionnaire includes 8 scales assessed from 0-100 points: physical functioning (PF), role functioning due to physical condition (RFP), pain intensity (PI), general health (GH), mental health (MH), role functioning due to emotional state (RFE), social functioning (SF), vital activity (VA).

#### Results:

Results: High mortality in patients with transplanted organs is observed in connection with CVD [6]. Risk factors for the development of such diseases are lack of physical activity, tobacco smoking, alcohol consumption, high blood pressure, and obesity [7]. After analyzing the questionnaires we developed, we found that patients participating in transplant games regularly go in for sports and walk outside every day. Also, most (80%) of them have a normal body weight and adhere to nutritional recommendations. Only two admitted to occasional smoking, the rest do not smoke. Blood pressure (BP): BP sys. 124.4+ 11.4 and BP diast. 77.5

+ 8.4, which corresponds to the norm. All participants were surveyed using the SF 36 questionnaire (QOL assessment), which included 8 scales assessed from 0-100 points. According to the results of the questionnaire analysis: all participants have high scores in the scales of general health 70%, vitality 75% and mental health 73%, as well as physical functioning 85.5%, role functioning due to physical condition 78.9% and role functioning, due to the emotional state of 84.5%, which is associated with regular physical education and sports. All participants of the competition spoke about the need and importance of holding sports events for people with transplanted organs. To the questions of the questionnaire “Do you think you need to go in for sports and physical education?”, “Is it necessary to develop a sports community among people with transplanted organs?” “Would you participate in World Sports Games for Organ Transplants?” 100% of patients percent answered “Yes”.



**Figure 1.** Indicators of the quality of participants in sports games according to the SF-36 questionnaire.

**Conclusion:**

Thus, high quality of life indicators among patients with transplanted organs and on dialysis who participated in competitions confirm the role of an active lifestyle, physical education and sports in reducing the risk of cardiovascular diseases and require further study in this area in this category of patients.

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医学信息学方法在临床前药物开发中的应用前景  
**THE PROSPECT OF USING MEDICAL INFORMATICS METHODS  
IN PRECLINICAL DRUG DEVELOPMENT**

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抽象的。本文讨论了确定关键风险因素的方法，以客观评估药物在临床前开发阶段的安全性。

从现代观点来看，药物安全性评估新方法的发展与在临床前阶段评估关键风险因素以成功预测药物的医疗使用结果的数学工具的研究计划的引入密不可分。药物。在这方面，在临床前研究中采用循证和预后医学方法，以便对患者未来临床使用药物的安全性和有效性进行平衡评估仍然具有重要意义，特别是对于人口中的弱势群体——孕妇和儿童[1, 2]。

所提出方法的相关性取决于妊娠期间使用药物的安全性和有效性缺乏可靠的预测因素，以及药物治疗的副作用以检测到的后代开始畸形的形式引起围产期风险的可能性很高。处于产后发育时期。

这项工作的目的是在针对孕妇和儿童人群的医疗用途开发的药物的遗传毒性的临床前研究中采用循证医学方法。

关键词：证据权重、数学预测、临床前研究。

**Abstract.** *The article discusses methods for determining the key risk factors necessary for an objective assessment of the safety of medicines at the stage of their preclinical development.*

*The development of new approaches to the assessment of pharmacological safety, in the modern view, is inextricably linked with the introduction into the research program of mathematical tools for assessing key risk factors at the preclinical stage for the successful prediction of the outcomes of medical use of medicines. In this regard, the adaptation of evidence-based and prognostic medicine methods in preclinical studies to obtain balanced assessments of the safety and effectiveness of drugs in the future of their clinical use by patients remains relevant, especially for vulnerable groups of the population - pregnant women and children[1, 2].*



*The relevance of the proposed approach is determined by the lack of reliable predictors of the safety and effectiveness of the use of drugs during pregnancy and the high probability of perinatal risks caused by the side effect of pharmacotherapy in the form of initiation of malformations in offspring detected in the postnatal period of development.*

*The purpose of the work - adaptation of evidence-based medicine methods in preclinical studies of the genotoxicity of drugs developed for medical use in the population of pregnant women and children.*

**Keywords:** *weight of evidence, mathematical prediction, preclinical studies.*

### Introduction

Taking into account the regulatory requirements and peculiarities of the development of drugs for the population of pregnant women and children, the main task of the study was to adapt a new methodological approach in the preclinical assessment program to predict the significance of genotoxic effects as key factors of embryotoxic risk.

The materials for this work were previously conducted experimental data of preclinical studies, domestic and foreign regulatory documents devoted to research on the effectiveness and safety of drugs, scientific sources containing a description of the principles of evidence-based medicine and prognostic research methods. [Baranov A.A. et al. System analysis in medicine and biology. 2015; Good I.J. Weight of Evidence: A Brief Survey. 1985; GOSTP 56701-2015; GOSTP 57130-2016].

### Materials and methods

The experimental data used in this work were obtained from several series of experiments devoted to the assessment of induced DNA damage in embryonic and placental tissues of rats, leading to disruption of intrauterine development, and the possibility of their modification with the drug fabomotizol [3-7]. The design of the experiments included the creation of models of teratogenesis induced by cyclophosphamide (CFA), hemic hypoxia (HH), streptozotocin diabetes (SD), prenatal alcoholism (PA), tobacco smoke (TS) using mongrel white rats to assess genotoxicity and embryotoxicity and the use of fabomotizol as a pharmacological corrector of developmental abnormalities.

The calculation of genotoxic and apoptotic indices of damage in the tissues of placentas and embryos was carried out according to a modified relative risk formula, with an increase in the index values of more than 2, in accordance with the methodological recommendations [8], it was considered to be a genotoxic risk associated with the formation of congenital malformations.

The applied analysis included the transformation of experimental data into target values (indices) based on the modification of formulas for the construction of a

mathematical forecasting model (simulation model) based on the multiple regression equation:  $y = a + \beta_1x_1 + \beta_2x_2 + \dots + \beta_nx_n(1)$

Statistical analysis of experimental data, the development of simulation models for predicting the risk of developmental anomalies and the construction of diagrams of a multilayer perceptron and based on neural network algorithms were carried out in the application IBM SPSS Statistics 20 [9, 10].

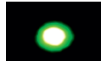
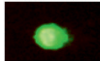
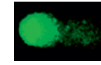
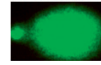
#### Results

The first stage of this work was the construction of a conceptual scheme of the study, which is based on the consideration of the object of study as a homeostatic model and scientific and theoretical justification for the selection of a combination of methods for system analysis aimed at assessing, on the one hand, teratogenic outcomes of genotoxic effects, on the other - the effectiveness and safety of pharmacological correctors of congenital malformations. A hypothesis was formulated about the interconnectedness of indicators of pathogenetic processes observed at different biological levels of experimental teratogenesis systems and the assumption about the possibility of developing a mathematical model for predicting the risks of VPR based on the multiple regression function. The formulation of the hypothesis within the framework of this concept (1) was based on a system of empirical dependencies identified as a result of a biostatistical study of the aggregate experimental research data: null hypothesis (H0):  $\beta_2 = \beta_3 = \dots = \beta_k = 0$ , against the alternative (H1):  $\beta_j \neq 0, j = 2, 3, \dots, k$ , where  $\beta$  – regression coefficient. That is, statistically, the null hypothesis was formulated as the absence of significant relationships between the indicators of genotoxic effects at the molecular-cellular level (independent variables X) and congenital morphogenetic variants in rats (dependent variable Y). As proof of an alternative hypothesis, it was accepted to establish the above-described relationships in the format of the conjugacy of molecular-cellular level processes with the formation of morphogenetic variants of embryogenesis, regarded as congenital malformations.

Based on previously studied data [4], the physiological norm of the ratio of cells with varying degrees of DNA fragmentation in the tissues of embryos and placentas of control animals was established (Table 1).

**Table 1**

*The ratio of cells with varying degrees of DNA fragmentation.*

Pregnancy period (day)	Intact rats	“DNA comets” up to 10%, (%)	“DNA comets” from 10% to 30%, (%)	“DNA comets” from 30% to 50%, (%)	“DNA comets” more than 50%, (%)	Number of cells studied, (abs. val.)
						
Placenta						
Day 13	Control 1	91.12	5,53	0,27	3,08	1103
Day 13	Control 2	92.90	3,74	0,38	2,98	1042
Day 14	Control 3	90.77	4,65	0,53	4,05	1332
Day 15	Control 4	83.18	6,80	0,00	10,02	1116
Day 15	Control 5	89.84	2,26	0,56	7,33	709
Embryo						
Day 13	Control 1	90.06	6,88	0,21	2,85	1438
Day 13	Control 2	91.50	6,21	0,33	1,96	2447
Day 14	Control 3	90.54	7,09	0,19	2,19	2103
Day 15	Control 4	90.83	5,21	0,15	3,82	1364
Day 15	Control 5	89.69	7,36	0,15	2,80	678

**Note 1.** Here are the data of control groups selected from five independent studies of teratogenesis induced by experimental genotoxicants: alcohol, tobacco smoke, hemic hypoxia, streptozotocin diabetes, cyclophosphamide.

The established frequency ratio of cells with varying degrees of DNA fragmentation was taken as an indicator of physiologically normal molecular genetic balance in the tissues of placentas and embryos of control rats in the period from 13 to 15 days of embryogenesis. The shift in the ratio of frequencies of placenta cells and embryos towards an increase in cells with % DNA in the tail exceeding 10% and an increase in the number of apoptotic comets was considered as an indicator of a violation of the molecular genetic equilibrium that triggers the processes of teratogenesis.

Similarly, the ratio of frequencies of cells with different degrees of DNA fragmentation in embryos and placentas of rats exposed to experimental genotoxicants was studied PA, TS, HH, SD and CFA [3-6].

Further, based on the frequency ratio of cells with different degrees of DNA fragmentation in embryos and placentas of control and experimental rats, genotoxic indices (GI) and apoptotic indices (AI) were calculated. The calculation was carried out in accordance with the methodological recommendations [8] and the formula of relative risk in modification relative to the balance ratio of cells with different degrees of DNA fragmentation (Table 2).

**Table 2**

*Index of DNA damage in tissues of placenta and embryos of experimental rats*

Group	The total frequency of cells with DNA fragmentation is 10-50%	«DNA comets» more than 50%, (%)	DNA Damage Index (DDI) <sup>1</sup>	Genotoxic index (GI) <sup>3</sup>	Apop-totic index (AI <sub>control</sub> ) <sup>2</sup>	Apop-totic index (AI <sub>model</sub> ) <sup>4</sup>
<i>Placenta</i>						
Control <sup>1</sup>	4,1	3,0	0,14	-	0,03	-
Control <sup>2</sup>	3,8	2,9	0,13	-	0,03	-
Control <sup>3</sup>	5,8	3,1	0,15	-	0,03	-
Control <sup>4</sup>	5,5	2,7	0,14	-	0,03	-
Control <sup>5</sup>	5,2	4,1	0,18	-	0,04	-
ModelPA	38,0	7,9	-	5,16	-	2,63
ModelTS	28,0	2,6	-	3,16	-	0,90
ModelHH	18,6	5,4	-	2,49	-	1,74
ModelSD	27,2	1,93	-	2,60	-	0,71
ModelCFA	30,0	30,8	-	7,67	-	7,60
<i>Embryo</i>						
Control <sup>1</sup>	6,5	2,0	0,13	-	0,02	-
Control <sup>2</sup>	5,7	1,5	0,11	-	0,02	-
Control <sup>3</sup>	7,1	2,9	0,16	-	0,03	-
Control <sup>4</sup>	5,3	2,8	0,14	-	0,03	-
Control <sup>5</sup>	7,3	2,2	0,14	-	0,02	-
ModelPA	29,9	2,3	-	3,16	-	0,77
ModelTS	20,2	1,3	-	2,55	-	0,45
ModelHH	13,8	3,2	-	1,56	-	1,03
ModelSD	44,7	0,7	-	3,54	-	0,26
ModelCFA	39,6	11,7	-	5,99	-	2,90

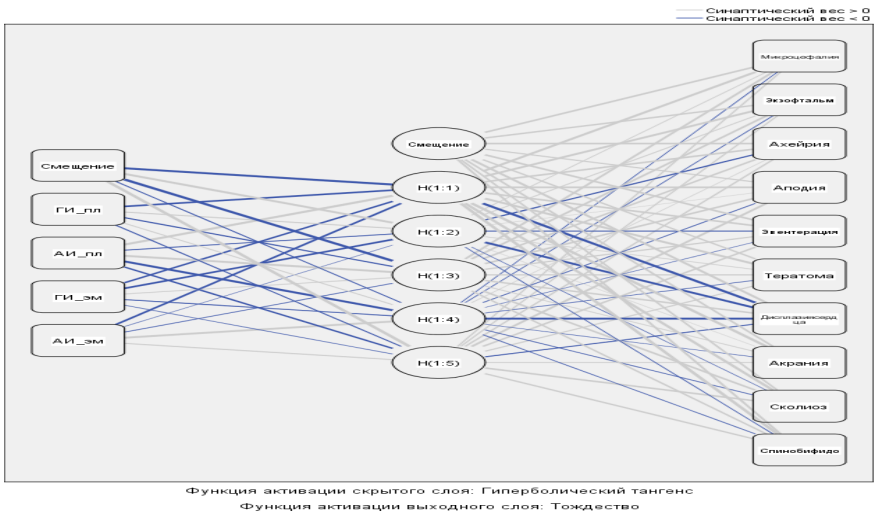
**Note2.** The threshold value confirming the presence of a genotoxic effect in the assessment of GI and AI indicators was taken to be 2.0 [8]. The total number of cells, expressed as a percentage with a degree of DNA damage from 10 to 50%, is taken as the total frequency.

<sup>1</sup>DDI = (0×A+1×B+2×C+3×D) /100, where A is the proportion of cells with "DNA comets" up to 10%; B is the proportion of cells with "DNA comets" from 10% to 30%; C is the proportion of cells with "DNA comets" from 30% to 50%; D is the proportion of cells with "DNA comets" more 50%; <sup>2</sup>AI<sub>c</sub> = D/100; <sup>3</sup>GI<sub>% DNA in the tail</sub> = A/B, where A - the proportion of cells with "% DNA in the tail" from 10% to 50% in the model group; B - the proportion of cells with "% DNA in the tail" from 10% to 50% in the control group of the corresponding series of experiments;

$^4(AI_m) = (D_m / (A_m + B_m + C_m + D_m)) / (D_c / (A_c + B_c + C_c + D_c))$ , where  $A$  is the proportion of cells with “DNA comets” up to 10%,  $B$  is the proportion of cells with “DNA comets” from 10% to 30%;  $C$  is the proportion of cells with “DNA comets” from 30% to 50%;  $D$  is the proportion of cells with “DNA comets” more 50% in the model and control groups, respectively.

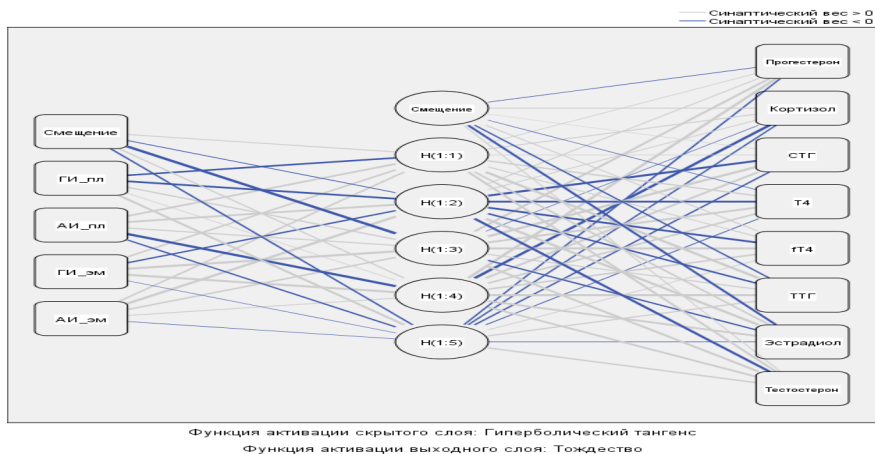
As can be seen from Table 2, exceeding the threshold value [8] for the GI indicator was registered in all placentas and embryos of the experimental groups with the exception of the HH model. Exceeding the threshold value of AI was noted in placental tissues exposed to PA ( $AI_m = 2.63$ ) and CFA ( $AI_m = 7.60$ ). In the embryos of the cyclophosphamide model of teratogenesis, the threshold value of AI ( $AI_m = 2.9$ ) was also found to be exceeded.

It should be noted that out of the five studied models of genotoxically induced teratogenesis, gross developmental anomalies in embryos associated with a high GI and AI index in embryonic and placental tissues were recorded only in the group of rats exposed to CFA (Fig. 1) Exceeding the threshold value of the placental GI in combination with an increase in this indicator in the tissues of embryos indicates a high degree of probability of both genetic (epigenetic) and metabolic disorders, representing a high risk of the formation of morphogenetic variants of rat development. This hypothesis was confirmed by the method of establishing correlations between the indicators of genotoxic risk, hormonal imbalance and the formation of congenital malformations (Fig. 2, Fig. 3).



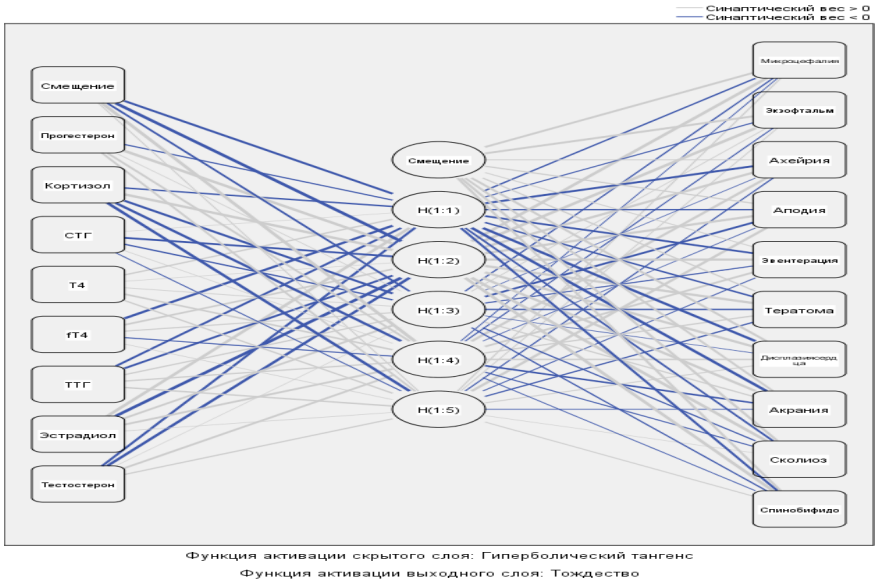
**Figure 1.** Diagram of the conjugacy of genotoxic effects (GI and AI) with the formation of congenital malformations in rat embryos subjected to CFA (hereinafter, a multilayer perceptron built on the basis of neural network algorithms in the package IBM SPSS).

Figure 2 shows the result of visualization of the conjugation of increased GI and AI of placentas and embryos with the risk of endocrine disorders, and Figure 3 shows the correlation between the indicators of hormonal imbalance and the formation congenital malformations of CFA-induced teratogenesis in embryos.



**Figure 2.** Diagram of the conjugacy of genotoxic effects (GI and AI) with indicators of hormonal imbalance in rat embryos.

It has been shown that hormonal shifts can be considered as prognostic factors characterizing the intermediate link of pathogenesis between DNA damage of placentas and embryos and, initiation of biochemical imbalance processes, as a risk, subsequently leading to the formation of various variants of metabolic syndromes in embryos of model rats.



**Figure 3.** Diagram of the conjugacy of genotoxic effects (GI and AI) of hormonal imbalance indicators with the formation of congenital malformations in rat embryos exposed to CFA during pregnancy.

Thus, a mathematical model (1) describing correlationally dependent changes occurring at the molecular-cellular, tissue, organ and morphofunctional (systemic) levels of embryogenesis of experimental rats can be used to confirm the H1 hypothesis.

### Conclusions.

1. The statistical hypothesis of “conjugacy of processes in a multilevel biological system of teratogenesis”, based on the multiple regression equation  $y = a + \beta_1x_1 + \beta_2x_2 + \dots + \beta_nx_n$ , describing the relationship between the indicators of teratogenic lesions at different levels of the biological system of experimental teratogenesis.
2. Mathematical models for calculating genotoxic indices of GI, AI, can be used for predictive assessment of the risk of formation of metabolic and morphogenetic developmental anomalies.

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DOI 10.34660/INF.2023.65.47.055

含有益生菌、益生元和水飞蓟素的产品对纯种马粪便微生物群和血液指标的影响  
**INFLUENCE ON FAECAL MICROBIOTA AND BLOOD INDEXES  
A PRODUCT CONTAINING PROBIOTIC, PREBIOTIC AND  
SILYMARIN IN THOROUGHBRED HORSES**

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抽象的。马匹进入牧场会导致土地和泥土的消耗。马会食用地面和污垢中的有害微生物或蠕虫卵，尤其是在春季、秋季和冬季，从而引起慢性腹泻和绞痛。本研究的目的是评估含有益生菌和水飞蓟素（PCPS）的产品对纯种马粪便微生物群和肝功能的功效。本研究结果表明，添加 PCPS 对马粪便细菌群落多样性、CBC 指数和血清生化有显著影响。与食用益生菌之前一样，粪便微生物群成分也有所不同（试验期间的变化为 85–90%）。乳酸菌的过度生长导致血铵减少（ $p < 0.001$ ），从而减少肝酶马的活性（GOT（ $p < 0.05$ ）、ALP（ $p < 0.05$ ）、LDG（ $p < 0.01$ ）、GPT（ $p < 0.001$ ）、GGT（ $p < 0.001$ ）。它还改善了造血功能：Hb 和 MCH 浓度增加（分别为  $p < 0.001$  和  $p < 0.05$ ）。益生菌消耗结束后，乳杆菌显著减少（ $p < 0.05$ ），而双歧杆菌仍然增加（ $p < 0.01$ ）。

关键词：益生菌、益生元、水飞蓟素、粪便微生物群、纯种马。

**Abstract.** *Pasture access in horses can cause consumption of ground and dirt. Horses can consume harmful microbiota or helminthes eggs with ground and dirt, especially in spring, autumn and winter, thus can caused chronic diarrhea and colic. The purpose of this study was to evaluate the efficacy of a product containing probiotic and silymarin (PCPS) on faecal microbiota and hepatic function in Thoroughbred horses. The results of this study showed significant effects of PCPS addition to horses on the diversity within the faecal bacterial community, CBC indexes and serum biochemistry. The faecal microbiota compound was varied, as before probiotic consumption, such as after that (it's variations was 85-90% during trial).The overgrowth of Lactobacterium was led to a decrease in blood ammonium ( $p<0,001$ ), which reduced hepatic enzyme activity in horses(GOT( $p<0,05$ ), ALP ( $p<0,05$ ), LDG ( $p<0,01$ ), GPT ( $p<0,001$ ), GGT ( $p<0,001$ ). It was also improved haemopoiesis: increasing Hb and MCH concentration ( $p<0,001$  and  $p<0,05$  respectively). After ending of probiotic consumption Lactobacterium was significantly decreased ( $p<0,05$ ) whereas Bifidobacterium still increased ( $p<0,01$ ).*

**Keywords:** *probiotic, probiotic, silymarin, faecal microbiota, Thoroughbred horses.*

**Introduction.** Horses – non ruminant animals – had some features that allow them to digest plant foods – it's a small stomach and larger cecum and colon harboring up to  $10^8$  microorganisms per gram. They're hindgut fermenters which have allowed them to evolve as grazers on lands producing marginal forages [1]. Crucial role in horse nutrient digestion, maintaining animal health and welfare play a gastrointestinal microbiota, include of bacteria, protozoa, and fungi. Microbiota are usually referred to as the assemblage of microorganisms present in a gastrointestinal environment, has enormous impact on the health and performance of horse, whereas microbiome is the complex of biotic and abiotic factors, the entire habitat, including microorganisms and their genomes [2]. Various factors may affect microbial balance often leading to disturbances that may result in debilitating conditions such as colic, laminitis and other diseases. The invention of next-generation sequencing technologies and bioinformatics has provided valuable information on the effects of factors influencing equine gut microbiota [3]. It's maybe are different factors, such as dietary (cellobiose, starch levels in ratio [4, 5], barley form [6]), different types of diet, including even types of hay [7-10], management and environment factors [11, 12-15], health condition and presence of diseases [16-19].

So, the equine intestinal tract contains a complex microbial population that plays an important role in health and disease. As methods to characterize the microbiota and its genetic makeup (the microbiome) have evolved, the composition

and complexity of this population are starting to be revealed. As is befitting a hindgut fermenter, members of the Firmicutes, Bacteroidetes, Proteobacteria, Verucomicrobi phylum appear to predominate, yet there are significant populations of numerous other phyla [7, 8, 14, 15, 20-22]. However, under certain conditions, this ratio varies somewhat, dominant bacterial phyla in all research groups of animals were Bacteroidetes > Firmicutes > Fibrobacter [10, 13, 19]. Abundances of Proteobacteria were increased for aged animals and Bacteroidetes, Firmicutes, and Actinobacteria were increased for obese animals [19].

To evaluate hindgut microbiota balance or imbalance in experimental trials, digestive contents are typically collected in the caecum and the colon. The accessibility to such contents is not possible routinely from non-experimental animals, as there is no direct access to these gut regions, whereas faeces can easily be collected and could be used as suitable samples to generate biomarkers to evaluate the status of the hindgut microbiota. Faeces could be used for evaluating the balance of the equine hindgut microbial ecosystem, which would offer a practical method for assessing gut health and how this relates to disease. Faecal samples and their bacterial analyses could be used to represent caecum and RV colon hindgut microbial ecosystem in terms of variations during a change from a high-fibre to a high-starch diet, and thus could be markers of particular interest to diagnostic proximal hindgut microbial disturbances [23]. Therefore, faecal samples may be useful to evaluate the microbial composition of the hindgut distal area, but not the proximal region or hindgut activity. Some studies concluded that faeces microbial ecosystem was not representative of the proximal hindgut (caecum and ventral colon). However, the proximal region and, particularly, the ventral colon are the main areas for microbial activity required for fibre digestion and energy generation from volatile fatty acid production in horses [24]. In all, fermentation parameters and bacterial abundances were impacted by hay type and sampling location in the hindgut [9].

So, intestinal microbiota appear to play an important role in the pathophysiology of several diseases in equids [25], it's extremely important for human and animal health. Investigations into the composition of the microbiota and its therapeutic modification have received increasing interest in human and veterinary medicine. Probiotics are a way of modifying the microbiota and have been tested to prevent and treat diseases [26].

Despite widespread availability and use, scientific, peer-reviewed evidence behind commercial probiotic formulations in horses is limited. Additionally, quality control of commercial over-the-counter products is not tightly regulated. Although promising in vitro results have been achieved, in vivo health benefits have been more difficult to prove. Up to date only different strains of the yeast *Saccharomyces cerevisiae* (SC) are officially registered probiotics for horses in the European

Union. However, studies evaluating the impact of SC supplementation in vivo showed equivocal results in the equine [5]. However, in the United States none of the 11 tested probiotics met their label claim. Nine of the 11 did not have statistically significant inter-lot variability. Several products lacked microorganisms listed on the label based on both culture and polymerase chain reaction (PCR) analyses [26]. In review article showed, also no clear benefits were identified to support supplementation of equids with probiotic bacteria to improve starch and fiber digestion, nor for the treatment of colic or prevention of salmonellosis. There is a paucity of evidence to support the use of probiotic bacteria in the health maintenance and disease management of horses. While there are unclear and conflicting results associated with probiotic bacteria use for gastrointestinal conditions in both horses and foals, the administration of multistrain bacterial formulations to increase stamina in exercising horses shows promise [27]. Another research (in vitro) showed same results. Results from this study indicate that some microorganisms in equine probiotics do not appear to be adversely affected by exposure to the equine proximal GI tract [28].

We hypothesize that daily administration of a commercially available product containing probiotic, prebiotic and silymarin will be effective in the change gut microbiota and improve hepatic function in Thoroughbred horses.

**Materials and Methods.** We studied 11 healthy adult Thoroughbred horses (TBH) – 8 mares and 3 geldings, aged 7-15 years. All horses were kept in individual stables on straw or sawdust and had pasture access. None of the animals included in the study were treated with antimicrobials within the last four months, and none of the horses had any health problems in the past four months, and their feeding program also was stable before trial period. The mares were barren (non-pregnant) and all horses were not “in work” during the study period. The general health, appetite and behavior of the horses were assessed daily by one of the study personnel. During the trials, the horses had a median body condition score (BCS) of 5-6 measured on a 9-point scale based on the Henneke scoring system [29], and a median cresty neck score (CNS) of 2 measured on a 6-point scale [30].

During the study, horses were daily free to eat alfalfa hay (about 50% DM), flattened grain oat, sunflower cake (about 40% DM) according feed standards. Besides that, all horses were to eat different grasses (about 10% DM) on pasture. The product containing probiotic and silymarin (from fructus milk thistle spotted) (PCPS) consist of probiotic “Emprobio” (200 cm<sup>3</sup> per horse) and fructus Milk thistle spotted (*Silybum marianum*), it's were fed once daily with grain. PCPS and feed was given along for 15 days. Probiotic was included a mixture of cultures containing bacterial cells of *Lactobacillus casei*, *L. lactis*, *L. plantarum*, *L. acidophilus*, *Saccharomyces cerevisiae* and products of their metabolism. The number

of living microbial cells in 1 cm<sup>3</sup> of probiotic is at least 10<sup>6</sup>-10<sup>8</sup>. Milk thistle fruits were feeding in crushed form at a dose of 200 g per horse once daily.

With minimal manipulation of the horses, blood samples were collected from all horses into two types of tubes: for complete blood count (CBC) – in spray-coated K<sub>2</sub>EDTA tubes ; for biochemistry – into vacuum tubes without additives in the morning (5:00 AM-6:00 AM – before morning feeding and pasture access) by venipuncture of the jugular vein after cleaning and antiseptic preparation of the site. The samples were centrifuged at 3000\*g for 10 min to obtain the serum, aliquoted into Eppendorf tubes, and then frozen at –20°C until analysis. CBC was analyzed for VetScan HM5 (Abaxis, Zoetis, U.S.A.). In sera were analyzed for total protein (TP), blood ammonia (BA), glutamate pyruvate transaminase (GPT), glutamate oxalate transaminase (GOT),  $\gamma$ -glutamyltransferase (GGT), lactic dehydrogenase (LDG) and alkaline phosphatase (ALP) using an automatic biochemical analyzer (Fuji DRI-CHEM 4000ie, Fujifilm, Japan). To obtain the faecal samples, the tail of the horse was wrapped, and the perineal region were scrubbed and rinsed. The area was then dried with sterilized gauze. While wearing a sterilized sleeve or surgical glove, faecal samples were obtained directly from the rectum. Bacteriological studies of faeces were performed according to Methodological recommendations “Bacteriological diagnostics of intestinal dysbiosis” (approved by the Ministry of Health of the RSFSR on April 14, 1977). 3. Methods of bacteriological research. Bacteria of the E. coli group index (BGECI), Staphylococcus index (SI), Lactobacterium (LBI) and Bifidobacterium (BBI) indexes were detected. Perfringens-titr (PT) was detected according to Methodological guidelines MG 1446-76 Methodological guidelines for sanitary and microbiological examination of soil (with amendments) MG 2.1.7.730-99 “Hygienic assessment of soil quality of populated areas”.

Faecal and blood samples from horses were collected and tested before starting trials (1<sup>th</sup> day of experiment), and on the 15<sup>th</sup>, 22<sup>th</sup> day after the first feeding PCPS.

Statistical analysis. Blood indexes during research were studied for statistical connected group differences using the Student’s T-test (their critical values). The level of significance was set at  $p < 0,05$ . Results are presented as the mean (M) and standard deviation (SD). Pearson’s correlation (PC) analysis was used to evaluate the relationship blood and faecal parameters in 1<sup>st</sup> day of experiment.

**Results.** All horses were remained clinically normal during the study period. There was no change in general health, appetite and behavior throughout the trial.

Comparison of the faecal microbiota indexes (FMI) during trials are shown in Table 1.

**Table 1**

*FMI during research, \*10<sup>5</sup> CFU/g (M±SD)*

FMI	1 <sup>th</sup> day of experiment	15 <sup>th</sup> day of experiment	22 <sup>th</sup> day of experiment
BGEI	96850,0±65009,4	18963,6±55921,7**	34827,7±19229,3*
SI	< 500 in 7 samples	< 500 in 4 samples	Non detected
LBI	< 500 in 7 samples	186368,6±183720,5	34897,2±25947,6*
BBI	< 500 in all samples	52182,2±33946,4	311608,4±220084,5**
PT	Non detected	Non detected	Non detected

\* – p<0,05; \*\* – p<0,01.

All faecal samples were free from helminthes eggs during trials.  
Results of serum biochemistry (SBH) are shown in Table 2.

**Table 2**

*SBH in TBH, (n=11)*

	TP, g/l	BA, μmol/l	GPT, U/l	GOT, U/l	GGT, U/l	ALP,U/l	LDG,U/l
1 <sup>th</sup> day of experiment							
M± SD	65,3±3,35	36,9±5,45	23,4±5,13	270,8±43,12	7,69±1,71	130,9±25,54	336,2±53,54
C <sub>v</sub> , %	5,13	14,76	21,9	15,9	22,2	19,5	15,9
15 <sup>th</sup> day of experiment							
M± SD	64,4±2,34	29,6±4,84	16,5±1,40	257,7±41,32	6,44±1,3	118,4±17,55	305,7±46,53
C <sub>v</sub> , %	3,64	16,4	8,5	16,0	20,2	14,8	15,2
p<*	–	0,001	0,001	0,05	0,001	0,05	0,01
22 <sup>th</sup> day of experiment							
M± SD	68,4±1,44	33,2±4,26	16,2±1,63	266,4±27,67	7,11±2,17	122,9±28,82	331,8±48,49
C <sub>v</sub> , %	2,11	12,84	10,0	10,4	30,5	23,4	14,6
p<*	0,01	0,05	0,001	–	–	–	–

p<\* – regarding starting blood indexes.

Results of CBC are shown in Table 3.

**Table 3**

*CBC indexes in TBH (n=11)*

	RBC, T/l	WBC, G/l	Hb, g/l	PCV, %	MCH, pg	MCV, fl
1 <sup>th</sup> day of experiment						
M± SD	6,74±0,52	8,10±0,35	103,43±4,47	40,91±3,91	14,89±1,38	61,04±7,09
C <sub>v</sub> , %	7,66	4,35	4,33	9,56	9,28	11,61
15 <sup>th</sup> day of experiment						
M± SD	6,85±0,3	8,41±0,45	110,05±4,20	41,00±1,61	16,67±2,06	56,17±2,38
C <sub>v</sub> , %	4,42	5,33	3,82	3,93	12,34	4,24
p<*	–	0,05	0,001	–	–	–
22 <sup>th</sup> day of experiment						

M± SD	6,88±0,38	8,84±0,92	114,40±5,06	38,64±2,58	16,59±1,56	58,28±3,41
C <sub>v</sub> ,%	5,50	10,41	6,66	6,68	9,41	5,85
p<*	–	0,05	0,001	–	0,05	–

p<\* – regarding starting blood indexes.

**Table 4**  
*PC faecal and blood parameters in 1<sup>st</sup> day of experiment*

	RBC	Hb	TP	BA	GPT	GOT	GGT	ALP	LDG
BGECI	0,15	0,01	-0,12	0,31	0,61*	0,66*	0,54	0,49	0,59
RBC	1	0,95***	-0,15	0,02	-0,31	-0,40	-0,58	-0,43	-0,42
Hb		1	0,39	0,33	-0,22	-0,26	-0,44	-0,43	-0,30
TP			1	-0,11	0,68**	0,69**	0,48	0,45	0,44
BA				1	0,63*	0,68**	0,61*	0,53	0,52

\* - p<0,05, \*\* - p<0,01, \*\*\* - p<0,001

**Discussed.** Our study did observe a significant effect of supplement probiotic on faecal microbiota composition. The patterns of changes in the faecal microbiota in the present study were generally consistent with those obtained and didn't contrasts with previous studies in which probiotics supplementation the intestinal microbiota have been demonstrated [5].

In our study we did detect significantly increase Lacto- and Bifidobacterium whereas BGECI and SI decrease on 15<sup>th</sup> day of experiment (p<0,01). PT was not detected during trials. BGECI, SI, and PT we was detected as unhelpful, some of this strains was even harmful, and can was diseases reason. But enteric pathogens, such as Clostridium difficile and Salmonella, can be isolated from feces of healthy animals; therefore, presence of presumed pathogenic organisms does not necessarily cause disease. But, throw one week (on 22<sup>th</sup> day of experiment) this situation was some changed. SI was still decreased and not detected in all horses, whereas BGECI was increased about in two times approximately (p<0,05), BBI – in six times approximately (p<0,01). LBI was decreased in five time approximately (p<0,05). Also an increased abundance of lactic acid bacteria was reported to be a major cause of intestinal dysbiosis and colic [17]. Decreasing LBI was contribute to the growth of BGECI and BBI, and the latter is much higher. Thus the use of PCPS was contribute to increasing helpful strains (BBI), decreasing unhelpful (SI, PT and some BGECI). Based on the current study and the previously published data, pasture access seems to affect microbiota composition in equids. Therefore, the changes in bacterial diversity and community structure observed in the faecal samples in the present study may be a good proxy to similar changes occurring in the colon [7, 9]. However, it should be noted FMI varied, its variation was about 85-95% as before consumption PCPS, such as after it. At the same time, almost half of the horses did not change FMI after consumption PCPS.



Changes in FMI was contribute changes in SBH and CBC. So, in serum was significantly decreasing blood ammonium throw two weeks of use PCPS ( $p<0,001$ ). The decrease in ammonia levels was probably due to a decrease in its fermentation by harmful gut microbiota and an increase in the digestibility of feed protein. The TP was significantly higher on 22<sup>th</sup> day of experiment regarding starting indexes ( $p<0,01$ ). Whereas previously, it has been reported that a dietary probiotic had no effect on liver enzymes concentration [31]. In our view, consumption PCPS was contribute decreasing all serum enzyme activity, above all GPT, GGT and less more LDG, GOT and ALP. We're thinking it was good effect and improve hepatic function doe to silymarin addition. To determine the association between BA and hepatic enzymes, Pearson's correlation analysis was conducted. The strongest correlation was found with GOT ( $p<0,01$ ), followed by the GPT ( $p<0,05$ ) and GGT ( $p<0,05$ ) activity, with this parameters showing moderate positive correlation, and weak negative correlation was detected between the BA and TP (not significant) concentration (Table 4). But GPT activity isn't informatively in horses, its most likely "traditionally detection". Also PC was positive moderate between BGEI and GOT ( $p<0,05$ ). In our opinion decreasing unhelpful microflora was to improved hepatic function and digestibility of protein. Also it was improved blood parameters in TBH. It was detected an significantly increasing Hb and WBC ( $p<0,001$  and  $p<0,05$  respectively) during all period of trial. Increasing of RBC was far less and not significantly (about 1,6-2,0%). We hypothesized that BBI increasing improve Hb synthesis due to increasing vitamins group B in gut (it will be aim of our future research).

**Conclusions.** The current study provides essential baseline information on variation in faecal microbiota in a group of thoroughbred horses consumed probiotic with silymarin under normal management circumstances. Bifidobacterium is the largest phylum found in the faecal microbiota of the horses included in this study, followed by Lactobacterium. The faecal bacterial community profile identified in this study was not similar to the profile reported in other works on pasture-fed horses [8, 10-14]. This may be due to methodological differences between the studies or reflect differences methods investigation with other research. These results indicate that is hepatic function and blood parameters improved by several horse-related (probiotic and silymarin consumption). Studies investigating potential relationships between environmental factors or disease status and faecal microbiota should take these factors into account when interpreting observed differences to avoid the risk of overinterpretation. We can recommend PCPS for TBH during training for tournament.

**Acknowledgement.** The authors would like to thank their colleagues Mrs. Yulia A. Starostina, and Ms Lenara Abibulaeva for their contribution and support of the research.



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DOI 10.34660/INF.2023.76.28.056

UDC 636.033

畜牧过程建模中使用的逻辑变量  
**THE LOGICAL VARIABLES USE AT LIVESTOCK PROCESSES'  
MODELING**

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**摘要。** 2019 年,俄罗斯农场所有类别的屠宰结构中的牛产量达到专用肉类和杂交牛产品的 18.3% (51.65 万吨),而 2023 年为 12.8%。我们研究的目的是确定国内不同地区的专业肉牛和杂交牛养殖特点以及创新饲养技术的使用效果。研究的材料和方法是对我们自己对肉牛和杂交牛群的研究以及文献数据的科学分析。在研究现场观察中,采用了科学技术基础和最佳实践方法以及技术法规进行专家评估所获得的科学信息的收集、研究、系统化和处理。研究结果反映了肉牛饲养技术的差异。与专用肉牛相比,杂交牛每增加 1 公斤活增重要花费 0.60 EFU 或 8.1% 的饲料,肉类成本高出 7.1%,盈利能力为 156.8% 176.4% 为特种牛。为了确定不同类型的牲畜育种有效性,采用了一种方法论方法,具有特征回归的数学和逻辑表达式:  $f_1/f_2 + m_1/m_2 + g_1 / g_2 + (n \sum y \dots u)$ , 其中变量  $g$ 、 $m$ 、 $f$  是数学变量,其余的逻辑特征是已开发出来的。

**关键词:** 肉牛和杂交牛、生态学、数学和逻辑函数。

**Annotation.** *The cattle production in slaughter structure of Russian farms' all categories in 2019 reached 18,3% (516,5 thousand tons) of the specialized meat and crossbreed cattle products against 12,8% in 2023. The aim of our study was to determine the features of domestic specialized beef and crossbreed cattle breeding in different areas of the country, so as the effectiveness of innovative feeding technologies using. Material and methods of research was scientific analysis of our own research in beef and crossbred cattle herds, and literature data. At the research field observations, collecting, studying, systematizing and processing scientific information obtained from expert assessments of the scientific-and-technical foundation and the best practices methods, as well as technological regulations were used. The research results reflect the differences in the beef cattle raising technologies. Crossbreed cattle spent in 0,60 EFU or 8,1% more feed per 1 kg of live weight gain than specialized meat one, the cost of meat is in 7,1% higher,*

and the profitability is 156,8% in compared to 176,4% for specialized cattle. To determine the different types of livestock breeding effectiveness, a methodological approach, with a mathematical and logical expression of the features' regression:  $f1/f2 + m1/m2 + g1 / g2 + (n\sum y...u)$ , where the variables  $g, m, f$  are mathematical, and the rest –logical features, was developed.

**Keywords:** beef and crossbred cattle, ecology, mathematical-and-logical functions.

**Introduction.** In the cattle production's structure for slaughter in all categories of Russian farms, the specialized meat and crossbred cattle products' share in 2019 reached 18,3% (516,5 thousand tons) against 12,8% in 2013 [1,2]. In 2019, the number of specialized meat breeds and crossbreeds cattle in farms of all categories amounted to about 3,85 million heads and was increased in 33,8%, or 0,97 million heads in compared to 2013. The share of specialized meat and crossbred cattle was 21,2% of the total number of cattle (for comparison, this figure in the USA and Canada reaches 70-75%, in Australia – 85%, in the EU - 40-50%) [3,4].

The specialized beef cattle breeding efficiency is determined by the young animals' growth intensity and high feed payment, as well as precocity increasing [5,6]. Over the past decades, Russia has accumulated considerable experience in specialized meat breeds animals' fattening and breeding, including imported ones, as well as crossbred animals obtained by industrial crossing of low-yielding dairy, dairy-meat and meat-dairy cattle with sires of meat breeds [7,8,9].

**The aim of this study** was to determine the features of domestic specialized beef and crossbred cattle breeding in different areas of the country, so as the effectiveness of innovative feeding technologies using and young animals on fattening in various economic and geographical conditions keeping.

**Material and methods** of research. Scientific analysis of our own research in beef and crossbred cattle herds, and literature data. At the research field observations, collecting, studying, systematizing and processing scientific information obtained from expert assessments of the scientific-and-technical foundation and the best practices methods, as well as technological regulations were used.

#### **The results of the research.**

The beef cattle reproduction is limited by the cows' reproductive capacity that can give only one calf per year, and it is spent much more feed at necessary weight gain obtaining than in other livestock industries, although animals, both specialized beef and crossbreeds, as a rule, give good use of local feed. In this regard, many authors who had conducted research in beef cattle herds recommended between specialized breeding and crossbred cattle breeding these differences into account to take, and the main technological features at these animals breeding effectiveness evaluate study their share of influence on different groups

of animals to neutralize. In this case, the expression of these factors can initially determine the result of breeding effectiveness of these type of cattle in different areas of Russia (Table 1).

Given that specialized beef and crossbred cattle breeding require capital investments, energy, feed and labor resources, we should pay attention to the climatic characteristics of zones where livestock is located. Specialized beef cattle breeding has the best prospects for breeds' zoning on farms that have high-tech feeding and maintenance conditions – abundant green pastures, juicy feed, and positive climate features. That all contributes to the beef cattle genetic potential realization at it muscles tissue and subcutaneous connective specific development: the prevalence of intermuscular fat in the total mass of the carcass, giving the meat a delicacy “marbling”, had great taste and juiciness, while it is dominated by the fat on the internal organs, with much lower quality [5,6,10,11].

**Table 1**

*Features of specialized beef and crossbred cattle effective breeding with extreme variants (max/min) of weight coefficients according to the research traits (n=27)*

The factor of breeding efficiency	Specialized beef cattle	Weight coefficients of specialized beef cattle	Crossbred cattle	Weight coefficients of crossbred cattle
Geographical location of the farm	temperate climate, good pastures, abundant food supply	1/0 e	steppe and semi-desert country zones, with a coarse-stemmed feed predominance	1/0e
Reproduction	Mass autumn-and-spring calving	1/0 y	Regular year-round calving	1/0y
Slaughter output	65%	$f_1$	55%	$f_2$
Average fattening weight of the young animals' carcass, kg	600-650	$m_1$	450-550	$m_2$
The fat deposition	intermuscular fat	1/0 o	hypodermic and abdominal fat	1/0o
Average daily gains, g	1800-2500	$g_1$	850-1500 and more	$g_2$
The technology of young animals' growing	Intensive, as a rule	1/0 u	Extensive (often used)	1/0u
Technology of feeding	Specific grain fattening	1/0 a	Feed according to the feeding rate (often used)	1/0a

**Table 2**

*Features of specialized beef and crossbred cattle effective breeding with weight coefficients according to the studied characteristics (n=27)*

	Farm location	Reproduction of herd	Slaughter output	Average slaughter weight	The inter-muscular fat deposition	Average daily gains	The technology of young animals' growing	Technology of feeding	Total
Specialized beef cattle	1	1	1,2	1,8	1	2,8	1	0	9,8
Crossbred cattle	0	1	0,84	0,84	0	0,36	1	1	5,04

The adaptive biological advantages of crossbred beef cattle include a well-developed skin and hair cover, protecting from hypothermia, overheating, wind, and the effects of precipitation in the form of snow and rain. Resistance to diseases it allows a high offspring safety to get. The specialized beef cattle growing technology adopt the general reproduction cycle at mass calving in February-March or autumn, when crossbred cattle maintaining cost by year-round calving is compensated.

Based on the relationship's assessment of such investigated compensation influence factors as herds reproduction, slaughter yield, fat in the carcass location, average daily live weight gain, growing and fattening technology, farm geographical location –cattle breeding efficiency model will look as:

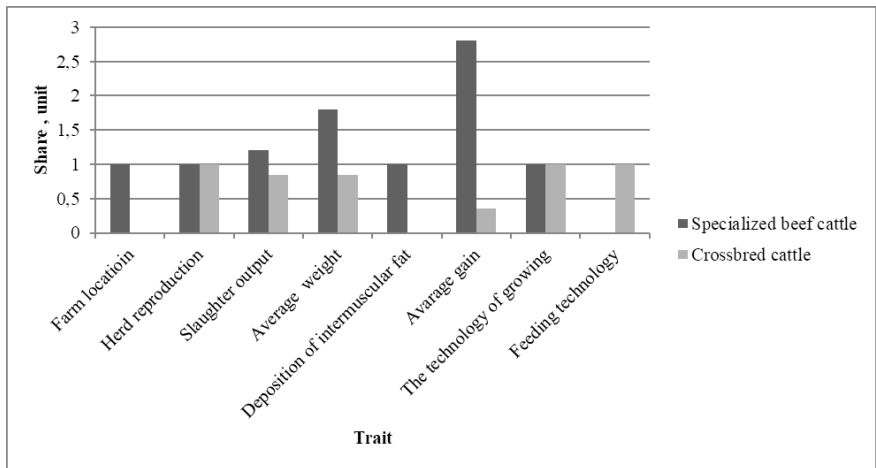
$\frac{f1}{f2} + \frac{m1}{m2} + \frac{g1}{g2} + (ny + na + ny + no + nu)$ , for specialized beef cattle (1),

and  $f2/f1 + m2/m1 + g2/g1 + (ny + na + ny + no + nu)$ , for crossbred one (2), where the g, m, f variables express mathematical features, and the other ones – logical. The specialized beef and crossbred cattle's studied traits mathematical expression is leveled by weighting factors, and the logical ones expression –by term “n”: “n” –available conditions data =1, and “n” – no data available by 0 for each factor. Thus, for n=0, the attribute does not have its own expression, and for n= 1, it gets the value 1, which as a summand in a numeric series is entered, and allows each value expression's effectiveness to determine.

Thus, it is possible the specialized beef cattle growing and fattening profile according to these characteristics and its effectiveness to obtain (Fig.). As it can be seen from the figure, the absence of a certain indicator in the scheme indicates its low value for the breeding efficiency, and therefore it further studies in this direction are required.

In addition to the high slaughter yield of 61-62% or more, specialized beef cattle have an advantage over crossbreeds in 10% or more in terms of growth energy and feed payment, because of there in specialized beef breeds animals' carcass are fewer bones, tendons, and more pulp –for example 3 kg of pulp per 1 kg of bones, in compared to 1,5 -2,5 kg at crossbreeds. In addition, our cattle fattening efficiency analysis also showed differences in the level of costs, specific weight of infrastructure elements, machinery and equipment using and their operation's intensity, electricity, fuel, fuel, wages and other production efficiency indicators' consumption.

In general, at beef cattle of various types experimental studies conducting, for a comprehensive assessment of the effectiveness of fattening, various signs of cultivation and fattening should be taken into account: technical, technological, economic, organizational, and others [11,12,13,14].



**Figure 1.** Indicators of cross-bred and specialized beef cattle fattening effectiveness quality

Thus, our scientific research, taking into account the assessment of the relationship (compensation) of the above named factors, allow to reveal the main and additional reserves of beef cattle effective breeding and meat producing to increase, domestic and imported breeds zoned in the Russian Federation at purebred, crossing breeding for their genetic potential more complete realization to find. The purebred cattle genetic potential full realization for hybrids creating, it allows the cattle fattening viability and feasibility at high load conditions for different periods of feeding to show, taking into account the optimal parameters of various types

of cattle fattening development for its meat quality and feeding cost reduce to improve. The experimental data processed by us showed that when it growing up to 18 months of age, black-and-white steers reach a live weight of 395,4 kg, crossbred ones – 431,5 kg, black aberdeen-angus -600-650 kg. The animals' breed affiliation is significantly affects the slaughter products yield: thus, crossbreeds carcass mass is lower than the purebred animals carcass at the age of 18 months in 6,7% or more ( $P < 0,05$ ). In terms of slaughter yield, purebred animals exceed of their crossbred contemporaries in 11-16%.

Differences in the animals growth intensity by different financial and economic results are caused. Crossbred animals spent 1 kg of weight gain during the growing period up to 18 months of age in 0,38-0,60 feed units or in 5,2-8,1% more feed in comparison with purebred peers, and therefore, the meat cost is higher in 4,4-7,1%, and the level of profitability and its economic efficiency is 156,8% against 176,4% purebred animals, which were by higher growth energy any more distinguished. The crossbred steers' carcasses mass was lower than the purebred analogues in 2,5%, heifers in 1,4%, the slaughter output was in 1,4 and 1,7%, respectively. The cost of crossbreeds' 1 center of weight gain was in 3,4%, and the level of profitability in 7,2% lower.

At the primary zootechnical data analyzing, it was found that with beef crossbreed young animals intensive raising, as an additional reserve for cheap beef production, up to 24 months of age, their live weight can be 550 kg and higher, against 600-750 kg in purebred cattle in 14-15; slaughter output 57,5 – 59,3% vs. 64,5 – 66,5%, respectively feed costs per 1 kg of weight gain is 7,7 – 8,0 vs. 5,5–6,5; the profitability level 45,2 against 46,9%.

Purebred beef steers and heifers are raised separately on suckling and at this feeding up to 8 months of age had a live weight by weaning age 355-375 kg respectively, against 255 kg in steers and heifers raised at standardized feeding using. There was also in the age of the first calving at heifers raised on suckling in 28,8 days decreasing, as well as the service period in 13 days reduction, success fertilization in 2,4%. Other parameters of economic and farm features were also different. The optimal age of steers slaughter was depends on the farm economic conditions.

Thus, on farms beef production technologies of crossbreed cattle for beef production's direction using, it is necessary steers up to a live weight of 450-500 kg and above weight to grow with a specific concentrates diet in share of 40-50%. Feeding with more nutritious feed is rearing it for a longer time, and won't be physiologically and economically feasible. To realize the genetic potential of purebred steers of specialized beef breeds production, it is necessary to grow them with live weight at least 550-650 kg achievement, with its the most optimal intensity.



**Conclusions.** The methodological approach is developed the share of various characteristics in the of cross-bred and specialized beef cattle influence to determine. It will contribute to the cattle breeding and the meat industry development, and on the regional scale, crossbred beef cattle production to increase.

Taking into account the type of growing livestock, as well as conducting scientific research, makes it possible to reflect in the mathematical model the biological characteristics of animals, various production-and-organizational and economic indicators for their share of influence to assess, namely: with a relatively marketable low yield of crossbred cattle products, taking into account the lower level of the required production infrastructure for additional beef production.

This methodical approach allows the possibility of reproduction of specialized beef cattle purebred and crossbred herds the optimal parameters of breeding efficiency to evaluate: the households' geographic location, meat characteristics of specialized and crossbred cattle to find, features technology for specialized and crossbred cattle to note, the presence of science-based technologies of keeping and feeding taking into account the available forage to give. This model allows to take into account other correlating farm features as well.

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DOI 10.34660/INF.2023.95.54.057

保存冷冻石区地基的完整性

**PRESERVATION OF THE INTEGRITY OF FOUNDATIONS IN THE  
CRYOLITHOZONE**

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抽象的。本文讨论了寒冷气候和永久冻土中基础结构完整性丧失的原因。分析了基础设计的经验以及导致基础劣化的原因。

关键词：多年冻土带，地基，冻土融化，变形，不均匀降水，脚后跟，变形能力，热岩溶，热侵蚀，诺里尔斯克，雅库茨克

**Abstract.** *The article discusses the reasons for the loss of integrity of foundation structures in cold climates and permafrost. The experience of designing foundations and the reasons leading to the degradation of foundations are analyzed.*

**Keywords:** *permafrost zone, foundation, thawing of the frozen base, deformations, uneven precipitation, heels, deformability, thermokarst, thermal erosion, Norilsk, Yakutsk*

The problem of maintaining the integrity of foundations and foundations in the permafrost zone is being worked on for a long period of time. Even after the first construction experience at the beginning of the 20th century, which ended with the rapid destruction of structures, it became clear that traditional methods were not suitable for designing on permafrost.

Engineer Kim M. V. in 1946 suggested using a pile foundation with a ventilated underground. The uniqueness of the idea was the drilling of piles. The proposed method is still in use today. Such large urban complexes as Vorkuta, Norilsk and Yakutsk were built using pile foundations with ventilated undergrounds designed to maintain the lowest possible temperature. However, the degree of deformation of the foundations indicates that the methods used, although they increased the

durability of buildings, did not completely solve the problem and require serious improvements.

Despite the constructive decisions made when designing in permafrost areas, engineering infrastructure facilities have a significant thermal effect on the soil, changing its physical and mechanical properties, which further reduces the bearing capacity of foundations and leads to damage to the structures erected on them. The most common deformations of the foundations of residential buildings, manifested as a result of the thawing of the frozen base, are uneven precipitation and rolls, which subsequently lead to the appearance of progressive cracks, both in the foundations themselves and in the overlying structures. Untimely inspections and performance of current repairs ultimately lead to the impossibility of further operation of buildings.

Similar deformations in the form of cracks, which arose as a result of permafrost degradation and subsequent uneven settlement, spread along the supporting structures of the building of the Palace of Culture in Norilsk, built in 1965. (Fig. 1).



**Figure 1.** The facade of the building of the Palace of Culture in Norilsk (a) and the resulting cracks in the building (b) (data as of summer 2021) [1, p. 27].

The foundation of the facility was made in the form of reinforced concrete piles frozen into the frozen ground. To remove the heat released through the floor of the first floor, an underground ventilated through the air was arranged. The peculiarity of the foundation on which the building was erected is the lake that was previously located there. As long as the soils were in a frozen state and had a constant bearing capacity, uneven deformations did not occur. However, as soon as the permafrost began to degrade, the building began to experience deformations, manifested in the formation of progressive cracks in the upper structures on a significant part of the building and cracks in a number of strip grillages. In addition, the roof of the rocky soils within the building was at different depths, ranging from three to thirty-seven meters. As a result, depending on the depth of immersion, the piles worked differently [1]. As temporary measures, the purpose of which is to reduce uneven deformations, additional supports and sleeper cages were installed (Fig. 2).



**Figure 2.** The basement of the building of the Palace of Culture [1, p.28]:  
a - additional supports; b - cages from sleepers

However, temporary measures proved to be ineffective and the deformations continued. To find out the causes of settlement and take the necessary measures to restore operational capacity, various geodetic measures, engineering surveys of the facility, and thermal engineering calculations were carried out. However, the results of the studies were quite contradictory, so a reliable method for solving the problem was not proposed. The building is currently decommissioned [1].

In the largest urban complex of the permafrost zone, the problem of foundation deformity is significant: by the end of the 20th century, the state of the housing stock of Yakutsk was recognized as catastrophic [2, 3]. The main feature of the territory is its location on the flat surfaces of the terraces of the river, Lena, as a result of which, active swamping can be considered the root cause of the deformation of the foundations: within the city, there is an intense waterlogging of the soil, a change in its heat balance and the formation of man-made lakes.

In turn, the active mass development of the territory has led to changes in a number of other components of the microenvironment, including the temperature regime and the morphology of frozen strata [4]. As a result of the combined impact of the above factors, the processes of heaving, thermokarst and thermal erosion have intensified, the consequences, in the form of uneven sediments, of which are observed in various parts of Yakutsk. On fig. 3 shows the consequences of flooding of pile foundations: destruction of reinforced concrete, exposure of reinforcement and roll.

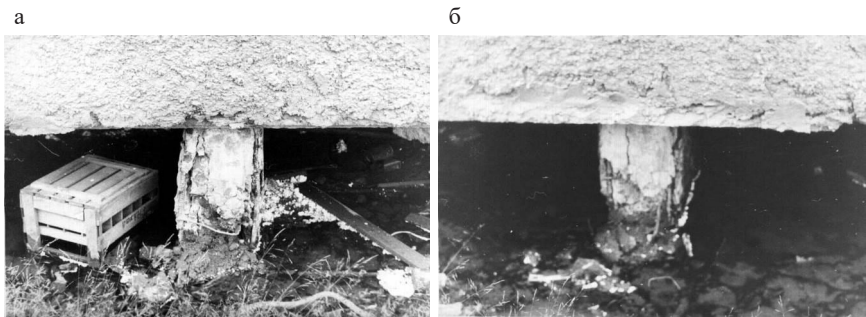


**Figure 3.** Destruction of foundation pile structures as a result of swamping (Yakutsk, 2008) [4, p.29].

Untimely solution of problems, the lack of proper vertical planning near buildings and a storm sewer network often lead to the fact that residential infrastructure facilities become unusable after 6-10 years of operation, with a standard period of 50 years. Thus, in Yakutsk, since 1970, the number of buildings that received various kinds of damage as a result of uneven settlement reached 300, including more than 20 cases of large collapses of stone buildings, which, according to experts, was caused by the loss of the bearing capacity of piles [3, 5].

In addition, foundation materials and other underground structures built in permafrost, along with geocryological processes, are aggressively affected by low winter temperatures and pollutants, especially soluble salts that enter the active layer and subsequently penetrate into the base. It has been established that the wear resistance of materials in the permafrost zone is significantly lower than in other regions. So, for example, the physical wear of reinforced concrete in the city of Norilsk and in the surrounding areas ranges from 15–20 to 70–80% of the design values, depending on the permafrost-soil characteristics, conditions and duration of operation. Mineral materials used for the manufacture of foundations, exposed to aggressive environments, are weathered and leached. Elements made of wood, such as grillages and piles, decompose when moistened and heated. There is corrosion of metal reinforcement, beams, steel and cast iron piles. Masonry thaws when wet, resulting in fragments falling out over time, the formation of cracks and efflorescence, which can lead to erosion of the mortar of masonry joints [6, 7]. The unsatisfactory condition of the foundations is shown even by a visual inspection. Reinforced concrete, most often used as a material for the manufacture of piles, as a rule, collapses in the zone of influence of the active layer and 20–30 cm above its surface. Deformations are manifested by the following defects: cracks, caverns, peeling and loss of coarse aggregate, exposure of reinforcement. In some cases, as a result of external and internal influences, concrete loosening leads to the formation of destruction belts up to 7 cm deep (Fig. 4) [8].

The deformations of reinforced concrete piles are very diverse: often within the same building there are from 5 to 8 zones with different material conditions, which affects the strength of the piles, as a result of which the average strength value in different zones can differ significantly from each other. Basically, the most serious deformations of piles occur in the central parts of the building, next to communications, as well as in flood zones.



**Figure 4.** Cryogenic pile failure, Norilsk, 2000 (a) [9, p. 740]; Formation of the zone of destruction of reinforced concrete piles in the near-surface layer. Foundation of a residential building in Dudinka, 2001 (b) [9, p. 741]



Thus, the engineering infrastructure of cities in the permafrost zone operates in very difficult natural and geotechnical conditions, some of which can be called extreme. Modern principles of designing buildings on permafrost do not provide accurate guarantees for the duration of preservation of the operational properties of objects, from which we can conclude that fundamentally new approaches to the design of foundation structures are required to solve the problem.

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多年冻土条件下建筑物变形的原因及特征

## CAUSES AND CHARACTERISTIC FEATURES OF BUILDING DEFORMATIONS IN PERMAFROST CONDITIONS

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抽象的。本文讨论了冻土失稳导致建筑结构（主要是地基）出现不可接受的变形的原因，分析了地下冰融化过程的出现和发展的原因，从而导致了低温地貌的形成，唉，拜哲拉赫人，热侵蚀的出现，分析了导致微环境参数变化的负面影响，确定了导致永久冻土条件下物体变形的原因。

关键词：永久冻土、冻土过程、热岩溶、热岩溶路堤、融化、泥石流、雅库特、冻胀、热侵蚀。

**Abstract.** *The article discusses the destabilization of frozen soils that cause unacceptable deformations in building structures, primarily in foundations, analyzes the causes of the emergence and development of processes of thawing of underground ice, leading to the formation of cryogenic landforms, the causes of the occurrence of alases, baidzherakhs, the appearance of thermal erosion, analyzes the negative impacts that lead to to change the parameters of the microenvironment, the reasons causing the deformation of objects in permafrost conditions are determined.*

**Keywords:** *permafrost, geocryological processes, thermokarst, thermokarst embankments, thawing, solifluction, Yakutia, frost heaving, thermal erosion.*

Intense anthropogenic impact is the cause of a rapid increase in the global temperature of the earth, which in turn leads to the destabilization of frozen soils and the emergence of geocryological processes, which result in the loss of strength of the foundations and the occurrence of unacceptable deformations in the foundation structures. One of the processes occurring in the areas of permafrost distribution

and becoming more frequent due to recent climate changes is thermokarst - the process of thawing of underground ice and subsequent disturbance of the terrain.

The danger of the process lies in the insignificance of the changes required for its further development: even small fluctuations in the parameters of the microenvironment can lead to the melting of ice in the soil. The causes of thermokarst are changes in the average annual air temperature, precipitation and vegetation cover, as well as forest fires and disturbance of the landscape. Another dangerous aspect of the process is that the water absorbs five times more solar radiation than the soil, which means that once the water appears on the surface, the melting of ice is almost unstoppable.

Numerous subsequent manifestations of the process also have a devastating effect on the stability of the foundations and foundations of residential buildings. So, for example, the most frequent manifestation of thermokarst found in Central Yakutia is alas - hollows formed as a result of subsidence and reaching several tens of square kilometers in size.

The microrelief of the alas slopes is characterized by a pronounced polygonality; therefore, these territories are characterized by the presence of frequently occurring thermokarst mounds - baydzherakhs. Often, the lack of runoff at the site of subsidence can lead to the formation of thermokarst lakes. As a rule, lakes are shallow, however, if the lake arose as a result of thawing blocks of ice or ice veins, its depth can reach several meters.

If there is a possibility of complete drainage of the lake, then the process of thermokarst can be stopped. Sometimes the evaporation of water from the surface of the lake exceeds the precipitation, which also leads to the drying of the lake. For example, in Alaska and in the semi-arid regions of China. In Central Yakutia, thermokarst lakes occupy up to 80% of the territory, but they all dry up quickly. As a result of complete drainage, depressions form on the site of the lakes, which also impede the normal construction process. In heaving soils, the processes of thermokarst are often accompanied by solifluction - the flow of moist and ice-rich sediments down the slope. The greater the angle of the earth's surface and the less vegetation cover on the slope, the more intense the process. With slow solifluction, the flow rate is not uniform, and the movement does not exceed a few centimeters per year. The fast course of the process is, as a rule, destructive, and the displacement can reach several tens of meters. During the thawing process, the soil causes landslides and shifts. Another common process that is characteristic of dispersed soils and poses a danger to foundation structures and buildings in general is frost heaving resulting from seasonal freezing of the soil. The freezing process occurs gradually and is due to the migration of a significant amount of water to the freezing surface and an increase in the volume of water during crystallization by 9%. Since rocks are characterized by intense moisture migration, frost torment is a

serious problem in the Russian Far East, the Kuril Islands and the Japanese island of Hokkaido.

During the crystallization process, the soil is compacted to such an extent that the pressure eventually equals the pressure of the weight of the rock, and any further ice formation leads to the uplift of the overlying layers of frozen soil in proportion to the excess ice and the formation of large mounds, the dimensions of which can reach several meters in height [1-3]. The forces of frost heaving of soils are often uneven, since the depth of freezing of soils in one area can be different and have local compositional features. The consequences of frost heaving are as dangerous for foundations of any kind as the process itself: when the ice formed in the rock thaws, the soil consolidates into a denser layer, which causes additional settlement of buildings. In a closed system, the volume of subsidence may exceed the volume of swelling by 20% during the first few cycles. In arid areas such as Mongolia and northeastern Tibet, the movement of both surface and groundwater can contribute to pingos and icing.

Ice - flat-convex bodies of a layered structure, different in shape, are formed in areas where groundwater comes to the surface. As a rule, the formation of ice occurs due to sources that unload groundwater or freezing waters of rivers and streams. For the formation of icing, the following set of climatic conditions is necessary: the presence of a dense water-resistant layer of soil, a large amount of groundwater and negative temperatures. Formation occurs due to the narrowing of the cross section of water flows during freezing, as a result of which groundwater has a pressure that breaks through the soil. The number of cycles can reach several tens during the winter, and the icing, in the process of formation, acquires a layered structure, with interlayers of snow and injection ice. Despite the fact that most of the icings are located in the valleys, a significant number of them occur in areas within the engineering structures of the areal and linear type, as well as undermined territories, while the icings can reach large sizes, up to several tens of kilometers [1, 2].

About 70% of the world's coastlines, to one degree or another, contain ice inclusions, as a result of which thermal erosion often occurs on the shores of the Arctic seas, thermokarst lakes and artificial reservoirs composed of dispersed rocks, resulting from the simultaneous thermal and mechanical effects of a large amount of moving water. water [1, 4, 5]. Along with thermokarst, thermal erosion is one of the most common and dangerous processes of permafrost destructuring, the consequences of which are changes in topography, water runoff and sediments, which, in turn, poses a threat to coastal engineering structures [5].

Coastal erosion develops exclusively in the season when there is no ice on the surface of the reservoir, with the onset of the cold season and the appearance of ice, the process of coastal erosion temporarily stops. The destruction rate is deter-

mined by the wave energy, the cryogenic structure of the shore, and the depth of the reservoir near the eroded shore, and can vary over a wide range: from several centimeters to several tens of meters per year. Several decades ago, the development of thermal erosion was limited by the natural conditions of the tundra, however, in the last decade, the process has become more widespread. This allows us to make an assumption that the activation of the process of thermal erosion is associated with recent climate changes [5]. In Russia, Canada, as well as in the state of Alaska, the USA, the rates of coastal erosion are rapidly increasing, reaching up to 20 m/year. The situation is most extreme in Alaska, where the sea ice that served as a barrier against severe storms has thinned and retreated, exposing coastal areas to tsunami-sized waves and strong winds that are not uncommon during storms emanating from the Bering Sea. On fig. 1 shows the distribution of thermal erosion rates around the Arctic Ocean where data are available. Based on the monitoring results, it can be seen that high rates of thermal erosion are limited to certain regions [1, 2].



*Figure 1. Circumpolar map of thermal erosion rate [2, p.422]*

Long-term monitoring of coastal erosion on the coasts of the Barents and Kara Seas has shown that periods of high rate alternate with periods of low rate of erosion [6]. Arctic permafrost coasts are sensitive to climate change due to the presence of ice-rich sediments. Where there are no ice veins, wide (1–3 m) and shallow (5–25 cm) erosion channels can develop. It is important that the considered cryogenic processes, which act as the main cause of the emergency state of buildings in the permafrost zone, are only 15–20% caused by an increase in global

temperature or natural relief variability. In all other cases, negative technogenic impacts are the cause [7].

Thus, in some urbanized areas located in the permafrost zone, the process of degradation of the frozen soil strata develops regardless of the variability of the climatic parameters of the microenvironment. From which we can conclude that another reason for the occurrence of unacceptable deformations in the structures of buildings and structures is the violation of established standards in the design and construction, as well as improper operation. The degree of degradation of the permafrost in the situation under consideration depends on the technogenic type of impact, the intensity of contact of heat sources with the surface, and the duration of their anthropogenic impact [8].

As a rule, degradation manifests itself in the formation of local thermal fields and talik zones under the building and in the adjacent territories. Various negative thermal effects have an impact on the frozen soil base even at the stage of construction of the facility. Aggressive mechanical impact is the result of the imperfection of existing methods of engineering preparation of territories, which primarily include: the installation of technogenic bedding that does not meet the necessary requirements and is characterized by a high level of filtration, due to which surface water can penetrate through the bedding, and low-quality, poorly sorted composition; development of soils for foundations with the corresponding works on the construction of quarries, excavations, laying of mines, etc., during the creation of which a large amount of heat is released, leading to a change in the strength properties and continuity of the frozen base. In addition, during the development of the territory, a significant part of the vegetation cover, as a rule, is removed, subsequently being replaced by asphalt or paving slabs, which contribute to an increase in heat flow into the frozen ground due to intense heating in summer and cooling during snow removal in winter. However, the most dangerous and destructive effect that a building can have on a frozen foundation is the thermal effect during operation. Even taking into account the observance of the necessary requirements and established design standards, which include the installation of a ventilated underground and other systems to maintain the temperature regime of frozen grounds, the building contributes to the flow of additional heat into the ground. The greatest impact, as a rule, is exerted by an underground technogenic system of collectors for communications, buried in the ground. Throughout the year, a positive temperature is maintained inside the collectors, due to which local areas of thawing are formed around. In winter, the collectors are prone to ice formation. Snow cover, its nature and mechanized redistribution have a special effect on the stability of the thermal regime of soils. Based on the monitoring results, it was found that the thickness of artificial deposits can exceed the natural thickness in the tundra by 8-10 times (Fig. 2) [7].



**Figure 2.** Snow deposits next to the building (Dikson) (<https://24warez.ru/main/photo/1157609796-dikson-samyj-severnyj-naselennyj-punkt-rossii.html>, date of access 07/28/2023)

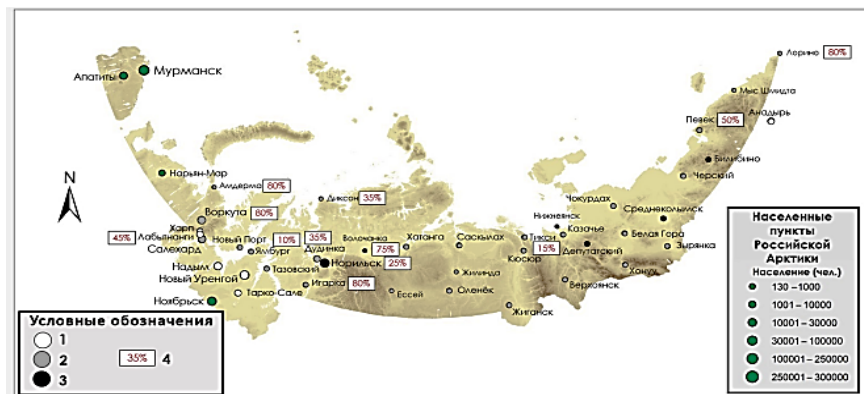
In addition, snow dumps, as a rule, are annually located in one place, which increases the temperature of the frozen base, and, consequently, reduces the bearing capacity of foundations frozen into it. It is important that the combined effect of elevated temperatures and changes in snow accumulation conditions significantly increases the intensity of activation of geocryological processes [7]. In urbanized areas of permafrost, the geocological and geotechnical situation deteriorates significantly due to the ingress of various pollutants into the active layer and their subsequent penetration into the frozen base. Of particular danger are easily soluble salts, which aggressively affect the materials of underground structures. Summarizing the above, we can conclude that the main reasons for the deformity of the construction and industrial infrastructure are geocryological processes, in most cases resulting from anthropogenic impacts, less often as a result of natural and climatic changes. However, in combination, these factors have a much more aggressive effect on the frequency and rate of development of destructuring processes.

Thus, frozen soils used as a foundation for construction in the permafrost zone have high strength in their natural state, but even small temperature fluctuations can lead to a loss of bearing capacity. For a number of reasons, to date, the number of deformed engineering infrastructure facilities located in the permafrost zone has reached critical values. More than 75% of all buildings and structures in the permafrost zone are built on the principle of maintaining a frozen foundation, therefore, during the degradation of permafrost, a sharp decrease in the bearing capacity of frozen foundations is observed, and since the loads from buildings retain their value, objects are deformed [9].

Field surveys conducted in the period from 2018 to 2020 showed that a significant number of buildings and structures in large Arctic cities, such as Norilsk, Vorkuta, etc., are in emergency or pre-emergency condition. The percentage of



deformity of the residential and industrial infrastructure of permafrost varies from 20–25 to 75–80% (Fig. 3) [7].



**Figure 3.** Assessment of the degree of deformability of infrastructure facilities during the activation of dangerous cryogenic processes: 1 - moderate; 2 - medium; 3 - maximum; 4 - the number (in percent) of deformed objects as of the second decade of the 21st century [7, p. 30]

The most common deformations that occur in the structures of buildings and structures as a result of subsidence and changes in the bearing capacity of the foundations are distortions, rolls, and settlements of the foundations, followed by the formation of through cracks in them. This entails deformations of the overlying wall structures, opening of seams at the joints of slabs, displacement of floor slabs in apartments, skewing of windows and doors, and the roll of the building. Often, such deformations lead to the need to decommission the entire structure, and in some cases to the complete collapse of the building.

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基于感应悬浮原理的稳定器

## STABILIZERS ON THE PRINCIPLE OF INDUCTION SUSPENSION

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抽象的。基于感应悬浮原理的稳定器广泛应用于各行业以及研究和测试中，需要获得多个标称稳定输出值，确保高精度、可靠性、特性稳定性等。负载电流，有必要获得最佳性能。为此，为稳定器选择了对称磁系统，这使得工作气隙中存在均匀的磁场。因此，采用III形磁棒系统。该设计简单，满足多级精密稳定器的设计要求。一项重要的设计任务是建立初始数据与几何尺寸和参数之间的分析关系。

关键词：感应悬浮、稳定器、悬浮屏、原理、绕组、负载、来源、标称值、参数、悬浮坐标。

**Abstract.** *Stabilizers based on the principle of induction suspension are widely used in various industries, as well as in research and testing, where it is required to obtain several nominal stabilized output values, ensure high accuracy, reliability, stability of characteristics, etc. To accurately stabilize the load currents, it is necessary to obtain optimal performance. For this purpose, a symmetrical magnetic system was chosen for the stabilizers, which allows the presence of a uniform magnetic field in the working air gap. Therefore, a III-shaped rod magnet system is adopted. This design is simple and meets the design requirements of multi-rated precision stabilizers. An important design task is to establish analytical relationships between the initial data and geometric dimensions and parameters.*

**Keywords:** *induction suspension, stabilizer, levitation screen, principle, winding, load, source, nominal value, parameter, levitation coordinate.*

Induction suspension is one of the ways to levitate bodies. The value of such a suspension lies in balancing the electrodynamic force acting on the body with the force of gravity. The main purpose of the induction suspension is to use it as new high-precision current and voltage stabilizers. Stabilizers based on the principle of induction suspension [8-12] are divided into two groups:

- current stabilizers with levitation screen;
- voltage stabilizers with excitation winding levitation.

To obtain several nominal values of the stabilized current, the windings are divided into sections. To obtain a direct current on the load, the alternating current is rectified by means of a rectifier bridge. According to their design parameters, they are divided into stabilizers with a straight and stepped magnetic circuit. To reduce the height of the excitation winding and improve its cooling, the winding can be divided into two parts (placed on the extreme rods). The separated windings are connected to each other in series-opposite. In this case, the inductive resistance of the winding is two times less than when the winding is placed on the middle rod [1-7]:

$$x_1 = \omega \left[ \frac{1}{2} \omega W_1^2 \lambda \left( \frac{0.5h_1}{3} + x_M + \frac{h_2}{3} \right) \right],$$

here  $h_1, h_2$  – the height of the excitation winding and levitation screen (or short-circuited winding);  $\lambda$  - specific magnetic conductivity of the working air gap.

Winding current :

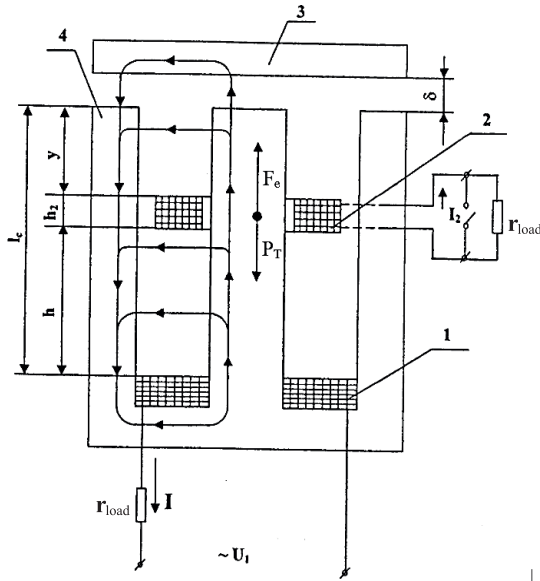
$$I_1 = \frac{U_1}{x_1} = \frac{U_1}{\omega W_1^2 \lambda \left( \frac{h_1}{6} + x_M + \frac{h_2}{3} \right)}$$

When placing the winding on the middle rod:

$$x_1 = \omega W_1^2 \lambda \left( x_M + \frac{h_1 + h_2}{3} \right)$$

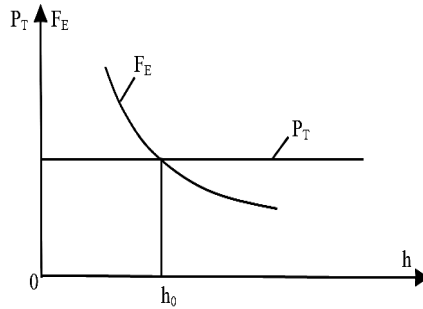
$$I_1 = \frac{U_1}{I_1} = \frac{U_1}{\omega W_1^2 \lambda \left( x_M + \frac{h_1 + h_2}{3} \right)}$$

The current stabilizer with a levitation screen consists of a III-shaped magnetic core 4 in a vertical position, an excitation winding 1 located in the lower part, a levitation screen 2 moving along the middle rod (fig. 1). From the influence of gravity  $P_T$  and electrodynamic force  $F_E$ , the levitation screen in the vertical direction freely moving changes its position. The operation of the stabilizer is based on the mutual balancing of these two forces acting on the short-circuited winding [3-7].



**Figure 1.** Structural diagram of a current stabilizer with a levitation screen

Figure 2 shows the dependence of the electrodynamic force  $F_E$  of the gravity of the screen  $P_T$  on the movement (or stroke) of the short-circuited winding or levitation screen. At any position of equality, that is,  $P_T = F_E$ , the short-circuited winding is in the levitation position. The levitation coordinate  $h_0$  is determined by the intersection point of the traction characteristic  $F_E = f(h)$  of the horizontal direct gravity  $P_T$ . If equality is violated, for example, with an increase in voltage  $U_1$  supplied to the excitation winding, the load current increases, the electrodynamic force  $F_E$  and the screen moves up. In this case, due to the influence of the inductive resistance of the excitation winding, the current decreases to the initial value, the forces  $P_T$  and  $F_E$  are balanced again. Thus, stabilization of the alternating current is observed on the excitation winding. Stabilization on the excitation winding causes current stabilization on the levitation screen. Therefore, the load can be connected to the shield circuit. With the help of armature 3, the value of the working air gap  $\delta$  is adjusted, which contributes to the initial position of the levitation screen.



**Figure 2.** Dependence of the electrodynamic force  $F_E$  and the gravity force  $P_T$  on the coordinate levitation  $h$

In addition to the electrodynamic force  $F_E$ , radial forces also act on the levitation screen. These forces are equal in value, but opposite in direction, so the levitation screen is centered relative to the core of the magnetic core. As a result, friction is observed between the screen and the magnetic circuit. Current stabilizers based on the principle of induction suspension are characterized by the following advantages: simplicity of design and control circuit, high reliability, high stabilization accuracy (in a wide control range)  $0.015 \div 0.02\%$ , sinusoidal form of stabilized current, small dimensions and weight. The disadvantages include: inertia (0.1s.), Low power factor ( $\cos\varphi=0.6 \div 0.7$ ) [5-11].

The presence of a movable winding (screen) for stabilizers based on the principle of induction suspension is not a disadvantage, since it is in a free state of levitation and can move without friction. Therefore, current stabilization is high [1-5].

### CONCLUSION

Changing the voltage at the terminals of the winding or the load resistance contributes to a change in the levitation coordinate of the moving part. The choice of sections of the excitation winding allows you to get different values of the stabilized current.

The conditions for electromechanical and thermal stability are established, the dependences of the motion of the moving part on the frequency, mains voltage and load resistance are determined.

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DOI 10.34660/INF.2023.23.90.061

在构建新供应链的背景下优化物流提供商的活动

## OPTIMIZATION OF LOGISTICS PROVIDERS' ACTIVITIES IN THE CONTEXT OF BUILDING NEW SUPPLY CHAINS

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**摘要。**目前，现有货物流正在重新分配，正在积极寻找新的货物运输替代方案，新的物流链正在形成。在国家经济运行条件迅速变化的情况下，公路和铁路运输的重要性日益增加。公路运输是新型运输链发展中变化最快的渠道。铁路运输的重要性仍然非常高，尤其是长途货运。物流企业在新运输通道建设中效率的提高直接取决于企业经营战略的选择和企业整体的发展。

**关键词：**供应链、物流公司绩效效率、公司盈亏平衡点、物流提供商。

**Annotation.** *At present, there is a process of redistribution of existing cargo flows, an active search for new alternative options of cargo delivery is underway, and new logistics chains are being formed. In the rapidly changing conditions of functioning of the country's economy the importance of road and railway transport is increasing. Road transport is the most rapidly changing channel in the development of new transport chains. The importance of railway transport also remains very high, especially for long-distance freight transport. Improving the efficiency of logistics companies in the construction of new transport corridors directly depends on the choice of business strategy of the company and the development of the company as a whole.*

**Keywords:** *supply chains, logistics companies' performance efficiency, break-even point of the company, logistics provider.*

The purpose of the current study was to optimise the performance of logistics companies by determining the feasibility of developing the logistics company's own fleet of rolling stock, warehouses and terminals. This article presents tools that give the opportunity to assess the efficiency of logistics companies. Methods for performing such an analysis are proposed, allowing to draw conclusions about the necessary number of transport infrastructure facilities, about the choice of transport type necessary for the full development of a given cargo flow in new

supply chains. The result of the research of this article is the analysis of the method of minimising the costs of logistics companies, using the method of comparative analysis, which takes into account the costs of maintenance of transport infrastructure facilities, the costs of maintenance and servicing of vehicles, the costs of organising transportation, by finding the break-even point of the logistics company.

One of the forms of business organisation in the modern economy is outsourcing, which is a practice that helps companies to solve problems of functioning and development by reducing costs, improving the quality of products and services, and reducing risks.

Outsourcing allows to increase the efficiency of certain functions in the field of information technology, procurement and supply, service, finance, personnel and even production. Cost reduction is a powerful tool to increase profitability and outsourcing allows not only to reduce costs, but also to use the latest management and information technologies, allowing small businesses to solve large-scale problems and successfully develop.

One of the ways to improve the efficiency of companies can be the use of logistics outsourcing[1]. Outsourcing of logistics functions consists in the transfer of partially or fully separate logistics functions or complex logistics business processes to an external organisation - an outsourcer. Specialised organisations - logistics providers - can act as outsourcers.

The development of logistics outsourcing system is caused by the following reasons:

- economic globalisation;
- increasing complexity of supply and sales processes;
- transformation of logistics knowledge into a key success factor;
- increasing consumer demands to the quality of products, services, and maintenance;
- high costs of maintenance of production infrastructure [2].

Many organisations, when deciding to switch to logistics outsourcing, do not refuse to perform some logistics functions in-house, as they already have the necessary warehousing and transport facilities. Sometimes the services of a logistics provider are more favourable than maintaining, repairing and servicing the relevant infrastructure in-house.

Only specialised logistics companies are able to provide high quality logistics. Moreover, the range of services provided by them is constantly expanding, depending on the requirements of customers [3,4].

Logistics providers can fulfil several basic functions. Firstly, directly provide warehousing and transport services, for which they need warehouse complexes, terminals and rolling stock[5]. Secondly, they can organise the logistics process to meet the needs of a particular client. One or more logistics functions can be



outsourced. This may be the transport of goods by different modes of transport, warehousing, storage and picking of consignments to consignees, loading and unloading operations.

Logistics companies that own real assets, such as warehouse complexes or rolling stock, specialise mainly in the provision of related warehousing and transport services. However, there are logistics companies that do not own real assets. They often take over the functions of creating and optimising an integrated logistics chain.

The logistics provider builds its interaction with the producer, consumer of products, warehouses, terminals, transport companies in the integrated logistics chain. At the first stage, suppliers, consumers, production companies are independent links in the supply chain. Their interaction with each other is minimised. At the next stage of their interaction, the internal supply chain is formed. The logistics provider assesses the market, identifies products of appropriate quality and competitive price. Then there is a process of integration of terminals, transport companies into the logistics provider's chain. This interaction is ensured through the establishment of a single logistics management body. As a result, there is a process of forming a single integrated supply chain. The target function of the logistics provider is to fully meet the needs of consumers, recover costs and ensure the profit of all links of the logistics chain.

As follows from the available statistical data, the highest revenue is received by companies that have no real assets. They account for a significant share of revenue, which in itself is evidence of the success of this type of business.

The prerequisites for the emergence of new generation logistics providers, have been the increased demands of customers for the following aspects:

- Increased comprehensiveness of logistics services. This aspect is important when building new supply chains;
- Individual approach to each client. It is common to find that a logistics provider serves just one customer.
- More efficient inventory management, as logistics providers control inventory throughout the entire supply chain, not just in certain parts of it.
- Real-time information exchange. This is a requirement of the new information age, where operational tracking of business processes has become the norm.
- Closer co-operation with partners within the logistics network. Providers building a new generation of logistics infrastructure must be able to build close cooperation with different companies and organisations that offer new services and reduce costs.

Let us name the main advantages of cooperation between companies and logistics providers:

Freeing up financial resources for the development of the company's core business areas;

Simplification of the contractual side by working with one transport service provider;

All errors and risks related to logistics and cargo transportation fall on the outsourcer's company;

The manufacturing company receives a full range of services from the outsourcer company;

Logistics provider has more opportunities to manage cargo flows, has extensive knowledge and experience in this area;

High quality integrated logistics services are provided by the logistics provider.

The level of quality of services for the end user increases, which positively affects the image of the customer company [6].

The construction of new supply chains in the organisation of cargo transportation makes it necessary for logistics companies to apply reasonable and competent decisions on the allocation of their resources. This can be the involvement of logistics providers in the organisation of transportation or finding the best way to distribute their own resources to increase the efficiency of their activities. In freight transport, it is a decision on how many transport infrastructure facilities will be necessary and sufficient to serve existing customers. Whether to build up its own fleet of rolling stock or to use the services of external carriers. Which modes of transport should be used in transport operations.

The study of the efficiency of own resource allocation in the transportation of goods by road and rail is carried out by comparative analysis, taking into account the costs of maintenance of transport infrastructure facilities, costs of maintenance and servicing of vehicles, costs of organising transportation, by finding the break-even point of the logistics company.

The costs of a logistics company can be fixed and variable. Fixed costs are costs that do not depend on the volume of transport. This type of costs can be attributed: costs of maintenance of transport infrastructure facilities, rent of the company's office, salaries of management personnel. Fixed costs do not depend on the volume of cargo traffic, but can change abruptly under the influence of demand for transport infrastructure facilities and vehicles. When the volume of cargo traffic exceeds the capacity of these facilities, the logistics company may invest in increasing its capacity, incurring additional fixed costs. In this sense, fixed costs become variable at a certain point and depend on the volume of goods transported.

Variable costs of a logistics company are costs directly related to the process of transporting goods. One important source of variable costs is distance. The greater the distance over which the cargo is transported, the higher the costs, and vice ver-

sa, the shorter the distance, the lower the costs. Distance affects costs through fuel consumption, labour costs, and rail fare. Another source of variable costs is the volume of cargo transported. Cargo volume can affect costs in the following ways:

- the greater the volume of cargo, the greater the volume of cargo handling (loading and unloading);
- the greater the volume of cargo, the greater the weight of cargo transported and the greater the cost of transporting it.

The sum of fixed and variable costs makes up the total costs of the company.

Decision-making on increasing the rolling stock fleet and developing transport infrastructure facilities should be based on strict quantitative criteria that allow for a comparative assessment of various alternatives.

As a tool for such an analysis it is proposed to use a graphical method of determining the break-even point of the logistics company's activity.

The break-even point is the minimum necessary volume of transportations required to cover all the costs of the logistics company.

The graphical method of determining the break-even point of the logistics company is based on the construction of a graph of the dependence of the volume of transported cargo, shown on the x-axis, on the amount of costs associated with the process of its transportation, as well as the revenue received by the logistics company from the transportation of this volume of cargo flow in monetary terms, shown on the y-axis.

Let's consider the sequence of determining the break-even point using the graphical method. We start with a straight line of constant costs of transport infrastructure facilities. It is a straight line parallel to the x-axis, since the costs under consideration do not depend on the volume of cargo traffic. And even if the company does not transport a single unit of product, the fixed costs will be incurred by the logistics company in full.

Then we plot the fixed costs, which depend on the volume of cargo traffic in a jump-like manner. Let's call these costs semi-permanent. This is the case when the logistics company will increase its assets by attracting additional rolling stock, warehouses and terminals.

Variable costs will grow in proportion to the volume of transported cargo traffic.

Then we build a straight line of total costs, it will be parallel to the straight line reflecting variable costs.

The next step will be the construction of a straight line reflecting the revenue of the logistics company and finding the break-even point of the logistics company. The point of intersection of the line reflecting revenue and the line reflecting total costs will be the break-even point.

The following conclusions can be drawn from the obtained graph. The range of cargo transport volumes lying to the left of the break-even point on the x-axis shows the expediency of engaging a logistics provider in transport in new supply chains, as the company suffers losses in this case. The volume of freight transported on the x-axis to the right of the break-even point brings profit to the company, even taking into account the use of additional transport infrastructure facilities.

Logistics companies strive to set prices for their services so that their operations are profitable. In order to remain profitable, revenue must exceed the company's costs. Therefore, companies that use any mode of transport to carry out their operations seek to ensure that the cost of performing their work in the transport market is competitive while maximising the use of available resources. Where operating profits exist, however, logistics companies need to actively reinvest in transport infrastructure and vehicles.

In the conditions of the developing global crisis, redistribution of transport flows, it becomes relevant to build new supply chains. Minimisation of costs of a logistics company is possible with efficient allocation of its resources. The developed method of finding the break-even point of the logistics company's activity will allow to estimate the efficiency of the company's work in the transport market, will increase the quality of services and the level of competitiveness of the company, will reduce the costs of the enterprise. Application of this method will provide an opportunity to determine the development strategy of the logistics company when building new supply chains. It will make it possible to assess the feasibility of the development of transport infrastructure facilities of the logistics company and determine their optimal number.

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材料质量是交通工程在全球市场上的竞争力的基础  
**QUALITY OF MATERIAL AS THE BASIS FOR THE  
COMPETITIVENESS OF TRANSPORT ENGINEERING IN THE  
GLOBAL MARKET**

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抽象的。当今工程的竞争力基于四个最重要的标准：质量、成本、服务水平和维护成本。质量和价格因素被纳入设计阶段，这决定了在初始阶段优先考虑其规划的必要性。

分配标准必须基于层次原则，该原则定义了技术系统的结构组件的互连和相互从属关系。当使用这种方法时，决定机械产品单独部件的消费者质量（期望质量）的技术要求反过来决定这些部件的材料的期望质量。这使我们能够确定，规划用于生产特定机械部件的材料的理想质量必须取决于该材料的三个复杂属性的指标值和规范：其执行其目的的能力、制造的难易程度和安全。在这种情况下，结构部件材料的质量标准的选择起着特殊的作用，因为它们允许总体上规划材料和技术系统（机械生产）所需的性能，以及改变经济规模。

关键词：竞争力、质量规划、系统方法、质量标准、层次原则、结构组成部分。

**Abstract.** *The competitiveness of present day engineering is based on the four most important criteria: quality, cost, level of service, and maintenance costs. Quality and price aspects are embedded at the design stage which determines the need for prioritising their planning in the initial stages.*

*Assigning criteria must be based on the hierarchy principle which defines the interconnection and inter-subordination of the structural components of a technical system. When using such an approach, the technical requirements that determine consumer quality (desirable quality) of separate components of machinery products, determine in its turn the desirable quality of the materials of these components. This allows us to ascertain that planning the desirable quality for the material used for production of a specific machinery component must depend on the values of indicators and norms for the three complex properties of this material: its capability to perform its purpose, ease of manufacturing and safety. The choice of quality criteria for the material of structural components plays a special role in this case as they allow for planning the demanded properties for*

*both the material and the technical system (machinery production) on the whole, as well as for varying the economic dimensions.*

**Keywords:** *competitiveness, quality planning, systemic approach, quality criteria, hierarchy principle, structural components.*

## INTRODUCTION

Since 1990, Russian machinery engineering has manifested insignificant growth in production that does not exceed 10% annually. On the whole, load levels of the machine engineering capacities of the RF industrial sector are less than 30%.

The competitiveness of Russian machine engineering production, including transport machinery, is based on the four major criteria: quality, price, service level and operating costs as well as on several additional ones: brand, efficient advertising, and the authority and reputation of the manufacturer.

On the one hand, the quality of some kinds of machinery products has notably improved recently. However, the low cost of domestically produced machinery has been a weighty factor in its competitiveness. Authorized service is being developed. Maintenance expenses at the operating stage of domestically produced machinery are, as a rule, higher than the corresponding parameters of foreign analogues. The reasons for this are as follows: very high energy absorption capacity, inadequate reliability and the resulting repair expenses.

Thus, despite of the emergence of recent positive tendencies, the pace of competitive growth of the Russian machine engineering industry is obviously unsatisfactory. As a result the share of imported machinery remains high – exceeding 20%.

In the opinion of customer representatives, the reasons for purchasing foreign equipment are as follows:

The domestic market offers no products with analogue properties i.e. the uniqueness of some types of foreign equipment;

The imports are superior to the domestically manufactured products in some functional characteristics and reliability;

Customers are offered high quality and timely service with a flexible approach to its organization and regard to customer preferences;

In meeting the above mentioned conditions, the prices for domestically produced and for imported equipment are equivalent.

On the whole, Russian machine manufacturing enterprises produce machinery which is in fact modernized structures from the past. Meanwhile advanced overseas enterprises are far ahead as they develop new generation technical equipment. Russian machine engineering successfully develops general purpose equipment

aimed at conventional but not specialized technologies (i.e. high technologies). The equipment for R&D-intensive operations is, as a rule, purchased abroad.

What are the reasons for the insufficient competitiveness of the domestically produced machinery? They are absolutely obvious.

These are, first of all, financial difficulties. As is known, the economic situation makes manufacturers seek ways for cutting down overheads and other expenses. In the majority of cases such approaches impact the quality of the products manufactured.

The next issue is the insufficiently high quality of materials and constituent parts as well as the obsolete fleet of technological equipment in some industrial enterprises.

In order to eliminate the above mentioned negative indicators, the manufacturers of machinery products must precisely understand the stages of quality planning and of quality assurance.

#### MAJOR TRENDS IN MATERIAL QUALITY PLANNING

Each product manufactured must not only meet all the requirements for the demanded consumer properties but also must ensure minimal expense in its production.

Expenses connected with the consumed means of production and wages in monetary terms are called product cost. There exist several ways of calculating product costing. Let us consider one of them as an example. Product cost consists of the three major elements: expenses on materials  $M$ , with the deduction of the cost of scrap; expenditures on wages and salaries and payroll charges including deductions for social insurance and vacation payments; and overhead expenses. In this case, product cost can be presented as formula 1.

$$C = \sum_{i=1}^p M + \sum_{i=1}^m \left( 1 + \frac{a_1 + a_2}{100} \right) S \quad (1)$$

Where  $M$  is the expenses on materials per unit of final product deducting the cost of scrap, RUB;  $a_1$  are deductions from wages for social insurance charges, %;  $a_2$  are overhead expenses charged to wages, %;

$S$  is the wages of the production workers, RUB;  $p$  is the number of various grades of materials spent per unit of output; and  $m$  is the number of operations to manufacture a unit of output.

On the other hand, in accordance with the words of Professor V.N. Protasov, “if the expenditures that consumers can afford are insufficient to ensure the demanded quality of a technical system, they (consumers) can either increase or decrease the system’s quality level through changing the norms on the indicators of the consumer properties they consider the least significant”. [1]



In such a case it is necessary to define what determines the quality of material, what is its desirable quality and what criteria should be taken into consideration when assessing its quality.

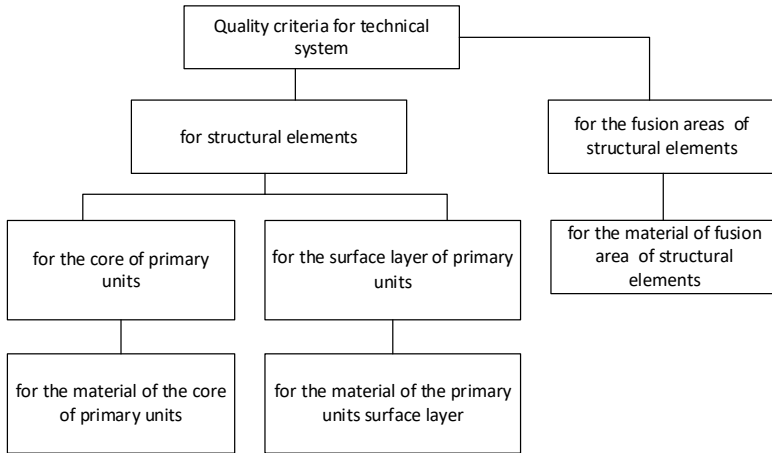
The desirable quality of the material should be considered as the target quality determined by its purpose and manifested in a complex of the demandable properties, indicators of these properties and norms on these indicators that ensure the capability of the material to perform its purpose.

The purpose of the material is its functions, indicators of the performance of these functions, conditions of the application of the material and the specified service life of the product. [2,3 ]

Analysis of the concept of “material quality” shows that the property is only one of the constituents of the essence determining an object’s difference and the similarity with other objects. Therefore the complex of the demandable material properties is a necessary but not a sufficient condition for determining the desirable quality of this material [4-6].

No less important constituents determining the desirable quality of the material are the indicators of the target properties of the object in its initial condition and under various kinds of external impacts at different stages of its service life, and the norms on these indicators [1, 7,8].

Let us turn back to Formula 1 which shows that value  $p$  determines the complexity of the product (technical system) in which all its components are interconnected and inter-subordinated in accordance with the hierarchy principle. In this case technical requirements that determine the desirable quality of the separate elements of a machinery product determine the desirable quality of the materials for these elements, i.e. following the hierarchy principle, quality criteria for the structural elements determine the quality criteria for the materials (Fig. 1).



**Figure 1.** Hierarchy principle of choosing quality criteria for material

The desirable quality of the material, applied for manufacturing a specific component of machinery products, is determined by the three following complex properties of this material:

Firstly, by the capability of the material to perform its purpose within this component which, in its turn, is determined by the purpose of this component in a specific machinery product;

Secondly, by the workability of the material determined by the target workability of the element of machinery product under the specified conditions of production;

Thirdly, by the safety of the material under the specified conditions of production and application of the machinery product.

Each of the above mentioned complex properties of the material of a machinery product element is determined by the aggregate of its plain properties.

The aggregate of the plain properties of the material of a specific element of machinery product that determines the capability of the material to perform its purpose in this element should be divided into two groups:

1. Material properties determining the desirable quality of the surface layer of the component under consideration;
2. Material properties determining the desirable quality of the core of this element.

On the other hand, the technological properties of the material should also be taken into consideration. In this case, the workability of the material applied for manufacturing of a specific element of equipment determines the technical capability of ensuring the desirable quality of this element under the specified working

conditions and the expenses of ensuring this quality. In addition, in accordance with the hierarchy principle, the demanded material properties determine the criteria for the choice of structure and chemical composition.

The above said is presented in Fig. 2 in a simplified form.

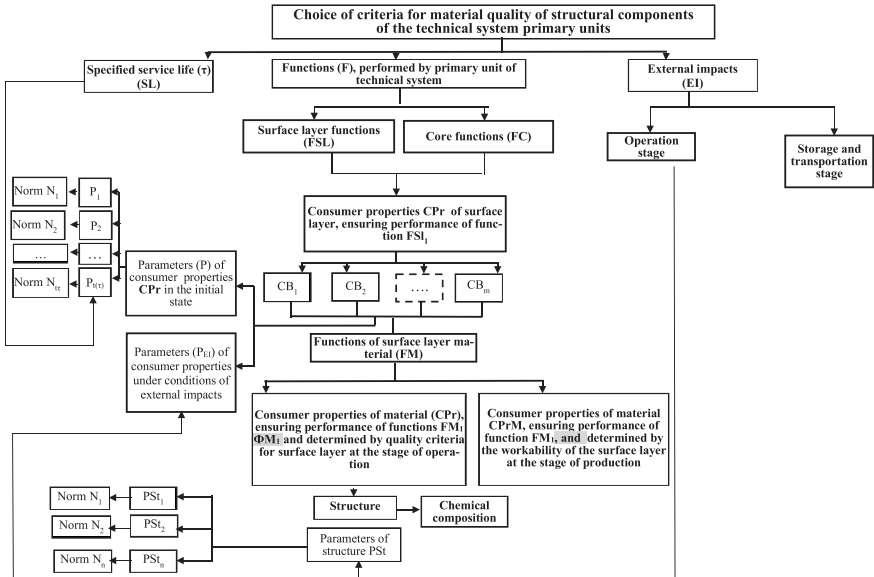


Figure 2. Algorithm of choosing criteria for material quality

Figure 1 shows that the choice of criteria is a multifactor task that requires detailed consideration at each stage. Dividing the properties into the above mentioned groups facilitates the assessment of the economic viability and technical feasibility of manufacturing a specific element of machinery product of a certain material or a combination of materials. It is the economic viability and technical feasibility that determine the demanded gradient of properties of this element within specified coordinates. No less complicated a task is the second stage – ensuring the compliance of the actual material quality with the specified technical requirements.

CONCLUSION.

Planning and maintaining the quality of materials for production of a specific equipment component with regard to ensuring the desirable properties of the output product is a complicated multifactor task that requires a systemic approach to assigning quality criteria and their norms. In addition, it is necessary to pay special attention to maintaining and changing material quality during each component

job at the stage of production. In the course of resolving this task, boundary values must be introduced and taken into account which determines the optimum combination in the “price - quality” system and will ensure the high competitiveness of the present day machine building including its transport engineering industry.

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DOI 10.34660/INF.2023.99.91.063

论物流企业效率评估问题：新现实、概念方法

**ON THE ISSUE OF ASSESSING THE EFFICIENCY OF LOGISTICS COMPANIES: NEW REALITY, CONCEPTUAL APPROACH**

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摘要。最近，世界范围内的供应链遭到破坏。运输公司面临着提高竞争力和吸引新货主的问题。运输市场运营商被迫改变路线并提高服务成本。对于俄罗斯航空公司来说，事实已经变得显而易见：市场将不一样。在最好的情况下，公司可以保留供应商并重新安排物流路线，优化仓库运营和运输成本，而在最坏的情况下，他们可以减少合作伙伴数量并寻找新的物流方案来规避制裁。文章讨论了提高铁路运输竞争力的各种方法以及吸引新货主的可能性。描述了评估公司经济效益的概念，该概念考虑了通过计算成本现值的方法汇总的总成本，并考虑了投资回报率。拟议的方法将能够根据定量特征和已确定的规律，从系统方法的角度评估公司活动的效率。并对物流过程的效率进行评估，概述减少费用的合理方法，评估公司的运作质量并揭示公司的竞争力水平。

关键词：仓库运营和运输成本优化、物流路线、运输和物流系统、服务范围。

*Annotation. Supply chains have been disrupted in the world recently. Transport companies are facing the problems of increasing competitiveness and attracting new cargo owners. Transport market operators are forced to change routes and raise the cost of services. For Russian carriers, the fact has become obvious: the market will not be the same. In the best case, companies can retain suppliers and rearrange logistics routes, optimise costs of warehouse operations and transportation, while in the worst case they can reduce the pool of partners and search for new logistics schemes to circumvent sanctions. The article discusses various ways to improve the competitiveness of railway transport and the possibility of attracting new cargo owners. The concept of assessing the economic efficiency of the company is described, which takes into account*

*the total costs aggregated by methods of calculating the present value of costs, taking into account the volume of return on investment. The proposed approach will make it possible to assess the efficiency of the company's activities from the standpoint of a systematic approach, based on quantitative characteristics and identified regularities. And also to give an estimation of efficiency of the logistic process, to outline rational ways of decreasing expenses, to estimate the quality of functioning of the company and to reveal the level of competitiveness of the company.*

**Keywords:** *optimisation of costs for warehouse operations and transportation, logistics routes, transport and logistics system, range of services.*

Conditions of the modern competitive market of transport services rather rigidly determine new requirements to their quality, as the sphere of logistics undergoes really large-scale changes: robotisation is introduced, unmanned systems of goods delivery are tested, transfer of transport to environmentally friendly energy sources is carried out, automation of transport processes takes place, for improvement of data transmission system a new high-tech direction is developed, which is formed at the junction of photonics and quantum technologies. The most significant technologies include the Internet of Things (IoT), distributed registries (Blockchain), intelligent systems (AI/ML), virtual and augmented reality (VR/AR) and others.

All of the above innovations together become a significant catalyst for the development of logistics. Naturally, Russian operators are also actively improving their own business processes. According to Rosstat data, the geography of freight traffic has changed significantly in recent years. Moreover, there is a kind of a jump in freight turnover, and among all existing types of freight transport the land transport is the undoubted driver [2].

However, despite the convincing figures, the issue of the efficiency of the transport and logistics system and its elements is still the cornerstone, and the transport component of the goods movement process in logistics chains remains a system-forming factor of the market. The correctness of this conclusion was convincingly confirmed by the survey of managers of enterprises that intensively use supply chains conducted by PwC agency at the beginning of this year: “increasing efficiency” and “managing or reducing costs” in logistics chains were the most popular answers of respondents [3,4].

On the other hand, the processes in the transport and logistics system are essentially a competitive transport service, involving the freedom of choice of services by consumers. Naturally, such a system includes many participants whose activities are oriented towards obtaining the greatest effect (result) while satisfying the interests of the clientele as much as possible [5].

The above means that in modern conditions the activity of logistics providers focuses both on solving the issues of implementation of basic functions and improving the quality of logistics services in general. In other words, modern business and companies providing services in the field of transport forwarding face a complex multidimensional task of creating an innovative logistics space by establishing highly efficient supply chains.

It should be emphasised that the high quality of logistics can be ensured by companies specialising in logistics services. Moreover, the range of services provided by them should be constantly expanding and take into account the needs of the clientele in combination with the fulfilment of basic functions (services) [6].

Firstly, we are talking directly about the provision of services in the field of warehousing and transport, which requires warehouse complexes, terminals and rolling stock. Secondly, companies should focus on the organisation of the logistics process for the needs of a particular client.

Currently, companies that own real assets, be it warehouse complexes or rolling stock, specialise mainly in providing relevant warehousing and transport services. Other companies are significantly expanding their range of services. They often take on the functions of creating integrated logistics chains by improving and adapting logistics infrastructure, using advanced means of transport, working on cost reduction in the format of SCM -Supply Chain Managements, etc. In other words, the logistics company is a logistics provider.

In other words, a logistics provider builds its interaction with producers, consumers of products, warehouses, terminals, transport companies in an integrated logistics chain from the moment of receipt of an order from a consumer (of course, of proper quality and competitive price). Then the market is assessed and product quality is identified, and terminals and transport companies are integrated into the provider's logistics chain. In this case, as it follows from the available statistics, the highest profits are made by companies with no real assets. They account for a significant share of revenue, which in itself is a testament to the success of this type of business.

What will be expected for logistics providers in the foreseeable future? The essential prerequisites for the formation of a new generation of companies are the significantly changed customer requirements, in particular:

- increasing the comprehensiveness of logistics services. This aspect is all the more important as the complexity of material flow management has increased dramatically in recent years;
- individual approach to each client. It is common to find that a logistics provider serves just one client.
- efficient inventory management, as new generation providers control inventory throughout the entire supply chain, not just in individual sections.
- real-time information sharing, as fast tracking of business processes has now become the norm;

- close co-operation with partners within the boundaries of the logistics network. Providers must be ready to build synergies with companies and organisations that implement new services and reduce costs. Logistics outsourcing can be one of the ways to improve the efficiency of companies' operations.

The main advantages in the field of interaction between companies and logistics providers include:

- freeing up financial resources for the development of the company's core business areas;
- simplification of the contractual side (processing of primary documentation) due to work with one transport service provider;
- assignment of logistic risks to the outsourcer company;
- the enterprise-manufacturer receives a full range of services from the outsourcing company;
- maximum provision of opportunities to the logistics provider in the management of cargo flows [7];
- realisation of complex logistics services of the highest quality that can be provided by the logistics provider;
- significant increase in the quality of services for the end user, which has a positive impact on the image of the customer company.

The need to establish highly efficient supply chains in the organisation of freight transport exacerbates the problem of developing fully justified decisions on the allocation of available resources. For example, in the freight transport sector, the issue of justifying the use of transport infrastructure facilities necessary and sufficient to serve the clientele can be solved. No less important and relevant is the issue of developing the company's own rolling stock or the practice of using the services of third-party carriers. Finally, one of the effective ways to improve the efficiency of companies' activities can be the use of logistics outsourcing.

In our opinion, it is advisable to assess the efficiency of own resources distribution in cargo transportation in the course of comparative analysis with obligatory taking into account the costs of maintenance of transport infrastructure facilities, maintenance and servicing of vehicles.

All costs of a logistics company should be divided into fixed and variable. Fixed costs are costs that are not related to transport volumes. This type of costs includes the costs of maintenance of transport infrastructure facilities, rental of premises, and wages. Fixed costs do not depend on the volume of cargo to be transported, but can change abruptly under the influence of demand for transport infrastructure facilities and vehicles. When the volume of cargo traffic exceeds the capacity of these facilities, interested market players may invest in increasing the capacity of the logistics company, thus increasing fixed costs. In this sense, fixed costs become variable and dependent on traffic volumes.



Variable costs are primarily determined by the process of transporting goods. The greater the distance over which the cargo is transported, the higher the costs, and vice versa, the shorter the route, the lower the costs (fuel consumption, labour costs, etc.). However, the other determinant of variable costs is still the volume of cargo transported.

By adding fixed and variable costs, the total costs of the company are determined. Consequently, the development of decisions on the improvement of rolling stock and the development of transport and logistics infrastructure should be based on strict criteria that allow for comparative evaluation.

The authors of earlier works in this area suggested that the efficiency of a logistics company's activity should be assessed based on several principle ratios:

- the result attributed to costs, or the result (the company's profit) obtained per unit of costs;
- costs attributed to the result, or the unit value of costs per unit of result obtained;
- the result minus costs attributed to the result, in other words, the specific value of the effect per unit of the result obtained.

A number of experts recommend using pairwise comparison methods, finding the break-even point of the logistics company's activity, etc. as a tool for such analyses.

In practice, the so-called simplified method of assessment, which only takes into account logistics costs, is also allowed.

It should be emphasised that all of the above methods require deep analytical work, including the identification of so-called conflicting costs with further justification and design of optimal solutions. Naturally, logistics companies strive to set tariffs that ensure their profitability. In addition, companies need to actively reinvest some of their profits in transport infrastructure and vehicles in order to maintain their market position.

Indeed, the economic efficiency of logistics providers can be determined by the ratio of results to costs associated with their establishment and operation. The results can be assessed both by quantitative indicators, for example, the volume of performed transportations, and by indicators of service quality, for example, the level of fulfilment of the established deadlines for cargo delivery, etc. It seems that in the conditions of the modern market the comparison of quality indicators is more preferable, as they can characterise their competitiveness.

In our opinion, when assessing the economic efficiency of the company, it is necessary to take into account the total costs aggregated by methods of calculating the present value of costs, taking into account the volume of return on investment. For this purpose, it seems appropriate to use the methodological approach proposed in the paper and assess the company's efficiency by vector criterion:

$$K(x_i) = \{k_1(x_i), k_2(x_i), \dots, k_m(x_i)\} = \{k_j(x_i); j = \overline{1, M}\}, \quad (1)$$

where  $k_j(x_i)$  -  $j$ - th private criterion;  
 $M$  – the number of private criteria.

The function  $K(x_i)$ , which takes into account the set of initial variants, in its turn generates an order relation depending on the meaning of the function. Thus, if it follows from  $K(x_i) > K(x_s)$  that  $x_i > x_s$ , then the criterion of the “effect” type makes sense. Traditionally, such criteria in transport are the achieved level of fulfilment of the established terms of cargo delivery, the indicator of the complexity of customer service, etc. If  $x_s < x_i$ , then  $K(x_i)$  is a criterion of the “cost” type. It is reasonable to include the costs of maintenance of production infrastructure, etc.

Then the mathematical formulation of the problem in vector form takes the form:

$$X_j^* = x_j \begin{cases} \max k_j(x_i), j = \overline{1, M} \\ x_i \in X \\ \min k_j(x_i), j = \overline{m+1, M} \\ x_i \in X \end{cases} \quad (2)$$

System (2) shows that each of the equations defines a solution variant, the use of which is most preferable from the point of view of one criterion only. The general solution is represented by the intersection of sets of results of solutions for each partial criterion

$$X^* = X_1^* \cap X_2^* \cap \dots \cap X_M^* \quad (3)$$

It is reasonable to estimate the mismatch of criteria of the “effect” type on the basis of a dimensionless function  $(1 - \frac{k_j}{k_{j\phi}})$ , (4)

and for criteria of the “cost” type - in the form of  $(\frac{k_j}{k_{j\phi}})$ . (5)

In our opinion, the proposed approach allows the most complete consideration of several objectives. Its advantage is the possibility to assess the efficiency of the company’s activities from the position of a systematic approach, based on quantitative characteristics and identified patterns.

**Conclusions.** The current geopolitical situation, rising fuel prices, shortage of qualified personnel have significantly exacerbated the uncertainties in the field of logistics and, thus, predetermined the ways to improve the sustainability of supply chains by improving cost management by logistics companies.

The authors propose a toolkit that allows them to assess the effectiveness of the logistics process, to identify rational ways to reduce costs, to assess the quality of the company’s functioning and to identify the level of competitiveness of the com-

pany. The obtained calculation data can be used as a basis for business planning strategy and design of new supply chains.

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利用信息模型 (BIM 技术) 分析室内四季滑雪场的设计特点  
**ANALYSIS OF DESIGN FEATURES OF INDOOR ALL-SEASON  
SKIING COMPLEX WITH THE USE OF INFORMATION  
MODELING (BIM-TECHNOLOGIES)**

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抽象的。具有人工冬季环境的体育场馆的出现,使得人们可以在一年中的任何时间、无论天气如何,足不出户甚至出国进行高山滑雪和单板滑雪。这些设施扩大了职业运动员全季节训练的机会,并为以前因经济或其他限制而无法访问滑雪胜地的广大人群提供了冬季运动教学的机会。因此,室内滑雪场的出现是非常有意义的。对此,本文作者以位于中国哈尔滨的“哈尔滨万达城”为例,利用信息技术分析了室内滑雪场的设计特点。

关键词: 滑雪场、综合体、信息建模、设计特征、分析、建模。

**Abstract.** *The emergence of sports complexes with artificial winter environment makes it possible to engage in alpine skiing and snowboarding without leaving the city or even the country, at any time of the year and regardless of the weather. Such facilities expand the opportunities for all-season training for professional athletes and for teaching winter sports to a wide range of people who previously could not visit ski resorts due to financial or other constraints. Thus, the emergence of sports indoor skiing complexes is currently very relevant. In this regard, the authors of this article analyze the design features of the indoor skiing complex with the use of information technology on the example of “Harbin Wanda City” located in Harbin (PRC).*

**Keywords:** *skiing complex, complex, information modeling, design features, analysis, modeling.*

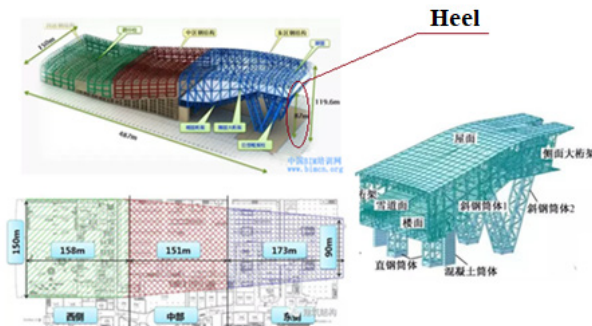
In 2017, the world's largest indoor skiing complex “Harbin Wanda City” opened in Harbin (PRC), China, with an area of 900,000 m<sup>2</sup> (Figure 1), which united 6 slopes with a total length of more than a kilometer under one roof. In

Harbin Wanda City, visitors can enjoy dozens of different winter and summer activities at the same time. In addition to ski slopes, the complex has tubing slides, ice rinks, swimming pools, water park and shopping and entertainment area with stores and hotels. One of the features of this complex is that it is divided into three separate sections, which are manufactured separately from each other and separated from the surrounding commercial catwalk to reduce forces on the structure (Figure 2) [1], [2].



**Figure 1.** «Harbin Wanda City»

(Site photo [https://yandex.ru/images/search?from=tabbar&text=Harbin%20Wanda%20City&pos=2&img\\_url=https%3A%2F%2Fimage.wanda.cn%2Fuploadfile%2F2019%2F0306%2F20190306035823277.jpg&rpt=simage&lr=2/](https://yandex.ru/images/search?from=tabbar&text=Harbin%20Wanda%20City&pos=2&img_url=https%3A%2F%2Fimage.wanda.cn%2Fuploadfile%2F2019%2F0306%2F20190306035823277.jpg&rpt=simage&lr=2/), circulation date 06.08.2023)



**Figure 2.** Structural design of the complex with division into separate blocks “Harbin Wanda City”

(Site photo [https://www.sohu.com/a/106102683\\_242704/](https://www.sohu.com/a/106102683_242704/), circulation date 06.08.2023)

Among the three parts of the enclosure, the eastern part is the most complex and unique. The floor structure in the eastern part is supported by only two V-shaped giant columns. The central dimension of the column is 13.5 meters, the distance between the axes of the floor truss structure is 10 meters, and the distance between the axes of the roof truss structure is 8 meters. The western and middle parts are horizontal trusses and longitudinal frames. The upper steel structure can be regarded as a portal system of rigid frame structure without inter-column support, and the lower concrete structure is a frame structure.

According to the needs of ski functions, it has a curvilinear shape with streamlined lines of special shape, the “heel” design is used. At the same time, it introduces great difficulties to the design. The distance between the center of mass and the center of rigidity is large, the structure is unstable.

The total height of the building is 119.66m, and the height of the “heel” alone is 87m. The total height exceeds 93.5 m (*Figure 2*).

The maximum height difference of the snow track reaches 87 meters, and the horizontal stiffness on both sides is very different. The floor of the 117-meter-long snow track has an inclination angle of almost 30 degrees, which makes the floor construction very complex.

Estimated base period and service life - 50 years, building seismic resistance category - class B, seismic resistance class - class II [1].

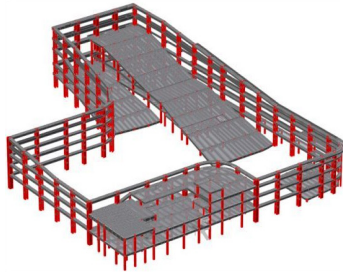
Since the structure is 487 m long, it was separated from the concrete structures to reduce it and simplify the structural load. Two hinges were installed to divide it into three parts: low zone, middle zone and high zone.

The high ground is a giant frame structure consisting of a steel cylinder, a ski floor structure, a large side truss and a roof structure.

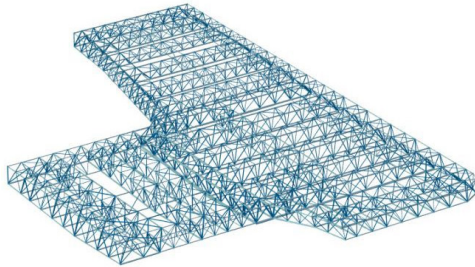
The difference between day and night temperatures in Harbin is large (up to 15 °C), and requires high fire resistance of the giant frame columns. The maximum cross-sectional width of the column supports is 1.8 meters. In the process of painting a large area, the fire-resistant paint, under its own weight and extreme temperature difference, is prone to cracking, bubbling, hollowing and other phenomena, and can be easily removed. Combining the above characteristics, according to the requirement of ensuring the fire resistance limit and safe use, choose a thick fireproof coating with low self-weight, high bonding strength and good weather resistance, also in the fireproof coating is added steel mesh, the strength of which is not less than 6 MPa. The coating of the metal structures of the ski resort should be guaranteed not to be repaired more than twice within 50 years. Fire protection coating is applied over the intermediate paint and under the finish coating.

For large-scale public buildings, the complex changes in plane and vertical direction and the special space requirements determined by the external form and internal functions are realized by a three-dimensional reinforced concrete-framed

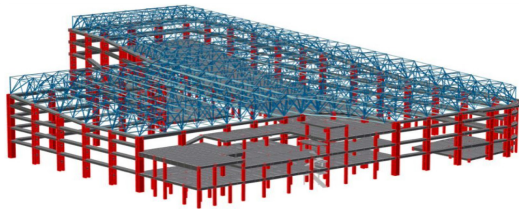
tubular truss system. The stability and control criteria of the structure, the design of the intersection nodes is accomplished, and at the same time the local key nodes as a whole are verified. Building Informational Modeling (BIM) technology was introduced into the design process and structural design realized effective professional cooperation, design optimization and deepening, design review and construction cooperation. The calculation and analysis of the structure uses a simulated coupled model to take into account the coordination of the upper and lower structure (*Figure 3-5*) [1], [2].



*Figure 3. Lower concrete structure [3]*



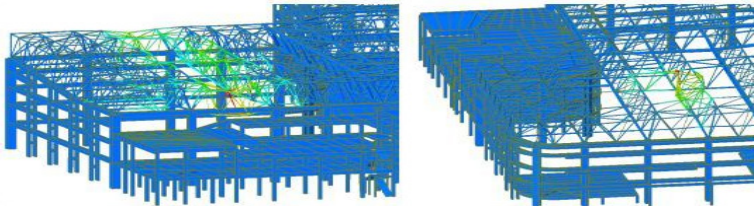
*Figure 4. Upper structure [3]*



*Figure 5. Linked model [3]*



The preliminary calculation shows that the instability affected both the columns (Figure 5) and the steel roof structures (Figure 6-7), this can be clearly seen by the color of the load in figures 5 and 6, where the state of stress in turn can be seen by coloring the corresponding elements in the 3D model. This method of visualization helps the experts to understand the actual performance of the building after the design load thereby comparing the damage of the buildings. The stability of the bottom concrete structure is much higher than that of the roof steel structure, and its stability factor is almost 2 times higher than that of the roof steel structure, and the shape of the instability shows a certain overturning of the structure [2].



*Figure 6. Shape of unstable steel roof structure [3]*

The analysis of the study presented in [2] showed that with a fully fixed hinge support scheme, the horizontal shear force of individual supports is very large, but by installing a series of sliding supports, the peak value of the support shear force can be effectively controlled, and the local concentration effect of horizontal shear force can be propagated to the surrounding area. However, this has led to new problems in the design and analysis of support assemblies. In the past, it has been difficult to accurately model the sliding boundary conditions of a support using only nodes as isolating bodies to impose constraints and loads. With the currently available general structural analysis methods, by substituting the nodes (Figure 7-8) of a sliding slip grid into a general structural model, it is possible to obtain the stress state of the nodes under different operating conditions under realistic boundary conditions, but this is time consuming.



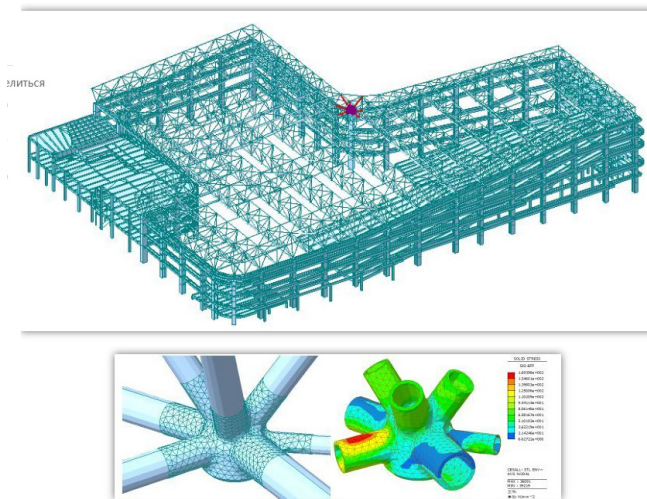


Figure 7. General analysis of the design scheme [2]

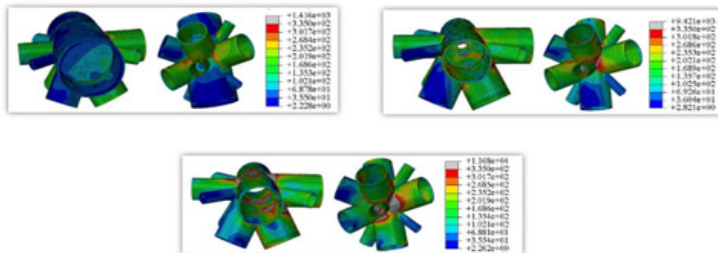


Figure 8. Calculation of structural units [3]

At the junction where several pipes intersect, the load carrying capacity is checked by means of a general finite element analysis. Thus, after performing the object modeling and preliminary model calculation, the weak points of the structures were identified, which allowed us to make recommendations for strengthening these points and to reveal that transverse internal reinforcement is a very effective way to strengthen the intersecting joints, but in most cases the main pipe has sufficient bearing capacity, while the branch pipes overlap each other and weaken. A recommendation was developed to reinforce the design in the need to increase the diameter of the main pipe and reduce the overlap of the spigots. Consequently, the most optimal design of the assembly should be rigidly fixed on one side and have mobility on the other.

Professional software Revit (USA) and Tekla (USA) were used in the modeling of this facility, which allowed to provide a basis for integration of structural elements both horizontal and various vertical (curtain walls, thermal insulation, ventilation, etc.) at different stages of modeling. This provides an accurate and convenient means for visual inspection, which is essential for designing large-scale and complex steel structures and extending design management.

Thus, the application of information technologies (BIM-technologies) can significantly improve the processes of design, construction and operation of facilities. The use of BIM-technologies provides more accurate and efficient interaction between different project participants such as architects, engineers and builders. Through a centralized approach to storing and sharing information, BIM allows for better coordination of work, reduces errors and conflicts during the design phase, and increases the transparency and understandability of project documentation. Implementation of BIM technologies has a positive impact on the efficiency and quality of construction, improves interaction between project participants and reduces the cost of the facility, especially for complex structures, including ski resorts.

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DOI 10.34660/INF.2023.12.70.120

某煤矿企业生产系统开发  
**DEVELOPMENT OF THE PRODUCTION SYSTEM OF A COAL  
MINING ENTERPRISE**

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抽象的。本文指出了形成方法论对于煤矿企业生产体系发展的相关性。博罗金矿区的经验表明，随着煤矿经营内外部环境的变化，需要制定煤矿企业生产体系发展方法论，并实施该方法论，保证煤矿企业的竞争能力。面对日益严峻的外部环境挑战和不确定性。

面对日益增加的外部环境不确定性，煤矿企业的竞争力的提高是通过共同商定的生产系统技术、技术和组织子系统的开发来实现的，并由协调标准确定。这又是由组织对生产过程质量的持续改进和人员的发展所决定的，必须将其视为企业竞争力的战略潜力。

关键词：发展、生产系统、协调、生产过程质量、人员发展、无形资产、无形资产、煤矿企业。

***Abstract.** The article indicates the relevance of the formation of a methodological approach to the development of the production system of a coal mining enterprise. Based on the experience of the Borodinsky mine, it is shown that changes in the internal and external environment of its operation necessitate the development of a methodology for the development of the production system of a coal mining enterprise, the implementation of which ensures its competitiveness in the face of increasing challenges and uncertainty of the external environment.*

*Increasing the competitiveness of a coal mining enterprise in the face of increasing uncertainty of the external environment is achieved by mutually agreed development of the technological, technical and organizational subsystems of the production system, determined by the harmonization criterion. This, in turn, is determined by the organization of continuous improvement of the quality of the production process and the development of personnel, which must be considered as a strategic potential for the competitiveness of the enterprise.*

**Keywords:** *development, production system, harmonization, quality of the production process, personnel development, intangible assets, intangible assets, coal mining enterprise.*

The need to achieve an acceptable level of competitiveness in the labor, mineral and capital markets in the context of increased environmental dynamics and tougher competition creates the need for Russian coal mining enterprises to improve the efficiency of resource use and develop business development strategies that provide for the constant search and development of solutions that provide higher than competitors, results [1].

According to analysts, the new political and economic reality has revealed the most vulnerable aspects of business in most sectors of the Russian economy: supply chains, import dependence, funding, sales markets, labor force, state influence. At the same time, according to analysts, for the coal industry, the factor associated with additional risks is import dependence; factors that have a mixed influence are defined as supply chains, funding and sales markets, the influence of the state; a factor contributing to maintaining sustainability in the current situation is the labor force [2].

The globalization of international economic relations creates conditions for exacerbating economic risks, increasing instability of the entire world market and its individual parts, in particular the coal market. According to analysts, fuel and energy companies are forced to act in the new realities - sanctions affect the fuel and energy complex in the following areas:

- direct restrictions on the purchase of Russian energy resources;
- indirect restrictions (maintenance of merchant ships carrying Russian energy resources);
- technological restrictions (restrictions on the supply of dual-use technologies, equipment);
- organizational restrictions (withdrawal of foreign companies and their capital);
- macroeconomic conditions (strengthening of the ruble exchange rate, currency control) [3].

The coal market, according to its main characteristics and development trends observed in recent decades, is inherently unstable (unsustainable) commodity market.

The problem of ensuring the competitiveness of coal industry enterprises is also aggravated due to the fact that the social requirements of the state and society for the safety and environmental friendliness of coal mining in the regions and enterprises are constantly increasing [4].

In order to effectively manage the functioning of the production system of a coal mining enterprise in response to the challenges, threats and opportunities of the external environment, it is necessary to determine stable relationships between the parameters of the technical, technological and organizational subsystems of the production system, ensuring its normal functioning and development, and the competitiveness of the coal mining enterprise.

The main provisions of the methodological approach to the development of the production system of a coal mining enterprise are as follows:

1. The gap in the dynamics of development of the technological, technical and organizational subsystems of the production system and, as a result, the decrease in the competitiveness of the coal mining enterprise, due to the dominance of performance parameters in the management decision-making system over the efficiency and safety of production, predetermined the need to develop a new conceptual approach to the development of the production system, implementation of which is able to eliminate this negative phenomenon.

2. Sustainable development of the production system of an open-pit coal mining enterprise is achieved by a harmonious (balanced) development of the technical, technological and organizational subsystems of the production system, characterized by consistency, interdependence and balance in the development of subsystems.

3. The competitiveness of a coal-mining enterprise is determined by the level of development of its production system, which, in turn, is naturally limited by the level of development parameters of the subsystems of the production system: technical, technological and organizational.

4. Harmonization of the processes of development of subsystems of the production system of a coal mining enterprise with an acceptable level of balanced parameters allows to reduce the risk of failure of the production cycle and the consumption of resources for production.

5. Implementation of the concept of harmonizing the development of subsystems of its production system in the practical activities of a coal mining enterprise makes it possible to naturally increase the competitiveness of an enterprise in the face of increasing requirements for efficiency and safety of production.

In the practice of management activities, approaches to the development of mining enterprises prevail, based on its consideration as a mining technical (production) system - an ordered set of objects, georesources, tools and objects of labor, personnel, technology and organization of production, designed to transform resources into a product or service. Such a consideration of the production system without taking into account the social and economic needs of its subjects does not allow to increase the level of use of technical, technological and labor potential,

thereby reducing its investment attractiveness, as well as the reputation of the enterprise as an employer in the labor market [5,6].

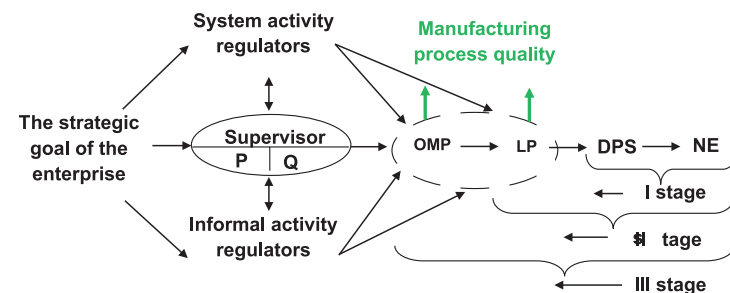
In practice, the problem of developing the production systems of open-pit coal mining enterprises lies in their periodic loss of competitiveness, even if they have all the material, technical, financial and labor resources necessary for successful operation, which is due to different rates of equipment renewal, technology development, organizational structure and personnel training, which affects the quality of the production process and the use of the production potential of the enterprise [4].

For a more complete realization of the existing production potential of the enterprise and its effective use, it is advisable to improve the quality of the production process, which, along with the development of personnel, predetermines the required dynamics of production efficiency and safety.

The quality of the production process is determined by the quality of organizational, managerial and labor processes (Fig. 1). Let us briefly characterize the most important factors that form the quality of the production process.

Organizational and managerial processes are processes related to the organization of labor and management on a shift, in a department, at an enterprise as a whole.

The labor process is direct and (or) indirect, through technical means, the impact of an employee or employees on the subject of labor to obtain the results that are necessary for a person and society [4,7].



**Abbreviations**

- P - positioning of the head; Q - qualification of the head;
- OMP - organizational and managerial process;
- LP - labor process;
- DPS - dangerous production situation;
- NE - negative event.

**Figure 1.** Logic scheme for the formation and improvement of the quality of the production process

The labor process as a key one is included in the production process and performs the following functions in it:

- energy - the employee is a source of physical and mental energy;
- technological - the worker connects the subject and means of labor;
- regulatory - the employee controls the condition of the means and objects of labor, adjusting, if necessary, the regulations for their maintenance and processing;
- goal-setting - the employee directs all his actions towards their main goal: meeting his needs and the requirements of the employer.

The quality of the labor process is an integrative property and characteristic of the process, reflecting the correspondence of its actual parameters to the target ones when employees perform their labor functions [8].

Systemic and informal regulators of activity are essentially institutions, i.e. all forms of restrictions (rules) created by people in order to give a certain order to activity and interaction. The nature of these rules, which constitute the essence of institutions, makes it possible to divide them into systemic (formal) and informal ones. Formal - documented norms and rules in legislative and regulatory acts, which are based on administrative and economic incentives and a personalized guarantor of their provision. Informal institutions are relations, customs, traditions, values that are rooted in the minds of people and are based on moral incentives (public opinion) and a non-personalized guarantor of their provision (group, collective, society) [9].

A hazardous production situation (HPS) as a result of a certain quality of organizational, managerial and labor processes is a combination (combination) of conditions and factors under which an employee cannot complete a production task without violating safety requirements. From the point of view of production risk management, an HPS can exist in the production system of a coal mining enterprise in the following forms:

- uncontrolled occurrence and existence in the activities of the enterprise (section) of factors and circumstances that can form such a (critical) combination that will inevitably lead to a negative event;
- controlled occurrence and existence in the activities of the enterprise (section) of factors and circumstances, excluding the formation of such a (critical) combination, which will inevitably lead to a negative event.

The practice of developing production systems at coal mining enterprises has shown that it is necessary to improve the quality of the production process in stages (Fig. 1). At the first stage, it is necessary to determine a dangerous combination of factors and circumstances, i.e. such a combination (combination) of conditions and factors for the implementation of the process, in which in the event of unsafe behavior or employee error, a direct threat of a negative event (injury) is created.

Next, determine, evaluate, fix the OPS in the divisions of the enterprise and take measures to reduce the risk of their implementation.

The second stage is the assessment of the quality of labor processes in which the HPS “live” and are implemented. To study labor processes, you can use a technique, the essence of which is to represent the process as a combination of four components: personnel, technical means, working conditions and work processes [10]. At the third stage, the quality of organizational and managerial processes of employees is assessed. The application of the methodology for assessing the quality of labor and organizational and managerial processes allows not only to identify “non-obvious” critical and high risks in processes, but also to identify and implement measures that improve the quality of processes and, as a result, facilitate work, make it safer and more productive.

Studies carried out by the RDCQ at coal industry enterprises in 1991-2020 show that, depending on the depth of understanding by the worker of the environment (processes, phenomena, events and situations in the production process) and, consequently, the error in the constructed forecast of the behavior of the environment and the object, the quality of the production process changes significantly (Table 1).

**Table 1**  
*Characteristics of the effectiveness of process management based on the depth of understanding by the employee [11]*

<b>Depth of process understanding – established and understood</b>	<b>Process Prediction Error</b>	<b>Process control efficiency</b>
1. Facts (phenomena) that determine the content of the process	Unacceptably high	Extremely low
2. Influence of factors on the process	above average	Low
3. Causal relationship (dependence) in the process	Medium	Medium
4. Pattern of events	below average	high
5. Essence and mechanism of process management	Low	Very high

An analysis of the results of work with the personnel of the Borodinsky mine over the past 10 years has shown that there is an increase in intangible assets as factors that ensure the harmonization of the functioning of the technological, technical and organizational subsystems of the production system. This is due to a change in priorities in working with factors that determine the quality of the production process. The priority is the formation of intangible and intangible assets as factors to improve the quality of the production process. This is confirmed by the results of assessing the level of qualification and motivation of employees who passed developmental certification: the level of motivation of employees in the



third cycle increased on average by 4.5 times compared to the first cycle, the level of qualification - by 1.4 times, respectively.

The experience of the Borodinsky mine in mastering the methodological approach to the development of the enterprise's production system showed that this work should be organized cyclically. Therefore, it is no coincidence that developmental certification of line managers in the cycle mode was chosen as one of the methods. It is also necessary to carry out work on planning, ensuring and improving the quality of the production process cyclically and on an ongoing basis. This is due to the ever-increasing requirements for the level of performance of a coal mining enterprise, including the efficiency and safety of production. Improvements should be carried out at the enterprise constantly throughout the entire time of its operation.

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科学出版物

上合组织国家的科学研究：协同和一体化

国际科学大会的材料

2023 年 8 月 9 日。中国北京

编辑A. A. Siliverstova

校正A. I. 尼古拉耶夫

2023 年 8 月 9 日。中国北京

USL。沸点：98.7。 订单253. 流通500份。

在编辑和出版中心印制

无限出版社



