



# 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

Materials of the  
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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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## Foreword

*We thank all participants of our conference "Scientific research of the SCO countries: synergy and integration" for the interest shown, for your speeches and reports. Such a wide range of participants, representing all the countries that are members of the Shanghai Cooperation Organization, speaks about the necessity and importance of this event. The reports of the participants cover a wide range of topical scientific problems and our joint interaction will contribute to the further development of both theoretical and applied modern scientific research by scientists from different countries. The result of the conference was the participation of 56 authors from 7 countries (China, Russia, Uzbekistan, Kazakhstan, Azerbaijan, Tajikistan, Kyrgyzstan).*

*This conference was a result of the serious interest of the world academic community, the state authorities of China and the Chinese Communist Party to preserve and strengthen international cooperation in the field of science. We also thank our Russian partner Infinity Publishing House for assistance in organizing the conference, preparing and publishing the conference proceedings in Chinese Part and English Part.*

*I hope that the collection of this conference will be useful to a wide range of readers. It will help to consider issues, that would interest the public, under a new point of view. It will also allow to find contacts among scientists of common interests.*

**Fan Fukuan,**

*Chairman of the organizing committee of the conference*

*"Scientific research of the SCO countries: synergy and integration"*

*Full Professor, Doctor of Economic Sciences*

## 前言

我们感谢所有参加本次会议的“上海合作组织国家的科学研究：协同作用和整合”，感谢您的演讲和报告。代表所有上海合作组织成员国的广泛参与者都谈到此次活动的必要性和重要性。参与者的报告涵盖了广泛的主题性科学问题，我们的联合互动将有助于不同国家的科学家进一步发展理论和应用的现代科学研究。会议结果是来自7个国家（中国，俄罗斯，乌兹别克斯坦，哈萨克斯坦，阿塞拜疆，塔吉克斯坦，吉尔吉斯斯坦）的83位作者的参与。

这次会议的召开，是学术界，中国国家权力机关和中国共产党对维护和加强科学领域国际合作的高度重视的结果。我们还要感谢我们的俄罗斯合作伙伴无限出版社协助组织会议，准备和发布中英文会议文集。

我希望会议的收集对广大读者有用，将有助于在新的观点下为读者提供有趣的问题，并且还将允许在共同利益的科学家中寻找联系。

范福宽，  
教授，经济科学博士，中国科学院院士，会议组委会主席“上合组织国家科学研究：协同与融合”



企业管理的经济手段

## ECONOMIC TOOLS OF ENTERPRISE MANAGEMENT

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抽象。 本文考虑了管理餐饮企业的主要经济工具,尤其是定价和计划。 将管理工具应用于计划中的企业示例。

关键字: 企业, 管理工具, 定价, 战略计划, 战略图。

**Abstract.** *The article considers the main economic tools for managing a catering enterprise, in particular pricing and planning. Management tools are applied on the example of a projected enterprise.*

**Keywords:** *enterprise, management tools, pricing, strategic planning, strategic maps.*

### Introduction

This paper proposes pricing, planning, a strategic map and SIPOC analysis as economic tools for managing a catering business. Various management tools were proposed earlier in works of S.I. Glavcheva and E.I. Kozlova [3, 5]. The developed management tools meet the criteria for SMART, which differs from those proposed previously.

Catering is understood as the sphere of entrepreneurial activity, the purpose of which is to satisfy the needs of people in tasty, varied and healthy food and, as a result, making a profit.

Catering enterprises are one of the most promising and rapidly developing component of the service sector, which is developing under the conditions of its macro- and microenvironment [3].

Of scientific interest is the microenvironment of public catering, because it is one of the resource sources for increasing the competitiveness of the enterprise.

The microenvironment of a public catering enterprise is a combination of factors influencing which the enterprise management establishes and maintains cooperative relations with employees and customers [5]. There are several basic elements of the microenvironment:

- Company management;
- Suppliers;
- Marketing intermediaries;
- Customers.

**Methods**

To identify the goals and objectives of catering enterprises, a comprehensive analysis of the internal (micro) environment of the enterprise is used, which is carried out in the following areas:

1. Management organization – management system, organizational structure, internal company culture, company image.
2. Production – the range of products, volume of production, equipment, raw materials, inventory levels.
3. Staff – qualification, quantitative composition, labor productivity, staff turnover, labor cost.
4. Marketing – the share occupied in the market, sales market, pricing, advertising.
5. Finance and accounting – profitability, solvency, rentability, economic stability [5].

In the conditions of a modern market economy, various economic instruments play the main role in increasing the efficiency of the organization of management of public catering enterprises. The economic tools of managing a catering enterprise include: planning, commercial calculation, pricing, loans, marketing [4].

In the field of catering, pricing is one of the key elements of enterprise management. The restaurant business is characterized by price formation in a stepwise fashion, i.e. the cost of goods consists of the prices of food and raw products, as well as various types of margins that compensate for the losses at all stages of production, the organization of marketing of products. The figure below shows a diagram of the stages of the movement of goods of a catering enterprise [1].



*Fig. 1 – general goods distribution scheme*

Price is the basis for the functioning of finance, credit and wages. The distribution and redistribution of value manifested has a financial impact on the production process and customer service.

The prices in the menu reflect the socially necessary costs for the manufacture of dishes and their selling, taking into account consumer properties and the ratio of supply and demand. Therefore, the pricing mechanism is organized in such a way that it contributes to the reduction of processing, and maintains a balance of material and value proportions of the reproduction of products and services [2].

An important function in the management of production at a network-wide enterprise is the planning of internal production activities. In the process of enterprise development planning, the main managerial, organizational, economic and social functions are closely connected with the chosen economic activity. In addition, they are to a certain extent reflected in both short-term and long-term plans [1].

Planning in the food industry allows not only to develop the business from the inside out, but also to attract investors, partners and credit resources. A business plan is a guide to action and execution and must meet SMART criteria (specific, measurable, achievable, restricted in time). That is why during the life cycle of a catering enterprise, a business plan can also be adjusted as ideas, goals and objectives are tested. At the same time, the sub-tasks associated with the identification of patterns of development of the external environment of the enterprise as a whole and its individual factors determining changes in the flow of visitors, the formulation of goals and likely strategies, the identification of primary problems, as well as actions to achieve them are solved.

An integral part of business planning at a catering company is strategic planning, which should be aimed at a long-term development period. Strategic planning includes achieving high rates of economic performance through the phased development of organizational and managerial structures and improving production and technical factors [6].

To formalize business processes in strategic planning, the following tools are used:

- SIPOC – analysis (Supplier, Input, Process, Output, Customer);
- Strategic maps;
- Balanced Scorecards.

After approval of the business plan of the enterprise, calculations are carried out, and it is presented in figures, subsequently forming the budget of a catering enterprise [4].

### **Results**

Using the example of publicly accessible canteen enterprise under development, a strategic map was compiled in the coordinate system Training – Processes – Clients – Finance, presented in Figure 2.

**Finance**

Profit increase	Business value increase		
Revenue increase	Productivity growth	Cost reduction	Profitability compared to competitors

**Customers**

Sales growth	Attracting and retaining customers	Creation of a positive reputation
Feedback analysis	Timely and quality service	Reliable suppliers

**Processes**

Controlled production	Operational efficiency	Quality and safe products	
Market monitoring	Organization of work with a customer	Effective work of staff	Improving the quality of services provided
Enterprise Promotion	Customer friendly attitude	Improving working conditions	

**Training**

Staff qualification	Efficient workforce	Quality control system
Staff training costs	Introduction of new technologies	

*Fig. 2 - Strategic map of the public dining room*

As can be seen from the strategic map, the most important internal processes in planning the activities of the catering enterprise will be production management, ensuring operational efficiency and quality, safe products, increasing sales, attracting and retaining visitors, increasing profits and, as a result, increasing the value of the business as a whole.

SIPOC - analysis of the designed enterprise of a public canteen at the sales stage was conducted (Fig. 3).

S	I	P	O	C
Product range	Product sales	Release of finished goods and purchased goods	Seat turnover	Director
Job descriptions	Cashier's checks	Calculation of discounts and promotions	Revenue	Accountant
Loyalty system regulations	Bonus Cards	Sales analysis and planning	Profit	Financier
Marketing information	Cash register equipment	Accounting and financial reporting	Profitability	Cashier
Accountant	Retail store equipment			Customers
Director	Advertising			

*Fig. 3 - SIPOC - analysis of the business process of sales*

This analysis allows you to parse the process from consumers to the final results to its initiators.

The “suppliers” group includes a range of products, job descriptions, regulations on the loyalty system, marketing information. All this is the source of the sales process at the catering company. The accountant and director also belong to the “suppliers” group, since they control the above indicators.

Sales of products, cashier's checks, bonus cards, cash registers and commercial equipment, advertising belong to the group of “inputs” because this is what is going to carry out the process

The group “processes” includes operations that add value to the final result of the process (analysis and planning of sales, calculation taking into account discounts and advertising campaigns, sales of finished products, accounting and financial reporting).

At the output of the process, we get the turnover of seats in the hall of the catering company, revenue, profit, profitability.

The final consumers (the “customer” group) are visitors to the public cafeteria, cashiers, financier, accountant and director.



## Conclusions

The management of a catering enterprise is significantly affected not only by its external, but also by its internal environment. To manage the internal environment of a catering facility, it is necessary to use appropriate economic instruments. The most important of these are pricing and planning. Planning the activity of a catering enterprise is more often called business planning. At the moment, when parrying a long-term short-term period of time, it is important to use the latest economic management tools.

These management tools include strategic maps and SIPOC analysis. These tools are visual and allow you to track the sequence of internal processes when achieving planned goals.

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俄罗斯经济的不稳定性和前景

## INSTABILITY AND PROSPECTS OF RUSSIAN ECONOMY

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抽象。 本文结合俄罗斯经济发展部, 俄罗斯中央银行和专家科学家的观点和  
分析数据, 分析了俄罗斯经济的不稳定因素和前景。

关键词: 通货膨胀, GDP, 增值税税率, 养老金改革, 劳动力结构, 商品市场, 人口统计学, 制裁波, 央行和IER分析数据, 外国经济状况, 金融风险加剧, 世界价格, 生产率动态。

**Abstract.** *The article analyzes the instability and prospects of the Russian economy, taking into account the opinions and analytical data of the Russian Ministry of Economic Development, the Central Bank of Russia and expert scientists.*

**Keywords:** *inflation, GDP, VAT rate, pension reform, labour force structure, commodity market, demographics, sanctions waves, central bank and IER analytical data, foreign economic conditions, aggravation of risks in finances, world prices, productivity dynamics.*

In recent years, the Russian economy is quite unstable. This is due to fluctuations in currency quotes, aggravation of risks in finances, worsening of relations with other states and other issues. In 2018, the Russian economy was not able to maintain high growth rates in the conditions of the external economic situation and radically undermined hopes that the restoration of world prices for raw materials, including under the influence of OPEC policies, could automatically solve all problems.

The spasmodic development of Russia has an impact on various factors in the life of citizens in our country. In our article, we will analyze the problems and prospects for the development of the Russian economy, taking into account the views and analytical data of the Ministry of Economic Development of Russia, the Central Bank of Russia and expert scientists.

One of the factors that slow down Russia's economic growth is a decrease in investment growth. If by the end of 2017 they grew by 4.4%, then in 2018 the growth is at the level of 3.5%, and in 2019 it is expected to grow by 3.1%.

The next factor is the rise of inflation. By the end of 2018, it accelerated from 2.3% per year to 3.1%, and by the end of 2019 it will accelerate to 4.3% (expectations of the Central Bank — 4%) [1].

After a rapid increase in salaries in the year of the presidential election (the Ministry of Economic Development (MED) shows that nominal salaries in the public sector increased by 13.1% in 2018), real (taking into account price increases) salaries in 2019 will not change, they increase by only 0.8%.

This is the situation despite the fact that oil prices are trying to support the Russian economy.

The decrease in forecast GDP indicators and inflation growth are primarily due to the decision to increase the VAT rate from 18 to 20%, which the economy faces in 2019.

With an increase in the VAT rate before the implementation of the May presidential decree, it became not closer, but further. As the forecast of the Ministry of Economic Development demonstrates. The increase in VAT affects not only inflation and the decline in GDP growth: due to an increase in the value added tax, investment growth will decrease by 0.4–0.7%, imports - by 0.35–0.45% [2].

There is one more factor - this is an increase in the retirement age, which will certainly affect both the quality of life of Russians and macroeconomic dynamics. It is important for the Ministry of Finance to unload the budget as much as possible from the support of the Pension Fund [3].

The Ministry of Economic Development proceeds from the fact that an increase in the retirement age will automatically increase the number of employees. As a result, according to the estimates of the main compilers of the forecasts, growth will accelerate by 1.3 in 2019–2023.

However, far from all experts share the official optimism of responding to the challenges of pension reform. The problem is that not all potential “new employees” will be able to find work. Analysts at Raiffeisenbank, for example, note: the employment of people of pre-retirement age is already steadily declining. Their forecast is directly opposite to the estimates of the Ministry of Economic Development: they expect "a significant increase in unemployment among people over 55-60 years of age" [1].

Raiffeisenbank analyst Stanislav Murashov sums up: “According to our calculations, the influence of the reform will lead to stagnation of GDP at best, and at worst, the reform will take away from the economy up to 1.5 GDP growth per year.”

Thus, due to decisions made by the Russian government on its own initiative, economic growth has every chance of an even greater slowdown. There is no time for the May decree with all its goals and promises. There are also sanctions waves, and shocks of the unfolding international trade war, fraught with a global slow-

down in the global economy (which, in turn, will limit demand for raw materials and reduce the growth potential of the Russian economy), and the instability of the oil market given the fact that shale producers are from the United States they can also surprise OPEC + manufacturers, including Russia.

The main promising areas in the Russian economy - trends, the Ministry of Economic Development of Russia has laid for the long term are:

*The first trend* is related to the dynamics of commodity markets. The Ministry of Economic Development expects a rather serious decline and a rather low level of prices for basic commodities in the long term. By 2025–2030, prices will be at about \$ 50 per barrel and will continue to remain at that level - in real terms.

This level corresponds to the long-term, multi-year prices that have developed in the oil market. It is clear that they reflect risks in terms of changes in the demand structure in the global economy - the structure of energy demand [4].

*The second important trend* – is how Russian demography will change. Now the Ministry of Economic Development is in a difficult period with decreasing pressure on the economically active population in the coming years. After 2024, the economically active population will grow. This will be a consequence of the increase in the duration of active life and the demographic introductory that we now have associated with the active increase in the birth rate, which has been observed since 2000.

It is important to understand that the structure of the workforce will change. The young generation (people aged 15 to 25 years) will grow actively - it will increase from 16 million to 20 million people. The older generation will actively grow (people aged 50 to 75 years) - about 7 million people will increase over the period under review. At the same time, the middle part of the working-age population (25–50 years) will experience a serious decline. This is a demographic wave that has been going on since the 1990s, associated with a sharp drop in the birth rate in that period [2].

*The third trend* is associated with the dynamics of labor productivity. As part of the medium-term forecast, the Ministry of Economic Development expects a significant increase in productivity growth, which will allow the Russian economy to reach economic growth rates of more than 3%, which is higher than world average levels. The reasons for this acceleration of productivity are associated with the expectations of the Ministry of Economic Development of an increase in investment activity in the economy and its growth to over 25% of GDP, as well as the active introduction of new management technologies. The ministry is engaged in this within the framework of the national project on labor productivity [4].

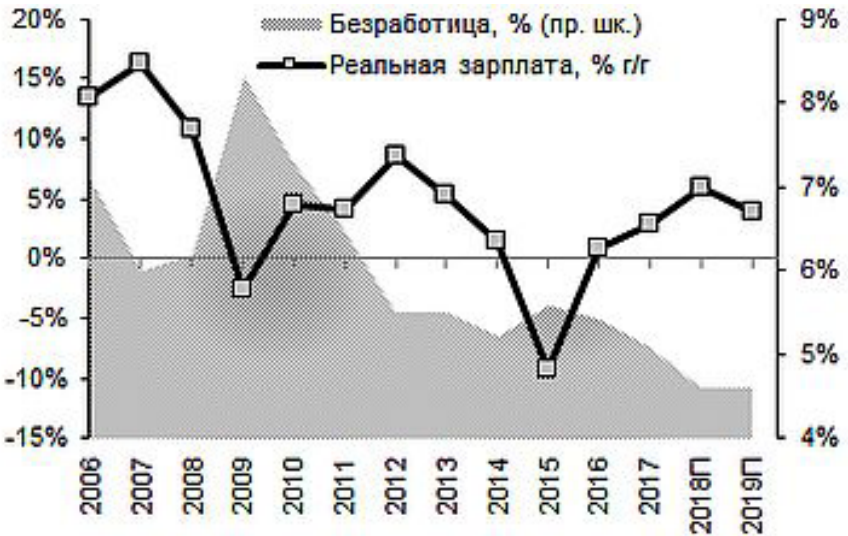
However, after 2024, when the country enters new levels of labor productivity growth, it will begin to gradually slow down. As a result, the Ministry of Economic Development has two global trends: a positive demographic trend and a gradual

slowdown in labor productivity growth, which will generally provide fairly stable economic dynamics, long-term, in the region slightly above 3% of GDP.

In order to reach these levels, the successful implementation of national projects, the successful implementation of the plan to increase investment - that is, all those initiatives that are now accepted and are being implemented by the Government, are very important. Their success will determine whether the country enters this trajectory or not.

According to the Federal State Statistics Service, a slowdown in wage growth, an increase in VAT and pension reform will limit consumption growth at 1.5% y/y in 2019.

**Diagram 1**  
 “Unemployment and real wages in Russia”[5]



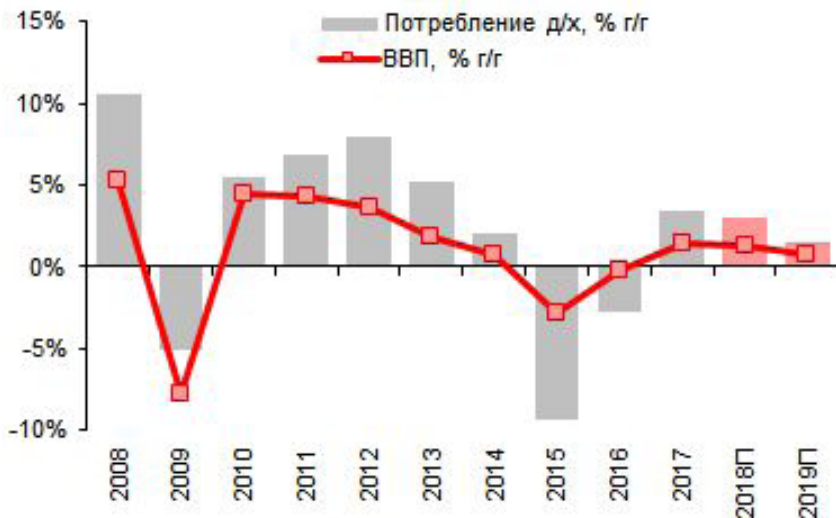
The increase in VAT in 2019 eased the wallets of Russians by 500 billion rubles. In addition, about 2 million future pensioners will not receive their pensions, which is equivalent to about 300 billion rubles.

Experts expect household consumption growth to slow from 3% this year to 1.5% in 2019, and GDP will grow by only 0.8% versus 1.3%.

In total, according to analysts, the purchasing power of the population will be reduced by 800 billion rubles. On average, every Russian citizen over 18 will give 6.6 thousand rubles for government reforms, and the average household will be missing almost 20 thousand rubles.

A painful blow on citizens' incomes will ricochet consumer demand. The Bank predicts that consumption growth, already modest enough, will slow down by half - from 3% this year to 1.5% in 2019. Sluggish activity of customers, in turn, will force companies to wait a while with indexing salaries and recruiting new employees [6].

**Diagram 2**  
 “GDP and household consumption,%” [5]



Next year unemployment will not fall below 4.5 - 4.6%. The good news is that weak economic growth reduces inflationary risks. This will keep the Central Bank from raising rates, therefore, loans will remain relatively cheap [7].

VAT is a rather complex tax: it applies not only to end consumers, but also to manufacturers who are forced to either reduce the rate of profit or to reconsider the remuneration mechanisms of their employees.

But since the tax will grow by only 2%, rather, we can talk about a slowdown in wage growth and profit growth. In addition, part of the weight of increased VAT will not be borne by the Russians, but by importers, who will also have to moderate their appetites, including on profits.

Of course, the increase in VAT cannot be called a positive factor: the additional tax burden negatively affects the income of Russians and the rate of economic growth. But the negative effect will be noticeable only in the first months of the year, the expert predicts, and then it will be partially offset by an increase in budget expenditures, for the same pensions and in other areas.

On the horizon of the year, the situation will equalize, and the growth of the economy, according to the analyst, will turn out to be about the same as it would be without raising the VAT - slightly below 2% (of course, this also depends on the dynamics of oil prices and external factors) [8].

Raising the key rate before the end of 2019 does not seem necessary. The combination of moderate inflationary pressures and lower forecasts of economic growth indicates that a scenario of rate hikes is unlikely.

In the case of stabilization of the foreign exchange market, there is no need to raise the rate until the end of next year. A very cautious forecast of the Central Bank for inflation at the level of 5.5-6.0% opens up great opportunities for reality to be better than expected, and this fact indicates that the Central Bank in practice is not ready to raise the rate from the current level.

The main risk for the regulator is an increase in global rates, and especially the Fed rate. In the baseline scenario, the Central Bank is expected to maintain interest rates at 7.5% in 2019. [7]

*Table 1. "The main Russian macro-indicators, 2016-19P" [5]*

	<b>2016</b>	<b>2017</b>	<b>2018F</b>	<b>2019F</b>
GDP, % y/y	-0,2%	1,5%	1,3%	<b>0,8%</b>
Consumption h/h, % y/y	-2,8%	3,4%	3,0%	<b>1,5%</b>
Investments, % y/y	0,8%	4,3%	2,5%	<b>3,0%</b>
Inflation, %	5,4%	2,5%	3,8	<b>4,2%</b>
Key rate, %	10,0%	7,75%	7,5%	<b>7,5%</b>
Ruble exchange rate, rub./\$ (end of the year)	60,7	57,6	62,0	67,0

A new portion of US sanctions may worsen the financial situation of Russians. If supplies of technologies and equipment to Russia are stopped, this will negatively affect the manufacturing industry. Metallurgical enterprises will also suffer.

Now there is a deliberate policy of cutting costs, preserving the economy, the main goal is to fill the national welfare fund. It is likely that the economy is intentionally slightly frozen in case even more stringent sanctions are introduced, if everything goes according to the Iranian scenario.

Experts do not understand why the government does not make any concessions, for example, tax cuts for business, which would help develop the economy. There is potential for this, the budget is executed with a surplus. For 2019, the budget will be balanced without a deficit even at an oil price of \$ 50 per barrel, and now it is holding at \$ 85. Of course, in some perspective it may decrease, but hardly to \$ 50 per barrel.

Independent expert analysts identified the risks on the basis of which the Russian Federation can expect another crisis next year, expressed in increased inflation pressure, the risk of falling prices in the markets for raw materials, especially oil, as well as the unchanged composition of industries and the negative political situation with other countries.

And this will lead the economy of our country, as the same expert analysts say, reduce the treasury by five percent, decrease oil production, export indices will stop at a figure of 140 million tons, and increase the supply of energy resources abroad to 247 million tons, as well as It will not stop the increase in rates for the movement of people and goods by 4.5%, reaching the level that was before the crisis, by 2020, provided that the cost of oil remains at \$ 70 per barrel. Otherwise, the authorities are obliged to revise gas prices, and this will entail an increase in prices for plants by 2%, and for people by 3%. Further, it should be noted that the tariff for energy for people and industries increased by 5.6% and the economy grew by 3.1%.

According to experts, next year the indices of the economy of our country will increase by 1.8 percent. The average annual oil price will be approximately \$ 63 per barrel. But due to the increase in oil shale production, the cost of oil will decrease to 2025. This will provoke a twofold increase in the lag in the economic growth of the Russian Federation from world economic indices, and three in the BRICS countries.

Consequently, next year the country will begin to prepare citizens for the next crisis. This is due to the fact that this year the limits of the Reserve Fund will be exhausted, and after another two years - the NWF. Therefore, the country's authorities will look for ways to replenish the treasury and combat the crisis.



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参与“新丝绸之路”项目，以此作为保留民族语言的一种方式  
**PARTICIPATION IN THE NEW SILK ROAD PROJECT  
AS A WAY TO PRESERVE THE NATIONAL LANGUAGE**

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抽象。在全球和平的现代条件下，对于“追赶”式发展，转向原材料经济的国家来说，对国家安全和维护国家主权的威胁比以往任何时候都更为严重。他们参加一体化协会和国际组织的尝试并没有解决相应经济和文化空间的灾难性荒漠化问题。作为一种选择，这不是后苏联地区国家经济发展的储备，而是其文化特性和语言特性的拯救，因此提出了“合作的基础-尊重国家真实性”项目，可以在中国“新丝绸之路”于2013年开发的格式框架内实施。

关键字。国际合作，跨国竞争，运输走廊，国家主权，文化统一，丧失民族语言

**Abstract.** *In modern conditions of global peace, for countries of the “catching up” type of development, gravitating toward a raw material type of economy, threats to national security and the preservation of national sovereignty are more acute than ever. Their attempts to participate in integration associations and international organizations do not solve the problem of catastrophic desertification of the corresponding economic and cultural space. As an option, it is not so much a reserve of economic development of the countries of the post-Soviet region as the salvation of their cultural identity and linguistic identity, the project “The Foundation of Cooperation - Respect for National Authenticity” is proposed, which can be implemented within the framework of the format developed in 2013 by the PRC “The New Silk Road.”*

**Keywords.** *International cooperation, cross-country competition, transport corridors, national sovereignty, unification of cultures, loss of national language*

The modern world economy is a rather complex system of economic relations of its subjects, in which the huge advantage is not given to countries by nature comparative advantages, but the ability to find themselves in a new format, adopt new rules developed by representatives of leading international economic organizations, integration associations and transnational companies. Those states that are trying to independently confront the threats and challenges of global peace are among the “replaced” countries thrown to the periphery of the modern geo-economic space [2, 5, 6]. Completely unnoticed for themselves, they lose control of their own resource base, turn into “raw materials appendages”, pure recipients of foreign investments and technologies, find themselves unable to independently make the transition to the post-industrial stage of development, lose their traditions, culture, language, national sovereignty.

Of course, rivalry between countries has always been going on since the first signs of statehood appeared. However, the goals and, most importantly, the methods of its conduct underwent significant changes during the evolutionary development of the world economy. We believe that the main goals of inter-country competition are clearly complicated from the simple enrichment of the nation and the expansion of its living space to the establishment of full control over all forms of international economic relations and the collection of monopoly rents from virtually all markets for goods and services. In turn, the methods used for this progressed from banal aggression in the form of capturing colonies and waging wars, to the art of building a competent dialogue in the form of supranational structures and conducting information attacks.

Sensibly assessing current trends in the development of the world economy, countries that refuse to see themselves among the satellites do not abandon attempts to find options for maintaining their own national security and sovereignty. The problem lies only in the fact that in the context of globalization it is practically impossible to achieve these goals for developing countries with a commodity-type economy: their participation in international economic organizations and integration associations only exacerbates the situation.

A striking example of the existence of obvious barriers in the further progressive national development is the post-Soviet space. Within its framework, integration has not brought (and cannot bring) positive results, since the economies of the respective countries are actually monocultural, not diversified, and cannot mutually complement each other. A dialogue in the format of international structures, such as the Shanghai Cooperation Organization (SCO), the Collective Security Treaty Organization (CSTO), and others, of course, help to identify problems, but do not solve the issues of economic and cultural desertification of the corresponding territory.

We believe that for Russia and the countries of Central Asia, an option to increase the symmetry of the functioning of national economies (avoiding the dominance of the raw material factor that dampens the effect of economic development) could be their participation in the 2013 New Silk Road (NSR) proposed by the PRC in 2013. This “platform” can contribute not only to the development of the infrastructure of the participating countries (due to attracted foreign capital and technology), but also become a reserve for growth of competitiveness at the micro level, generate domestic demand (Table 1), and, most importantly, it gives a chance to try to maintain if not culture as a whole, then at least such a part as the national language.

**Table 1**

*Comparison of factors of formation and development and positive consequences for the participants of the Great Silk Road and the New Silk Road*

Factors of formation and development		Positive consequences for participants	
GSR	Modern transport corridors (NSR)	GSR	Modern transport corridors (NSR)
<b>Economic</b>		<i>1. Expanding the assortment and nomenclature of goods and services in domestic markets with a subsequent increase in demand for them.</i>	
1. The presence of unique goods not produced in other countries, knowledge of the secrets of production technologies	1. The presence of "unified" products (consumer goods) produced at minimal cost		
2. Incentive to receive benefits (in the form of the product itself, profit from its sale, levied duties)		2. Technological development of economies (due to the constant exchange of goods, knowledge, ideas)	

Factors of formation and development		Positive consequences for participants	
GSR	Modern transport corridors (NSR)	GSR	Modern transport corridors (NSR)
<i>3. Availability of necessary infrastructure</i>		Oriental spices stimulated the development of drug production in Europe, Chinese paper - the process of active circulation of books. From Turkestan, silkworming gradually moved to Iran (5th century AD), Greece (6th century AD). Having created in 9 in AD gunpowder The Chinese became just one of the developers of cannons (14th century AD) In member countries, regardless of whether they were selling or buying goods, new industries began to be created	Organization of joint ventures in industry, for example, to create railway equipment (which are one of the types of modern branches). Companies of the participating countries, regardless of their functions (sellers, buyers, transit countries), have the opportunity to develop at the expense of foreign capital. This means new jobs, lower unemployment, solvent demand, etc.
While European cities could only serve local markets, Asian cities were oriented towards international trade. They were transit points, had caravanserais, markets for consumer goods for foreign merchants, translators, money changers, prostitutes worked.	High-quality railways, highways, operating air carriers, ports ... HUBs accompanying their activities Information infrastructure Activities of banking, insurance institutions ...		
4. The desire to "get out of the shadow" - whoever robbed before, now could get the opportunity to become a conductor of caravans, while charging a fee for security (micro level)	4. The desire to guarantee national security, maintain sovereignty, revive interest in the national language and traditions	<i>3. Increase in trade surplus (positive trade balance for leading exporting countries is growing). This was both in the case of GSR (Europe fell into a liability), and at the present stage (the main supplier of goods - most often China - has an active trade balance)</i>	
<b>Non-economic</b>		<i>4. Subsequent infrastructure development</i>	
<i>1. Political stability</i>		Organization of transshipment points; specialized bazaars; stable settlement mode (including cash); protection of property rights of merchants	Creation of high-quality transport, information infrastructure; institutions aimed at organizing the quality work of the logistics system
Concentration in one hand of real control over vast territories, when you set the rules yourself or in a dialogue	The complete absence (minimized number) of real threat of the development of the crisis in the economy and society of the participating countries of the corresponding process		

Factors of formation and development		Positive consequences for participants	
GSR	Modern transport corridors (NSR)	GSR	Modern transport corridors (NSR)
	2. Membership in international organizations and integration associations. The first - develop uniform rules of the game, they are a kind of guarantors. The second - help reduce the cost of transported goods, provide markets for them (through the unification of customs norms)	5. Dissemination of knowledge (primarily geographical)	5. Increasing the competitiveness of national producers (for exporters), which may be followed by an increase in the level of national competitiveness
	3. Striving for partnerships with countries	6. The spread of religions (primarily Islam)	6. FDI growth in virtually all countries (mainly from the country - the main supplier). These investments, including those aimed at the construction of HUBs, the development of industrial production

Note: compiled by the authors

This assumption is based on the following obvious fact. If the main goal of participation in the NSR is to make the transition from raw materials appendages-countries to transport hubs-countries, then it will be necessary and sufficient to increase the reach and depth of knowledge of the main international languages (English and Chinese). However, if the goal is more ambitious - on the basis of improving the infrastructure, to realize the progressive development of the national economy, then in an effort to satisfy demand (presented, first of all, by the countries of the developed world, whose markets are saturated with traditional goods, and they are in constant search for a rare, unique, original product or services) it is necessary to rely on increasing the importance in the national development of their own languages. Along with the fact that, on the basis of knowledge of the national language, you can export your culture (which is currently actively being done by developed countries [3]), owning it will allow you to open the finest facets of the mentality of citizens and get an economic effect. In addition, in a global world in which the ideals of freedom in decision-making are proclaimed, citizens of all countries should have a chance to learn the language of interest.

In addition to the above, it is important to note that in the XXI century the problem of the unification of languages (in fact, the extinction of a huge number of national languages) is global in nature [7]. Particular attention is paid to it in the framework of the work of the United Nations (UN) Organization for Education, Science and Culture - UNESCO. At the end of XX, in the framework of popularizing this issue, the specialists of this specialized organization published the “Atlas of World Languages Endangered”, which later acquired an interactive online version. The main idea of this project was to attract the attention of the public and authorities to the problem of the extinction of languages, as well as the preservation of world linguistic diversity (Table 2).

**Table 2**  
*Disappearing Languages: Statistics for the XXI century*

<b>Criterion</b>	<b>Value</b>
Number of languages existing in the world	6 000
Number of endangered languages including in Russia	2 500 136
Number of languages that have completely disappeared including in Russia	200 20
Number of languages spoken by less than 50 people	360
Countries at risk of losing national languages	India, USA, Brazil, Indonesia, Mexico
Regions whose nationalities will suffer the greatest losses from the loss of their language	Australia, Oceania and Southeast Asia

Note: compiled by the authors based on materials []

It is important to understand that each language with its individual cultural identity, philosophy and value system is a reflection of a unique view of the world. Its disappearance can lead to an irreversible loss of historical, spiritual and cultural values, which play an important role not only for native speakers of this language, but also for society as a whole.

As an option to solve the indicated problem, we developed a project to create an online platform in the space of NSR countries with appropriate educational and linguistic programs, which meets the key trends in the development of the global economy (post-industrialization, informatization, innovation) [4]. Its mission is to preserve the national language and culture of the NSR member countries.

The main objectives of the project were formulated on the basis of a short, medium and long-term period of its implementation:

- in the period until 2021, it is necessary to rank the demand of the countries participating in the NSR by the level of preservation of languages, culture and identity;

- in the period until 2030 - to establish itself in the NSR space as a reliable educational center interested in preserving the national culture and language;
- in the period until 2040 - take a leading position in the study of the national languages of the NSR member countries.

Setting goals, we, first of all, focused on the short and medium term, understanding that the scenario of the project can be adjusted (from the option of full support of the corresponding initiative by countries, receiving financial injections from investors, unhindered entry into the NSR space, combined with active demand for this platform to the limited participation of NSR member countries in the project, caused by the state of the current geopolitical situation in the world) under the influence of internal and external factors (Table 3). Among the most significant tasks we attributed:

- conducting opinion polls to determine the level of linguistic and cultural identity (2020);
- attraction of native-speaking linguists to participate in the project (2020 - 2021).
- search for an initiative group to develop and create an online platform for learning the languages of the NSR member countries (2021);
- search for investors, receiving grants (2023);
- creation of an online platform (2024);
- conducting advertising campaigns on the implementation of projects in national languages in the NSR member countries (2024 and after).

The target audience of the project under development are people interested in learning the national languages of the NSR member countries, as well as economic entities seeking long-term cooperation with the NSR member countries based on trust.

According to preliminary estimates, the initial cost of launching the project is about 56 million rubles. (tab. 4). However, of course, they can increase due to the deepening of its weaknesses and the aggravation of external threats.

With our project, we join the conclusions of experts that the loss of national languages is indeed one of the global problems, that in the context of globalization, "small languages ... will disappear ... if states do not purposefully cultivate the development of national cultures and languages of small peoples" [1] and we propose to begin active work in this direction, especially since UNESCO declared 2019 the International Year of Indigenous Languages, urging governments to do everything necessary to save them. [7].



**Table 3**

*Project Swot Analysis*

*“The foundation of cooperation - the respect for national authenticity”*

<b>Strengths</b>	<b>Weaknesses</b>
<ul style="list-style-type: none"> <li>- association of native speakers of all languages of NSR member countries on a single platform;</li> <li>- the possibility of online learning with a native speaker (such categories as time and space are erased);</li> <li>- competitiveness of the proposed product at a price;</li> <li>- maintaining national authenticity, respect for the culture of NSR member countries.</li> </ul>	<ul style="list-style-type: none"> <li>- staff turnover;</li> <li>- low effectiveness of the advertising campaign;</li> <li>- malfunctions in the functioning of the Internet site.</li> </ul>
<b>Opportunities</b>	<b>Threats</b>
<ul style="list-style-type: none"> <li>- growing demand for the study of national languages;</li> <li>- the need to preserve national languages and culture;</li> <li>- growing demand for online products;</li> <li>- the disseminated practice of state support for cultural projects;</li> <li>- active cooperation between the NSR member countries.</li> </ul>	<ul style="list-style-type: none"> <li>- unification of educational standards with a minimal emphasis on the study of national languages in favor of English and Chinese;</li> <li>- loss of dialogue between the NSR member countries;</li> <li>- high competition in the online environment.</li> </ul>

Note: compiled by the authors

**Table 4**

*Calculation of initial costs for launching project*

*“The foundation of cooperation - the respect for national authenticity”*

<b>Cost Types</b>	<b>Funds</b>
Surveys to identify linguistic and cultural identities (20 countries)	1,5 mln. rub. – one-time payment
Salary of system administrators (6 people)	240 000 rub. * 12 = 2,88 mln. rub.
Salary of native-speaking linguists (2 persons per country)	1,6 mln. rub. * 12 = 19,2 mln. rub.
Development and creation of an online platform (online course, language learning games, theoretical materials, individual consultations, video materials about the culture of the NSR member countries, additional materials)	3 mln. rub. – one-time payment
Salaries of managers (2 per country)	1,2 mln. rub. * 12 = 14,4 mln. rub.
Salary of system administrators (4 people)	240 000 rub. * 12 = 2,88 mln. rub..
6 months advertising campaign (outdoor, targeted)	800 000* 12= 9,6 mln. rub. 300 000* 12= 3,6 mln. rub.
<b>Total:</b>	<b>56,06 mln. rub.</b>

Note: compiled by the authors

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评估现代消费者合作社的经济潜力  
**ASSESSMENT OF THE ECONOMIC POTENTIAL  
OF MODERN CONSUMER COOPERATIVES**

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抽象。对现代消费者合作的经济潜力的评估是通过提供就业机会，农村人口的收入增长，将农产品，原材料和野生植物吸引到经济营业额，商品和服务的生产以及随后向该领域的过渡来进行的。消费，满足消费者需求，构成其获利能力的一部分。俄罗斯的现代消费者合作主要基于消费者协会及其工会，俄罗斯联邦中部地区的科学和教育机构以及共和国，地区等的合作组织。

为了使合作社成功开展活动，它需要政府的支持和一致的经济政策，以便企业具有竞争力并能够满足在困难的经济，政治和其他情况下需求不断变化的人们需求。

关键字：消费者合作，综合评估，经济潜力，潜力水平，国家市场

**Abstract.** *Assessment of the economic potential of modern consumer cooperation is formed by means of providing employment, as well as growth of rural population incomes, attracting agricultural products, raw materials and wild plants to economic turnover; production of goods and services with subsequent transition to the sphere of consumption, satisfying consumers' needs, forming part of their profitability. Modern consumer cooperation in Russia is based primarily on consumer associations and their unions, scientific and educational institutions of the Central region of the Russian Federation, as well as on cooperative organizations of republics, regions, etc.*

*In order for a cooperative to successfully carry out its activities, it needs government support and a consistent economic policy so that the business is competitive and able to meet the needs of people whose needs are changing in difficult economic, political and other conditions.*

**Keywords:** *consumer cooperation, integrated assessment, economic potential, level of potential, national market*

Market changes in the Russian economy lead to a radical restructuring of economic mechanisms. Cooperation is a widespread social phenomenon of the 21st century; interest in it is growing more and more every day. The cooperation realizes its type of activity, adhering to its values, which were adopted by the ICA (International Cooperative Alliance), and also supported by the ILO (International Labor Organization) and the UN (United Nations).

Modern consumer cooperation in Russia is mainly based on consumer societies and their unions, scientific and educational institutions of the central district of the Russian Federation, as well as cooperative organizations of the republic, oblasts and krais.

Consumer cooperation is a market in a country that links its alliance with consumer organizations that have permission to conduct commercial activities (trade, catering, agriculture, procurement, production, etc.). Consumer cooperation (hereinafter - CC) is a system of social orientation of a market economy.

This is confirmed by the main goal - the social mission of consumer cooperation. The rural population is consumer cooperation, which is created by the people and serves the people to meet their basic needs, consumer cooperation contributes to the well-being of the people, especially the most disadvantaged part of it, it is also a union of consumers and society at various levels, while a private organization was created to meet the material and other needs of members of society.

On the basis of membership, through the unification of the consumer society - the creation of an association on a voluntary basis, associations of individuals and (or) legal entities, its members, as a rule, create trade, procurement, production and management bodies of state self-defense, and the heads of consumer-shareholders rationally and professionally interact in the management structure of consumer societies and unions. The functions of the management bodies indicate that shareholders make decisions on various issues of the economic and social activities of the consumer society and its association. Consumer cooperation is actually a school of autonomy for active shareholders.

The revival of the cooperative movement occurs when the government creates favorable conditions for the development of cooperation, that is, during the period of intensive development of market relations in the country.

For a cooperative to successfully implement its activities, it needs state support and a consistent economic policy, for the enterprise to be competitive and also able to meet needs, given the fact that people's demand is changing in difficult economic, political and other conditions.

As a result of increased demand for domestic agricultural products, the process of creating consumer cooperatives has recently begun to develop more intensively.

The main factors that cooperation should take into account when building its strategy are:

### 1. GDP growth

According to forecasts of the Bank of Russia, GDP growth rates in the current period are in the range of 1.5-2% per year, which affects the ability of business entities to save on financial services and generate demand. In 2019, according to World Bank experts, the Russian economy will grow by 1.5%, and in 2020-2021, the growth will be 1.8%<sup>1</sup>.

Slowdown in economic growth, mainly due to the unfavorable situation in the global financial and commodity markets, worsening investment climate, difficulties in attracting foreign financial resources, geopolitical factors, including credit, can negatively affect the state of participants in the Russian financial market, including consumer credit cooperatives<sup>2</sup>.

### 2. Inflation

If we take into account the policy of slow tightening of the monetary policy of the Bank of Russia, which is aimed at stabilizing inflation and containing the expected increase in inflation, then its level in Russia in 2019 will amount to 5.2% and decrease to 4% in 2020-2021, according to World Bank forecast for late 2019<sup>3</sup>.

Lower inflation and interest rates contribute to macroeconomic and financial stability, creating opportunities for lengthening the horizon in the financial planning of enterprises and the population.

### 3. Real incomes and savings of the population

Over the past 5 years, real incomes of the population of Russia decreased by 10.8%.

According to the Ministry of Economic Development of the Russian Federation, the growth in real disposable cash incomes of the population will grow more intensively and will average 2% in 2019–2024. According to Rosstat, after taxes, the average salary in 2018 amounted to 36 540 rubles. The average salary of a Russian citizen according to the rating agency RIA Rating in 2018 amounted to 26.9 thousand rubles per month. The average, most typical salary of Russians lies in the range of 17-44 thousand rubles per month. And at the same time, almost every fifth employee in the Russian Federation has a monthly salary of less than 15 thousand rubles<sup>4</sup>.

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<sup>1</sup>Federal State Statistics Service: [Electronic resource]. – Access: <http://www.msu.ru>. (Appeal date: 10.06.2018).

<sup>2</sup>Tkach A.V., Zhukov A.S. Consumer cooperation in the Russian economy. The main directions of development of cooperation: experience, problems, prospects: Materials of the International scientific and practical conference in the framework of the annual Chayanov readings (November 10, 2017). – Yaroslavl-Moscow: Chancellor Publishing House, 2017. P. 115 – 122.

<sup>3</sup>Website of the Ministry of Economic Development of the Russian Federation - <http://www.economy.gov.ru/>.

<sup>4</sup>Information and analytical comments of the Central Bank of the Russian Federation. Economy. 2018. № 4. [Electronic Resource]. – Access: [http://www.cbr.ru/Collection/Collection/File/5915/Infl\\_exp\\_18-04.pdf](http://www.cbr.ru/Collection/Collection/File/5915/Infl_exp_18-04.pdf) (Appeal date: 10.06.2018)

Currently, the poverty level remains above 13% and is projected to average 12% over the next 3 years. According to the results of a survey commissioned by Sberbank CIB from 2014 to 2018. the proportion of Russians who consider themselves to be middle class declined by 13%, that is, it was 60%, and now 47%. If we talk about the lower class, then, according to the RANEPА, 22% (about 32 million) of people live in Russia. In addition, about 35.6% of citizens of the Russian Federation were in the zone of consumer risk<sup>5</sup>.

Over the past 10 years, the share of Russian cash income in the field of savings in 2018 was the lowest and reached 5.6%. Visa conducted research and according to the results in 2018, 34% of Russians surveyed have no savings at all.

If there is high competition, each company's market position should be strengthened. In order for the company to be in demand in the competition segment, it is necessary on an ongoing basis not only to maintain the benefits received, but also to seek new ones. This statement plays a special role for the enterprise in the CC system.

Now in Russia, consumers of CC services are the rural population and the population of small cities, since they especially need to satisfy the need for goods and services that consumer cooperation offers<sup>6</sup>.

*Table 1 - Activity vectors of consumer cooperation of the Central Union of Russia,%, 2018<sup>7</sup>*

Federal districts	Retail	Purchase of agricultural products	Public services	Catering	Wholesale	Other work
Central Union of the Russian Federation	61,5	11,9	11,8	6,6	4,47	3,8
Central	67,4	9,2	7,3	5,9	6,61	3,6
Northwestern	68,1	6,0	11,5	5,3	5,64	3,5
Volga	56,5	17,0	12,3	7,5	4,20	2,6
Ural	62,6	8,1	8,3	8,8	5,29	6,8
Siberian	66,3	10,6	10,4	5,3	2,04	5,3
Far Eastern	64,2	4,5	12,4	7,0	3,97	8,0

<sup>5</sup>Gross domestic product, nominal (eng.). The World Bank (1.06.2018). — GDP, nominal. Appeal date October 10, 2019.

<sup>6</sup>Ministry of Economic Development: On the current situation in the economy of the Russian Federation following the results of the first half-year of 2019. URL: <http://economy.gov.ru>.

<sup>7</sup>Tkach A.V., Zhukov A.S. Consumer cooperation in the Russian economy. The main directions of development of cooperation: experience, problems, prospects: Materials of the International scientific and practical conference in the framework of the annual Chayanov readings (November 10, 2017). – Yaroslavl-Moscow: Chancellor Publishing House, 2017.P. 115 – 122.

CC's core business is trade, procurement, food, and manufacturing. Trading is the most popular. It charges 65% of activity against the background of the entire mass. For the effective implementation of its activities, CC creates a room (transport and (or) storage, repairs equipment for improved productivity, performs banking services, trains staff, etc.

Nevertheless, CC was unable to maintain and save its former position in the competitive environment in connection with the transition to market relations. Consumer cooperation has lost profit and support from the country. The low solvency of the company in the 90s gave rise to a number of problems that are still not resolved: the number of enterprises involved in trade has decreased, the methodology of productive management of the enterprise has been lost, the rent and sale of stores in busy flows has worsened, etc.

New participants entered the market - these are private entrepreneurs, whose main goal is to make a profit, and they just partially displaced the consumer community from the market. But despite the prevailing difficulties, consumer cooperation will continue to adapt to the competitive environment, work in the market<sup>8</sup>.

In order to improve the positioning of consumer cooperation, it is necessary to increase their competitiveness, which can only be done if there is a competitive advantage (CA). Cooperative organizations need not only to satisfy the needs of consumers, but they must be leaders and exceed their competitors.

In the formation of socio-economic orientation in the Russian Federation, cooperation can play a significant role. To do this, we need a developed strategy for the development of a coordinated movement of the state, based on the following principles: the preservation of cooperation is not an end in itself, a cooperative form of organizing cooperation and self-organization of a people to improve the socio-economic situation, when society does not have the opportunity to solve the problems of their own life without interference, either without the support of the country, and when it is fundamental in developing development strategies.

It is worth remembering that a cooperative will achieve favorable efficiency only when it brings people together to solve important problems that are extremely difficult to solve, and therefore it is most difficult for the cooperative movement to find and solve these problems.

They analyzed the coordination of the practice of the cooperative movement, its development strategies, ensuring the equitable distribution of vital resources, promoting cooperation in organizing vital events that contribute to improving the living standards of the population.

One of the strategic directions for the development of cooperation is the use of a cooperation form to overcome the crisis of agricultural enterprises; on this basis, the National Food Security and the general food problem are being solved.

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<sup>8</sup>Doing business in the Russian Federation - Doing Business: // World Bank [Elec-tronic Resource]. - Access: <http://russian.doingbusiness.org/data/exploreconomies/russia> (Appeal date: 10.06.2018).

Based on this, the activities of cooperative organizations are <sup>9</sup>:

- given the subtleties in the field of territorial distribution, climate, culture, etc. there is coordination of the work of CC;
- building a common strategy and development plan for CC in conjunction with the regions, taking into account the economic situation and political;
- positioning of values and protection of CC in various government bodies;
- development of a concept and program for the development of areas of activity related to the cooperative movement, determination of the most effective organizational and legal forms, promotion of structural adjustment and a new investment policy;
- improvement and development of economic relations of cooperative organizations within the regions of the country, as well as between them;
- supporting one's view of the movement of cooperatives in the educational sphere and in science;
- training in the professional sphere of personnel through the network of educational CC institutions by region;
- the opportunity to participate in programs for the exchange of experience in various types of activities;
- CC development activities by region and country (trade, production, procurement, construction, medicine, education, etc.);
- participation of cooperative organizations in the process of international innovative scientific and technical cooperation (IISTC), involvement in the international innovation and technological space.

Therefore, if we take into account the globalization process of the world economy, the competitive environment between regions, inter-regional competition and market asymmetry, improvement of aspects in the field of economics and politics in the country's development as a social model of economic development, we can conclude that CC will have a beneficial effect on the economy , since it contributes to the organization of the cooperative sector of the economy, which will contribute to the development of sparsely populated areas.

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<sup>9</sup>Sagaidachnaya O.V., Repushevskaya O.A., Timonina E.S. Modernization, as part of the investment policy of the state. Russian economic online magazine № 2 (01.04.2015-30.06.2015).



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创业的创新和技术潜力  
**INNOVATION AND TECHNOLOGICAL POTENTIAL  
OF ENTREPRENEURSHIP**

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抽象。 本文讨论了确定企业家精神的创新和技术潜力的基本条件。 介绍了企业创新潜力的特征。 考虑了小型创新型企业的功能特征。

关键字: 创新, 企业家精神, 小型企业, 创新基础设施。

**Abstract.** *The article discusses the basic conditions that determine the innovative and technological potential of entrepreneurship. The characteristic of the innovative potential of the enterprise is presented. The features of the functioning of small innovative enterprises on a practical example are considered.*

**Keywords:** *innovation, entrepreneurship, small enterprises, innovative infrastructures.*

One of the tasks of increasing the competitiveness of entrepreneurial structures in the domestic and foreign markets at the present time is the development of innovative activities, primarily the increase of innovative and technological potential. The same direction is considered as strategic by universities with the goal of long-term functioning in the form of research organizations of an entrepreneurial type. Leading positions can be taken by developing and implementing technologies and tools to expand innovative and entrepreneurial activities.

One can cite as a successful example the development of St. Petersburg ITMO University as an entrepreneurial type research university since 2009, which allowed it to occupy a leading position among leading Russian universities. ITMO University has the most advanced and efficient innovative infrastructure in Russia. The amount of financing attracted by projects during the acceleration programs for the entire history of activity is more than 252 million rubles. The program of assistance to innovative and entrepreneurial development of the Russian regions involves more than 30 regions of the Russian Federation, about 8000 entrepreneurs and developers. The work to raise funds from citizens, the state and business in the

non-profit sector, namely fundraising, involves tracking 450 funds and processing over 1000 contests. 47 small innovative enterprises were organized on the basis of ITMO. Achievements include 2,000 applications for startup accelerators, more than 150 graduates of startup accelerators [1].

The basis for increasing innovative technological entrepreneurship is the availability and launch of a certain number of innovative projects. The full cycle of support for an innovation project should be ensured by the interaction of the following elements of the innovation infrastructure: technopark, business incubator, department for working with small innovative enterprises, laboratory associations, an engineering center, a project management and promotion center, a venture fund, an initiative for the development of innovative projects, a project department activities and fundraising.

To strengthen innovative and technological entrepreneurship, methods of implementing various types of activities can be applied. The following services for business can be distinguished:

- development of innovative entrepreneurial projects;
- intellectual property protection;
- project expertise;
- consulting;
- acceleration programs, business incubator;
- technology transfer and commercialization;
- fundraising;
- venture capital investments;
- engineering services;
- office space, technology park;
- prototyping workshops.

In general, the creation of a small innovative enterprise on the basis of the university includes 5 stages:

- protection of intellectual property, for this it is necessary to determine the result of intellectual activity for the future enterprise and contact the appropriate department of the university, for example, the department of intellectual property or scientific and technical information;
- discussion at the scientific and technical council of the university, this stage involves the preparation of a development strategy and the formulation of proposals for the creation of a small innovative enterprise;
- registration of the organization in the tax service, it is necessary to prepare a set of constituent documents and submit them to the tax service;
- conclusion of an agreement with a university; at this stage, preparation, execution and signing of a license agreement between a small innovative enterprise and a university occurs;

- notification of the Ministry of Science and Higher Education, here it is necessary to prepare copies of the constituent documents, transfer them to the departments of the university, for further notification of the Ministry on the creation of a small innovative enterprise.

Providing students and university staff with various mechanisms for translating ideas into a successful business may include, for example, registering a small innovative enterprise together with a university or creating a startup.

Considering the functioning of venture capital funds, we can identify priority areas of investment:

- in the field of public health, these are: medical instrument making; creation of medical diagnostic and therapeutic products; bionic systems; devices and software that enhance the social adaptation of people with disabilities; medical supplies; information technology in medicine;

- in the direction of preserving the human environment, these are: alternative energy and systems for the efficient conversion and use of energy; energy-saving materials and devices; treatment of industrial and domestic wastewater, waste management; biodegradable materials; life and health safety systems;

- in the direction of progressive production and M2M, these are: industrial robotics and high-level automation technologies; laser, plasma, ultrasonic, radiation and optical technologies; modern membrane technology; digital production; promising systems for processing and transmitting information, M2M technology in transport, utilities, monitoring, control and security systems.

In solving numerous problems with the goal of creating the most developed and effective infrastructure for innovative entrepreneurship, considerable attention should be paid to the formation of a partnership network aimed at improving and supporting the development of the innovation space, as well as ways to organize the innovation ecosystem at the city, national and international levels. In order to develop an innovative ecosystem on the basis of universities, the participation of foreign partners in projects aimed at improving the innovation infrastructure and creating mechanisms for the formation and promotion of research and development of the university on the international market should be ensured. This will become the basis for the formation of an entrepreneurial university, technology transfer processes and the commercialization of R&D.

For supporting universities, it is necessary to ensure measures to achieve the status of leading innovative and entrepreneurial universities associated with an increase in the number of innovative companies, the successful conclusion of agreements and partnerships, and the involvement of investors and international specialists in the activities of universities. It is important to make every effort to ensure that advanced scientific developments are successfully introduced to the market, provide the research teams of the university with space for the devel-

opment of projects and consulting support from the best domestic and foreign experts. Also, as effective measures to ensure the creation of a stable stream of high-tech business projects and startups, we can propose the active distribution in the regions of the Russian Federation of a network program for the formation and development of startup schools. Such a program may include an educational program, trainings, competitive events, popularization events, as well as the possibility of connecting to a network of techno-brokers to work with projects.

The intensification of innovative and technological entrepreneurship, the creation of conditions for the successful operation of innovation infrastructure and the organization of effective interaction of the innovation ecosystem of the region, can provide the prospect of socio-economic development of the Russian regions.

Distinctive features of innovative entrepreneurship and high-tech business in the current economic realities are the high level of costs for research and development in the total investment and the increasing speed of market updates. One of the key competitive advantages in the Russian market is the volume and adequate terms of financing various innovative projects [2].

The innovative potential of the enterprise in the process of entrepreneurial activity is realized in a specific form of innovation. In this case, certain barriers arise, the reasons for the violation of the implementation process, which are manifested in the discrepancy between the actual and design utilization rate. To structure these causes and operational management of them, we can consider the classification by to a number of signs: the degree of surmountability, the source of occurrence, the functional scope of the enterprise. This allows you to apply an integrated approach to solving the problems of the effectiveness of managing the innovative potential of the enterprise. The tasks of managing the innovative potential of entrepreneurial activity include: planning and acquiring resources to achieve the innovative goal, quantitative and qualitative improvement of the parameters of innovative potential, and the transformation of its individual components into the final innovative product. For a systematic study of the innovative potential of entrepreneurial entities, it is necessary to study the process of implementing the basic management functions in relation to the components of potential. An important role is also played by the assessment of innovative potential, which expresses the degree to which the business structure is provided with individual components of innovative potential.

Despite the limited resources, innovative firms play a great role in the embodiment of many achievements of scientific and technological progress [3, p.15].

Thus, at present, various forms of innovative activity of entrepreneurship can be effectively applied, since All necessary economic conditions are at the disposal of enterprises for the implementation of investment projects in various sectors of the economy, primarily related to the creation of new industrial enterprises.

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房屋破产可能性的立法规定  
**LEGISLATIVE REGULATION OF THE PROBABILITY  
OF BANKRUPTCY IN HOUSING**

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抽象。在经济危机和西方宣布的制裁封锁的背景下，建筑组织的破产案件变得非常频繁，因此，股权持有人被剥夺了在已经通过建造完成的房屋中购买公寓的机会。而是获得未完成的建筑项目一部分的权利。在这种情况下，还有其他非常多样的侵犯共同建筑参与者的权利和合法利益的案件。

本文探讨了俄罗斯联邦打击住房破产的立法措施。

关键词：破产；共享建筑；建筑群货币义务的要求；未完成的对象。

**Abstract.** *In the context of the economic crisis and the sanction blockades declared by the West, bankruptcy cases of construction organizations became quite frequent and, therefore, equity holders are deprived of the opportunity to purchase an apartment in a house that has been completed by construction, acquiring instead the right to a part of the unfinished building project. In this case, there are also other, very diverse cases of violation of the rights and legitimate interests of participants in shared construction.*

*The article examines the measures of the legislation of the Russian Federation to combat bankruptcy in housing.*

**Keywords:** *bankruptcy; share building; building complex; requirements for monetary obligations; unfinished object.*

In modern conditions, when providing citizens with housing is of particular importance, the construction complex is an essential element of the national economy. In connection with the current socio-economic situation, the Federal Law of December 30, 2004 № 214-FL “On participation in shared construction of multi-apartment buildings and other real estate objects and on amendments to some legislative acts of the Russian Federation” was adopted [1], (hereinafter — Law on shared construction). According to this law, one of the special legal grounds for acquiring a dwelling is an agreement on participation in shared construction (hereinafter referred to as the agreement on shared participation). Citizens invest in the construction of primarily multi-family residential buildings with the aim of

the subsequent acquisition of apartments in the property. However, for a variety of reasons, developers may experience financial difficulties, as a result of which apartment buildings remain unfinished. The developer is unable to properly and on time fulfill its obligations under the equity agreement.

According to the data provided on the website of the Federal State Statistics Service in the Russian Federation as of 01.01.2019, among the main factors hindering the activities of construction organizations, it is possible to distinguish: insolvency of customers (37% of respondents indicated this factor), high taxes (21%) and competition from other construction firms (24%) [4]., Table 1.

**Table. 1**  
*Monitoring of factors constraining the activities of construction organizations in the Russian Federation*

<b>№</b>	<b>Factors Constraining Construction Organizations</b>	<b>for 01.01.2016</b>	<b>for 01.01.2019</b>	<b>Change in% (-, +) 2019 to 2016</b>
1	The high cost of materials, structures, products, in%	13	15	+ 15,4
2	High level of taxes, in%	22	21	-4,5
3	Competition from other construction companies, in%	24	24	-
4	Customer insolvency,%	36	37	+2,8
5	Lack of skilled workers,%	5	3	--0,6
6	The number of construction organizations in bankruptcy, (units)	103	108	+4,8
7	The total number of affected equity holders due to the bankruptcy of construction organizations (thousand people)	20387	200958	+2,8

Thus, there is a tendency to a significant increase in the percentage of bankruptcies, insolvent construction companies, the growth is 4.8%. The negative consequences of the insolvency of construction companies are mostly experienced by participants in shared construction, the growth of which was 2.8% since cash investment is directly related to risk of their losses.

According to information by V.V. Yakushev, in a report on improving the quality of state and municipal services in the field of construction, presented on the website of the Working Group of the Presidium of the General Council of the “United Russia” Party, “the implementation of investment projects for the development of real estate is associated with a variety of risks, their success depends on a professional approach to solving problems, such as attracting financial resources, organizing the process of project implementation ”[3].



With regard to the investment of funds in real estate Andryushina T.O. and Tsaritsinsky N.V. outline five risk groups:

- 1) legal (for example, the presence of previously unrecognized encumbrances);
- 2) urban planning, design, technological (errors in the project, improper choice of location for its implementation, etc.);
- 3) administrative (changes in tax legislation, the introduction of additional restrictions);
- 4) economic and organizational-economic (incorrect macroeconomic forecast, errors in assessing the situation);
- 5) financial (quality of financial support of the project) [6, p. 6].

The proposed classification is based on an integrated approach to identifying the causes of financial instability of construction organizations.

In addition to the above risks, Belousov V.N. identifies a social group of factors that cannot but affect the fate of legal relations under the considered share agreement, these include:

- legal literacy of participants in shared construction;
- a system of state-developed preventive measures used to prevent the bankruptcy of construction firms;
- the presence in the constituent entities of the Russian Federation of authorities empowered to provide real assistance to participants in shared construction;
- coordinated interaction of authorities at all levels to resolve difficulties encountered in this area and others [8, p. 36].

It is the totality of these groups of factors, in our opinion, that make it possible to identify and correct legislative gaps in relation to the bankruptcy of construction companies in order to minimize the risks of financial instability of developers and the risks of participants in shared construction, who invested money in creating real estate.

Legal regulation of relations in regard to the liquidation of construction companies under an agreement on participation in shared construction is currently carried out through the general provisions of the Civil Code of the Russian Federation and Federal Law of October 26, 2002 № 127-FL On Insolvency (Bankruptcy) (hereinafter - the Bankruptcy Law) [2]. So, in accordance with the general provisions of the Civil Code of the Russian Federation, insolvency (bankruptcy) is a special case of liquidation, which entails the termination of a legal entity without transfer of its rights and obligations by succession to another person. Bankruptcy may be voluntary (declared by the debtor himself) and compulsory (recognized as such by a court decision). There are no special rules governing the bankruptcy of construction organizations either in the Civil Code of the Russian Federation or in the Bankruptcy Law. However, taking into account the specifics of the relations under consideration, the need to create such norms is obvious.

Based on the legislative definition of insolvency (bankruptcy) as the debtor's inability recognized by the arbitration court to fully satisfy the creditors' claims for monetary obligations and / or fulfill the obligation to pay mandatory payments, we can conclude that in this case, creditors are entitled to rely only on partial satisfaction their requirements. And for this it is necessary that there is a uniform and fair distribution of the debtor's property between creditors. In case of bankruptcy of construction companies, the requirements of equity holders (as lenders) are subject to satisfaction within the third stage, i.e., in fact the last.

Moreover, A. Altukhov claims that the bankruptcy of construction companies raises a number of issues that are not regulated by law:

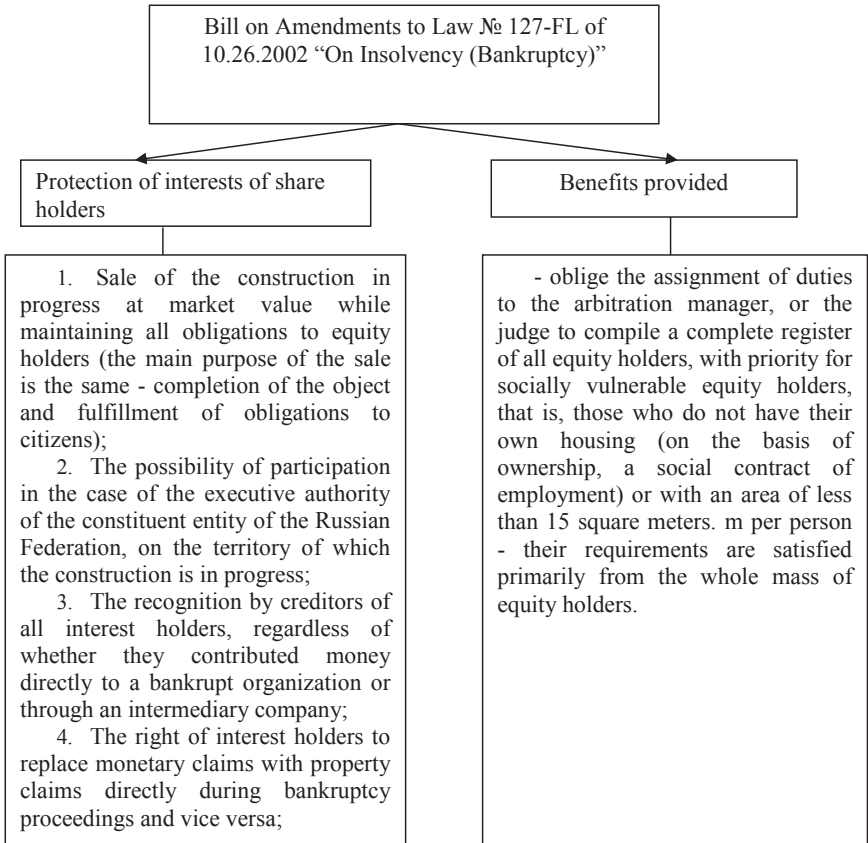
1. So, in case of bankruptcy of a construction company, in practice there is a problem of including property in the bankruptcy estate.

The fact is, A. Altukhov explains that in case of difficulties in the financial situation of the developer, construction is suspended and, as a result, the object remains unfinished. In parts 1-5 of article 13 of the Law on shared construction, it is said that if there are grounds for foreclosing on the subject of pledge, the developer is obliged to register the ownership of the object under construction. In the event of bankruptcy, the property of the debtor is to be included in the bankruptcy estate. And due to this property, the claims of creditors are subsequently satisfied (participants in shared construction are third-stage creditors (according to paragraph 4 of article 134 of the Bankruptcy Law)). As a result, an unfinished object (as part of the bankruptcy estate) is sold, and participants in shared construction lose the right to acquire an immovable property in the construction of which they invested their money.

2. In addition, A. Altukhov states that some participants in shared construction cannot be recognized as creditors at all, since they did not directly contribute money to the developer, but to a third-party company (intermediary company), which is not directly a side engaged in raising funds from citizens for construction [5, p. 98].

In connection with the existing problem, it seems to us that it is necessary to prescribe in the Bankruptcy Law the specifics of the bankruptcy procedure of construction companies, to legislatively resolve the situation with property to be included in the bankruptcy estate. At the same time, take into account the purpose of such legislative innovations - fulfillment of obligations to interest holders, protection of their rights and interests, organization of assistance in resolving the situation on the part of state bodies in relation to interest holders and construction organizations.

Currently, there is a draft law "On Amending the Law "On Insolvency (Bankruptcy)", developed by the Working Group of the Presidium of the General Council of the "United Russia" Party to protect the rights of shareholders and investors, where the following scheme for protecting the interests of shareholders is proposed, Figure 1.



*Figure 1 - Scheme for protecting the interests of share holders*

The listed provisions of the bill seem appropriate, since they relate to the social group of factors (mentioned above) that affect the degree of protection of participants in shared construction, but some are still controversial. In particular, a proposal on the obligation of the court to compile a complete register of all equity holders. Since,

- this does not comply with the principle of independence of judges (there is a risk of outside interference in the activities of the court);
- the implementation of this obligation is a rather labor-intensive process that requires significant time costs.

The compilation of the register of interest holders could, in our opinion, be entrusted to the arbitration manager. The proposal to recognize all interest holders as creditors, regardless of whether they contributed money directly to a bankrupt organization or through an intermediary company, also requires clarification and adjustment.

Today, according to the definition of Kruglov EP, in the Bankruptcy Law, creditors are defined as persons having rights to the debtor to claim monetary obligations and other obligations to pay mandatory payments. In the case of depositing funds not directly to the developer, but to the intermediary company, the shareholder does not have the right to claim monetary obligations, and he does not become a creditor in the sense in which the concept of “creditor” is given in the Bankruptcy Law [9, p. 86]. Therefore, in our opinion, it is necessary to clarify the concept of “creditor” as applied to equity holders in the framework of relations under an agreement on participation in shared construction. The proposals discussed above could substantially fill the legislative gaps in the field of bankruptcy of developers and positively affect the dynamics of relations on shared participation in construction.

In addition to the above, let us turn to the experience of regional administrations, in which equity holders also found themselves in a difficult situation. So, in Moscow, when working with one of the unfinished construction of real estate objects, it was proposed to transfer the rights and obligations to the bona fide developer in order to complete the construction of a residential building. (It would be worthwhile to get the consent of the shareholder to replace the developer.) In addition, a schedule for the preparation of the necessary documentation for putting the house into operation with specific dates for each stage was adopted [3].

In the Voronezh oblast, the administration adopted a resolution on the support of citizens affected by the actions of unscrupulous developers. At the moment, the decision is valid with current changes [3].

In the Omsk oblast, control over the provision of citizens with housing is carried out by the State Housing Construction Supervision, whose tasks are to protect the rights and legitimate interests of citizens, improve the quality of public services, provide the population with high-quality, comfortable and affordable housing [3]. Additionally, the Regional Union of Builders was created in the region, and regional authorities are counting on their help. The Omsk administration also offers developers to keep money on deposits, so that in case of bankruptcy, equity holders can get their money [3].

In the Vladimir oblast, the administration prepared a guide for participants in shared construction in order to assist them in difficult situations and increase their legal literacy [3].

To achieve these goals, a number of legislative innovations have been introduced to fulfill obligations.:

- implementation of the construction in progress at market value while maintaining all liabilities to interest holders, and the main goal of implementation is the same - completion of the facility and fulfillment of obligations to interest holders;
- the possibility of taking part in the case of the executive authority of the constituent entity of the Russian Federation, in whose territory there is an object of incomplete construction;
- recognition by creditors of all interest holders, regardless of whether they contributed money directly to a bankrupt organization or through an intermediary company;
- the right of interest holders to replace monetary claims with property claims directly during the bankruptcy procedure and vice versa;
- the obligation of the court to compile a complete register of all equity holders; giving priority to socially vulnerable equity holders, that is, those who do not have their own housing (on the basis of ownership, a social contract of employment) or are provided with an area of less than 15 square meters per person - their requirements are satisfied primarily from the whole mass of equity holders.

It is with the help of an integrated approach to studying the problem that we can find the best ways to solve the problems of equity holders, in particular, problems associated with the bankruptcy of construction organizations. Moreover, it seems that the achievement of positive results in this area is possible with the support of the state and with the policy of social responsibility of the authorities to citizens.



国家和个人对P.I.的解释 诺夫哥罗采夫  
**STATE AND INDIVIDUAL IN THE INTERPRETATION  
OF P.I. NOVGORODTSEV**

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The concept of correlation of state and individual - is an independent theoretical problem of state-legal structures, in particular, of the 19th-20th centuries. Most lawyers of this time were inclined to think that the state was one: it knows no dualism of the sovereign and the people, power and law, as it was in the Middle Ages. At the same time, within the state, this dualism is manifested and has not only historical, as Jellinek claimed, but of fundamental importance. The fact is that in modern times, unlike the ancient period of the existence of the state, a legal claim arose for a certain sphere of freedom in relation to the state. Even in the era of state absolutism, as noted by P.I. Novgorodtsev, it was impossible to suppress the belief that the individual and in relation to the state represents a self-sufficient and therefore due and legal value<sup>1</sup>. As for the opposition of power and personality, government and people at the beginning of the 20th century, it was believed by Kant's supporters in Russia that it was not so much defeated as it was enclosed in a framework of legitimate manifestation. The dualism of the state and the individual, general law and individual freedom can be overcome only by the requirement of legal consciousness - the moral restrictions that stand above the state. Thus, the law receives its legal existence on the basis of state recognition. But to admit - does not mean to create and bring to life; in this case, according to Novgorodtsev, recognition of the necessary self-restraint of the state also has significance. Individual freedom exists beyond this recognition, but in order for the freedom of persons, which exists as an inevitable fact and as a moral requirement, to be fixed by law, a complex process of struggle for freedom against the constraints imposed on it is necessary. The recognition of freedom means the state's renunciation of previous encroachments on the rights of individuals and, then, confirmation of these rights for the future. Therefore, on the part of the state, it is negative: it means nothing more than an official confirmation of a fact that requires its sanction with all the force of an unconditional life phenomenon.

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<sup>1</sup>Novgorodtsev P.I. State and law // Questions of philosophy and psychology. M., 1904. Book 74. P. 526, 527.

The state consolidates the objectively established position of society, in this it finds its foundation, but not the limit: state interest and purpose extends to further development, the transformation of public relations in accordance with the goals. L. Dugi defined this objective state by the concept of “social norm”: the social duty of everyone to fulfill a certain thought and power to carry out the actions required by the fulfillment of this mission; I. Kant in this position of objective relations saw a state where everyone has a duty, moreover, in relation to everyone, G.V.F. Hegel - the power of a collective or individual will to oppose itself, as such, to another will (similar to G. Jellinek), R. Iering - legally protected interests, i.e. interests protected by regulated intervention of collective power - by the state. Russian jurists of neo-Kantian philosophy, first of all, P.I. Novgorodtsev, assessed the state of society as a fact of freedom that cannot be adequately expressed in legal formulas: for a lawyer it is important not so much that he finds the appropriate formula for the rights of freedom, but that he constantly has in mind the rights of the individual and his freedom in the general construction state theory; the principle of freedom should be guiding in resolving controversial issues of legal construction<sup>2</sup>. The principles of natural law Novgorodtsev, like other state scientists, considered necessary to include in the activities of the state to implement the development of freedom as a general direction of the political process. In this regard, not only a critically-evaluative function, but also a creative basis for subsequent social development was recognized as natural law. The necessary self-restriction of the state was recognized by both formal-dogmatic and natural-legal schools, but the latter saw the source of the state’s self-obligation not in legal grounds (formal-dogmatic jurisprudence), but in moral requirements<sup>3</sup>.

The idea of distinguishing between the spheres of activity of the state and civil society (the state - public authority, the sphere of common interests, society - the sphere of private interests, individual freedoms) is a subject of special attention to Novgorodtsev. This idea, which gave rise to the idea of the constitution as the basic law of the relationship between society and state power, the agreement on the distribution of power between them, in the process of evolution of European constitutionalism, organically combined with ideas about the rights of the individual, independ-

<sup>2</sup>Nevertheless, it seems more justified to consider the concept of freedom as one of the basic legal concepts: freedom - the ability (right) to do everything that does not violate the rights of others; - the right to do everything that is not prohibited by law; - The generally accepted prohibition to do what you do not want to be done to you; - Dependence only on equal law for all, based on the recognition of individual rights.

<sup>3</sup>In jurisprudence of the beginning of the XX century, several theoretical directions can be distinguished, which consider it necessary to limit the activity of the state and are focused on: freedom rights, moral law (neo-Kantianism, etc.); class solidarity (sociologists of law, Dugi); historical process, present level of culture, personal rights won, legitimacy of power (Jellinek and others). Novgorodtsev, as was noted, theoretically substantiated natural law - both as an idea and as a modern assessment, a requirement for positive law.



ent of their source from state power and only protected by it . Most representatives of the theory of state and law of this time firmly held the position of recognition of certain rights by the individual and considered the person to be the subject of law.

In modern times, progressive legal awareness for the first time called individual rights inalienable and contrasted them with the state, as the absolute legal boundaries of its power. Later, a monistic tendency appears, which reduces the concept of these rights to the meaning of the simple reflective consequences of objective law (the concept of legal positivism). The newest doctrine (Jellinek) restores the value of subjective rights for the rights of individuals: the ability of an individual to set the rule of law recognized by the state creates subjective competence, therefore a person is a public law concept. It is a condition of private law and any rule of law in general. In this approach to the individual, philosophers of law at the beginning of the 20th century saw a consonance of the state legal doctrine with the ancient one, which in the person of Aristotle proclaimed that in the political sense, law is possible only between free people, and without such a law there is no state<sup>4</sup>. Aristotle, however, had other freedom in mind, but in this case the statement of the problem - the right of the individual in the state - is equally relevant both in the ancient city and in the modern state.

When characterizing the relationship “individual - state”, Novgorodtsev drew attention to the difference in the characteristics of the concept of people in the state-legal theories of Girke and Jellinek (people - the subject of law) and Laband, Seidel (the deputy corps - subject of law)<sup>5</sup>. From the point of view of the first lawyers, a representative assembly is precisely an organized people in the legal sense of the word; from the position of Laband and Seidel - not the people represent the authority, but only the representative office elected by them - the deputy corps. Theories of the state at the beginning of the 20th century constructed two direct organs in the rule of law - the people and the monarch, which are independent of each other in the field of the manifestation of their will. However, if the state is recognized as the bearer of power, and all incarnations of state power are the organs of the whole, then the idea of responsibility and connectedness of state bodies, which many Russian state historians advocated, does not seem so certain. Where are the guarantees that precisely from such a state of affairs “mutual responsibility” will not appear - the absence of a specific executor and a specific defendant, and the state will not turn from a party to the treaty into a powerful dictator who does not fulfill his obligations. The state, as historical practice shows, does not “owe” anything to anyone, from a formal-dogmatic point of view, no guarantees of its activity can be provided. Neither the “idea of the state” nor the “right of individuals (public groups) to function as an organ”, for which theorists of the state spoke out,

<sup>4</sup>See Aristotle. *Nikomakhov's Ethics / Works*. V. 4. M., 1984. P. 159.

<sup>5</sup>Novgorodtsev P.I. *State and law // Questions of philosophy and psychology*. M., 1904. Book 75.P. 629.

change things, since the “idea” from the point of view of positivism is a legal fiction, and the institution of public groups, which, should be of the general interest of the entire state, practically impossible. In addition, the process of implementing the concept of “common interest” is a problem that is hardly solvable at all.

To solve these issues, Novgorodtsev, like other representatives of neo-Kantianism, used the natural-legal theory, according to which the objective connection of members of society (moral unity) allows us to unite individuals into social groups. The law from these positions is not a product of the mechanical addition of private wills, not the result of a quantitative summation of the individual elements involved in the formation of the state’s will, but a special synthesis in which the opposites and differences are not only combined, but also neutralized, and thus a special and towering above them<sup>6</sup>. The more accurately the idea of the law is formulated, the brighter is the importance of the process of formation of state will. The expression of state will is a task of great complexity, therefore, it is necessary to create a clear system of mutual restrictions in the activities of individual bodies. This, according to Novgorodtsev, implies the desire to exercise universal suffrage: each individual is recognized as having the right to influence the formation of a common will and to contribute his share in the decision of state affairs. From these positions - the state is “the corporate unity of the whole people”, it is not something standing above people<sup>7</sup> (Hegel) or next to them, it is not a product of unconscious historical forces, which once and for all left their mark in the form of unshakable traditions and continue to act at the beginning of inertia (Savigny). As Novgorodtsev showed, the interest of the state is as personal as common; it follows from the depths of moral consciousness, from a sense of personal connection with the general consciousness of the responsibility of each and everyone for a common cause.

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<sup>6</sup> Novgorodtsev P.I. *State and law // Questions of philosophy and psychology.* - Moscow, 1904. Book 75.P. 533, 534.

<sup>7</sup> "... The goal of the state is the general interest as it is, and in it the preservation of special interests, the substance of which it is ...". Hegel G.V.F. *The philosophy of law.* - Moscow, 1990. P. 294.

法律文化：界定标准的问题

## LAW CULTURE: THE PROBLEM OF DEFINING CRITERIA

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抽象。 本文提供了文化的一般定义，并指出了俄罗斯法律科学中法律文化概念形成的特征。 它显示了在现代俄罗斯法律文献中强调法律文化内容价值的标准的不确定性。 作为确定法律文化价值的普遍基础，提出了一个标准，以使法律现实的要素与法律的基本必要参数即客观法律相一致或相近。

关键词：文化，法律文化，法律文化的客观依据和标准。

**Abstract.** *The article provides a general definition of culture and notes the features of the formation of the concept of legal culture in Russian legal science. It shows the uncertainty of the criteria by which the values of the content of the legal culture are highlighted in modern Russian legal literature. As a universal basis for determining the values of legal culture, a criterion is proposed for the correspondence or proximity of elements of legal reality to the essentially necessary parameters of law, its objective laws.*

**Keywords:** *culture, legal culture, objective grounds and criteria of legal culture.*

Let us decide on the object of study. It is culture as a general social phenomenon that has its own particular manifestations in certain areas of human life, including - in law. At the beginning of the 20th century, the Russian thinker Nikolai Trubetskoy, considering culture in the context of the development of human civilization, noted that “culture at any given moment is the sum of the recognized discoveries of the modern and previous generations of this people” [1, p. 120]. In the Soviet period, from Marxist materialistic positions, it was determined that “culture is the totality of material and spiritual values accumulated by mankind in the process of its socio-historical practice” [2, p. 389].

Modern researchers show an increased interest in the problems of culture, which led to the formation in the XX century of a special branch of scientific knowledge - cultural studies [3]. This interest is due to the increasing role of social factors proper as opposed to natural factors in the functioning and development of the human community; it is associated with the increasing unity of the human world and the processes of globalization; with ongoing attempts to dominate certain ethnic groups on earth and a response aimed at preserving national identity.

Without delving into the differences between the numerous philosophical and cultural concepts of culture [4], we note that in general, culture in philosophical literature usually means “a historically defined level of development of society and human creative abilities, manifested in various ways and forms of human life and the material and spiritual values ”[5, p. 417]; “A holistic, sustainable way of life of any ethnic group or citizens of the country, which, developing historically, is gradually updated and at the same time preserves its identity” [6, p. 157].

Culture is a way of life of an individual person, social group, ethnic group, country, which is associated with the production and accumulation of material and spiritual values. The prominent Russian sociologist P. Sorokin noted on this: “Every great culture is not just a conglomeration of diverse phenomena that coexist, but are not related to each other, but there is unity or individuality, all of whose components are permeated by one fundamental principle and express one, and main value. The dominant features of the fine arts and sciences of such a unified culture, its philosophy and religion, ethics and law, its main forms of social, economic and political organization, most of its mores and customs, its way of life and thinking (mentality) are all in their own way , express its fundamental principle, its main value. It is value that serves as the basis and foundation of any culture ”[7, p. 429].

It is the values accumulated by mankind that give a specific meaning to the category of culture, but values of a special kind. Culture is not generally life activity and its achievements (the atomic bomb is the same achievement), not generally values (for some writers and mate is a great value), but only what works to improve the personality and progress of human society. Here we refer to the opinion of A. Schweitzer: “Culture is the result of all the achievements of individuals and of all mankind in all areas and in all aspects to the extent that these achievements contribute to the spiritual improvement of personality and general progress” [8, p. 46].

From the point of view of the subject social sphere in which culture is produced and the corresponding specifics of the content of the created values, we can distinguish economic culture, political culture, legal culture, artistic culture, scientific culture, religious culture and its other types [6, p. 183-184]. According to the criterion of community of subjects that are carriers of cultural values, we can distinguish the culture of human civilization as a whole, the culture of individual countries and peoples (national culture), the culture of various social groups and

social institutions, the culture of an individual. These types of culture, developed in the historical process, will allow to classify culture according to the types of different historical eras. Other classifications and typologies of culture are possible, which are cited and analyzed in philosophical and cultural literature.

The methodological philosophical provisions allow us to formulate a definition of culture, which will serve as a guide for the analysis of the parameters of the legal culture of society. Under the present study, culture will be understood as the aspect, side of the life of society, its social groups and institutions, individuals, which consists in the formation, accumulation and assimilation in all areas (in our study - in the legal sphere) of social life of material and spiritual values, ensuring the progressive development of man and humanity.

The concept of "law culture" by historical standards has recently appeared in the categorical apparatus of the Russian theory of law. This concept does not appear to be independent in textbooks, monographic literature and fundamental works on the theory of law of the Soviet era, at least until the 70s of the XX century [9]. Since the 80s, the concept of legal culture begins to be actively introduced into the scientific circulation, its analysis is published in separate articles and special monographic studies [10]. Currently, the problems of the legal culture of society are among the most discussed in Russian scientific legal literature, and the very concept of legal culture is firmly included in the system of basic concepts of the theory of law, as evidenced by its inclusion in most textbooks and manuals on the general theory of law.

Without the task of considering the features of numerous definitions of legal culture, which for the most part repeat the differences of philosophical and cultural approaches, we focus on the most significant common features that characterize the phenomenon of legal culture from the point of view of modern Russian legal science. Let us note the following: legal culture stands out as a separate type of social culture with specific features; it is considered as a special state of legal phenomena of society, which is associated with the level of development achieved by legal phenomena; the level of development or the quality of legal phenomena is determined by the degree of accumulation of valuable, positive components in them.

At the same time, a number of problems remain in the modern Russian concept of legal culture, the solution of which is not produced directly from the philosophical and cultural definitions of culture and requires other methodological approaches based on the peculiarities of legal matter proper. One of these problems, which stands out as the subject of this study, is to identify the quality of those values that characterize legal phenomena as a culture. What are, in fact, the criteria that allow to separate the phenomena of legal culture from non-culture or anti-culture; What achievements and values created in practical legal activity work on the progress of the legal system of Russian society?

In modern Russian legal theory, the criteria characterizing the quality of legal culture are determined, as a rule, using terms such as “state”, “level of development”, “degree of implementation” and the like, which, according to the authors, are distinguished, for example, simply by lawmaking or the rule of law, from lawmaking and the rule of law as accessories of legal culture. It has to be noted that since a legal phenomenon exists, it already by virtue of this has a certain state, level of development and degree of implementation. You can, of course, say how this is often done, that legal culture is a higher level of state or development of legal phenomena. But then the question immediately arises: higher than what, where is the starting point for the transition of the state of legal uncivilization into legal culture?

With such a theoretical approach, it is impossible to adequately determine the cultural components in practical activities. For example, the existence of a totalitarian regime is usually accompanied by the most severe, higher level requirements for compliance with the acts adopted by the authorities. Is it possible to classify such a state of law as elements of a legal culture? Or, for example, it is difficult to refuse a number of laws in a high level of professional training. But when a mass of highly professional changes exceeding the volume of the original text is introduced into such a law in a historically short period of time, can this kind of law be attributed to the phenomena of legal culture? What about the fact that such an act undermines the basis of the perception by the subjects of social life of the law as a factor, not temporary, but permanent?

The foregoing is sufficient to conclude that no matter how much you add to the characterization of the legal phenomenon of epithets “degree”, “level”, “high”, “developed”, it does not become clearer what the quality of the elements of legal culture consists of, what are the criteria for distinguishing them. After reading a lot of literature on legal culture, in most cases it seems that the authors attribute certain elements of the legal system to the legal culture on an intuitive level or on the level of evidence of sensations. This gives good reason for some scholars to evaluate the category of legal culture as being in a very vague state [11, p. 3-8.].

Methodologically, the problem arises due to the prevalence in the analysis of the criteria of the legal culture of the positivist approach, when one state of the legal phenomenon is compared with another and the question of which one is better, more perfect, more useful, etc. However, at the stage of rational scientific thinking, the criteria of legal culture cannot be justified by subjective feelings about what is good or bad in law, about the perfection of the level of certain legal phenomena. Such ideas can always be successfully contrasted with ideas about legal values based on other subjective assessments. Valid criteria are determined by objective parameters; understanding of what elements acquired by the legal system are valuable for it and work for progressive development. Let's try to highlight these objective parameters.

The legal system appears empirically as a legal reality or direct being of the diverse legal phenomena of society, united in the process of streamlining social relations and protection from violations. The apparent existence of legal phenomena is a mixed stream of material and non-material, necessary and random, natural and spontaneous, in which the elements of legal culture are not designated by themselves. Their presence begins to be revealed when thinking distinguishes between the direct existence of legal phenomena and legal reality [12, pp. 126-127], which, in contrast to legal reality, is the sphere of manifestation of the essential basis of law.

The internal essential basis of legal phenomena is formed by legal will, as a special kind of social will. Its formation is determined by specific social needs; the bearer of legal will is society as a whole, and the spokesman is the social groups that dominate it; legal will has special objective goals - achieving a balance of interests of the main social groups, and ultimately - the harmony of these interests, by regulating, streamlining public relations [13, p. 253-258]. Like any social will, legal will unfolds in a focused objective practical activity aimed at achieving the goals laid down in it, and finds itself in the sphere of existence not only in separate legal phenomena or in their totality, but manifests itself in a consistent movement through various legal phenomena to the end result is the achievement of law and order, thus forming a completed legal reality [14, p. 150-158].

The relationship between legal validity and legal reality is contradictory. Legal validity is the potency of the essence of law, which is embodied in the elements of its content and forms, which are naturally necessary for the adequate implementation of the goals of legal will. Legal reality is what ultimately results from the realization of the potentials of the essence of law in the specific historical situation of a particular country, this is a sphere of manifestation of not only natural law, but also its various anomalies [15, p. 170-180].

Legal validity as an adequate expression of the essence of law represents the elements of the legal system that ensure the most effective functioning of legal practice, if this is not hindered by anomalous elements of legal reality into which legal validity is interwoven. Legal reality therefore potentially contains a desire to replace legal validity, freeing itself from arbitrary and random by transforming it into a substantial and regular one. This general tendency is found in the historical development and actual functioning of legal reality, determining the vector of its progress. However, it does not exclude the prevalence of negative objective and subjective reverse factors by increasing the number of anomalies of law and the regression of legal reality.

The key methodological moment, allowing to determine the objective basis for the production of the legal culture of society, is to understand the differences between legal validity and legal reality and the nature of their relationship. The legal system, realizing the needs of legal practice in effective functioning, naturally seeks the state of legal validity, gradually overcoming the features of legal reality. It is in this movement that a system of legal values is formed, developed, fixed and maintained that ensures the progress of the legal system, i.e. the legal culture of society is produced and reproduced.

Legal culture, if we consider its content on the essential side, concentrates in itself those legal phenomena and processes or those sides and elements that correspond to the laws of legal validity, its necessary content and forms, and ultimately - the legal will as the essence of law and implemented its goals. We emphasize once again that such goals are to achieve a balance and harmony of the interests of the subjects of social life, through the regulation and streamlining of social ties. It is quite appropriate to say that the legal culture accumulates and translates value-progressive elements that express elements of legal validity, as opposed to possible deviations from it in legal reality.

We note in conclusion that the legal culture does not develop where the slogans about the need to improve the legal culture of the population and professional workers are heard louder, but where there is a conscious and consistent work to transform legal reality into legal validity. It includes an awareness of the essential foundation of law, the necessary elements of its content and forms, the logical relationships between them, which is achieved at the level of fundamental legal sciences. Such work involves determining the features of the manifestation of the essential aspects of law in certain areas of its functioning, which is achieved by a complex of industry and special legal sciences. It consists of focused activities on the production by the entities of the legal system of the essentially necessary sides of law on the basis of practical thinking, which was transformed under the influence of the perceived achievement of the legal sciences of legal education.

What is reasonable is true; and what is true is reasonable - Hegel said in the preface to the "Philosophy of Law" [16, p. 53]. Legal culture is the statement of the rational, i.e. valid in law. From this it becomes clear what to focus on, setting the criteria of value in law. The development of legal culture should be determined by the degree of proximity of the elements of content and forms of law, all practical legal activity to the parameters of legal validity.



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私人补习是高中生主观地位的体现

**PRIVATE TUTORING AS A MANIFESTATION  
OF THE SUBJECTIVE POSITION OF HIGH SCHOOL STUDENTS**

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抽象。目前,在教育机构的学生中非常受欢迎的是由私人老师进行学校课程主题的个人补习。对于俄罗斯和外国而言,这种现象都不是新鲜事物,但是,正如研究人员所指出的那样,在过去的二十年中,这种现象已经广泛传播,这证实了这一主题的重要性。新颖之处在于利用辅导课的潜力,不仅可以解决增加学生学习和增加学术知识的问题,而且可以提高孩子的个人素质。本文介绍了补习班作为一种学习过程,旨在形成和发展学生的主观立场。

关键字: 导师, 私人教师, 主观职位, 主观性, 教学支持。

***Abstract.** At present, individual tutoring with a private teacher in the subjects of the school curriculum are very popular among students of educational organizations. This phenomenon is not new, both for Russia and for foreign countries, however, as researchers note, in the last two decades it has become widespread, which confirms the relevance of this topic. The novelty lies in the idea of using the potential of tutoring classes not only to solve problems of increasing student learning and increasing the amount of academic knowledge, but also to develop the personal qualities of the child. The article presents a look at tutoring classes as a learning process aimed at the formation and development of the subjective position of students.*

***Keywords:** tutor, private teacher, subjective position, subjectivity, pedagogical support.*

Currently, both in the Russian Federation and in other countries, there is a high popularity of classes for students with private tutors. If a decade ago, tutoring classes were positioned as short-term, aimed at achieving a certain educational result, now tutoring is often considered as pedagogical support for the child's educational activities. Studies state the following statistics: "As a result of a survey of 1505 parents of students in grades 1–11, it was found that 31% of Moscow schoolchildren use the services of tutors, namely: 13% of primary school children need

a private individual teacher, 28% schoolchildren in grades 5–7, in grades 8–11, up to 68% of students study with a tutor” [2, p. 106]. Based on this, we believe that the potential of these classes can and should be aimed not only at solving problems of increasing student performance and increasing the amount of academic knowledge, but also at developing the personal qualities of the child. Since classes with a tutor are not part of the traditional education system, but are carried out in addition to subjects of the school curriculum, a child who realizes the need for additional classes becomes the subject of his educational activity. Having realized his independence in gaining knowledge about the school lesson, having determined the goals of auxiliary classes, the student shows a subjective position.

In normative documents, including in the unified qualification reference book of positions of managers, specialists and other employees (UQR), in the section “Qualification Characteristics of Education Worker Positions”, approved by Order of the Ministry of Social Development of Russia dated 26.08.2010 № 761n [4], there is no such a teacher or specialist as a "tutor". In legislative documents there is only mention of the activities of tutors. In this article, the tutor is also referred to as a private teacher.

It is difficult to overestimate the significance of a person’s subjective position in modern society, since it implies independence, responsibility for one’s actions and reasonableness in decision making. The complexity and depth of this concept should also be noted. An analysis of the works of foreign and domestic authors on the definition of the concept of “subjective position” states the absence of a single universally accepted definition. Let us consider some interpretations of the concept of “subjective position” applicable to private auxiliary classes.

Mukhametzyanova F.G., Aksenova G.I. consider that “a personal subjective position implies active creative activity as opposed to passivity and reactivity of an object. The subjective personality position of the student includes:

- focused consciousness;
- effective goal setting;
- self-awareness as the manager of all his forming personality forces;
- freedom as a conscious need;
- the possibility of choice and therefore unpredictability to a certain extent;
- uniqueness, originality.” [5, p.12]

Having examined tutoring in this context, we are convinced of the subjectivity of a high school student in classes with a tutor. Conversations with high school students and their parents, as well as personal observations indicate that high school students, having come to the tutor classes, have a clear understanding of the goal, position themselves independently regarding school lessons. Private auxiliary classes are valuable in the possibility of free class planning, which is unattainable in the conditions of the mass class.

Garanina R.M. defines the subjective position as “an active, focused, positive and constructive position of a person, predicted as a prospective development, self-development and creative management of one’s own life” [3 p.217]. Indeed, having made the decision to study independently, the student becomes active in his educational activities, stops waiting when he is taught, begins to learn himself.

Garanina R.M. when analyzing approaches to the problem of the formation of the subjective position of the individual, comes to the conclusion that only “at the stage of education at the university does the student transfer from the subject of activity to the subject of self-development, since student age is the most optimal for the formation and development of subjective qualities and the formation of subjective position, develop own ideas and beliefs, the formation of a valued attitude (through the unity of cognitive and emotional) to the surrounding reality, and the effectiveness and the fruitfulness of such a transition depends on the quality of the reflex activity of the brain, personal activity, consciousness and the degree of self-expression in the process of cognition, subject-subject relations in the educational space, evolutionary self-development of the subject in the system of social relations” [3, p. 217 - 218]. However, analyzing the problem of private auxiliary classes for students in the subjects of the school curriculum, we conclude that students who consciously engage with a private teacher take the path of self-development at school age.

An objective reason for the effectiveness of tutoring classes is the individualization of instruction. “The essence of an individually and personality-oriented education is to teach a person to independently go through their educational path and maximize the use of various resources to build individual educational activities. It is the student, and not someone else, who is the customer for his education, he himself designs the content of his education and is responsible for it” [1, p. 72]. Private auxiliary classes for high school students are an eloquent illustration of the individualization of the educational process. Classes with a private teacher are attended, in most cases, by high school students who clearly understand the purpose of the classes and the planned result. In addition, FSES implies taking into account the individual characteristics of students in the construction of educational activities. Since the goals of the work of a private teacher are based on the specific educational needs of students, tutoring classes complement school lessons in implementing the requirements of the Federal State Educational Standard.

Tutoring classes, being initiated by the student himself, are a conscious choice of the student and his parents. The child already has motivation for learning activities outside of school, learning for himself, for himself; he understands that the success of tutoring classes will depend entirely on him, of course, if the tutor, parents and student have one common goal. Tutoring classes, being initiated by the student himself, are a conscious choice of the student and his parents. The child already has motivation for learning activities outside of school, learning for himself, self-learning ; he understands that the success of tutoring classes will depend entirely on him, of course, if the tutor, parents and student have one common goal.

Currently, a private teacher is positioned not as a teacher, communicating the finished knowledge to the student, but as a tutor, guiding the child in the educational process, creating conditions and shaping the subjective position of the student. One cannot disagree with the opinion of Stork, A., Walker V., [6] that improving academic performance is not the result of “dog training,” but the result of the student’s pedagogical support. The private teacher, having the position of a tutor, works not only on solving one educational problem, but creates the conditions for the child’s self-development.

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俄罗斯东部北极地区人口的健康状况  
**THE HEALTH OF THE POPULATION OF THE REGIONS  
OF THE EASTERN ARCTIC OF RUSSIA**

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抽象。 我们进行的旨在观察俄罗斯东部北极地区人口适应现代生活条件的研究表明,当地人口在适应北部生活方面遇到了巨大困难。 目前(2007-2018年),这些北极地区居民的健康潜力很低,儿童和成人的发病率和死亡率很高,这表明当地居民对极端环境条件的适应水平较低。

关键字: 俄罗斯东部北极地区, 适应性, 发病率, 儿童和成人的死亡率, 极端环境条件。

**Abstract.** *The studies we conducted to observe the adaptation of the population to modern living conditions in the regions of the Eastern Arctic of Russia showed that the local population experiences significant difficulties in adapting to life in the North. At present (2007-2018), the potential for the health of the population living in these Arctic territories is low and demonstrates rather high rates of child and adult morbidity and mortality, which indicates low levels of adaptation of the local population to extreme environmental conditions.*

**Keyword:** *Eastern Arctic of Russia, adaptation, incidence, mortality of children and adults, extreme environmental conditions.*

The successful development of the Eastern Arctic of Russia (EAR), which has enormous economic potential, is closely related to the problem of human adaptation, the peculiarities of the functioning of the physiological systems of the body in adverse climatic conditions of the Chukotka Autonomous Okrug (ChAO) and the Republic of Sakha (Yakutia). The study of the medical and geographical situation of the northern regions and the analysis of the relationship between population health and the geographical features of the territory are currently very relevant.

The environmental factors of the North that have a negative impact on human health are numerous and diverse. The EAR climate is characterized by cold, sharp fluctuations in atmospheric pressure, high humidity, high activity of heliocosmic factors, a sharp violation of photoperiodicity, frequent and large disturbances in the ionosphere, increasing the intensity and variability of the Earth's magnetic field to the north. There is a low mineralization of drinking water, a deficiency of biologically active elements, and insufficient supply of vitamins [1]. The Far North regions are characterized by: significant weather variability, manifested in barometric pressure drops (amplitudes up to 50 mm Hg); humidity fluctuations reaching 30-93%. The phenomenon of seasonal photoperiodicity is noted (polar day and polar night - north of the 67th parallel), which is characterized by abundant lighting with a low content of UV rays in summer and the effect of so-called light starvation in winter. The greatest importance in terms of the degree of influence on the human body is the lack of heat - the period of low temperatures ranges from 80 to 100 days a year (in the northern part of the region the heating period lasts almost the whole year). The influence of low temperatures is aggravated by the intense wind regime due to the high cyclonic activity characteristic of high latitudes. In the atmospheric air there is a low oxygen content, decreasing in winter to 19.8%. Strong geomagnetic disturbances are typical, which promote the growth of free radicals and a decrease in antioxidants with a further change in the cell membranes of organs [2,3]. Region-specific geomagnetic storms and accompanying processes (including auroras) affect the human body hundreds or more times more than at mid-latitudes and at the equator [4]. Bareness of the landscape and a long period of the polar night affect the psycho-emotional state of the newcomer population [5, 6]. The listed climatic factors have an adverse effect on the well-being and state of health of the population, primarily visitors, who make up a large part of the local EAR population. The newcomers include immigrants from various regions of the former USSR (Russians, Ukrainians, Belarusians, etc.) who do not have adaptive mechanisms, like those of the indigenous population, for living in high latitudes.

Summarizing the climatic characteristics of the region, it should be noted that they create certain conditions of discomfort for the living and life of the local population. Specific climate-related diseases here are vitamin, solar and immunobiological deficiency, the so-called cold syndrome, which provokes the development of a number of chronic diseases (bronchitis, arthritis, neuritis, etc.) and complicates the course of many diseases [4, 7]. Along with the climate-related discomfort of human habitation, there is also geochemically related, associated with a deficiency or excess of certain biogenic micro- or macrocells that form biogeochemical endemia. The deficient elements in the EAR include calcium, potassium, iodine, fluorine, copper, etc. All this creates the natural prerequisites for the occurrence of biogeochemical endemia (in particular, the pathology of dentin

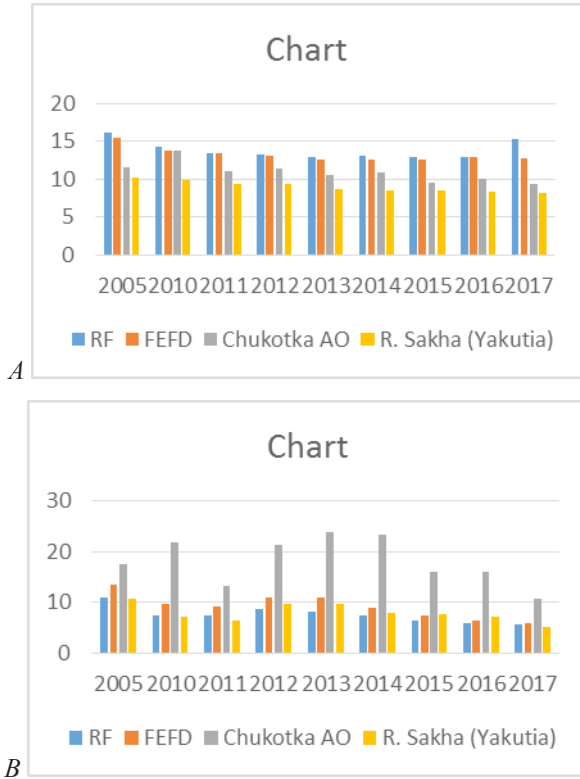
and endemic goiter) and other microelementoses. In addition to the natural and geochemical factors listed above, environmental and socio-economic factors also have a great impact on the health of the population, which must also be taken into account in a comprehensive assessment of the environmental impact on the formation of the population's adaptation to northern conditions.

Human health is a sensitive indicator of the environmental situation. Particularly noticeable changes in the human body are recorded in extreme environmental conditions, in particular in the Far North. The situation is aggravated by the population living in areas of pronounced anthropogenic press on the environment. Natural and anthropogenic factors, along with difficult socio-economic conditions, form local foci of a tense medical and environmental situation. In addition, EAR biogeocenoses have low resistance to economic factors and their recovery is much slower than in other regions.

The extreme expression of anthropogenic changes in the EAR is the low quality of life of the local population, which forms an environmentally dependent pathology with levels exceeding their background values in the territories located to the south. The regions of the North of Russia, especially those with a high level of technogenic impact, are characterized by the accelerated development of environmentally determined pathology, the complicated course of chronic diseases [6], premature aging and rejuvenation of mortality rates. The highest rates are recorded in the classes of diseases of the gastrointestinal tract and lungs [9]. Exceeding the all-Russian background by up to 10 times was noted in the class of congenital malformations in children, almost 2 times in the incidence of dermatitis, as well as in the incidence of respiratory diseases and malignant neoplasms. Negative environmental factors reduce the life expectancy of the population of the North of Russia, especially those living in industrial centers. The indicators of the upcoming life of northerners are 2–5 years below the national average: 54–58 years for men and 69–71 years for women [10].

The analysis of the geographical features of the territory revealed that there is a predisposition to the development of a number of natural focal diseases, which ultimately poses a threat to the epidemiological safety of the population. These are diseases of wild animals living in nature in certain geographical conditions within natural foci [11]. Pathogens are poly pathogenic and can be transmitted to humans, causing diseases in them. In the north, high incidence rates of opisthorchiasis were recorded (52.4 cases per 100 thousand people). Natural foci of tularemia caused by a population of pathogens among lemmings (tundra zone), hares, muskrats, water voles, and small mouse rodents were noted. The area of the natural center of rabies, associated with the circulation of rabies virus among arctic foxes and deer, has been identified. In connection with the reindeer husbandry developed in the forest-tundra zone, the spread of rabies is of epidemiological importance [12].



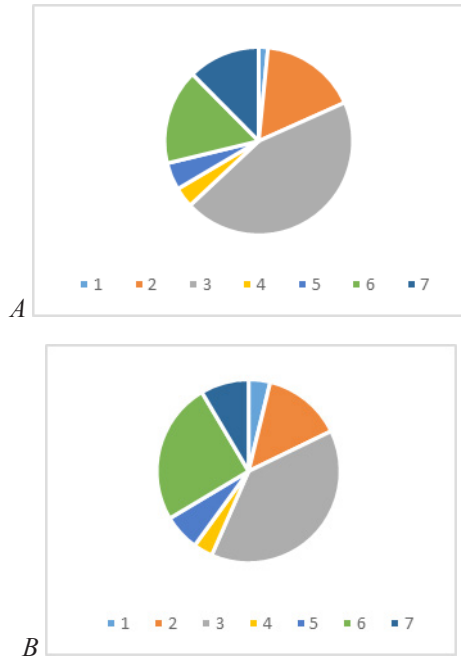


**Fig. 1.** The dynamics of mortality in the regions of the Eastern Arctic:  
 A. – total population (dead per 1000 population),  
 B. – infant mortality per 1000 live births).

To calculate the health potential of any territory, it is necessary to take into account the characteristics of the dynamics of mortality and morbidity of the entire population, infant mortality and child morbidity in certain regions. Thus, the total mortality of the population in the regions of the Eastern Arctic (Fig. 1A) in recent years has been lower than or equal to the total mortality in Russia and had a general downward trend. Mortality rates in Yakutia were consistently lower than in Chukotka. This is possibly due to the fact that all areas of Chukotka are fully included in the Arctic zone with a more severe climate, and Yakutia includes, in addition to the Arctic territories, regions of Siberia with a more comfortable climate for living. Infant mortality also tended to decrease, but in the Arctic regions, especially in the ChAO, it was 2-3 times higher than the all-Russian indicators

(1B), which can serve as an indicator not only of the severity of the climatic conditions of the region, but also a general indicator of the level of discomfort of the population living on this territory.

The mortality structure of the population of the Arctic regions from all causes is similar to Chukotka and Yakutia (Fig. 2 A, B). The main cause of death is cardiovascular disease: in Yakutia – 44.7%, in ChAO - 38.9%. In second place in Yakutia is mortality from neoplasms (Yakutia -16.7%, ChAO – 14%), and in ChAO – mortality from external causes (ChAO – 25.1%, Yakutia – 16.4%). Among the external causes, quite high indicators of the causes of suicide mortality (Yakutia - 3.4%, ChAO – 3.6%) are noteworthy, which indicates overstrain in the North of the nervous system and an imbalance in the mental health of the population, which leads to stress.



**Fig. 2.** The structure of mortality from all causes in the Republic of Sakha (A) and ChAO (B):

Mortality: 1 – from infectious and parasitic diseases; 2 – from neoplasms; 3 – from cardiovascular diseases; 4 – from respiratory diseases; 5 – from diseases of the digestive system; 6 – from external causes; 7 – from other diseases.

The average primary incidence rates for the entire population of EAR regions in 2018 were significantly higher than the average for Russia (Fig. 3A). In ChAO, it amounted to 1278.4 cases per 1000 population, in Yakutia - 1015.3, and in Russia only 778.9.



**Fig. 3.** The dynamics of the primary morbidity in the EAR regions:  
 A. - all population,  
 B. - children 0-14 years old (per 1000 people)

A negative development trend was observed in the incidence of the population for the study period from 2007 to 2018. In Yakutia, the incidence increased by 8%, in ChAO - by 9%, while in the Russian Federation - only 1%.

The first place in the structure of the incidence of EAR population is occupied by respiratory diseases. The respiratory system is practically the only system that cannot be protected from adverse effects by a reliable artificial barrier.

There are three groups of exogenous causes that induce significant tension in the respiratory system:

I group – real factors with a pronounced pneumotropic effect, these include cold exposure to the upper respiratory tract, trachea, bronchi, cooling of the face, a combination of low temperature and strong winds, as well as anthropogenic pollution of the atmosphere of northern cities;

II group – real factors with an unclear mechanism of action on the respiratory system — meteorological variability, exogenous fluctuating hypoxia of the North, geomagnetic disturbances;

III group – hypothetical factors, which include unipolar positive aeroionization, a possible decrease in the oxidative potential of atmospheric oxygen.

Tooth decay is widespread in EAR. On the coast, it is found in 100%; an increase in the thyroid gland - in 15-20% of the examined. The predominance of low-mineralized, so-called soft drinking water (with their long-term use) in the region creates the prerequisites for the development of cardiovascular pathology. Among the endemic diseases of the territory under consideration, hypophthorosis, hypoidism, urolithiasis, gallstone disease, bone pathology, etc. are distinguished.

Children's morbidity in the Republic of Sakha (Yakutia) and its Arctic regions is characterized by a more unfavorable situation (Fig. 3B). The average rates of primary childhood morbidity in the EAR regions in 2018 were significantly higher than the national average. In ChAO, it amounted to 3064.0 cases per 1000 population, in Yakutia - 2328.1. An extremely negative trend in the development of childhood morbidity was noted from 2007 to 2018. In Yakutia, the incidence increased by 22.2%, in ChAO - by 26.8%.

In the structure of children's morbidity in the Arctic regions, respiratory diseases predominate significantly, digestive diseases, injuries, poisoning and other external causes, skin and subcutaneous tissue diseases, and some infectious and parasitic diseases are much less represented.

Thus, the adaptation of the population to the extreme conditions of the Arctic regions, the risk of diseases in the Arctic territories is determined not only by natural and environmental factors, but also by socio-economic conditions - the nature of the development of the territory, the sanitary-hygienic situation, and the dietary characteristics of the population. Currently, the potential for the health of the population living in the Eastern Arctic of Russia is low and shows rather high rates of child and adult morbidity and mortality, which indicates low levels of adaptation of the local population to extreme environmental conditions.

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M.O. 门希科夫对1917年革命极端主义进行的社会哲学探索  
**M.O. MENSHIKOV'S SOCIAL-PHILOSOPHICAL SEARCHES  
GENERATED BY THE REVOLUTIONARY EXTREMISM OF 1917**

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抽象。20世纪初M.O. 门希科夫 (Menshikov), 反映了十月革命前夕改变该国社会和政治状况的过程。在革命极端主义时代的最后几年, 门希科夫试图找到公众幸福的良方, 思考资本主义和社会主义, 探讨它们在国家 and 世界上建立公正和繁荣的社会中的作用, 但是内战的残酷现实悲惨地结束了对社会主义和社会主义的追求。M.O. 门希科夫。

关键词: 极端主义, 民族主义, 社会主义, 保守主义, 自由主义, 黑人, 全俄民族联盟, 十月革命, 白人运动, 资产阶级制度。

**Abstract.** *Evolution of public views of the prominent Russian publicist of the beginning of the 20th century M.O. Menshikov, which reflected the process of changing the social and political situation in the country on the eve of the October Revolution. In the last years of his life in the epoch of revolutionary extremism M.O. Menshikov tried to find a recipe for public happiness, thinking about capitalism and socialism, about their role in creating a just and prosperous society in the country and in the world, but the rough reality of the civil war tragically ended the social and philosophical quest of M.O. Menshikov.*

**Keywords:** *extremism, nationalism, socialism, conservatism, liberalism, the Black Hundred, All-Russian National Union, October revolution, white movement, bourgeois system.*

Liberal reforms of the mid-60s of the 19th century had a radical impact on Russian journalism. In a short time, a new reader appeared in Russia, not too educated, living far away from the capital, but nevertheless, vividly interested in the social and political situation in the country. From the old sophisticated noble

reader, he was distinguished by his unpretentiousness and lack of refined taste. And the main thing is that this new reader was, for example, still quite numerous. These circumstances gradually led to the fact that the former social-literary magazines were noticeably pressed by newspapers, but newspapers of a new type. One of the first such newspapers was the "Novoye Vremya" ("New Time") newspaper under the leadership of A.S. Suvorin. Soviet art historians I.N. Solovyov and V.V. Shitova came to the conclusion that the Suvorin's newspaper was the main pre-revolutionary publication, which carried out the ideas of "ordinary bourgeois consciousness", "common people" and thus sought to form a "middle class" [8, p. 168, 174], which was supposed to be the backbone of capitalism. We are in tandem with this view, adding that "Novoye Vremya" ("New Time") not only ideologically shaped this "middle class", but at the same time was the spokesman for its opinion, otherwise it would not have been able to achieve such popularity, which was expressed in huge numbers of copies.

Based on this orientation of his newspaper, A.S. Suvorin deliberately abandoned the traditional orientation of previous editions towards a particular social and political trend, employing journalists exclusively on the basis of their talent. It happened that the same issue could have contained contradictory materials. A.S. Suvorin was proud of this approach, believing that "the newspaper is not a collection of truths, but a collection of opinions".

Such different personalities as the religious philosopher V.V. Rozanov, brother of the Prime Minister A.A. Stolypin, odious critic V.P. Burenin got along in this "collective". M.O. Menshikov was especially popular among the employees of "Novoye Vremya". A retired sailor without a professional literary education, but with a certain journalistic experience, he managed to find the right tone of an intimate conversation with the reader, as with his old acquaintance, leading the newspaper column "Letters to others". In the constantly changing conditions of social and political life in pre-revolutionary Russia at the beginning of the century, the reader-user needed a simple and understandable explanation of what was going on. And the navigator-publicist was able to give such explanations, based, for the most part, not on scientific knowledge, not on recognized authorities, but on everyday experience.

M.O. Menshikov belonged to the generation of people who owed their success to the "great reforms" of the reign of Alexander II. "I came out of extreme poverty", he confessed in his diary at the end of his life, "and got rich to the degree of a millionaire" [1, l. 7]. Despite his loud name, M.O. Menshikov came from an unknown family. On the mother's side, he belonged to a noble family. His grandfather was a priest, his father was a small official, for lack of money, who lived with his family in a peasant hut. The turning point in Mikhail Menshikov's life was his admission to the Kronshtadt Marine Technical School with the help of an influ-

ential relative. Even during the years of his studies, the future publicist began to demonstrate literary talent, but he decided to engage in professional literary activity only after a successful naval career, which guaranteed a stable pension. Having retired as far as possible, he soon made a brilliant journalistic career. Menshikov's success was not least due only to his high ability to work. However, shortly before his death, having been left out of business and with little to no means of subsistence as a result of the February revolution of 1917, M.O. Menshikov was inclined to attribute this success to a lucky confluence of circumstances, clearly underestimating his merits: "Without my demand, I was luxuriously paid for easy work" [3, p. 411–431.].

The readers found in Menshikov's articles what they had in mind. He was able to express their thoughts and aspirations. According to Menshikov's articles, we can trace the transformation of the views of the nascent middle class in pre-revolutionary Russia. A special characteristic of this class was its certain conservatism, but conservatism of a special kind. Remembering the difficult situation from which they or their parents managed to "get out of the way", this class, unlike other social groups, wanted not so much to improve life (as liberals) or return to the past (as the extreme conservatives), but to preserve what was available at the moment. To some extent, it was a model of moderation, as the ancient Greeks said, embodied the "golden mean", opposing the political and social extremism of the era. But since the situation in the country was constantly changing, so were the conditions under which it was possible to maintain such a status quo, and therefore, M.O. Menshikov and his readers also had to change their views.

The publicist took the establishment of the parliament as a given and relied on its fruitful work. Then he supported the coup d'état in June 1906. Like his readers, he, then, with approval, then with disbelief, watched P.A. Stolypin's attempts to lead the country "on a light brake forward". Like most of his readers, M.O. Menshikov considered all the leftist parties, including the Octoberists, unacceptable, but at the same time he was not satisfied with the activities of the Black Hundred organizations. As Don Rawson mentioned the Black Hundred "found themselves in the paradoxical situation of taking independent public action in order to place autocratic power in the ruler's hand" [4, p. 225 – 229]. As a result, he took part in the creation of a new party, becoming one of the ideologists and founders of the All-Russian National Union. At the heart of its program, the party did not put political or economic slogans at all, but a clear and simple principle of nationalism "Russia for Russians", which M.O. Menshikov called "the slogan of the Russian Renaissance" [6, p. 93]. This principle was borrowed from the Black Hundreds, but with the caveat that "Russians" are all those who put the interests of the Russian state above the narrow national ones. He sincerely believed in the national idea, but when the nation began to lose the war and allowed the fall of the monar-



chy, he moved from nationalism to the idea of globalization. In his diary of 1918, M.O. Menshikov wrote: "The superstition of nationality will pass when everyone learns that they are a mixture of amalgam of different breeds, and when they make sure that nationalism is a transitional stage for the world's human type - cultural ... Flowers do not fight between themselves, but peacefully fill each other, serving the harmony of forms and colors" [5, p. 17].

Menshikov's variability in views became a parable in the pagan shop even during his lifetime. This provoked attacks from both fellow journalists and fellow party members. But that was exactly what he was close to his reader. He was a kind of barometer of this reader's mood, and he did not lose this quality even after being fired from the newspaper at the request of the Provisional Government and having no other job, he was forced to leave for Valdai with his family.

Having been deprived of the opportunity to communicate with his readers, the journalist was actively engaged in a dialogue with himself through a diary. Among the various topics addressed by M.O. Menshikov in the last two years of his life, it is worth mentioning his reflections on the causes and consequences of the February revolution, in which he singled out not so much the political and economic, but rather the religious and ethical components.

Having found himself in the position of the majority of his former readers, watching what is happening in St. Petersburg from the outside, learning about political events from newspapers and rare letters, M.O. Menshikov as once a hero of Dostoevsky, comes to the conclusion that not only the political system, which tried to save the Provisional Government, but also the spiritual foundation of the collapsing political system - Christianity - is insolvent. One of the entries in his diary, dated August 5, 1917, according to the old style, is called "Christianity failed" [1, l. 9]. The basic mistakes of Christianity (as well as other world religions) the retired publicist saw in absence of a practical beginning and in idealization of people. "The Prophets thought," he thought, "that mankind in all its masses is able to perceive the idea of love for neighbors and moral purity, and to reconstruct life according to this idea" [1, l. 9]. Meanwhile, according to M.O. Menshikov, Christianity, like other moral teachings, can only be perceived in its purest form by a few, and it is impossible to build voluntary reform on the tiny minority of the population. From this reasoning, the publicist came to the unexpected conclusion that the Christian mission is capable of performing socialism: "Socialism," he writes, "is a great guess about what Christianity should do, like railroads or tunnels, not preaching, but deciding by some kind of power will. He sees socialism as a kind of good news, "salvation from all troubles and evil" [1, l. 10]. In the place of the Messiah or the Savior, socialism, through the mouth of M.O. Menshikov, puts forward the man himself: "This savior - you yourself, you will be united for the great goal of general salvation. Menshikov in his secluded thoughts departs from the

orthodox understanding of God and the miracle, proving: "There is no God in the world, acting on his own or our whims, bowing to our pleas, smoking and burning candles. Humanity prays in an empty space. But there is God, the world we enter, the world that produces the same natural wonders forever and in the order of natural wonders or laws, or saves or destroys us. It is up to us to either throw ourselves down from the roof or to go down the stairs: in one case, a natural miracle kills and preserves a human being in another" [1, l. 10]. Thus, Menshikov's religious views of this period can be regarded as pantheism, as it represents God with the natural forces of nature. God ceases to be a transcendent category and, as a consequence, socialism is presented as: "Christianity, freed from mysticism. I am deeply convinced," says M.O. Menshikov, "that socialism is a machine for a happy society that has already been invented, but has not yet been put into use" [1, l. 10].

Such a view of socialism might seem surprising, but the enormous and, as we noted above, contradictory heritage of the publicist in different periods of time met works that allowed some modern researchers to see the presence in the views of M.O. Menshikov certain socialist notes long before the revolutionary events of 1917. In particular, one of the few researchers of Menshikov's works of the early period, N.V. Zverev, studying Menshikov's articles of the period of cooperation in the folk "Week", devoted to the land issue, comes to the conclusion that they contain, albeit in an amorphous form, the idea of the "state of social justice" [9, p. 61], which the author believes can be interpreted as a kind of "prototype of the socialist state". N.V. Zverev also notes Menshikov's critical attitude to capitalism, which, together with technological progress, also caused "moral degradation of the individual" [10, p. 87].

S.M. Sankova, historiographer of Menshikov, also revealed similar views among Y.M. Kagramanov, who, in her opinion, has accurately revealed the contradictions of Menshikov's judgments concerning socialism: on the one hand - condemnation, on the other - approval" [7, p. 157]. She cites Kagramanov's illustrative judgment: "Live longer in M.O. Menshikov, he would have seen the rebirth of ... the elements of the armature he cherishes: a new general fortification, and the "iron structure" of the state, and the "prince" with a "metal" surname ..." [2, p. 17 – 20]. From himself, it should be noted that Y.M. Kagramanov based his reasoning solely on the articles of M.O. Menshikov, without resorting to his diary entries, which did not allow him to fully solve the question of whether M.O. Menshikov accepted the coming socialist system or not.

In his diary M.O. Menshikov offers a certain rescue program, which largely anticipated the slogans of the Bolshevik government after the October revolution. The first necessary condition for M.O. Menshikov is a strong power that can force everyone to obey a single law. He believes that such power is possible on one condition, if the world's poor unite and refuse to exterminate each other on the command of rich, class-leaders. This condition M.O. Menshikov explains by the fact

that, in his opinion, wars have always been and are a source of wealth and power, and the general world will contribute to the maintenance of universal equality both within and between states. The idea of the need for universal peace appeared in the pages of Menshikov's diary a few days earlier in the course of reflection on the reasons that prompted Germany to start the war. He had utopian plans: "Let's unite into a common world homeland! To hell with the Habsburgs, the Hohenzollernes, the Romanovs, and all that old medieval power buffoon! Let's establish a world parliament, which would meet for three years in Berlin, another in Paris, the third in London, the fourth in Moscow, etc. The world of the worlds - no matter what!" [1, l. 5].

The next item on the M.O. Menshikov program is the nationalization of capital and means of production. M.O. Menshikov writes: "Never convince neither the people, nor the mankind to heal with a brotherly, pious life, but it is possible to put the people and mankind in the conditions of piety and brotherhood in almost silence. To do this, the authorities (which are still in charge) must declare their determination to support violence: the means of labour - land and machinery - are common. Labor must be common and obligatory. The products of labour must be common. Then there will be no poor and rich, envious and envious, oppressed and oppressed" [1, l. 10 – 10 A]. Only under such conditions, in Menshikov's opinion, will the kingdom of God come, by which he understood the creation of conditions for the perfection of the human race: "If you want bliss, reach it yourself, using your mind and your love. God, through his realization - the world - will give you powerful support and powerful obstacles. It is up to the human mind to enjoy support and bypass obstacles. Start your own salvation!" [1, l. 10].

On the same day, M.O. Menshikov described in his diary a family dispute about socialism, where he was an opponent of his wife and mother-in-law, who cursed socialism, especially forced labour. M.O. Menshikov, on the other hand, assured that he was ready to work under the pressure of the socialist system for the confidence that he and his family would have a guaranteed livelihood. "Forcing me to work in the old bourgeois system was not news to me: hunger and pity for my family made me work in the old bourgeois system" [1, l. 7]. Obviously, Menshikov's position was influenced by the life situation in which he found himself and the fear for the future of the family.

The events of October 1917 forced M.O. Menshikov to return to the understanding of socialism and the reasons for the collapse of the bourgeois system. He writes down his thoughts, entitled "The Way of Salvation". Despite the fact that three months earlier M.O. Menshikov talks about socialism as a future model of society, now he speaks about it more modestly: "The question is," he ponders, "whether socialism represents a successful invention, that is, whether it is consistent with the conditions of truth" [1, l. 25]. In order to answer this question, he recommends that we first try it out in small states.

It should be noted that M.O. Menshikov was arguing in August 17, along with the statements about his readiness for forced labor: "I, a man who once appeared on earth in eternity, do not want to be a slave to a single monarch or to a mass of 160 million people. I deny the infinite power of anybody, even of the entire human race" [1, l. 16]. However, he already sees the irretrievability of the bourgeois system, believing that he is less satisfied with the demands of the people than even the serfdom. The problem with the bourgeois system, according to M.O. Menshikov, is that he has removed almost insurmountable barriers between the classes, establishing the "right of general competition".

In the diaries of 1918 M.O. Menshikov is even more critical of socialism and seeks to find positive moments in the capitalist system. In the old, free order, he argued, "everyone was given the opportunity to look for the state which he particularly liked... It is not necessary to abolish the freedom of competition, but to ensure it, and only then Darwin's selection of viable ones will be properly carried out". M.O. Menshikov declared "disrespect for inequality to be "the greatest sin" [5, p. 28].

Thus, Menshikov's diary records show the inevitability in his view, after the February revolution, of the advent of socialism, which he viewed not only as a new social and political system, but also as a renewed model of Christianity. However, this option, despite the ambiguity of the publicist's statements, was not acceptable to him personally.

M.O. Menshikov was not destined to solve the question of his compatibility with the socialist system in practice. The Bolsheviks continued to consider the publicist, following the definition of V.I. Lenin, the "singer of the Black Hundred". August 20, 1918. M.O. Menshikov was shot as a hostage, but was later accused of involvement in the anti-Bolshevik conspiracy [5, p. 250]. There was no conspiracy, M.O. Menshikov was not going to join the white movement, which, however, later declared it one of the first victims of red terror.

A talented publicist, a bright thinker, in the last years of his life in the era of revolutionary extremism tried to find a recipe for public happiness, reflecting on capitalism and socialism, on their role in creating a just and prosperous society in the country and in the world, but the harsh reality of civil war tragically ended the social and philosophical quest of M.O. Menshikov, leaving them unfinished. Is it possible to overcome the imperfection of man and mankind in a broad social context, what is the role of social engineering in this situation? The controversy is still not over today.

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关于理解存在的完整性的一些方法  
**ON SOME APPROACHES TO UNDERSTANDING  
OF THE INTEGRITY OF BEING**

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抽象。 本文讨论了在现代条件下存在问题的实现,完整性作为存在法则及其在统一原则中的概念性表达及其在世界知识中的作用。

关于在哲学和科学思想中发展的理解认知的方法,关于意识的存在,自我意识,反思的存在。 关于古代印度人,古代中国人,古代希腊人的智慧,关于俄罗斯古代哲学。

关于整体类别和唯一类别中存在知识的相关性。 关于发展现代整体世界观的需要。

关键词: 古代智慧, 世界观, 存在, 非存在, 完整性, 统一原则, 意识存在, 自我知识, 反思, 条件真理, 绝对真理。

**Abstract.** *The article talks about the actualization of the problem of being in modern conditions, about integrity as the law of being and its conceptual expression in the principle of unity, their role in the knowledge of the world.*

*About approaches to understanding cognition that have developed in philosophical and scientific thought, about the beingness of consciousness, self-awareness, reflection. About ancient Indian, ancient Chinese, ancient Greek wisdom, about Russian ancient philosophy.*

*On the correlation of the categories of the whole and the sole in the knowledge of being. About the need to develop a modern holistic worldview.*

**Keywords:** *Ancient wisdom, worldview, being, non-being, integrity, principle of unity, beingness of consciousness, self-knowledge, reflection, conditional truth, absolute truth.*

The problem of being, an understanding of its essence, integrity, is connected with an understanding of cognition, consciousness, its role in comprehending historical and unconditional truth, determining the limits of cognition. Consideration of these issues in modern conditions is of particular importance not only for Russia, but also for the entire western and eastern world.

The history of philosophical thought has developed different approaches to these ultimate, unconditional and transient, historical issues. It is believed that the foundations of their consideration were laid down by ancient Greek philosophers. But a more ancient thought is known, aimed at searching for the beginning of the world, the characteristic of being and its knowledge.

In ancient Indian philosophy, the origin of the world is represented by the Supreme Lord. Along with it, being included and constitute the whole, the Highest Absolute Truth - the manifested cosmos, living beings, time and karma. That is, everything that exists includes both that which is accessible to the perception of man, and that which is beyond.

In ancient Greece, the representatives of the Milesian school first began to deal with questions of being and its knowledge: Thales (c. 625-545), Anaximander (c. 610-540), Anaximenes (c. 585-525). They referred to the elements of life as natural elements: water, apeiron, air. They saw the principle of being all that exists in the world<sup>1</sup>, contained the philosophical representation of the world as a single whole, consisting of many single things. Initially, they have considered universal, eternal, permanent. Single things - temporary, transient.

In integrity, the basis of which, according to Anaximander, apeiron, is seen as the universal law<sup>2</sup> of being, existing, expressed in a word by the principle of unity. Plotinus (205-270) speak about the law of integrity as the internal law of the One, which is the beginning of life, generating the Divine and human consciousness, about the Universe, consisting of numerous and interconnected elements.

In Heraclitus (544-483), multiple, limited, ultimate, finite being is eternal formation, the source of which is fire, the objective law is the struggle, its measure, and existence, the integrity of being and order in it are associated with rhythm and cycle.

Parmenides (540-450), a representative of the Eleat school, characterized being as one, whole, eternal, extended, infinite, unchanging. Change can only lead to non-existence, and Parmenides denied it. Later, Sartre will similarly characterize being [16].

<sup>1</sup>Perhaps here we can talk not only about the correlation of being, but also its identity with the concept of being. It is believed that the terms of being and non-being were introduced by Parmenides. The question of existence and being as a concept is formulated by Paid in his "Sophist". It says: the person involved in being is existing, other than being (for example, movement) is non-being. Then the problem of being was justified by Aristotle.

<sup>2</sup>It is believed that the term "law" was introduced by Anaximander. The essence of the law was known long before Anaximander. In Slavic-Russians, the universal law was called *rota*, it meant integrity, unity, interconnection and a constant circulation of parts of the universe. Among the Indians, it was called *rita*, *rita*, among the Latins it was *veritas*. A.S. Pushkin knew about it, who wrote about the golden chain (Universal Law) on an oak tree, which ancient wisdom associated with life, the Universe, M.Yu. Lermontov, Griboedov. The Russian cosmists were guided by him.

Democritus (460-370) believed that everything that exists, including the state and law, consists of atoms. Atoms, arising from "cleaner matter" (non-being), when combined, give rise to various phenomena of the material world.

Plato (427-347) used the position of both Parmenides and Heraclitus, and the numerical symbol of Pythagoras, to a certain extent, possibly, Democritus. Being, according to him, is represented by an unchanging world of ideas. This world constitutes genuine being, and truth is embodied in it. The world of sensual things between being and non-being is limited, changeable, imperfect, therefore it is inaccessible to true knowledge and is being in opinion.

Aristotle (384-322) criticizes the views of his predecessors, saying that no one has clearly explained the essence of being a thing and essence [1]. His diverse being is represented by matter, which has a form and is the basis of all changes, and divine being - an eternal, motionless entity.

In anthropological consciousness, being is represented by sensually perceived things about which nothing can be said definite, the sophists claimed (5th century BC). There are only opinions, therefore, how many people, so many opinions and truths. Therefore, Protagoras (486-411), guided by the principles of ethical relativism and individual benefit, called man the measure of all things.

Such a concept N.G. Kholodny (1882-1953), a representative of the philosophy of anthropocosmism and the evolutionary theory of knowledge, described as a reflection of the reaction of human consciousness to its dependence on nature.

This reaction to man's dependence on nature escalated in connection with the affirming rationalization of consciousness, which determined the consideration of being through the category of substance. The substance of Spinoza (1632-1677) is identical to natural nature. Berkeley (1685-1753) considered substance to be spirit. Descartes (1596-1650) claimed the independent existence of two substances: thinking matter, consciousness identified with reason, and extended, inanimate matter, nature.

Further rationalization, reflected in the ideology of the Enlightenment, embodied in the French Revolution, led to the actualization of the cognitive subject, expressed in the philosophy of Kant (1724-1804) and Hegel (1770-1831). In relation to being, Kant operates with the concept of totality, which reflects totality, unconditionality, qualitative completeness, unity, including many. And this absolute totality of all phenomena, he has only the idea of transcendental mind [11].

Being in Hegel's doctrine appears at first as pure being, as an idea in which the integrity of the world is embodied, an absolute thought of it, as a thesis, almost equal to the antithesis of non-existence. Their synthesis in formation gives a become, present being, which is characterized by certainty, and therefore - oneness and finiteness, which is the basis of infinite occurrence. Hegel called these qualities of being, this infinity bad, after the ancient Greeks introduced the concept of measure, as the unity of quality and quantity, in which being reaches final definiteness and called God the measure of everything. Consciousness has a thinking spirit, and the basis of knowledge is an absolute idea [5].



The connection with Plato is obvious, in which the knowledge of the real begins with recollection, finding in the depths of consciousness a universal, holistic thought, an idea representing true reality, unconditional, unchanging being.

A. Bergson (1859-1941) called all thinking people Platonists, since the human mind, he said, tends to search into which well-known idea the object being studied can be credited to [2]. The search for the human mind, aimed at cognizing the world, begins with a way out of integrity - this universal law of being, with the realization of human presence, says I.A. Isaev [9].

In accordance with this constant search for the human mind, different approaches to cognition of the integrity of the world are highlighted. Cognition is considered through the beingness of consciousness, self-knowledge, reflection.

According to Parmenides, who, as is commonly believed, laid the foundations of the knowledge of being, it is carried out in the process of reflection, which gives the truth, and feeling determines the opinion. Therefore, knowledge arises from general, a priori assumptions, and not from experience. The connection of being with thinking is expressed in the words: to think is to be. Later, Descartes will say: I think, therefore I am.

It is believed that Plotinus has a special way of knowing the whole, the truth. It consists in combining human consciousness with the whole idea of Divine consciousness, which is realized not so much by sensory perception as by supersensible intuitive comprehension. This peculiarity of comprehending the whole is initially visible among the Slavs, the ancient Indian and ancient Chinese thinkers, and it can be attributed to the knowledge realized through the beingness of consciousness.

An explanation of this feature can be approached from the position of the law that Newton discovered for material bodies, the law of universal gravitation. According to this law, the elements of the Universe, flowing from the One, the whole, are attracted to each other and to the whole. This law can serve as the basis for understanding a person's physical ability to interact with elements of the Universe, his energy (spiritual) ability to connect with the divine consciousness, to comprehend the source of being - the whole.

The knowledge of the whole in ancient Indian philosophy is carried out through the beingness of the consciousness of a living being (jiva), as a part of a higher material nature endowed with a consciousness acting within one body, similar to the consciousness of the Supreme Lord, the higher consciousness that extends to all bodies. The consciousness of a living being is self-awareness, i.e. understanding that "I am," "I exist." In the material, defiled consciousness, "I" - a product of a lower nature.

Man, as part of a higher nature, as a manifestation of divine energy, having a common spiritual essence with the Almighty, focusing on eternal, holistic being, is able to purify his consciousness through turning the thought inward, to the fact of being of consciousness itself, and not to objective experience [4].

In ancient Chinese philosophy, consciousness is represented by two types of reality: the consciousness of the actual, conditional individual being of mental processes and the universal, unconditional, single, other-existent consciousness. Cognition of the whole, of consciousness itself and being itself is connected with the inner beingness of consciousness, expressed in the transitions of movement and peace, in the action of intelligence and intuition. In this life stream, a single consciousness is born and its creative power, unlimited potency, called “de”, concentrated in the heart, is actualized. It is no accident that the concept of consciousness in the Chinese tradition is indicated by the word *Xīn* (heart). Consciousness, the source of which is the heart, can take the path of comprehending the integrity and consciousness itself, and the integrity of being [8].

The meaning of the movement of individual consciousness is to achieve the optimal state and functioning, in particular, of the state, and the optimal behavior carried out by wise rulers. The transition from this consciousness to a hidden, unconditional consciousness is associated with a distraction from existing being, the empirical world, with overcoming of experimental knowledge and liberation from the dominance of intelligence. It is concluded, according to Chuang Tzu (369-286), a representative of Taoism, in deepening oneself, in achieving peace (*jing*) and emptiness (*xǔ*) [20]. This is, as if a condition for the action of unconditional consciousness, capable of knowing the Tao path.

The knowledge of the Tao path is the knowledge of being, the fullness, unity, integrity of the world, and it is not the accumulation of information about this world, but its comprehension. To characterize this path leading to perfect wisdom, Confucius uses the following digital expressions in semantic (and not arithmetic) meaning: “know two by one”, “know four by one”, “know ten by one”. This deep wisdom, from which many conclusions follow. The main one is the knowledge of a single whole, including the manifested and latent consciousness, and being [12].

Socrates (468-399) expressed the problem of cognition in the thesis "Know Thyself" [15]. He can see the desire for knowledge of the one. But the whole course of his judgments about knowledge is carried out through the analysis and generalization of particular relative opinions, and knowledge consists in general concepts. And the laws of heaven, in his understanding, are inaccessible to knowledge.

The position of Socrates was the result of the opposition of the position of Protagoras, for which existence is only what it seems to each individual person and whose principles of knowledge are the principles of individualism, sensual-

ism and relativism. And the followers, guided by the thesis of Heraclitus about the general course and change, declared: some - about the impossibility of thinking movement without contradictions, others - about the impossibility of cognition in general.

Cognition in Plato is carried out by the supra-individual consciousness of the unconditional idea in which integrity is enclosed. Concepts, in his view, in contrast to conditional opinions about the changing, transient phenomena of conditional reality, should reflect the unconditional existence of ideas and be interconnected with them. According to N.M. Korkunova (1853-1904), Plato came to the distinction between two worlds: that which always is and never happens, and that which always happens and never is in reality [14].

The principle of reflection, which is the basis of rational cognition associated by F. Bacon (1561-1625) with the accurate display of objects and natural phenomena, established in modern times, dominates in modern conditions and determines the purpose of modern scientific knowledge, which is aimed at changing the world and adapting it to human needs.

Scientific knowledge, carried out on the basis of the principle of reflection, is aimed at the formation of theoretical concepts needed by modern civilization. These concepts highlight only the main thing that is common in the reflected phenomena, they do not reflect, said M. M. Bakhtin (1895-1975), prototypes of things, they do not rise to the level of the whole.

In Russian thought, various approaches to understanding life and its knowledge are presented. Slavophiles, N.A. Berdyaev (1874-1948) introduced the spirit of difficult self-knowledge. A.S. Khomyakov (1804-1860), called a Russian foreigner<sup>3</sup>, argued that in order to comprehend the integrity of being, a thought is needed that is consistent with the laws of all reasonably-existing, with all the forces of the spirit [19]. N.A. Berdyaev in self-knowledge saw a path to knowledge of the world [3].

Russian philosophy and the whole path of knowledge, as rightly noted in literature, is co-existence adequate to being. It is any wisdom, all-encompassing wisdom, which with its object has an idea and expresses its connection with the material world through a word [13].

It is necessary to add to this characteristic that the foundation of all wisdom is laid down in Vedic wisdom [17], which was reflected in ancient Russian thought and gained development in subsequent historical periods. This wisdom defined a special mindset of the Russian mind, formed in the specific conditions of being and worldview, expressed in the desire for the whole, for the search for the meaning of life, and therefore having an orientation from the temporal to the eternal, from human to divine.

<sup>3</sup>Previously, this definition was addressed to N.M. Karamzin.

According to ancient wisdom, being is represented by the unity of the spiritual (the world of Navi) and the material (the world Yavi). Its integrity is of over-experimental origin. It lies outside the realm of physical consciousness aimed at reflecting the World of Reveal. Therefore, the knowledge of the integrity of being is not feasible within the earthly, material life, since this life is represented by concrete historical facts that are in constant motion and visible change in time.

But endowed with the Higher energy, necessary both for knowing one's life Path and for realizing knowledge, one can gain Higher Wisdom through one's loving heart, Clear Mind and Bright Spirit [17].

The knowledge and expression of this Wisdom, concluded in God, in unconditional truth, in the unity of the material and spiritual worlds, in the laws and forms of cosmic, natural and social being, was associated with the concept of truth. This concept, the personification of which was law, reflected the thought of due, which manifests itself, according to E.N. Trubetskoy (1863-1920), as a message about the unconditional, logical and unified [18].

The possibility of comprehending Wisdom, according to Russian philosophy, is associated with spiritual and psychological intuition, a super-mental thought that rises above time, which is able to perceive the world as a whole, its unconditional and historical meaning, as a continuous process of what was, is and will be.

Cognition of the unity, integrity of the world, in the view of E.N. Trubetskoy is carried out by a superpsychic, absolute, unconditional consciousness, which exists along with the physical, temporary consciousness and which contains universally significant meaning. He connected it with the distraction of consciousness from the passage of time, from psychological boundaries, with intuition, which combines both being and justice [18].

It is appropriate to quote the words of I.A. Gerasimova, who says that in the ancient world and in Russian thought, a special sensitivity to the whole was developed [6]. Probably, wise thinkers understood that the meaning and purpose of the whole is to reveal, show the variety of states, transitions in which life was seen, and the only task is to hide the structure representing the real diversity of the world. They probably knew that preserving the whole is preserving the life of a person, society, state, and the world around it. According to this view, there is nothing unique in the world; there is a multitude united into a single whole [7].

Modern physics, in particular quantum theory, testifies to the fundamental integrity of the universe. It confirms the correctness of the worldview of Vedic civilization and the countries of the Ancient East. It allows you to take a closer look at Plato, who understood knowledge as a memory of ideas.

Maybe a modern scientist, on the basis of past and deep immersion in thoughts, should remember the ideas formulated by wise human thought and encourage modern thought to develop a holistic worldview.

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师生交流中的虚拟可能性  
**VIRTUAL POSSIBILITIES IN COMMUNICATION OF TEACHER  
WITH STUDENTS**

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抽象。在拟议的文章中，作者打算表明，交流过程不仅是时变的，即是暂时的，而且还以与人格强加于人的真实存在及其在大众中的表现有关的模态参数体现出来。一个人不仅在现实生活中经历的可能性，而且还在精神，虚幻和理想的空间中以他的想象力表现出来。或者：不是直接面对面，而是作为模型，图像和标志之间的交流模仿。现在，它通常被称为虚拟现实。

还显示对话的主题可以是：一个人，一个社会团体，一个官方机构。在哲学类型学中，可以区分直接对话和间接对话。在直接对话中，人们参加交流活动。转换和介导的互动显示了在空间或时间上分开的主题之间的对话。在现代世界中，随着信息技术的发展，对话的可能性达到了新的互动水平，即虚拟现实变成了乘法对话。

关键词：虚拟性，形态，交互，对话，社会参与者，交互形式的演变，虚拟现实中的对话。

**Abstract.** *In the proposed article, the authors intend to show that the communication process is not only diachronous, that is, temporary, but also manifests itself in modal parameters related to the imposition of the personality on the real existence and the manifestation in it of the mass of possibilities that a person experiences not only in real life, but also represents in his imagination, in the space of the spirit, illusory and ideal. Or: not directly face to face, but as a*

*communicative imitation among models, images and signs. Now it is commonly called virtual reality.*

*It is also shown that the subject of dialogue can be: a person, a social group, an official institution. In philosophical typologies, a direct and indirect dialogue can be distinguished. In direct dialogue, people participate in communication activities. Transformed and mediated interaction shows the dialogue of subjects separated in space or in time. In the modern world, with the development of information technologies, the possibilities of dialogue have reached a new - interactive level, when virtual reality breaks into a multiplicative dialogue.*

**Keywords:** *virtuality, modality, interaction, dialogue, social actors, the evolution of forms of interaction, dialogue in virtual reality.*

### **Introduction**

Information technology broke into both everyday life and the activities of pedagogues. Now we can not imagine communicating with pupils and students not only without the help of electronic means of teaching academic disciplines, but also without the use of electronic textbooks, online educational and methodological complexes, online teaching aids, webinars and trainings in free access mode. A distance learning form is increasingly being used, an indispensable element of which is interactive communication, during which the teacher not only broadcasts some information, but also forms images that develop into virtual reality.

“Virtual reality – is a *world of reflections* of human souls, initially not evil and not good. It exalts a person, infinitely expands his existence, the *virtual reality* artificially created by his imagination or his technique. And if at times it destroys it, then it is not the *depth* itself that destroys, but that syndrome of destruction that the person himself brought into it. The virtual world is dispassionate, it only reflects what is *inside* of us. [1, p. 134]

But in the virtual world, *reincarnation* is possible. A person constantly and widely uses reincarnation in the spiritual space, in a symbolic model, expanding with the help of possible, but here and now virtual states, the spectrum of his existence, playing mentally accessible options of personification that are generally available and inaccessible in principle.

### **Virtual communication components**

“The virtualization of life and communication is omnipresent,” wrote one of the authors of this article, “this is also the case with the variety of events that are contemporary to us. Around us, we see a lot of people becoming visible in the crowd and tangible in the bus or subway. “In faces and in life, alien to us, we look like a mirror, trying first of all to see our *own* possible, but *temporarily* passing and therefore *virtual* content.” [2, p. 140-142]

I listen to how a poet reads his poems or a popular singer performs, and I think

that I could be in their place, live a different, bohemian and hectic life with some kind of fate that is completely different from mine. Could become a driver or a cook - i already like to sit behind the wheel or fantasize at the stove. I could live in another city - Moscow or St. Petersburg; my wife would not be a brown-haired woman, but a blonde, and not Xanthippus, but Penelope; and I would have not two sons, but two daughters. And I think so because *other* people have it all, which, in principle, are no different from me, and that's why I try on the circumstances of *their* lives. But remembering, however, about those arrows, turning points in my biography, *bifurcation points*, as it is fashionable to say now - which brought my fate to the very track along which it rolls to this day. We add to this that thanks to books and films, generally to any iconic forms, the long-dead Socrates and Aristotle or the never-existing landowner Kostya Levin or Prince Andrei Bolkonsky fall into my attention. And then it becomes obvious that, along with the obvious fate, I also experience and *implicitly* carry a lot of latent, virtual lives in me.

The layers of time and space collide and intersect. An adult, a man who has lived and is burdened with experience, condescendingly looks at the angular — sometimes cheeky, then constrained manners of the lad, and shout something at his crude attempts, because he himself was like that. He knows that everything will be straightened, everything will come *in due time*: he sees his past and is not inclined to judge him too harshly. In the same way, the young talent reverently listens to his master; the student imitates the master even in the manner of lighting a cigarette. The girl recedes into the shadows before the mature and victorious beauty of a calm and self-confident woman and admires the apparent ease of her power over men. An ardent adherent listens with enthusiasm to the political tribune. All of them see and look forward to their future, they mentally try on themselves the opportunities that have already been realized by their senior contemporaries, and are waiting in *the wings*. So virtual plots for ourselves appear before us in the flesh, and we see ourselves yesterday or tomorrow *here and now*.

Thanks to the ability to reflection, which is determined by a spiritual, symbolic way of mastering reality, a person lives not only *now* and *here*, being in the immediate vicinity of the present point, but *there* and *then*, penetrating by memory and imagination into the past and future. He is mentally transferred from his being to another, from bodily existence to spiritual otherness, extrapolating all the richness of the diversity of reality to his inner world. It is in this process of mastering and understanding that *consciousness* is acquired.

We give an analogy with a TV. When we watch a program - a game show or a news release, it doesn't occur to us to say that all the stories that we see on the screen are localized and even more so in the television box itself. A television receiver provides only clarity, contrast, color image in the picture, but in no way



its content. And this is easy to see: just pull the antenna plug out of the socket and only the background ripple remains on the screen. The situation is the same with the mental image - visual or auditory, tactile or olfactory: it is not localized in the "space of the brain" or even in the "space of the body." It actualizes and concentrates the information circulating in the field of signals in the locality of subjective reality.

Since vision plays an exceptional role in the process of perception, which gives us the maximum of all information about external reality, then a *person* as a subject of orientation activity is "eye-perceiving", "seeing". The same should be reasoned about the intellectual components of subjective reality. The whole content of our thoughts is determined by the operational content of our practical activities, and the forms of expression of thoughts are completely determined by the sign system in which communication takes place. This is primarily and mainly language, external and, as a result, internal speech. Again: thought is actualization in the locality of the subject of reflection of information circulating in the field of signs. This is what *consciousness* is, a joint initially and, as a result, individual *possession of the sign system*, the manipulation of *signs*, which is *thinking*.

Information is denser where some intense changes take place, and merges into an even background where relative stability is maintained. Information is also specific in its modality at different levels of organization, it manifests itself in different ways in different types of material systems. In particular, the human psyche, on the substrate of which a subjective image is formed, is included in three different types of interactions and, accordingly, functions in three different spaces. In the *somatic*, in which the states of cells, tissues and organs of the body are formed and experienced in an emotional-sensual modality (pleasure, irritation, pain, ecstasy). In the *perceptual*, generating empathy, coupled with biologically significant natural environmental factors (green, sweet, warm) - through vision, taste, hearing. Finally, a *semiotic* space in which both external objects and internal mental complexes (for example, phonemes of the language) do not function in their natural modality, but in accordance with artificial quality, in other words, the meaning that is given to them by the content of human practical activity.

The image of reality is not an autonomous reality, but a kind of *quantum*, a bunch of a certain field of information, and in this sense it is as external to the subject as the internal element of its being. The continuum of information is not broken, but only concentrated in the content of the psyche, changing only the material, the materiality of the carrier. So, for example, the melody of "Moscow Evenings" can be sung in a voice: bass or treble; roared on a pipe or whistled on a flute; knocked on xylophone or piano. It can be recorded on a gramophone record in the form of a mechanical groove, on a magnetic tape, on a film tape in the form of a light track, in digital form in a computer. Similarly, the wavelength

of oscillations of the electromagnetic field or the frequency of air vibrations in the psyche is replaced by red or ringing, and the frequency of vibration of the molecules, depending on the range, is felt as sour or salty. In all cases, the *material* is different, but *eidos* is invariant.

### **Typologies of communication**

The development of social science in the past century, in which the principle of the division of labor dominated integral ideas about social processes and human life, led to simplified interpretations of communication. It came down to intersubjective interactions. Accordingly, diverse forms of communication were reduced to the idea of direct contacts between people. Although philosophical and methodological analysis clearly demonstrated the complexity of the problem of communication, today, in both casual and scientific consciousness, a stereotypical understanding of communication as a direct interaction between people dominates.

One of the authors of this article in his value concept of communication formulates a law: *the dignity of a human person is determined by the combined efforts, common and individual, spent on the formation of this person and on the self-realization of its spiritual wealth*. The inner world of a person is only to a very small extent expressed externally: in facial expressions, in eyes as a mirror of the soul, in clothing and manner of behavior. In its main content, the human soul is revealed in *communication*. The wise Socrates, entering a conversation with a man, suggested: "Speak, so that I can see you!". Initially, "communication precedes the formation of the human person ... and, categorically speaking, is the substance of the person." [3, p. 122]

For a holistic study of the communication process at a philosophical level, the Russian author A.V. Rezaev identifies three paradigms: a) information and instrumental; b) existential-phenomenological; c) Marxist historical materialistic. He writes that, functioning at various levels of social reality, "communication appears: a) as a relationship - interaction and exchange of formations of the material and spiritual order - abilities, activities, information, thoughts, feelings; b) as the realization of the inner potency of a self-conscious individual; c) as personification, updating and implementation of the structural characteristics of society - public relations." [6, p. 381]

Considering the evolution of socio-philosophical representations of the category of communication, A.V. Rezaev identifies five stages of development.

The first stage until the end of the XVIII century, when the interpretations of people's communication with each other appeared in the form of constructions revealing either the ethical or political characteristics of society.

The second period was marked by the industrial revolution and political cataclysms in France and England. Two characteristic features of the study of communication in this period are distinguished. The first feature (in the

development of the idea of Aristotle) is communication is a combination in one process of who says what he says and what the audience says. The second feature was due to the appearance of two opposite interpretations of society: “consensus”, where communication is presented in terms of a conflict of interests, and “conflict”, which is characterized by a critical attitude to existing social orders.

The third stage of the interpretation of communication in the history of social thought is associated with the discovery in the middle of the 19th century of a materialistic understanding of history and the formulation of the theory of social relations.

The fourth stage in the development of ideas about social relationships falls on the end of the XIX and XX centuries, the time of rapid development of sociology, psychology, linguistics, cybernetics. The methodology, models and principles of these disciplines become decisive for the study of communication in the twentieth century.

And finally, at present, according to A.V. Rezaev, the fifth, “search” stage of development of theoretical ideas about the essence of the phenomenon under consideration, focused on the synthesis and generalization of already achieved results, is unfolding.

Another Russian Yu.V. Perov proposed distinguishing only two main strategies of socio-philosophical *communicative* theories. Strategies of the first type, designated in the terminology of J. Habermas as “subject-centered,” are sent from the subjects and their activities as the starting point of the theory and methodology. In this case, we can talk about both individual and collective or historical subjects. Theories of this kind have a more significant historical and philosophical pedigree.

Another type of strategy, the opposite of the first, is the so-called “system-structural” or functional communication model. The proponents of this approach put at the forefront not the subjects, but the functions. The subject of the study is not the activity and consciousness of people, but systems of sustainable ways and forms of interactions - “discourses”, life “practices”.

Yu.V. Perov writes that throughout the 19th and 20th centuries, theories of social communication that implemented subject-centered strategies prevailed quantitatively and had a large degree of influence. For the first time, a different opportunity for analyzing communication was identified by Hegel in studies of civil society, where the diverse interactions of individuals form a universal social connection with its own laws. “But if Hegel had such an approach to the study of social communication been outlined, then at Marx it can be considered predominant. Such a system-functional approach has proven effective in relation not only to communication, but also to social activities in general.” [5, p. 22]

Yu.V. Perov emphasizes that both subject-centered and system-structural strategies, when implemented sequentially, turn out to be contrary and partly dead-

end. However, he considers problematic the possibility of a philosophical synthesis that would be able to overcome the one-sided extremes of these strategies.

For philosophy, communication is of particular interest, since it concentrates forms of thinking and activity, universally valid categories and subjective intentions of individuals. Within this category, we can distinguish direct and indirect communication, immediate and mediated. In direct communication, people interact face to face, the participants are here and now. In this form, compatibility, direct collectivity of human activity are realized. But, just as activity is not reduced to direct compatibility, communication cannot be limited only to the context of direct contact. Indirect or remote communication is the interaction of subjects separated in space or time, and the act of communication is carried out through the values created by people as embodied results of activity, identified or designated.

According to the theory of the Canadian philosopher M. McLuhan, depending on the method of communication between people, three eras can be distinguished in the history of mankind. The first era is the era of the tribal individual or "listening person". Communication of this individual was limited to oral speech, and the era itself lasted a very long time - from Adam to the fifteenth century. The second era is the era of the typographic individual or "reading person." This individual communicated with other people using printed text, and the era lasted from the fifteenth century, when Guttenberg invented the printing press, until the 80s of the twentieth century. The third era is the era of the information individual - "a person watching and listening" at the same time. [4, p. 73]

In the modern world, with the development of new computer information and communication technologies, communication opportunities have moved to a new level. Communicating on the Internet, a person plunges into virtual reality and gets the opportunity not only to "watch and listen", but also to react, express their emotions at a particular moment of communication, while it is possible to perform several acts of communication at the same time. And with the abundance of the so-called "Nicknames" there is another question: is communication through virtual reality a conversation? And what are the positive and negative aspects of the communication virtualization process? These questions will be relevant for both theoretical researchers and practical teachers in the very near future.

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CYP1A1 -462 T> C基因rs1048943多态性对急性胰腺炎及其并发症的影响

**CONTRIBUTION OF RS1048943 POLYMORPHISM  
OF THE CYP1A1 -462 T> C GENE TO THE DEVELOPMENT  
OF ACUTE PANCREATITIS AND ITS COMPLICATIONS**

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抽象。目的是研究CYP1A1-462 T> C基因的rs1048943多态性对急性胰腺炎的发展及其在俄罗斯人群中的并发症的影响。从502例急性胰腺炎患者和513例健康个体中采集全血样本。 CYP1A1基因的rs1048943多态性的基因分型使用PCR方法进行,使用TaqMan探针对等位基因进行区分。在当前的工作中,我们研究了CYP1A1-462 T> C基因的rs1048943多态性对急性胰腺炎及其并发症的影响,但我们并未发现多态性与急性胰腺炎的发生有关,但是,我们确定了CYP1A1-462 T> C基因的rs1048943多态性的C / C基因型与发生化脓性坏死性胰腺炎的急性体液积聚(假性囊肿)和败血症的风险增加相关。

关键词:急性胰腺炎;遗传多态性;异种生物转化酶; CYP1A1; rs1048943。

**Abstract.** *The goal is to study the effect of rs1048943 polymorphism of the CYP1A1-462 T> C gene on the development of acute pancreatitis and its complications in the Russian population. Whole blood samples were collected from 502 patients with acute pancreatitis and 513 healthy individuals. Genotyping of the rs1048943 polymorphism of the CYP1A1 gene was performed using the PCR method with discrimination of alleles using TaqMan probes. In the present work, we studied the contribution of rs1048943 polymorphism of the CYP1A1-462 T> C gene to the development of acute pancreatitis and its complications, we did not*

*find an association of polymorphism with the development of acute pancreatitis, however, we identified an association of the C/C genotype of rs1048943 polymorphism of the CYP1A1-462 T> C gene with the increased risk of developing acute fluid accumulation (pseudocyst) and sepsis with purulent-necrotic peripancreatitis.*

**Keywords:** acute pancreatitis, genetic polymorphism, xenobiotic biotransformation enzymes, CYP1A1, rs1048943.

**Introduction.** According to modern concepts of etiopathogenesis, acute pancreatitis (AP) is a multifactorial disease, the development of which is determined by the complex interaction of many genes and various environmental factors [1,2,3]. Issues related to the genetic mechanisms of AP and its complications have not been studied enough [1,2,3].

It is known that the susceptibility of an organism to harmful environmental influences largely depends on the activity of enzymes in the xenobiotic detoxification system. In the presence of functionally weakened variants of such genes, the risk of some frequent multifactorial diseases increases [4,5].

A lot of enzymes are involved in the biotransformation process, including the enzymatic transformation of foreign inclusions, or xenobiotics, and consisting of three phases: activation, proper detoxification and elimination [6,7]. So, P-450 cytochromes bioactivate polycyclic aromatic hydrocarbons (PAHs). It was found that *CYP1A1* is not detected in normal tissue, but is expressed only under the influence of xenobiotics.

The genes responsible for detoxification processes are an important link in the pathogenesis of acute pancreatitis. However, a small number of studies in the world are devoted to the study of the relationship between FBK genes and the risk of developing pancreatitis, and their data are contradictory. The role of FBK genes (GSTM1, GSTT1, GSTP1, CYP2E1 and CYP1A1) in the development of alcoholic pancreatitis and cirrhosis of the liver was studied among Brazilians who use alcoholic beverages; no association with pancreatitis has been established [8].

**Purpose.** In the framework of this work, the study of the effect of rs1048943 polymorphism of the *CYP1A1*-462 T> C gene on the development of acute pancreatitis and its complications in the Russian population was first conducted.

**Materials and methods.** The material for the study was DNA samples obtained from 573 unrelated patients with acute non-biliary pancreatitis (97 women and 476 men) of Russian nationality who were hospitalized in the surgical departments of the city of Kursk from 2015 to 2018 and 547 unrelated individuals of Russian nationality without gastrointestinal diseases (101 women and 446 men). The average age of patients was 48.9 + 13.1, healthy individuals - 47.8 + 12.1.

The diagnosis was established using the modern classification of acute pancreatitis developed by the Russian Society of Surgeons in 2014, taking into account the Atlanta-92 classification and its modifications proposed in Cochin in 2011 by the International Association of Pancreatology and the International Working Group on classification of acute pancreatitis (Acute Pancreatitis Classification Working Group) in 2012, using general clinical, laboratory (general and biochemical blood analysis) and instrumental (ultrasound and MRI of the pancreas, EGD) method in the study. All patients received consent to participate in the study.

All subjects underwent venous blood sampling for molecular genetic analysis and biochemical studies. Genomic DNA was isolated by the standard phenol-chloroform extraction method. Genotyping of the rs1048943 polymorphism of the CYP1A1-462 T> C gene was performed by real-time PCR by discriminating alleles using TaqMan probes using the CFX96 Bio-Rad Laboratories (USA) using protocols published in the literature [9]. In order to verify the quality of genotyping, 10% of the samples were randomly selected “case-control” for the purpose of repeated genotyping, the results did not differ from the original ones. To assess the associations of alleles and genotypes of the studied gene polymorphisms with a risk of developing AP, we used the  $\chi^2$  criterion and the odds ratio (OR) with 95% confidence intervals (CI). Statistical analysis was carried out using the program Statistica 6.0 (“StatSoft”, USA). The level of statistical significance was taken at  $p < 0.05$ .

**Results.** The frequencies of alleles and genotypes of rs1048943 polymorphism of the CYP1A1-462 T> C gene are presented in Table 1. The genotypes of the studied polymorphisms were in accordance with the Hardy-Weinberg distribution ( $p > 0.05$ ).

**Table 1**

*Frequencies of alleles and genotypes of rs1048943 polymorphism of the CYP1A1-462 T> C gene in groups of patients with acute pancreatitis and healthy individuals*

Gene (SNP ID)	Genotype, allele	n (%)		P	cor OR (95 %CI)
		Healthy (n=573)	Sick (n=547)		
CYP1A1-462 T>C (rs1048943)	T/T	507 (91,0)	489 (90,2)	0,07	1,00
	T/C	49 (8,8)	46 (8,5)		0,97 (0,64-1,48)
	C/C	1 (0,2)	7 (1,3)		7,26 (0,89-59,21)
	C	0,05	0,06	0,3	1,22 (0,83-1,79)
cor OR (95 %CI) – the calculation is corrected by sex and age					

As can be seen from table 1, we did not find associations of polymorphism with the risk of developing acute pancreatitis.



The analysis of the effect of the polymorphic variant on the development of complications of acute pancreatitis showed that the C/C genotype rs1048943 of the *CYP1A1*-462 T> C gene is associated with an increased risk of developing such complications of acute pancreatitis as acute fluid accumulation (pseudocyst) ( $OR_{cor}=18,43$ ,  $95\%CI=2,03-167,37$ ;  $P=0,0027^R$ ) and sepsis with purulent necrotic peripancreatitis ( $OR_{cor}=17,92$ ,  $95\%CI=1,98-162,30$ ;  $P=0,003^R$ ).

**Discussion.** The study of polymorphisms of xenobiotic detoxification enzyme genes is one of the actively developed research directions in revealing the pathogenetic links of the initiation and course of diseases of the lungs, breast, ovarian cancer and gastrointestinal tract organs in various populations [10,11,12].

The *CYP1A1* gene encodes a key enzyme that transforms polycyclic aromatic hydrocarbons into highly active mutagenic metabolites in the 1st phase of xenobiotic biotransformation. There are 19 known variants of gene polymorphisms that play a role in the development of cancer and occupational diseases [8].

In the present work, the contribution of the rs1048943 polymorphism of the *CYP1A1*-462 T> C gene to the development of acute pancreatitis and its complications was studied, no association of polymorphism with the development of acute pancreatitis was found, however, an association of the C/C genotype of the rs1048943 polymorphism of the *CYP1A1*-462 T> C gene with an increased risk of the development of acute fluid accumulation (pseudocyst) and sepsis with purulent-necrotic peripancreatitis was revealed.

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俄罗斯联邦奥勒尔地区儿童慢性腺样体炎的发病率分析  
**ANALYSIS OF CHRONIC ADENOIDITIS INCIDENCE  
IN CHILDREN IN THE ORYOL REGION  
OF THE RUSSIAN FEDERATION**

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抽象。 儿童咽部淋巴组织的慢性炎性病理在小儿耳鼻喉科的流行中起主要作用。 在这项工作中，我们分析了在俄罗斯联邦奥勒尔地区Z.I. Kroglova科学临床多部门医学中心治疗的慢性腺样体炎患者的病理结构，合并症和治疗结果。

关键词：咽部淋巴样环，Pirogov-Waldeyer环，腺样体植被，慢性腺样体炎，腺切除术。

**Abstract.** *Chronic inflammatory pathology of the pharyngeal lymphoid tissue in children play a major role in prevalence in pediatric otorhinolaryngology. In this work, we analyze of the structure of pathology, comorbidity and results of treatment of patients with chronic adenoiditis treated in Z.I.Kroglova scientific clinical multisectoral medical center of Orel region Russian Federation.*

**Keyword:** *pharyngeal lymphoid ring, Pirogov-Waldeyer ring, adenoid vegetation, chronic adenoiditis, adenotomy.*

Various forms of chronic inflammatory pathology of the pharyngeal lymphoid tissue in children occupy the first place in prevalence in pediatric otorhi-

nolaryngology. Moreover, the lymphoid tissue of the pharynx (Pirogov-Wald-eyer ring) is considered as the most important peripheral organ of the immune system, actively participating in the reactions of cellular and humoral immunity. Scientific studies of recent years have established the dependence of the adenoid vegetation size on the proliferation of immunocompetent lymphoid cells of the pharyngeal tonsil. The authors of these studies consider metamorphosis as a result of antigenic irritation and a variable associated with the constant recirculation of lymphocytes, ensuring the delivery of effector postmitotic lymphocytes to their "workplaces" [14]. The so-called "immune patrolling" connects various secondary immune organs with each other and with the Central organs of immunity in a single system of immunological protection of the body. Therefore, chronic persistent inflammation of the pharyngeal tonsil occurs simultaneously with the systemic processes of the body, reflecting the body's response to the introduction of a foreign pathological agent. Thus, the role of chronic persistent inflammation of the pharyngeal tonsil is comparable to that of retro-nasal obstruction. At the stage of penetration of the pathogen into the macro-organism, nonspecific protection of mucous membranes, the action of liquids (saliva), enzymatic systems (lysozyme, etc.) is formed. Lymphoid tissue is an important component of the first barrier to the pathogen. The pharyngeal tonsil is an inductive organ of the immune system of mucosa-associated lymphoid tissue or lymphoepithelial symbiosis (mucosa – associated Lymphoid Tissue, eng.). MALT is one of the compartments of the immune subsystem. The main function of the immune system is to recognize and eliminate infectious agents, as well as their products. Due to the retronasal direction of mucociliary clearance, the pharyngeal tonsil takes on antigenic effects. In the pharyngeal tonsil, B lymphocytes actively create a dimeric form of secretory immunoglobulin A (sIgA), which is involved in protecting the mucous membranes, as well as IgM and IgG. T-lymphocytes have cytotoxic properties [2, 10, 12]. In the pharyngeal tonsil, their protective function begins to activate due to the existence of a so-called lymphoepithelial symbiosis: the lymphocyte goes to the surface of the pharyngeal tonsil, which is covered by the ciliary epithelium, where it verifies the antigen entering the body and returns to the tonsil, after which, for about 10-14 days, immune memory cells (primary immune response) are formed. With repeated ingestion of the same antigen due to the already formed IgA and IgG, a powerful and rapid secondary immune response is realized [11, 12, 13]. Currently, the cells (including epithelial) of the mucous membranes and the MALT system are considered as one of the factors of innate immunity. In preschool age, 45% of children reveal hypertrophy of adenoid vegetations. In 48% of cases adenoid vegetation is accompanied by chronic inflammation, recurrence of which contributes to the formation of respiratory pathology [1, 2, 5]. Inflam-

matory forms of pharyngeal tonsil pathology lead in frequency among the total number of children treated in ENT departments. The proportion of children with chronic adenoiditis in the population ranges from 20 to 50%. In the group of frequently ill children, this figure ranges from 37 to 70% [3, 4]. Chronic foci of inflammation in the nasopharynx significantly change the immunobiological reactivity of the child's body [4, 12]. It is obvious that the significant prevalence among children of chronic forms of inflammatory pathology of the lymphoid tissue of the pharynx and their complications represent not only a medical but also a social problem. The relevance of these issues is also determined by the insufficient development of tactics for the treatment of chronic inflammation of the lymphoid tissue of the pharynx in children [10]. Despite the proven importance of the lymphopharyngeal ring in providing immunobiological protection of the growing organism, adenotomy remains the most common surgical operation in pediatric otorhinolaryngology [4, 7].

### Results

We analyzed 4268 case histories of children aged from 1 year to 17 years 11 months, who were treated in Z.I.Kroglova scientific clinical multisectoral medical center of Orel region Russian Federation during 2015-2017. From this group were selected medical histories of 1577 patients who were on hospital treatment and operated for hypertrophy of adenoid vegetations. Part of this group of patients had various comorbidities.

In 2015, out of 1,365 patients treated in hospital, 432 were operated on for adenoid vegetation hypertrophy, representing 31.65% of the total number of patients. From the operated group of patients in 86 patients (which is 19.9%) were identified comorbidities: hypertrophy of the tonsils 69-80.2%, chronic adenoiditis 9-10.5%, vasomotor rhinitis 2-2.3%, exudative otitis media 5-5.8%, tubotitis 1-1.2%

In 2016, 515 adenotomies were performed in 1,390 patients treated in hospital, representing 37.05% of the total number of patients. From the operated group of patients in 91 patients (which is 17.67%) were identified comorbidities: hypertrophy of the tonsils 75-82.4%, chronic adenoiditis 8-8.8%, vasomotor rhinitis 1-1.1%, exudative otitis media 7-7.7%.

In 2017, out of 1513 patients treated in hospital, 652 were operated on for adenoid vegetation hypertrophy, representing 43.09% of the total number of patients. From the operated group of patients in 112 patients (which is 17.18%), concomitant pathologies were revealed: hypertrophy of the Palatine tonsils 80-80.2%, chronic adenoiditis 16-10.5%, vasomotor rhinitis 5-2.3%, exudative otitis media 10-5.8%, tubotitis 1-1.2%.

### Conclusions

As a result of this work, we can note an increase in the absolute number of

adenotomies. Among the comorbidities in operated patients, the first place is occupied by hypertrophy of the Palatine tonsils. The combination of hypertrophy of the pharyngeal and Palatine tonsils shows the indissoluble connection of the pharyngeal lymphoid ring and suggests the possible use of the term adenotonsillitis. The lymphoid tissue of the pharyngeal lymphoid ring is a single morpho-functional structure. Immunotropic therapy can reduce the number of surgical interventions in the nasopharynx, which will improve the prognosis of the disease: reduce the number of exacerbations of chronic adenoiditis, chronic adenoiditis in General, and thus improve the quality of life of the patient in the future.

The continuation of studies of the features of the course of chronic adenoiditis, will reveal immune disorders in this group of patients, to assess the clinical and immunological possibility of treatment and its effectiveness in the group of children.

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肠系膜血栓形成模型中一氧化氮代谢物水平的稳定分析及缺血预处理的病理效应校正

**ANALYSIS OF STABLE NITRIC OXIDE METABOLITES LEVEL  
IN MESENTERIC THROMBOSIS MODEL AND CORRECTION  
OF ITS PATHOLOGICAL EFFECTS  
BY ISCHEMIC PRECONDITIONING**

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抽象。缺血和再灌注损伤在许多疾病的发病机理中起着最重要的作用之一。缺血预处理有助于减少局部缺血对组织的病理影响。为了研究缺血预处理的保护作用机理，我们在模拟急性肠系膜血栓形成中确定了稳定的一氧化氮代谢产物水平。所获得的数据表明，在模拟急性肠系膜血栓形成过程中，稳定的一氧化氮代谢产物水平存在明显的波动，以及缺血和再灌注的发作，这表明了器官外NO合酶的激活。

关键字：缺血/再灌注，急性肠系膜血栓形成，缺血预处理，NO合酶，一氧化氮。

**Abstract.** *Ischemic and reperfusion lesions play one of the most important roles in the pathogenesis of many diseases. Ischemic preconditioning helps to reduce the pathological effects of ischemia on tissues. In order to study the mechanisms of the protective effect of ischemic preconditioning, we determined the level of stable nitric oxide metabolites in the simulation of acute mesenteric thrombosis. The data obtained indicate significant fluctuations in the level of stable nitric oxide metabolites during the simulation of acute mesenteric thrombosis, as well as episodes of ischemia and reperfusion, which indicates the activation of extra-organ NO synthases.*

**Keyword:** *Ischemia / reperfusion, acute mesenteric thrombosis, ischemic preconditioning, NO-synthase, nitric oxide.*



## Introduction

Ischemic and reperfusion lesions play one of the most important roles in the pathogenesis of many diseases [3, 8]. The small intestine is no exception, and the decrease in blood flow even for a short time is manifested by pronounced morpho-functional changes [7, 15]. It was also found that the recovery of blood flow in the intestinal vessels leads to increased damage [10].

The discovery of ischemic preconditioning was a new stage in understanding the implementation of the protective influence of various factors and served as a starting point in the search for a pharmacological agent that implements its action through mechanisms of ischemic preconditioning [6, 11, 12, 13].

However, the mechanisms of the protective effect remain unknown, and therefore, the purpose of our study was to study the effect of distant and direct preconditioning on the dynamics of serum levels of stable metabolites of nitric oxide, as one of the messengers of preconditioning.

## Materials and methods

The experiment was conducted on female white rats of Wistar line of the same age weighing 250-280 g. To study taken rats without external signs of disease, past the quarantine regime and contained in standard vivarium conditions of the Kursk state medical University.

The animals were divided into groups as follows

Baseline group (10 animals)

Control group (20 animals) a group in which deep 30 minute ischemia of the small intestine was simulated followed by 30 minute reperfusion.

Direct ischemic preconditioning group (20 animals) - in this group, the effect of direct ischemic preconditioning on the 30-minute ischemia of the small intestine and subsequent 30-minute reperfusion was studied.

Group of direct ischemic preconditioning on the background of glibenclamide administration (20 animals) - in this group, the study of the effect of direct ischemic preconditioning on the 30-minute ischemia of the small intestine and subsequent 30-minute reperfusion on the background of glibenclamide administration at a dosage of 5 mg/kg was conducted .

Group of remote ischemic preconditioning (20 animals) - in this group, the study of the effect of distant ischemic preconditioning on the 30-minute ischemia of the small intestine followed by 30-minute reperfusion was carried out.

Group of remote ischemic preconditioning against the introduction of glibenclamide (20 animals) - in this group, the study of the effect of remote ischemic preconditioning on the 30-minute ischemia of the small intestine followed by 30-minute reperfusion against the introduction of glibenclamide at a dosage of 5 mg/kg was carried out.

The level of stable metabolites of nitric oxide was determined using Griss reagent after the reduction of nitrates into nitrites and expressed in mmol / DL.

The level of microcirculation was determined using Biopac systems MP100 equip-

ment with laser Doppler flowmetry (LDF) module LDF100C and invasive needle sensor TSD144 with recording and processing in the program AcqKnowledge 3.9.0.

Statistical analysis of the obtained data was carried out using Microsoft Excel version 2007, calculating the average value (M) of the indicators and the error of the average (m), and the reliability criterion (p), statistically significant differences were considered at values  $p \leq 0.05$ .

All manipulations were performed under General anesthesia by intraperitoneal administration of chloral hydrate at a dosage of 300 mg / kg.

Deep ischemia of the small intestine tissues was reproduced by clamping the upper mesenteric artery for 30 minutes, controlling the effectiveness with the help of LDF. Effective considered such clamping, in which there was a decrease in microcirculation to undetectable values.

Direct ischemic preconditioning was performed by clamping the upper mesenteric artery. The clamping time was calculated based on the level of tissue perfusion, the average time of cessation of blood flow was 10 minutes.

Distant ischemic preconditioning was performed by applying a tourniquet to the upper third of the femur for 10 minutes followed by 30-minute reperfusion to reproduce an episode of deep ischemia [2].

### **Results and discussion**

The study found that the baseline values of stable nitric oxide metabolites were  $0.728 \pm 0.046$  mmol / DL.

With prolonged ischemia for 30 minutes, the level of stable metabolites of nitric oxide increases to  $1.607 \pm 0.126$  mmol/DL, and with subsequent reperfusion falls to  $0.692 \pm 0.103$  mmol / DL.

Under the action of direct ischemic preconditioning (IPC), the level of stable metabolites of nitric oxide increases to  $1,536 \pm 0.119$  mmol / DL after a 30-minute episode of ischemia, after a 30-minute reperfusion it decreases to  $1,091 \pm 0.106$  mmol/DL, which is 95.58% and 156.21% of the indicators in the control group.

Under the action of distant preconditioning (DIPC) on the level of stable metabolites of nitric oxide changes as follows, with prolonged ischemia there is an increase to  $1,536 \pm 0.119$  mmol/DL, and with reperfusion falls to  $0.866 \pm 0.125$  mmol / DL, which is 97.94% and 125.14%, respectively.

In order to study the implementation of the action of direct and distant ischemic preconditioning, we used the introduction of glibenclamide at a dosage of 5 mg / kg 30 minutes before preconditioning intraperitoneal.

When glibenclamide is administered 30 minutes before direct ischemic preconditioning, the level of stable nitrogen metabolites increases to  $1.640 \pm 0.247$  mmol / DL after prolonged ischemia and decreases to  $0.712 \pm 0.167$  mmol / DL, which is 102.05% and 102.89%, in the absence of significant differences with the control group  $p > 0.05$ .

Administration of glibenclamide 30 minutes before distant ischemic precondi-

tioning led to the cancellation of the effect of the latter on the dynamics of changes in the level of stable nitric oxide metabolites in ischemia and reperfusion of the small intestine. Thus, after an episode of ischemia, the level of stable metabolites of nitric oxide was  $1,624 \pm 0.141$  mmol/DL, and after an episode of reperfusion decreased to  $0.683 \pm 0.214$  mmol/DL, which was 101.05% and 98.69% , and as in the case of the cancellation of direct preconditioning, no significant differences with the control group were revealed ( $p > 0.05$ ).

The obtained data indicate significant fluctuations in the level of stable nitric oxide metabolites during the ischemia and reperfusion episode, which indicates the activation of extra-organ NO-synthases, since both the main blood flow and blood flow in the microcirculatory bed is absent (according to LDF data). This is consistent with data from Randy M. et al. talking about a decrease in the level of nitric oxide metabolites in the perfusate of the ischemic zone and the restoration of the level with the resumption of blood flow [14]. The hypothesis of participation of nitric oxide in the mechanisms responsible for the development of the protective effect in ischemic preconditioning is currently the most controversial among researchers of the phenomenon [1, 4, 9]. Although most authors tend to believe that NO is the trigger of the second preconditioning window [5].

In the course of the study, we obtained data convincingly indicating the involvement of the nitric oxide system in the processes occurring during direct and distant preconditioning.

### Conclusions

1. Prolonged, 30-minute ischemia of the small intestine leads to an increase in the level of stable nitric oxide metabolites by 2.2 times, followed by their fall during reperfusion by 2.3 times.
2. Direct ischemic preconditioning reduces the amount of stable nitric oxide metabolites after a 30-minute episode of small bowel ischemia by 4.5% and increases their level after a 30-minute reperfusion period by 56.2%
3. Distant ischemic preconditioning reduces the amount of stable nitric oxide metabolites after a 30-minute episode of small bowel ischemia by 2.1% and increases their level after a 30-minute reperfusion period by 25.1%

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腹部器官微循环对缺血和再灌注中重组促红细胞生成素作用的响应  
**RESPONSE OF ABDOMINAL ORGANS MICROCIRCULATION  
TO THE RECOMBINANT ERYTHROPOIETIN ACTION  
IN ISCHEMIA AND REPERFUSION**

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抽象。 我们研究了在用促红细胞生成素校正的条件下，腹部器官微循环床对局部缺血和再灌注损伤的反应。 确定了早期缺血/再灌注后短暂时充血的情况。 促红细胞生成素的给药可防止肝脏和小肠缺血后短暂的充血发展，但可增加胰腺的血流速度。

关键字：缺血，再灌注，血流，促红细胞生成素。

**Abstract.** *We investigated the reaction of the microcirculation bed of the abdominal organs to ischemic and reperfusion injury in the conditions of its correction with erythropoietin. Transient hyperemia absence after ischemia/reperfusion at early stages was determined. Erythropoietin administration prevents transient hyperemia development after period of ischemia in liver and small intestine but increase blood flow velocity in pancreas.*

**Keyword:** *Key words: ischemia, reperfusion, blood flow, erythropoietin.*

### **Introduction**

Ischemia is a key stone in the pathogenesis of many diseases of the abdominal cavity, such as mesenteric thrombosis, damage to internal organs in visceral ischemic syndrome. This factor is of particular importance in connection with the development of high-tech surgery of organ transplantation and interventions with the use of artificial blood circulation devices. However, in the case of the pancreas, ischemia leads to the development of an independent nosological form, which was

first suggested in the works of Anderson, 1961 [6], and later formed the basis for the development of vascular models of pathology [8], and also found unexpected confirmation in the works of cardiac surgeons [7].

A special place is occupied by the problem of correction of microcirculatory disorders in acute pancreatitis. We have previously shown a positive effect of ischemic preconditioning on the prevention of microcirculatory disorders in liver ischemia [3]. However, the reaction of the pancreas, different from that in other organs, suggests a difference in the action of erythropoietin on pancreatic tissue in terms of its ischemia and reperfusion, which was the purpose of this study.

### **Materials and methods**

The study was performed on 120 white rats (males and females) weighing 280-300 g. the design of the study consisted of 6 groups of 20 animals each. Groups, according to the studied organs (liver, small intestine, pancreas) were combined into two blocks (intact groups and groups with the introduction of erythropoietin). All interventions were performed under General anesthesia (zoletil 100 at a dose of 60 mg / kg and chloral hydrate at a dose of 125 mg / kg intraperitoneal). Transient ischemia of the pancreas, liver and small intestine was reproduced by blocking the lumen of the corresponding feeding arteries for 30 minutes, followed by the resumption of blood flow [3,4]. Human recombinant erythropoietin ("epo-crine" produced by GosNII of especially pure biopreparations FMBA FSUE, Russia) was administered intraperitoneally at a dose of 50 IU / kg 30 minutes before ischemia modeling of the corresponding organ [5]. Volume perfusion rate was measured using Biopaq systems MP150 software and hardware with TSD144 sensor and expressed in perfusion units (PE) during median laparotomy under General anesthesia throughout the study [2].

### **Results and discussion**

During the study, it was found that the nature of the reaction of the microcirculatory bed of the small intestine to the transferred episode of 30-minute ischemia is characterized by the presence of transient hyperemia with a peak at the 15th minute, exceeding the indicators of the intact group by 3.7 times. The reaction of the liver to ischemia is similar to that in the microcirculatory bed of the small intestine, with a peak of transient hyperemia at the 15th minute of blood flow restoration, while the rate of volumetric perfusion is 2.3 times higher than in the intact group. An episode of 30-minute ischemia on the speed of blood flow in the pancreas has a fundamentally different character than in the liver and small intestine, which is manifested by the absence of transient hyperemia. Thus, the restoration of blood flow occurs only to the level of 79.6% of the indicators of the intact group.

Thus, an episode of 30-minute ischemia leads to pronounced changes in the hemodynamics of the microcirculatory bed of the liver and small intestine, stimulating a massive release of vasoactive substances, which subsequently de-

termines the nature of organ damage during the so-called reperfusion disorders. However, the pancreas is the most sensitive organ in relation to 30-minute ischemia, which is manifested by the absence of an episode of transient hyperemia with a sharp decrease in blood flow rate by the end of the reperfusion episode and indicates the implementation of the tissue response by the NFkappa-b mediated pathway [1].

The introduction of human recombinant erythropoietin intraperitoneally at a dose of 50 IU / kg 30 minutes before ischemia in the small intestine and liver leads to a decrease in the severity of transient hyperemia, and in the liver - 1.4 times, and in the small intestine - 1.3 times. This indicates a decrease in the release of biologically active substances and is accompanied by a decrease in their damaging effect. In the pancreas, the introduction of human recombinant erythropoietin at a dose of 50 IU / kg "restores" the tissue response to ischemia / reperfusion, which is manifested by an improvement in blood supply to the tissue in comparison with the ischemia/reperfusion group without the introduction of erythropoietin. Thus, if we extrapolate the data obtained in the study of perfusion in the liver and small intestine, the pancreas, the "estimated" level of transient hyperemia in the group of ischemia/reperfusion should be within 1000-1200 PU, and dynamics of changes in speed indicators of blood flow in the pancreas due to the introduction of erythropoietin, which is comparable with the dynamics of these indicators in the study of blood flow in the liver and small intestine. However, the real dynamics of blood flow rate with increased perfusion, compared with the ischemia/reperfusion group, suggests the implementation of protective mechanisms of erythropoietin through mechanisms different from those in the liver and small intestine.

### **Conclusions**

In the course of the study, the reaction of the volume blood flow rate in the pancreatic microcirculatory bed in response to an episode of 30-minute ischemia was established, different from the reaction in the liver and small intestine, which was manifested by the absence of a period of transient hyperemia. The obtained data indicate a pronounced protective effect of human recombinant erythropoietin in ischemia and reperfusion in the liver, small intestine and pancreas, and the reaction of the volume blood flow rate in response to the introduction of erythropoietin in the pancreas is different from the reaction in the liver and small intestine, which implies different ways of implementing its protective effects.

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谷胱甘肽合成酶 (GSS) 基因的变异赋予针对糖尿病足综合症的保护  
**VARIANTS IN GLUTATHIONE SYNTHETASE (GSS) GENE  
CONFER PROTECTION AGAINST DIABETIC FOOT SYNDROME**

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抽象。氧化应激是发展2型糖尿病和糖尿病并发症的重要因素。谷胱甘肽合成酶 (GSS) 是抗氧化系统的关键酶。GSS基因中的单核苷酸多态性可以影响氧化还原平衡并确定疾病并发症的发展。但是,关于GSS变异与糖尿病足综合征 (DFS) 之间关联的数据很少。这项研究的目的是调查GSS基因中的rs1801310和rs13041792多态性是否与糖尿病患者的DFS相关。该研究共招募了977名无关糖尿病患者,其中包括85名DFS患者。使用iPLEX技术在MassArray Analyzer 4基因组质谱仪上进行SNP的基因分型。使用在线工具SNPStats进行统计分析。测试了五个遗传模型: 显性, 显性, 隐性, 显性和对数加性。基因型A / A rs1801310 (OR 0,41 95CI 0,18–0,97, P = 0,023) 与DFS风险降低相关。G-A单体型,包括rs13041792的参考等位基因和rs1801310的保护性等位基因,与发展DFS的风险降低相关 (OR 0.68, 95CI 0.47–0.99, P = 0.042)。根据GTEx Portal数据,等位基因A rs1801310增加了GSS基因在多个组织中的表达,从而保护了它们免受T2D中过度产生的活性氧物种的破坏作用。这项研究首次证明,编码谷胱甘肽合成酶的基因可为糖尿病患者提供针对DFS的保护。

关键词: 谷胱甘肽合成酶, 氧化应激, 单核苷酸多态性, 活性氧, 糖尿病足综合征, 2型糖尿病。

**Abstract.** *Oxidative stress is an important factor for development of type 2 diabetes and diabetes complications. Glutathione synthetase (GSS) is the key enzyme of antioxidant system. Single nucleotide polymorphisms in the GSS gene can affect redox balance and determine development of the disease complications. However, data on the association between GSS variants and diabetic foot syndrome (DFS) are scarce. The aim of this study was to investigate whether polymorphisms rs1801310 and rs13041792 in the GSS gene are associated with DFS in diabetic patients. A total of 977 unrelated diabetic patients, including 85 patients with DFS, were recruited for the study. Genotyping of SNPs was performed with the use of iPLEX technology on a MassArray Analyzer 4 genomic mass spectrometer. Statistical analysis was done using online tool SNPStats. Five genetic models were tested: codominant, dominant, recessive, overdominant, and log-additive. Genotype A/A rs1801310 (OR 0,41 95CI 0,18-0,97, P=0,023) was associated with reduced risk of DFS. The G-A haplotype, including reference allele of rs13041792 and protective allele of rs1801310, was associated with decreased risk of developing DFS (OR 0.68, 95CI 0,47 – 0,99), P=0,042). According to GTEx portal data, allele A rs1801310 increases expression of the GSS gene in multiple tissues, thus protecting them from the damaging effects of reactive oxygen species excessively produced in T2D. The study demonstrates for the first time that gene encoding glutathione synthetase confers protection against DFS in diabetic patients.*

**Keywords:** *glutathione synthetase, oxidative stress, single nucleotide polymorphism, reactive oxygen species, diabetic foot syndrome, type 2 diabetes mellitus.*

Approximately 425 million people suffer from T2D worldwide, and the number is expected to rise to 642 million by 2040 [1]. According to the Federal Diabetes Register, at least 4.5 million patients with T2D are registered in Russia by the end of 2018, and about 92% of them are patients with type 2 diabetes [2]. Diabetic foot syndrome (DFS) is a serious complication of T2D worldwide and the most common cause of hospitalization in diabetic patients. There is an increasing body of evidence that oxidative stress plays an important role in the development of T2D and polymorphic genes encoding antioxidant defense enzymes have been reported to be associated with susceptibility to T2D in various populations [3-7]. However, data on the association between GSS variants and diabetic foot syndrome (DFS) are scarce. The aim of this study was to investigate whether polymorphisms rs1801310 and rs13041792 in the GSS gene are associated with DFS in diabetic patients.

The study protocol conforms to the ethical guidelines of the Declaration of Helsinki and was approved by the Regional Ethics Review Committee of Kursk State Medical University. Written informed consent was obtained from each par-

participant before enrollment for the study. A total of 977 unrelated diabetic patients, including 85 patients with DFS, were recruited for the study. T2D patients were admitted to the Division of Endocrinology of the Kursk Emergency Hospital from November 2015 to December 2018. T2D was diagnosed on the basis of WHO criteria: fasting blood glucose level  $\geq 7.0$  mmol/L or random blood glucose level  $\geq 11.1$  mmol/L and/or glycated hemoglobin HbA1c level  $\geq 6.5\%$  [8]. Venous blood samples for genetic analysis were collected in standard K3-EDTA tubes and stored at  $-20^{\circ}\text{C}$ . Genomic DNA was purified from the defrosted blood samples using a standard procedure of phenol-chloroform extraction and ethanol precipitation [9]. Two common polymorphisms in the *GSS* gene such as rs1801310 (G>A) and rs13041792 (G>A) have been selected for the study.

**Table 1.** Genotype frequencies for rs13041792 in the *GSS* gene in T2D patients with and without diabetic foot syndrome

Model	Genotype	T2D patients without DFS, n (%) <sup>1</sup>	T2D patients with DFS, n (%) <sup>1</sup>	OR (95% CI) <sup>2</sup>	P-value
Codominant	G/G	555 (62.8%)	52 (63.4%)	1.00	0.9
	G/A	287 (32.5%)	27 (32.9%)	1.00 (0.62-1.63)	
	A/A	42 (4.8%)	3 (3.7%)	0.76 (0.23-2.55)	
Dominant	G/G	555 (62.8%)	52 (63.4%)	1.00	0.91
	G/A-A/A	329 (37.2%)	30 (36.6%)	0.97 (0.61-1.56)	
Recessive	G/G-G/A	842 (95.2%)	79 (96.3%)	1.00	0.64
	A/A	42 (4.8%)	3 (3.7%)	0.76 (0.23-2.51)	
Overdominant	G/G-A/A	597 (67.5%)	55 (67.1%)	1.00	0.93
	G/A	287 (32.5%)	27 (32.9%)	1.02 (0.63-1.65)	
Log-additive	---	---	---	0.95 (0.64-1.41)	0.8

<sup>1</sup> Absolute number and percentage of individuals/chromosomes with particular genotype;

<sup>2</sup> Odds ratio with 95% confidence intervals;

Bold is statistically significant P- values;

DFS - diabetic foot syndrome; T2D – type 2 diabetes

Genotyping of SNPs was performed with the use of iPLEX technology on a MassArray Analyzer 4 genomic mass spectrometer. Statistical analysis was done using online tool SNPStats [10]. Five genetic models were tested: codominant, dominant, recessive, overdominant, and log-additive. The association between gene polymorphisms and the risk of DFS in T2D patients was evaluated by multiple logistic regression analysis with calculation of odds ratios (OR) and 95% confidence intervals (95%CI) adjusted for age, sex, and body mass index (BMI).

Genotype frequencies for the studied polymorphisms are shown in Tables 1 and 2. Genotype A/A rs1801310 (OR 0,41 95CI 0,18-0,97, P=0,023) was associated with reduced risk of DFS. There was no statistical significant difference in the genotype distribution of SNP rs13041792 between the T2D patients with and without DFS (P<0,05).

**Table 2.** Genotype frequencies for rs1801310 in the GSS gene in T2D patients with and without diabetic foot syndrome

Model	Genotype	T2D patients with DFS, n (%) <sup>1</sup>	T2D patients without DFS, n (%) <sup>1</sup>	OR (95% CI) <sup>2</sup>	P-value
Codominant	G/G	331 (37.1%)	38 (44.7%)	1.00	0.058
	G/A	423 (47.4%)	41 (48.2%)	0.84 (0.53-1.34)	
	A/A	138 (15.5%)	6 (7.1%)	<b>0.38 (0.16-0.92)</b>	
Dominant	G/G	331 (37.1%)	38 (44.7%)	1.00	0.17
	G/A-A/A	561 (62.9%)	47 (55.3%)	0.73 (0.47-1.14)	
Recessive	G/G-G/A	754 (84.5%)	79 (92.9%)	1.00	0.023
	A/A	138 (15.5%)	6 (7.1%)	<b>0.41 (0.18-0.97)</b>	
Overdominant	G/G-A/A	469 (52.6%)	44 (51.8%)	1.00	0.89
	G/A	423 (47.4%)	41 (48.2%)	1.03 (0.66-1.61)	
Log-additive	---	---	---	<b>0.70 (0.50-0.99)</b>	0.037

<sup>1</sup>Absolute number and percentage of individuals/chromosomes with particular genotype;  
<sup>2</sup>Odds ratio with 95% confidence intervals;  
 Bold is statistically significant P- values;  
 DFS - diabetic foot syndrome; T2D – type 2 diabetes

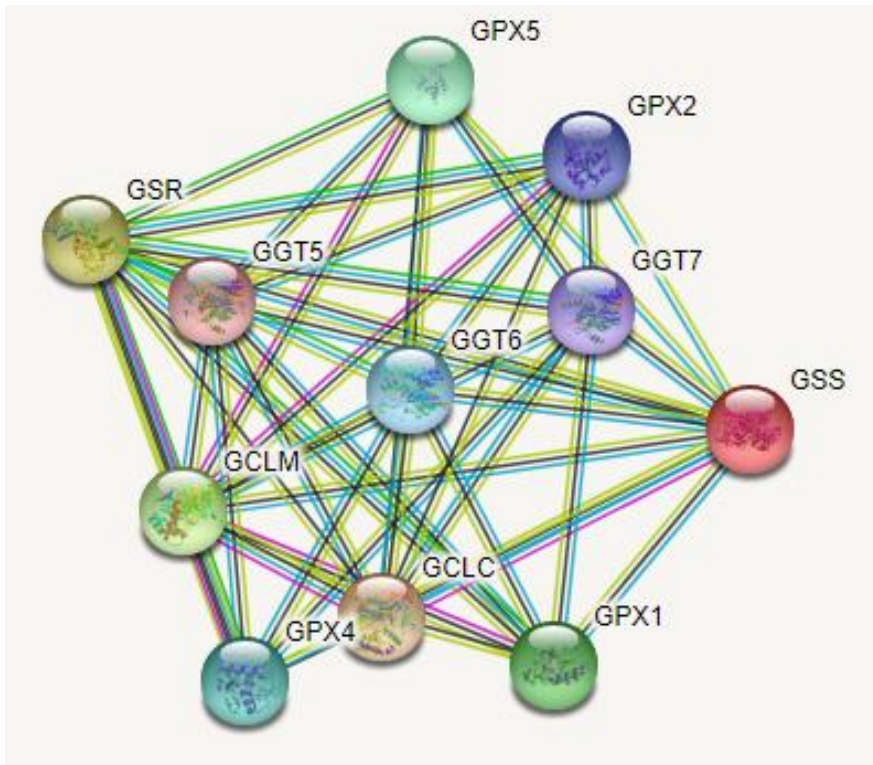
Estimated haplotype frequencies in two groups of T2D patients are given in Table 3. The G-A haplotype, including reference allele G of rs13041792 and protective allele A of rs1801310, was associated with decreased risk of developing DFS (OR 0,68, 95CI 0,47 – 0,99), P=0,042). The studied GSS gene polymorphisms were in positive linkage disequilibrium (D’=0,8593, P<0.0001), indicating that the wild type allele at one site is more likely to be associated with the wild type allele at the other site.

According to GTEx portal [11], allele A rs1801310 increases expression of the GSS gene in multiple tissues, thus protecting them from the damaging effects of reactive oxygen species excessively produced in T2D. We also studied the protein network formed by GSS using bioinformatical instrument STRING [12]. Functional partners of the GSS include enzymes involved in glutathione metabolism and redox balance maintenance (Figure 1).

**Table 3.** *Estimated haplotype frequencies in T2D patients with and without diabetic foot syndrome*

	rs13041792	rs1801310	T2D patients with DFS, n (%) <sup>1</sup>	T2D patients without DFS, n (%) <sup>1</sup>	OR (95% CI) <sup>2</sup>	P-value
1	G	G	0.4098	0.4887	1.00	---
2	G	A	0.3802	0.3127	<b>0.68 (0.47 - 0.99)</b>	<b>0.042</b>
3	A	G	0.1983	0.1986	0.83 (0.54 - 1.28)	0.4
Global haplotype association p-value: 0.09						
<sup>1</sup> Absolute number and percentage of individuals/chromosomes with particular genotype; <sup>2</sup> Odds ratio with 95% confidence intervals; Bold is statistically significant P- values; rare haplotypes with frequency < 0.01 are not shown; DFS - diabetic foot syndrome; T2D – type 2 diabetes						

The study demonstrates for the first time that variant rs1801310 in the gene encoding glutathione synthetase confers protection against DFS in diabetic patients due to increased level of the GSS enzyme in carriers of the alternative allele A. Further studies are required to substantiate a comprehensive contribution of antioxidant genes to the disease pathogenesis and identify new targets and pathways for antioxidant treatment and prevention of T2D and its complications.



**Figure 1.** GSS-centered protein network

- GCLC - Glutamate-cysteine ligase catalytic subunit;
- GSR - Glutathione reductase,
- GCLM - Glutamate-cysteine ligase modifier subunit;
- GPX1 - Glutathione peroxidase 1;
- GPX5 - Epididymal secretory glutathione peroxidase;
- GPX4 - Phospholipid hydroperoxide glutathione peroxidase, mitochondrial;
- GGT6 - Glutathione hydrolase 6;
- GPX2 - Glutathione peroxidase 2;
- GGT7 - Glutathione hydrolase 7;
- GGT5 - Glutathione hydrolase 5 proenzyme

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莱姆病病灶形成的规律及其监测

**REGULARITIES OF LYME DISEASE FOCI FORMATION AND  
THEIR MONITORING**

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抽象。该调查总结了外国科学家和我国科学家对莱姆病的调查结果,以及俄罗斯游戏管理和皮草养殖研究所的研究人员的实践。莱姆病被认为是世界上最常见的自然局灶性感染之一。在俄罗斯联邦,这种疾病的发病率在世界各地都有报道。研究表明,之间的疏螺旋体感染率为44.9%。进行的研究表明,在山地野兔 (*Lepus timidus* L.) 和狐狸 (*Vulpes vulpes* L.) 中,莱姆病的发病率最高,为52.7%。浣熊犬 (*Nyctereutes procyonoides* Gray) 和麝鹿的患病率略低。在自由生活物种内部的细菌BSK-III肉汤中,疏螺旋体标记为欧亚badger (*Meles meles* L.), 野猪 (*Sus scrofa* L.) 的肝脏和脾脏。

关键词: 莱姆病, 诊断, 虫, 动物

**Abstract.** *This survey summarizes results of Lyme disease investigations made by foreign scientists, and scientists of our country, and also the research workers' practices of Russian Research Institute of Game Management and Fur Farming. Lyme disease is counted among the most frequently encountered natural focal infections in the world. The incidence of this disease in the Russian Federation is reported everywhere. The tick studies showed that the Borrelia infection rate among ticks was 44.9%. The carried out research revealed that the highest sickness rate with Lyme disease was detected in mountain hare (*Lepus timidus* L.) 52.7% and fox (*Vulpes vulpes* L.) 38.4%. This rate was somewhat lower with raccoon dog*

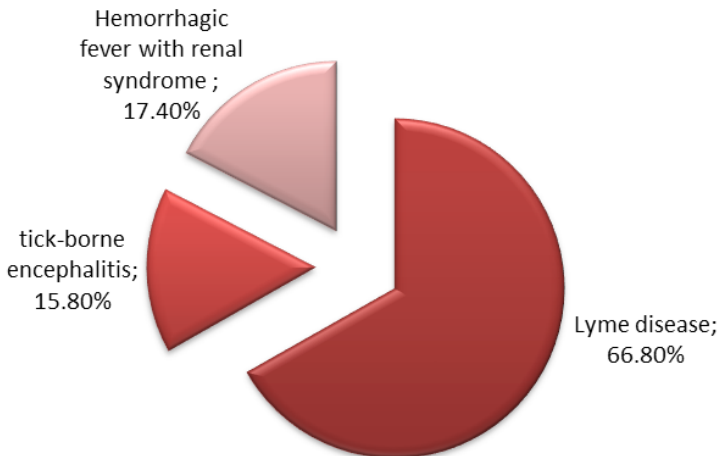


*(Nyctereutes procyonoides Gray) and elk. Among bacterial BSK-H broth platings of free-living species internal Borrelia was marked out of heart of Eurasian badger (Meles meles L.), liver and spleen of a wild boar (Sus scrofa L.).*

**Key words:** Lyme disease, diagnostics, ticks, animals

### 1. Introduction

At present time wide spreading of Lyme disease hot spots with high sickness rate by people and domestic animals defines urgency of this issue for many countries in America, Europe, Asia and Australia [1]. The number of ticks, the infection rate, and consequently the number of bit people and animals, especially in suburban areas grows steadily in Russia in spite of the acaricide treatment. The tick studies showed that the Borrelia infection rate among ticks was 44.9% [9]. Lyme disease is the leading natural focal infectious disease in Kirov region, its percentage being 66.8% (fig. 1). As reported by E.A. Belousova et al. (2019) who studied the epidemiologic situation in Kirov region, the incidence of Lyme disease in humans in 2018 remained high (18.58 cases per 100 thousand inhabitants), which is 4 times as much as the average Russian level (4.42 cases per 100 thousand inhabitants). Lyme disease incidents were reported virtually in all districts of the region and in Kirov [8].



**Figure 1.** Composition of natural focal infections in Kirov region

As shown by the analysis of infection conditions, people get in contact with forest areas generally for everyday purposes. This is mostly characteristic of unemployed population including persons of retirement age, and of pre-school and schoolchildren. This fact is directly reflected in age and social distribution of the disease incidents [8].

In this situation the necessity of an annual monitoring, the results of which have significance both for the application study and the fundamental science, is beyond doubt.

## **2. Materials and methods**

Biomaterial from game animals was collected during the hunting season or at another time pursuant to the special hunting license for scientific collection. Serums for serological tests were taken from following species: mountain hare (*Lepus timidus* L.), fox (*Vulpes vulpes* L.), raccoon dog (*Nyctereutes procyonoides* Gray), elk (*Alces alces* L.), wild boar (*Sus scrofa* L.), wolf (*Canis lupus* L.), dog (*Canis familiaris* L.), grouse (*Lyrurus tetrix* L., *Tetrao urogallus* L., *Tetrastes bonasia* L.), woodcock (*Scolopax rusticola* L.) (n = 318).

Bearing in mind the principle of genetic affinity we used immunofluorescence serums for productive and domestic animals to detect antibodies in wild animals' organisms.

For bacteriological research we used internals (heart, kidney, spleen and liver) from the following species: mountain hare (*Lepus timidus* L.), wild boar (*Sus scrofa* L.), Eurasian badger (*Meles meles* L.), cock of the wood (*Tetrao urogallus* L.) (n = 17), were used.

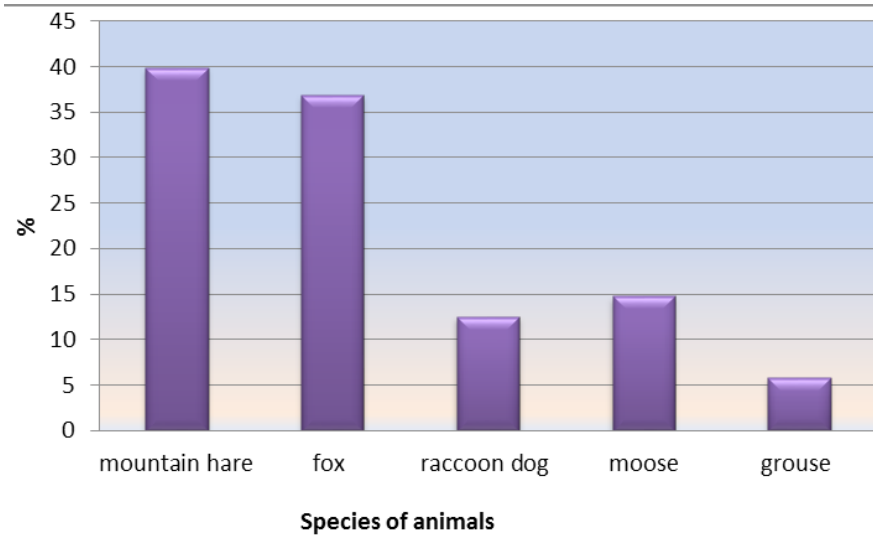
## **3. Results and Discussion**

The carried out research revealed that the highest sickness rate with Lyme disease was detected in mountain hare (*Lepus timidus* L.) 52.7% and fox (*Vulpes vulpes* L.) 38.4%. This rate was somewhat lower with raccoon dog (*Nyctereutes procyonoides* Gray) – 12.5%, elk (*Alces alces* L.) – 14.8%. The lowest infection rate was detected with grouse (*Lyrurus tetrix* L., *Tetrao urogallus* L., *Tetrastes bonasia* L.) – 5.8% (fig. 2). In serums taken from woodcock blood no *Borrelia* antibodies were detected.

A certain importance of domestic dogs for the Lyme disease epizootological chain was noted by many Russian and foreign authors [2, 3, 5, 7].

We have established that 8.3% of dogs have antibodies to the borreliosis agent in their blood. These results make it possible to classify domestic dogs among *Ixodes* ticks hosts and *Borrelia* reservoirs. Furthermore, when dogs are taken to the suburban area, it may result in bringing ticks along from the wildlife to urban parks and homes. This is how dogs can have a real effect on emergence and sustenance of the Lyme disease hotspots in urban areas and affect the local borreliosis incidence rates.

Among 54 bacterial BSK-H broth platings of free-living species internals *Borrelia* was marked out of heart of Eurasian badger (*Meles meles* L.), liver and spleen of a wild boar (*Sus scrofa* L.), that is in 5.5% cases.



In last three years in Kirov region area the *Borrelia* sickness rate with ticks more than 40%. According to A.S. Obert et al. [6] the infection rate over 25% is described as high.

It was defined, that ixodic ticks parasitize the mountain hare, fox, raccoon dog, dog, grouse, wood grouse, badger, and wild boar, so these species are reservoir hosts circulators of the infection in nature.

A considerable infection rate of the mountain hare (*Lepus timidus* L.) can be explained by higher probably of its contact with ticks through bites owing to such factors as size conforming to the ticks concentration field layer size, thick multi-layered coat, high activity and mobility in spring (the rutting season) including summer time.

The research analysis allows to assume, that widening of species composition of testes for *Borrelia* antibodies wild animals argues for a wide range of reservoir hosts for the agent, that includes besides mouse-like rodents (ixodic ticks in preim-agonal phase parasitize them) also many species of game, on which adult (imago) ixodic ticks live.

The conducted by our group comparative analysis of ixodic ticks and wild animals infection showed, that the *Borrelia* tick infection rate is high in areas of origin of infected animals.

We are inclined to believe that the abundance index of mountain hare (*Lepus timidus* L.) can be used as a parameter to predict the Lyme disease epizootic situation in subsequent years as even minor changes in reservoir hosts abundance can influence the number and infection rate of carriers as it increases possibility of *Borrelia* horizontal transmission. While abundance reduction of reservoir hosts will result in carrier's population decline and consequently in decline of the agent's number.

Similar data on the parasitic system dynamics in Lyme disease hot spots are given by Y.V. Kovalevsky et al. [4].

It is indisputable that the peculiarity of any zoonotic disease is its infection hot spot, which is independently from a man in nature, and in view of this a certain degree of probability of a man, domestic or productive animals' infection constantly exists.

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雌性蓝狐 (*Vulpes lagopus*) 血清中的性激素动态取决于年龄和季节  
**SEX HORMONE DYNAMICS IN THE BLOOD SERUM OF FEMALE  
BLUE FOX (*VULPES LAGOPUS*) DEPENDING  
ON AGE AND SEASON**

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抽象。本文对雌性蓝狐 (*Vulpes lagopus*) 中孕酮和雌二醇的浓度变化进行了比较分析。在俄罗斯基洛夫州的“Zverokhozyaystvo”“Vyatka”有限责任公司进行了生物材料的收集工作。我们研究了成年人的血清和雌性狐狸的当前出生年份 (16个目标)。该研究方法基于酶免疫测定。研究表明, 在生命的最初几个月, 雌性蓝狐中孕酮的含量很低, 在动物发育过程中逐渐增加, 到12月达到最大值。

在成年雌性中, 夏季和秋季的孕酮浓度较低, 但同时高于幼犬。到12月, 孕酮分泌增加, 到发情第二阶段达到高值, 这表明排卵开始。排卵后, 其水平持续增长2-3周, 最终在包被后达到最大值。在研究的所有阶段, 成年动物中的孕酮浓度均高于年幼动物。

九月是雌二醇的最高浓度, 然后逐渐下降到发情期。在整个研究期间, 成年动物中雌二醇的浓度高于年幼动物。

关键词: 本体发育, 蓝狐 (成人和年轻人), 年龄相关变化, 酶免疫测定, 孕酮, 雌二醇。

**Abstract.** *The article presents a comparative analysis of changes in the concentration of progesterone and estradiol in female blue fox (*Vulpes lagopus*). Work on the collection of biomaterial was carried out in “Zverokhozyaystvo”*

*Vyatka " LLC of the Kirov oblast, Russia. We studied the blood serum of adults and the current year of birth of female foxes (16 goals). The research methodology is based on enzyme immunoassay. As a result of studies, it was found that the content of progesterone in female blue fox in the first months of life in the blood was low, gradually increasing during the development of the animal, reaching maximum values by December.*

*In adult females, the concentration of progesterone was low in summer and autumn, but higher than in puppies at the same time. By December, there is an increase in progesterone secretion, reaching high values by the second stage of estrus, which indicates the beginning of ovulation. After ovulation, its level continues to grow for 2-3 weeks, ultimately reaches maximum values after coating. At all stages of the study, the concentration of progesterone in adult animals was higher than in young animals.*

*The highest concentration of estradiol was noted in September, then it gradually decreased to the rutting period. Over the entire study period, the concentration of estradiol in adult animals was higher than in young animals.*

**Keywords:** *ontogenesis, blue fox (adult and young), age-related changes, enzyme immunoassay, progesterone, estradiol.*

## **Introduction**

Over the past decade, a significant amount of information has been accumulated in the field of breeding animals with their cellular containment. It should be noted that the physiology of fur animals and especially their sexual behavior is influenced by age and seasonal changes. Given the fact that over the past twenty years, climatic conditions have undergone significant changes, it can be assumed that some changes have also occurred in the physiology of animals. In this regard, existing data require verification and adjustment.

An important biological feature of Arctic foxes (*Vulpes lagopus*) is the seasonality of breeding. These are monoestric animals and produce offspring once a year. The synthesis of hormones is influenced by both endogenous and exogenous factors, in particular the season of the year.

Currently, a large amount of background information has been accumulated in the physiology of fur animals. The morphology and biochemistry of blood [2,3], immunological parameters [4,5] were studied in detail. Moreover, there is much less data on the endocrine system and its effect on reproduction [1,7,8]. Relatively few publications, especially in the context of ontogenesis, analyzing the formation of hormones [6,9]. Perhaps one of the reasons for this situation was the complexity of laboratory methods for determining the concentration of a hormone. Modern diagnostic equipment and reagents can solve this problem.

As already mentioned, modern enzyme immunoassay analyzers allow for a wide range of studies in endocrinology and the reproductive system. The only obstacle is the limited choice of test systems for veterinary medicine or its absence in combination with a high cost. However, practice has shown that it is possible to use medical reagents to determine the concentration of certain hormones. It should be noted that the lack of their species specificity did not allow us to state this, since there are still some differences in the amino acid composition.

**Materials and methods**

Work on taking biomaterial from female blue fox (Polar fox) was carried out in “Zverokhozyaystvo” Vyatka "LLC. Laboratory studies were carried out in the animal husbandry department of the veterinary laboratory of the Federal State Budget Scientific Institution ARNRIHEFF named after prof. B.M. Zhitkova.

As the material for the study, we used the blood serum of adults and the current year of birth of blue fox females (16 animals). The serum concentration of progesterone and estradiol was determined.

Studies were carried out four times outside the rut, in the rut and after coating. The research methodology is based on an enzyme-linked immunosorbent assay. The serological reaction was carried out in standard polystyrene tablets using Stat Fax equipment (IFA reader, shaker-incubator, usher).

In the work, a test system was used to determine progesterone and estradiol in the blood serum of dogs manufactured by “Hema-Medica” LLC.

**Table - The content of progesterone and estradiol in adults and young female foxes ( $M \pm m$ ;  $n = 16$ )**

Blood collection period	Progesterone, nmol/L							
	september	october	november	december	rut *	rut **	rut ***	after coating
Youth	0,23± 0,01	0,74± 0,01	1,9± 0,48	2,42± 1,42	-	-	-	-
Adults	2,3± 0,89	1,76± 0,45	2,06± 0,58	4,27± 0,74	2,6± 1,06	2,03± 0,94	16,66± 7,35	74,95± 13,27
Blood collection period	Progesterone, nmol/L							
	september	october	november	december	rut *	rut **	rut ***	after coating
Youth	0,1 ± 0,1	0,25 ± 0,25	0,35 ± 0,07	0,99 ± 0,22	-	-	-	-
Adults	1,89 ± 0,37	0,9 ± 0,29	0,49 ± 0,07	0,41 ± 0,16	0,42 ± 0,14	0,58 ± 0,04	0,87 ± 0,39	0,56 ± 0,12

Note - \* - proestrus stage 1

\*\* - estrus 1 stage

\*\*\* - estrus 2 stage

The endocrine function of the ovaries in blue foxes was studied in the works of Yu.V. Polyntseva et al., 1979, Diveeva et al., 1982. In these works, it is noted that in fox puppies of 3-4 months of age, the concentration of progesterone and estradiol reaches the level of adult females during the rut. Given that animals reach a mass of sexually mature individuals by this age, the authors consider this rise a sign of puberty. In support of this point of view, they also refer to morphological data on the activation of growth and the onset of follicular development in the ovaries at this time [6]. According to these authors, in October, hormones decline in response to seasonal factors. The next rise in the hormonal activity of progesterone and estradiol was observed in 8-9-month-old puppies at the beginning of the rut.

When studying the content of progesterone and estradiol in the Arctic fox, we did not get results similar to described in the above works. According to our data, for example, the concentration of progesterone in puppies of 3 months of age was  $0.23 \pm 0.01$  nmol/L. Then there was a slight increase in concentration and by the age of 8 months was  $2.42 \pm 1.42$  nmol/L. A similar pattern was observed in puppies and estradiol. Thus, by the level of sex hormones in the blood of female foxes outside the rut, it is quite difficult to judge the onset of puberty. The same data were obtained by A.D. Antipov et al. (1987).

In adult foxes, a significant increase in the concentration of progesterone occurred in the second stage of estrus and amounted to  $16.66 \pm 7.35$  nmol/L. The maximum value of the concentration of this hormone we observed after coating was  $74.95 \pm 13.27$  nmol/L. That is, as a result of the corpus luteum formed after ovulation, the secretion of progesterone by the ovaries increases significantly and reaches a maximum during the first 7-10 days after coating. A high level of the hormone lasts during the first half of pregnancy. This level is necessary to maintain pregnancy and persists in animals for 60 days. From 20-30 days there is a significant decline. A particularly low level of progesterone is observed before childbirth [8].

According to our data, the highest concentration of estradiol in female foxes was noted in September and amounted to  $1.89 \pm 0.37$  nmol/L. Then it gradually decreased by the beginning rutting period ( $0.42 \pm 0.14$  nmol/L).

The maximum concentration of estradiol was observed 2-3 days before coating ( $0.87 \pm 0.39$  nmol/L). Similar data were obtained by A.D. Antipov et al. (1987). The concentration of estradiol after coating was  $0.56 \pm 0.12$  nmol/L.

### **Conclusions**

Our studies have shown that the study of hormonal blood parameters in captive foxes is one of the important stages in understanding the biological characteristics of fur animals.

As practice has shown, the physiology of individual representatives of one species may differ significantly, and will also change over time. We noted a low concentration of gonadotropins during the period of involution of the gonads, i.e. minimal activity of steroidogenesis.



The timing of puberty is different, it depends on the type of animal, color, feeding and keeping conditions and on climatic factors. In postnatal ontogenesis, females have different concentrations of progesterone and estradiol. As a result of the study, we showed the differences between young animals and adult animals. Most likely this is due to the restructuring of the body in critical phases of ontogenesis and in different seasons of the year.

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乳汁和蔬菜营养仔猪中血小板的分泌功能

**THE SECRETORY FUNCTION OF PLATELETS IN PIGLETS  
OF MILK AND VEGETABLE NUTRITION**

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抽象。血小板是体内稳态系统的组成部分之一，在动物体内具有严重的生理意义。它们的功能特性在很大程度上决定了毛细血管中的血液循环，因此决定了组织中新陈代谢过程的严重性。在早期本体发育过程中，仔猪的发育中最重要的是乳制品和植物营养的阶段。这些动物生产特性的发展可能取决于其整个止血机制的活性。有理由认为，血小板功能在这些过程中起着重要的作用，这些功能可能会影响微循环的活动，从而影响组织中合成代谢的水平以及仔猪的生长动力学。因此，为了继续发展养猪科学和实践，研究了从牛奶向蔬菜营养转变的仔猪血小板功能的分泌机制。在进行的工作中发现，在仔猪的牛奶和蔬菜营养阶段，血小板的分泌活性增加。应考虑这一机制，此年龄的仔猪中受体和受体后反应的活化发展，这为它们提供了增加的血小板分泌过程。显然，其基础在于仔猪的乳汁和胆固醇对蔬菜的营养增加，肌动蛋白，肌球蛋白，ADP的含量以及磷酸腺苷分泌的增加。这些变化有助于仔猪在开始食用植物性食物时保持体内的稳态和最佳的微循环水平。

关键词：仔猪，乳汁和蔬菜营养相，血小板，分泌。

**Abstract.** *Platelets, being one of the components of the homeostasis system, have serious physiological significance in the animal organism. Their functional characteristics largely determine the hemocirculation in the capillaries, and, consequently, the severity of metabolic processes in tissues. Of great importance in the development of piglets during early ontogenesis is the phase of dairy and plant nutrition. The development of the productive characteristics of these animals may depend on the activity of hemostatic mechanisms throughout it. There are reasons to believe that a large functional role in these processes is played by platelet functions that can affect the activity of microcirculation, and, consequently, affect the level of anabolism in tissues and the dynamics of growth in piglets. For this reason, in order to continue the progressive development of the science and practice of pig farming, a study was made of the state of the secretory mechanisms of platelet functioning in piglets that switch from milk to vegetable nutrition. In the work carried out it was found that during the phase of milk and vegetable nutrition in piglets, an increase in the secretory activity of platelets is noted. The mechanisms of this should be considered the development of activation of receptor and postreceptor reactions in piglets at this age, which provide them with increased platelet secretion processes. The basis of this, apparently, lies in the increase in platelets of piglets of milk and vegetable nutrition of cholesterol, the amount of actin, myosin, ADP and the intensification of the secretion of adenosine phosphates. These changes help maintain piglet homeostasis and the optimal level of microcirculation in the tissues during the start of their consumption of plant foods.*

**Keywords:** *piglets, phase of milk and vegetable nutrition, platelets, secretion.*

### **Introduction**

A very important regulator of the overall viability of the organism of productive animals is the hemostatic system. It has long been observed that during the entire ontogenesis, it supports many biologically significant functions. Its optimal state ensures the preservation of liquid blood during hemocirculation, and during vessel alteration, the rapid formation of a blood clot strictly in the damage zone. A sufficient degree of activity of the hemostasis system minimizes blood loss and maintains the viability of the whole organism of productive animals due to the necessary level of tissue trophism and metabolism in them. In this regard, it becomes necessary to further study the aspects of hemostasis in pigs. The practical use of this knowledge can significantly activate pig breeding and increase their growth. In addition, the practical application of new knowledge can help in the further development of economically advantageous options for regulating their functional state [5].

Platelets are considered a physiologically significant component of hemostasis. A change in their activity always significantly affects the processes of microcirculation, and therefore the severity of metabolism in the internal organs. Of great importance in the implementation of the program of early ontogenesis in all productive animals is the phase of dairy and plant nutrition. At this age, the hemostatic activity of platelets can significantly affect the intensity of development of the organism of pigs and the severity of their growth [3]. For this reason, studies of any aspect of the functioning of platelet hemostasis in piglets during the phase of dairy and plant nutrition are of great importance for science and practice.

Considering the above, the goal was set in the work: to find out the state of platelet secretion in piglets during the phase of dairy and plant nutrition.

### **Research methods**

The study was carried out in strict accordance with the ethical principles established by the European Convention for the Protection of Vertebrates Used for Experimental and Other Scientific Purposes (adopted in Strasbourg on March 18, 1986 and confirmed in Strasbourg on June 15, 2006).

The work was performed on 37 pigs of large white milk-vegetable nutrition breed having optimal functional status. Animals were examined and examined five times: at the age of 21 days, 25 days, 30 days, 35 days and 40 days of their life. All piglets included in the study were obtained from completely healthy sows 2-3 farrowing.

Platelets were isolated from the blood of the examined piglets using traditional washing and resuspension methods. In platelets of piglets, cholesterol levels were quantified using the enzymatic colorimetric method using a kit manufactured by Vital Diagnosticum (Russia).

The study determined the severity of platelet peroxidation of platelet lipids after washing and resuspension by the concentration of malondialdehyde and acyl hydroperoxides in them by traditional methods [2].

In the platelets of all piglets taken before and after thrombin activation, the amount of actin and myosin, as well as the ADP content and its secretion rate against the background of the appearance of thrombin in the plasma, were recorded [2]. The results obtained in the study were processed by t-student test.

### **Research results**

In the study, in the membrane structures of platelets in piglets during the phase of milk-vegetable nutrition, an increase in the amount of cholesterol was observed, which reached the level of  $0.62 \pm 0.009 \mu\text{mol}/10^9$  platelets by the end of the observation (Table 1). This was accompanied by a gradual weakening of lipid peroxidation processes in their platelets. This was indicated by the found decrease in the blood platelets of piglets by the concentration of acyl hydroperoxides by 9.9% and the level of malondialdehyde to a value of  $0.49 \pm 0.014 \mu\text{mol}/10^9$  platelets.

An increase in the quantitative content of ADP (by 12.5%) and an intensification of its secretion (by 14.1%), which develops in response to stimulation of blood platelets with thrombin, were found in the platelets of piglets during the phase of milk-vegetable nutrition.

**Table 1 - Platelet counts in piglets of milk and vegetable nutrition**

Parameters	Age of observation, n=37, M±m				
	21 days of life	25 days of life	30 days of life	35 days of life	40 days of life
Platelet Cholesterol, $\mu\text{mol}/10^9$ platelets	0.58±0.010	0.58±0.012	0.59±0.009	0.60±0.007	0.62±0.009 p<0.05
Platelet Acyl Hydroperoxides, D233/ $10^9$ platelets	2.11±0.010	2.08±0.016	2.04±0.011	1.97±0.007	1.92±0.012 p<0.05
Platelet malondialdehyde, $\mu\text{mol}/10^9$ platelets	0.56±0.010	0.54±0.010	0.53±0.008	0.51±0.011	0.49±0.014 p<0.05
The actin content in intact platelets,% of the total protein content in the platelet	28.6±0.12	29.2±0,09	29.6±0.14	30.0±0.15	31.4±0.09
The actin content in platelets on the background of thrombin aggregation,% of the total protein content in the platelet	62.4±0.16	63.8±0.10	64.9±0.11	66.6±0.16	68.4±0.13
Myosin content in intact platelets,% of total platelet protein	12.7±0.06	13.4±0.07	14.2±0.18	15.6±0.10	16.9±0.09 p<0.05
The myosin content in platelets on the background of thrombin aggregation,% of the total protein content in the platelet	73.9±0.14	74.2±0.18	77.8±0.12	75.3±0.10	76.4±0.15
ADP content in platelets, $\text{mmol}/10^9$ platelets	3.36±0.07	3.39±0.06	3.48±0.05	3.61±0.10	3.78±0.09
The degree of secretion of ADP from platelets on the background of stimulation,%	40.4±0.10	41.5±0.12	42.8±0.09	44.2±0.07	46.1±0.12 p<0.05

Legend: p – reliability of the dynamics of the considered indicators relative to the beginning of the phase of milk and vegetable nutrition.

The amount of actin in intact blood platelets in piglets at the age of 21 days was 28.6±0.12% of the total protein present in platelets. At an older age, its level increased and amounted to 31.4±0.09% of the total protein present in platelets on the 40th day of life (Table 1). The activity of the process of additional generation of actin macromolecules under the conditions of platelet aggregation in piglets during the entire observation period increased by 9.6%.

In intact blood plates of the observed piglets at the age of 21 days, the amount of myosin was  $12.7 \pm 0.06\%$  of the total protein content in platelets. As the age increased, its amount grew, reaching on the 40th day of ontogenesis  $16.9 \pm 0.09\%$  of the total protein content found in platelets. During the implementation of platelet aggregation in piglets during the observation period, this indicator increased by 3.4%.

### **Discussion**

Previously collected data on the physiology of pigs need further addition. The need to study the dynamics of the secretory activity of platelets in growing piglets due to its great importance in trophic processes becomes clear [4]. Its condition is very significant for hemocirculation in small vessels, as it determines the metabolic rate in the tissues. Despite the high physiological importance of platelet hemostasis activity, it remains poorly studied in piglets during the phase of dairy and plant nutrition.

The found reduction in the developmental period of platelet aggregation by applied inducers indicates an increase in the activity of receptor and post-receptor mechanisms of this process in piglets between 21 and 40 days of life, which is realized in response to strong and weak aggregation inducers.

The intensification of the platelet secretion process during the phase of milk and vegetable nutrition in piglets should be associated with the simultaneous activation of the membrane and intracellular mechanisms in their platelets. This is primarily due to an increase in the amount of cholesterol in their membranes. This should be considered the basis for the interaction of platelets with each other during hemostasis.

The intensification of ADP secretion processes was essential in the growth of hemostatic activity of platelets in the observed piglets. This was ensured by the revealed increase in the amount of actin and myosin in them and the activation of self-assembly of these molecules under platelet aggregation conditions [1]. In addition, the animals showed an increase in the amount of ADP in dense platelet granules and an intensification of its secretion under conditions of aggregation of blood plates in response to a strong aggregation inducer.

The increased severity of their platelet secretion mechanism inevitably stimulates platelet aggregation. This conclusion is based on the fact that adenosine phosphates and thromboxane released from platelets, acting on their receptors, stimulate primary hemostasis and ensure the growth of platelet plugs.

### **Conclusion**

For piglets during the phase of milk-vegetable nutrition, an increase in the secretory activity of platelets is characteristic. This is based on membrane changes that affect the functional state of receptors and intracellular platelet activation mechanisms. This is manifested in piglets of this age by increased platelet secretion of adenosine phosphates. The increase in activity of this process found in the work, apparently, helps preserve the optimal functioning of tissues in piglets by providing the necessary level of microcirculation adequate to the needs of their body at this age.

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乳阶段Kholmogory犊牛的血小板聚集功能特征  
**FEATURES OF PLATELET AGGREGATION FUNCTION  
IN KHOLMOGORY BREED CALVES  
DURING THE DAIRY PHASE**

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抽象。在不同种类的生产性动物中血小板聚集的严重程度会影响微循环的进程和器官中的营养水平，这强烈决定了生长过程。因此，属于不同品种的早期成虫的第二阶段中小牛的血小板聚集状态引起了人们的极大兴趣。该工作的目的是阐明霍尔莫哥斯克牛犊-奶牛中血小板聚集的特征。这项工作是对42头健康的Kholmogorsk犊牛进行的，这些犊牛是在经过2或3次怀孕后从完全健康的母牛身上获得的。小牛在工作中接受了五次检查。使用了生化，血液学和统计学研究方法。在观察期间，在年轻的霍莫莫斯基品种中，发现对所有测试诱导物的血小板聚集均增加。在这些动物中，观察期内无活性的血小板数量略有减少。同时，血液中活性血小板的数量增加了18.1%，不同大小的血小板聚集体的数量也增加了。这些变化基本上是基于所检查的牛犊中血小板中血栓烷生成量的增加，这是由于它们中环氧化酶和血栓烷合成酶的活性增加所致。研究结果表明，对于年轻的霍姆莫尔斯克奶粉喂养阶段来说，血小板聚集的某些特征是增加的。

关键词：犊牛，奶牛期，霍尔果蝇品种，血小板，聚集，分泌。

**Abstract.** *The severity of platelet aggregation in different species of productive animals affects the course of microcirculation and the level of trophism in organs, which strongly determines the growth processes. Therefore, the state of*



*platelet aggregation in calves in the second phase of early ontogenesis, belonging to different breeds, is of great interest. The purpose of the work is to elucidate the characteristics of platelet aggregation in calves-milkmen of Kholmogorsk breed. The work was performed on 42 healthy Kholmogorsk breed calves obtained from completely healthy cows after 2 or 3 pregnancies. Calves were examined five times during work. Biochemical, hematological and statistical research methods were used. In young Kholmogorsky breed during the observation, an increase in platelet aggregation in response to all tested inducers was revealed. In these animals, the number of inactive platelets during the observation period decreased slightly. At the same time, the number of active platelets in their blood increased by 18.1% and the number of platelet aggregates of different sizes increased. These changes were basically based on the examined calves increased thromboxane generation in their platelets due to increased activity of cyclooxygenase and thromboxane synthetase in them. As a result of the study, it became clear that for the young Kholmogorsk breed during the phase of milk feeding, some increase in platelet aggregation is characteristic.*

**Keywords:** calves, dairy phase, Kholmogory breed, platelets, aggregation, secretion.

### **Introduction**

The activity of aggregation of blood plates significantly determines the course of microcirculation in different species of mammals [1]. There are still many aspects of platelet hemostasis in cattle of different breeds that have not been sufficiently studied. Only the results of individual studies are available on the functioning of platelets in this type of productive animals, in which their breed was recorded [2]. However, the available information does not make it possible to create a clear opinion on this issue, which causes a great need for further research [3]. They are necessary due to the fact that platelet aggregation strongly affects microcirculation, which very much determines the processes of growth and development in the body of calves, which means the realization of their productive potential [4]. Due to the importance of assessing the role of pedigree features in ensuring the level of platelet functions in various highly productive cattle breeds, it seemed important to the authors to determine the level of activity of blood platelets in young high-dairy Kholmogorsk breed during the second phase of their early ontogenesis.

The goal – is to elucidate the specific features of platelet aggregation in Kholmogorsk breed dairy calves.

### **Methodology**

The work was carried out taking into account all ethical standards defined by the European Convention for the Protection of Vertebrate Animals, which are used in experimental and other scientific works (adopted in Strasbourg on March 18, 1986 and confirmed in Strasbourg on June 15, 2006).

In the work, 42 purebred calves of the Kholmogorsk breed were examined. Young growth is obtained from healthy purebred cows of 2-3 pregnancy, covered with a purebred Kholmogory bull. Animals were examined 5 times: on the 11th day, on the 15th day, on the 20th day, on the 25th day and on the 30th day of their ontogenesis.

In calves platelets, an indirect method was used to evaluate the level of thromboxane synthesis and the functionality of the enzymes performing this process - cyclooxygenase and thromboxane synthetase. For this purpose, three transfer samples were performed using a photoelectrocolorimeter [5].

The time of onset of platelet aggregation (PA) was determined using a visual micromethod [6] using a number of agonists: ADP (at a dose of  $0.5 \times 10^{-4}$  M), thrombin (at a dose of 0.125 units/ml), adrenaline (at a dose of  $5, 0 \times 10^{-6}$  M), collagen (in a dose - 1: 2 dilution of the main suspension), and ristomycin (in a dose of 0.8 mg/ml) in plasma, which was necessarily standardized by the number of platelets to a level of  $200 \times 10^9$  platelets per liter. The level of intravascular platelet activity was determined using a phase contrast microscope [6]. Statistical processing of all the digital data obtained during the study was carried out by the software package "Statistics for Windows V. 6.0", "MicrosoftExcel". Differences in digital data were considered significant at  $p < 0.05$ .

### **Results of the study**

During the milk feeding phase, calves of the Kholmogory breed showed an increase in the activity of blood platelets. In calves taken under observation, PA in response to collagen gradually accelerated and by the end of the phase developed in  $27.3 \pm 0.21$  s. A comparable PA acceleration was found for ADP and ristomycin (the process accelerated to  $31.9 \pm 0.23$  s and  $41.2 \pm 0.16$  s, respectively). In the case of using thrombin and adrenaline in the observed animals, a decrease in the time of development of PA to  $43.2 \pm 0.16$  s and  $85.2 \pm 0.25$  s, respectively, was also revealed (table).

The content of discoid blood platelets in the blood of young Kholmogorsky breed gradually decreased over the observation period. Moreover, during this time, the number of activated platelets in them increased by 18.1%. In animals, the content of free platelet aggregates of any size also increased.

The found increase in the level of synthesis in their blood plates of thromboxane can be considered very significant for realizing a reduction in the time of PA onset in young calves of the Kholmogory breed. This was evidenced by an increase in PA in a simple portable test, the value of the indicator of which in calves on day 30 was  $39.5 \pm 0.16\%$ . The revealed dynamics in the observed animals was formed as a result of an increase in the activity of platelet cyclooxygenase and thromboxane synthetase. This was proved by the found increase by 30 days of PA recovery during the collagen-aspirin test to  $89.9 \pm 0.12\%$  and an increase in PA recovery during the collagen-imidazole test to  $50.6 \pm 0.14\%$ .

**Table. Platelet Parameters in Kholmogorsk Breeding Dairy Calfs**

Considered indicators	Kholmogorsk calves, n=42, M±m				
	11 day	15 day	20 day	25 day	30 day
The recovery level of PA in the collagen-aspirin sample,%	81.9±0.09	83.6±0.05	85.3±0.08	86.4±0.05	89.9±0.12 p<0,05
The recovery level of PA in the collagen-imidazole sample,%	44.1±0.07	45.5±0.06	46.7±0.09	48.2±0.11 p<0.05	50.6±0.14 p<0.05
The severity of PA in a simple transfer sample,%	33.9±0.09	34.6±0.12	36.1±0.07	37.6±0.10 p<0.05	39.5±0.16 p<0.05
Duration of PA with ADP, s	36.9±0.17	36.2±0.13	35.5±0.20	34.2±0.16	31.9±0.23 p<0.05
Duration of PA with collagen, s	31.1±0.14	30.5±0.15	29.3±0.12	28.4±0.10	27.3±0.21 p<0.05
Duration of PA with thrombin, s	50.1±0.17	49.2±0.24	48.1±0.20	46.5±0.24	43.2±0.16 p<0.05
Duration of PA with ristomycin, s	47.6±0.18	46.9±0.16	45.9±0.13	43.0±0.20	41.2±0.27 p<0.05
Duration of PA with adrenaline, s	94.2±0.26	93.6±0.19	92.3±0.23	90.1±0.28	85.2±0.25 p<0.05
The level of platelets, discocytes,%	74.0±0.17	72.6±0.21	71.3±0.19	69.2±0.23	67.3±0.29 p<0.05
The total number of active forms of platelets,%	26.0±0.12	27.4±0.18	28.7±0.16	29.8±0.14 p<0.05	30,7±0.10 p<0.01
The level of small platelet aggregates, per 100 free platelets	4.1±0.06	4.3±0.04	4,6±0.03 p<0.05	4.9±0.07 p<0.01	5.2±0.08 p<0.01
The level of medium and large platelet aggregates, per 100 free platelets	0.16±0.024	0.17±0.019	0.18±0.017 p<0.05	0.19±0.015 p<0.01	0.21±0.018 p<0.01

Note: p - is the reliability of the dynamics of the recorded indicators in relation to the level of 11 days of age

### Discussion

Previous studies on various aspects of mammalian physiology have significantly clarified the work of a large number of hematological mechanisms in maintaining homeostasis [7]. We can assume that platelet activity is of great importance for the functioning of the body. In this case, the characteristics of the hemostatic properties of platelets in calves, taking into account their breed, are not clarified. In view of the presence of this gap in scientific information, a study was made of platelet functions in young Kholmogorsky breed, which is still considered one of the highly productive in milk [8]. Its high productive properties indicate its great genetic potential, which necessitates a thorough study of all aspects of its physiology.

A slight decrease in PA time in response to collagen and ristomycin was found to indicate an unexpressed increase in platelet adhesion in the examined animals during the milk feeding phase. Revealed its strengthening was ensured by the implementation of at least two processes. The first was to accelerate platelet aggregation under the influence of collagen. Apparently, this is due to an increase in the outside of platelets of young animals in the first month of life, the number of glycoproteins Ia-IIa and VI involved in the interaction with collagen. The second mechanism for enhancing the adhesion of platelets of animals of Kholmogory breed between 10 and 30 days of life should be considered the increase in the number of receptors on their membranes that bind to molecules of von Willebrand factor (GPIb), the level of which undoubtedly increases in their blood during this time. This was confirmed in the observed calves by a decrease in the period of development of PA with ristomycin [9].

The reduction of the time of the onset of platelet aggregation found in calves of the Kholmogorsk breed during the milk feeding phase provided strong protection for their body from blood loss resulting from trauma. The detected acceleration of PA development in them in response to the use of strong aggregation stimulants - collagen and thrombin, apparently, is associated not only with an increase in the density of receptors for them on platelet membranes. This is also associated with an increase in the activity of phospholipase C in their cytoplasm, which initiates the events of the phosphoinositol pathway, and with the activation of phosphorylation of proteins included in the platelet system of contractile proteins. An increase in the activity of formation of inositol triphosphate in platelets of young Kholmogorsky breed was evident against the background of an enhanced release of  $Ca^{2+}$  ions from their depot, which accelerated the actomyosin self-assembly and activated its reduction [1].

Assessing the effect on platelets of weak aggregation inducers (ADP and adrenaline) in calves of the Kholmogory breed, it was also possible to identify an acceleration of the aggregation process. Apparently, this was due to an increase in the density of fibrinogen receptors located on platelets (GPIIb-IIIa) and as a result of an increase in the activity of phospholipase  $A_2$  in their cytoplasm [2]. This was also caused by an increase in the exit of membranes into the cytoplasm of platelets of functionally significant amounts of arachidonic acid, which is a substrate for the synthesis of thromboxane  $A_2$ . The high activity of this process in young Kholmogorsk breed was formed due to an increase in the activity of enzymes that provide this process - cyclooxygenase and thromboxanesynthetase. This was indicated by the increase in PA, regulated during transfer of samples - collagen aspirin and collagenimidazole.

## Conclusion

Calves of Kholmogory breed during the phase of milk feeding have a functional optimality of platelet aggregation. Its condition forms the level of blood circulation required for the life support of their organs in the vessels of young animals of this breed during the second phase of their early ontogenesis. A small intravascular aggregation of blood platelets in calves of this breed during the milk feeding phase maintains their desired blood flow level in the muscle capillaries and in all internal organs, which lays the foundation for their future high productivity.

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农业导航坐标系

## AGRICULTURAL NAVIGATION COORDINATE SYSTEMS

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抽象。根据直角坐标系OXYZ中预定义的程序，对自行式农业机械和机械拖拉机单元 (MTU) 的运动路径进行自动控制。坐标系通过沿岬角的整个长度的线性地标和以无线电导航参考点形式的点地标链接到地形。

轨迹的编程由引导面和线执行，这些引导面和线表示满足生成路径失配信号的算法的点的几何位置。

将MTU轨迹链接到地形的坐标系统应具有较高的长期稳定性，多功能性，抗噪性，自治性和效率。只有由固定的线性界标以地下载流导线形式定义的坐标系才能满足这些要求。

关键词：农业导航，农业机械机器人，导航坐标系，引导面。

**Abstract.** *Automatic control of the motion paths of self-propelled agricultural machines and machine-tractor units (MTU) is carried out in accordance with the program predefined in the rectangular coordinate system OXYZ. The coordinate system is linked to the terrain by linear landmarks along the entire length of the headland and point landmarks in the form of radio navigation reference points.*

*The programming of the trajectories is carried out by the guiding surfaces and lines, which represent the geometrical place of the points satisfying the algorithm for generating the path mismatch signal.*

*Coordinate systems for linking MTU trajectories to terrain should have high long-term stability, versatility, noise immunity, autonomy, efficiency. Only coordinate systems defined by stationary linear landmarks in the form of underground current-carrying wires satisfy these requirements.*

**Keywords:** *agricultural navigation, robotics of agricultural machinery, navigation coordinate systems, guiding surface.*

Manual and automatic control of the trajectory of self-propelled agricultural machinery and machine-tractor units (MTU) requires the solution of three problems [1]:

- programming the desired motion path;
- execution of the program, during which the actual trajectory is monitored and the path mismatch signal is generated, as the difference between the program and the actual location of the MTU;
- motion assignments - converting a path mismatch signal into MTU steering command to reduce the mismatch.

It is widely believed that when manually operated, the tractor driver uses the trace of the previous pass or previous operation in the form of a furrow or a row of plants as a “program trajectory” [2]. This opinion is only partially true, since in reality the trace is the OX coordinate axis of the OXYZ coordinate system, formed by horizontal XOY and vertical XOZ and YOZ planes. At the same time, the trajectory control program is in the memory of the tractor driver, who initially receives the task to perform a specific job, and in the process of moving the MTU mentally forms a program based on his own knowledge and practical experience. The same coordinate line allows you to create different programs by tractor drivers of different qualifications or by managing different MTU.

Similarly, with automatic control, the trace of the previous pass is used to bind the actual path of movement to the terrain, and the path mismatch signal is generated completely or partially on the MTU. In this case, the “program” or “planned” trajectory represents the line of intersection of the “guide surface” with a horizontal plane in which the sensitive element of the path mismatch sensor moves.

If the MTU auto-driving system is equipped with a path mismatch contact sensor, the sensitive element of which converts the force impact of the trace into a useful sensor signal, the planned path coincides with the trace, that is, with the coordinate line. Non-contact sensors respond to electromagnetic or mechanical (acoustic) energy emitted or reflected by a reference point defining a coordinate system. In this case, the planned path of the MTU, characterized by the path of the sensor, is determined by the algorithm for converting the output signal of the mismatch sensor into a path mismatch signal at the output of the MTU positioning device. As well as the coordinate system, which implements the binding of the planned trajectory to the terrain.

The guide surface programming the MTU trajectory is the geometrical location of the points, when combining the path mismatch sensor with which there is no mismatch signal at the output of the positioning device.

The need to separate the “software path” into a coordinate system and a guide surface is caused by the need to identify and eliminate the causes of low quality MTU positioning, for example, - a high level of interference.

In agricultural navigation, two types of landmarks for defining coordinate systems are of practical importance: linear along the entire headland and point. In turn, linear landmarks can be track and stationary, and point landmarks can be fixed and mobile.

Trace landmarks are naturally formed when performing the previous pass or previous operation. Such guidelines do not require additional costs for their creation, but do not have universality, durability, and technological reliability. Stationary linear landmarks can be in the form of a “constant gauge”, an irrigation main channel or a forest belt, but only landmarks in the form of insulated underground wires are of practical importance. When wires are fed by alternating currents in the surrounding space, an alternating magnetic field arises, the measurement of which allows to determine the position of the MTU relative to the wires with millimeter accuracy.

The magnetic field is characterized by intensity, which is measured using induction transducers. Which is represented by magnetic antennas, the output voltage of which is used to generate a path-matching signal. Fundamentally, nothing changes if the underground wire is shortened to the size of the radio antenna and switched from induction, low-frequency navigation, to radio-technical - high-frequency. Therefore, it is unlawful to oppose “linear” programming of trajectories to “coordinate”, radio engineering. The difference is due to the different type of reference for coordinate systems, but not to the principle of programming required and determining the actual MTU trajectories.

In agricultural navigation, MTU trajectories are programmed in rectangular coordinate systems, and the measured parameters are distances. Radio navigation methods for measuring distances are based on the final propagation velocity of radio waves, which depends on the propagation medium. The maximum speed can be achieved in vacuum, and in material media is reduced. Which is the source of distortion in distance measurement accuracy and MTU positioning accuracy. The second source of distortion can be the instability of the parameters or low noise immunity of the hardware of the location device.

MTU auto-driving systems, positioning devices, coordinate systems and their landmarks should provide:

- accuracy of trajectory control, measured in hundredths of a meter;
- long-term stability of trajectories - harvesting should be carried out along the paths of sowing and planting;
- versatility regardless of soil and climatic conditions, cultivated plants and field work;



- autonomy guaranteeing operability during periods of field work;
- noise immunity, eliminating even a short-term loss of control, which can create emergency situations;
- profitability and ease of operation.

Track and radio navigation coordinate systems do not satisfy the above requirements, since the former do not have universality, noise immunity, and durability. The coordinate systems defined by navigation satellites do not have autonomy, and those specified by local radio navigation means do not have stability. Therefore, the only type of landmarks whose coordinate systems satisfy all the requirements are stationary linear landmarks, of which the most promising are landmarks in the form of underground current-carrying wires.

Algorithms for generating path misalignment signals in the magnetic fields of underground wires create two types of guide surfaces - as surfaces of symmetry of the magnetic field, and as isosurfaces, all points of which satisfy a given condition. Such a condition may be, for example, equality of tension to a given value:  $H = H_0 = \text{const}$ .

The symmetry guide surfaces are created by differential or difference-amplitude algorithms, the advantage of which is the high stability of the guide surfaces, and the disadvantage is the limitation of the distance between the wires to the maximum displacement range of the path mismatch sensor relative to the MTU longitudinal axis.

Isosurfaces are created by “rangefinder” algorithms and can be located at an arbitrary distance from current-carrying wires. So, the isosurface of the amplitude-compensation algorithm  $\delta = H = H_0$  is a cylindrical surface that is coaxial with the wire and spaced from it at a distance determined by the given value of  $H_0$ . The disadvantage of the algorithm or location method is the dependence of the location of the guide surface on the current strength in the wire and the electrical conductivity of the soil, and MTU on the  $z$  coordinate of the path mismatch sensor.

A rectilinear guiding surface is created by various computational algorithms, for example [3]:

$$\delta = \frac{r_1^2 - r_2^2}{2B} - y_0, \quad (1)$$

where  $r_1$  and  $r_2$  - the distance from the mismatch sensor to current-carrying wires located on both sides relative to the MTU, at a distance  $B$  from each other,  $y_0 = \text{const}$  - a given offset of the guide surface relative to the median plane between the wires.

Magnetic field strength is inversely proportional to the distance  $r$ :

$$H = \frac{l}{2\pi r},$$

therefore, algorithm (1) after substitution and transformation takes the form:

$$\delta = y - y_o = \frac{l^2}{8B\pi^2} \cdot \frac{H_2^2 - H_1^2}{H_1^2 \cdot H_2^2} - y_o. \quad (2)$$

Monitoring the execution of the motion program is possible in the same coordinate system in which the trajectory was programmed. In this case, the path mismatch signal is independent of the direction of the MTU longitudinal axis. If, however, when the sensor rotates a path misalignment around the vertical axis, the sensor output changes, the sensor measures the coordinates of a fixed reference point in the moving polar coordinate system associated with the sensor. Moreover, the closest distance to a fixed linear reference point, the distance to a point of reference with a given polar angle, or the polar angle can be measured. So, with manual control, the tractor driver can focus on the magnitude of the polar angle at a fixed distance to the point of sight; with automatic control, the positioning device can measure the distance to a linear landmark at a constant polar angle, or, like a tractor driver, the magnitude of the polar angle [4].

The programming of the trajectory of automatic MTUs in fixed coordinate systems can be considered as a special case of programming the trajectory of the driven unit with understudy driving, corresponding to the leader's zero speed. In the general case, the backup path is determined by the leader's movement program, and the relative position of the backup and the leader is additionally programmed in the "local" coordinate system associated with one of the units or both at the same time.

The connection of the path mismatch sensor on one of the units with the reference point on the second can be mechanical and energetic, electromagnetic. In both cases, the mutual movement of the units is carried out along the guide surfaces and lines, the shape of which is determined by specific technical solutions used as landmarks and sensors. The number of coordinate systems that may be required for the mathematical description of the dependence of the path mismatch signal on the relative positions of the leader and the understudy is increasing.

The unity of the principles of programming the trajectories of the leader and the understudy is ensured by the unity of the used technical means - the methods and means of locating single units are similar to the methods and means that can be used to determine the relative position of the leader and the understudy during understudy driving.

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形成钢轨端磁化的工厂和运营因素, 以及开发钢轨金属去磁新技术的需求  
**FACTORY AND OPERATIONAL FACTORS FOR THE FORMATION  
OF MAGNETIZATION OF RAIL ENDS AND THE NEED  
TO DEVELOP A NEW TECHNOLOGY OF DEMAGNETIZATION  
OF RAIL METAL**

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抽象。 本文分析了工厂和运营中轨道末端磁化的主要因素。 对现有退磁方法进行了分析和列举。 证实了创建新的消磁技术的必要性。

关键字: 磁化, 轨道末端, 信号, 去磁。

**Abstract.** *The article analyzes the main factors of magnetization of the ends of the rail, both factory and operational. The analysis and enumeration of existing methods of demagnetization are given. The necessity of creating a new demagnetization technique is substantiated.*

**Keywords:** *magnetization, rail ends, signals, demagnetization.*

As is known, [1, 2], during operation, the rails can be characterized by a certain residual magnetization, and in the region of insulating joints, the ends of the rails can be magnetized to values  $\pm (450-500)$  E. The magnetization of the ends of new rails of the rail track is one of many, but a significant cause of errors when reading ALSN signals during locomotive movement. In this regard, there is a need to consider the problem of the magnetization of the ends of the rails in more detail in order to exclude it in the future. A study of the magnetization of new rail circuits stacked and mounted on ballast can be carried out using [3], a meter (indicator) of residual induction (tension) ION-4. The value of the magnetic field should not exceed 3 mT. If it is necessary to accurately measure the magnetic field, a residual induction meter ION-5 is used.

The fact of the presence of the initial magnetization of the ends of the rails indicates that this magnetization appears even before their laying and installation of the rail chain. Consequently, the appearance of this magnetization must be sought not during the laying process, but at the stage of rail production, measures to determine the compliance of finished rails with technical requirements, non-compliance with measures for 100% demagnetization of rails dispensing lots, which is carried out at a rail rolling plant.

Finished rolled rails undergo volumetric quenching in oil along the entire length, however, according to [4], paragraph 1.7 - the surface of the rail head at its ends must be surface quenched (after rolling heating) by high-frequency currents, while according to paragraph 1, 6, the rails should not contain harmful heterogeneities of the macrostructure (spotted segregation, inversion of the crust, white and dark spots, drafts, fistulas, foreign metal and slag inclusions, etc.).

Surface quenching of the ends of the rails is necessary for the reasons:

- the ends are subjected to additional shock loads from carriage wheels moving at high speed;
- periodic longitudinal loads on mounting bolt holes with seasonal changes in ambient temperature;
- constant lateral loads during collisions of wagon wheels on sections of bolted fastenings of rails with each other.

There are several important processes in surface end hardening. First, in the structure of some ends, defects of hardened steel (cracks, kinks, tears) inevitably appear (Fig. 1) due to the sharp cooling of the material by a fast-moving jet of cold water and uneven changes in the volume of various zones, which in turn can lead to a decrease in the strength of the ends.

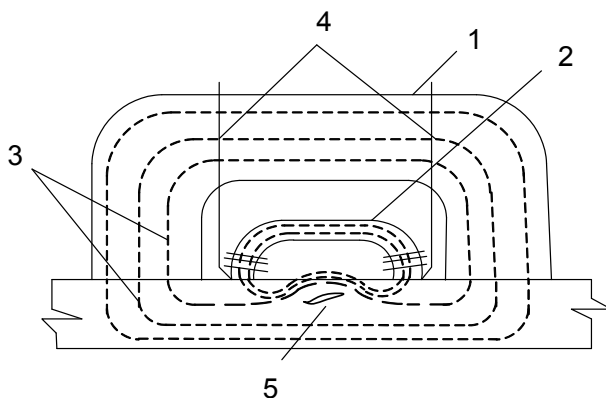


*Figure 1 - Quenching cracks in the hardened layer at the end of the rail*

After hardening, it is recommended to release steel at temperatures of 150-200 °C. Low tempering, slightly reducing the hardness of a surface-hardened product, significantly (often 1.5-2 times) increases the resistance of steel to brittle fracture, increases the fatigue strength of the part, reduces sensitivity to stress concentrators;

Secondly, to a depth of 2 mm to 10 mm over the entire surface of the end of the rail (including the head, neck, sole), the steel acquires a fine-grained structure similar to the martensitic one, which in turn is characterized by high coercive force and residual induction and, accordingly high magnetic energy.

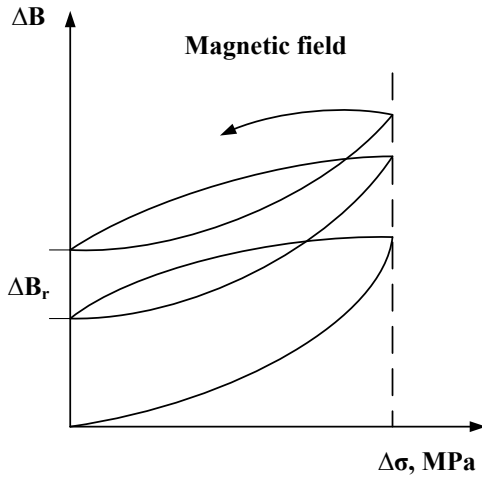
According to [5], and specifically paragraph 4.3, defects that are associated with violations of the rail manufacturing technology relate to defects obtained during surface hardening and such defects must be rejected by total non-destructive magnetic testing (NMT) (Fig. 3) at the factory.



**Figure 3** – The method of non-destructive magnetic control during DC magnetization (1 – electromagnet; 2 – flux probe; 3 – magnetic field lines; 4 – terminals of the recording device; 5 – defect)

During DC magnetization, the surface and subsurface layers of the test object are magnetized, which makes it possible to detect both surface and subsurface (to a depth of 5 mm) defects, but it is difficult to demagnetize after defectoscopy (especially for magnetically hard materials). The martensitic structure of hardened rail steel is a magnetically hard material. Therefore, after the NMT of the ends of the rails, a region of stable magnetization is formed in the end region. This area will subsequently cause a failure in the ALSN code signals if the ends of the rails are not demagnetized.

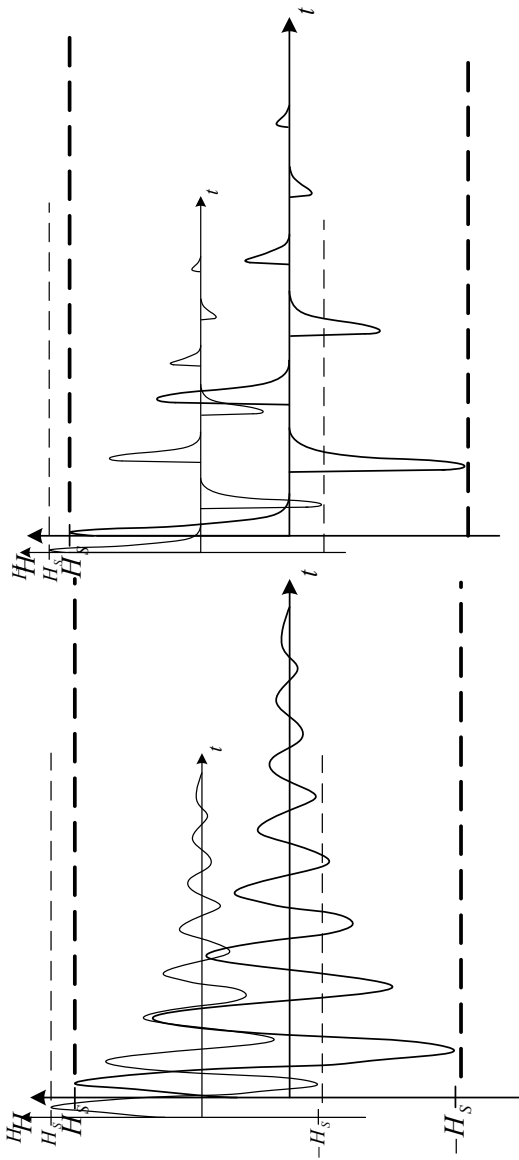
One of the reasons leading to magnetization can be attributed to the effect of hysteresis-free self-magnetization (Fig. 4) - with an extremely weak external field (which may be the Earth's magnetic field), sections of rails near the insulating junction can receive a significant level of magnetization, which was indicated in the beginning of the article.



*Figure 4 - Self-magnetization of metal*

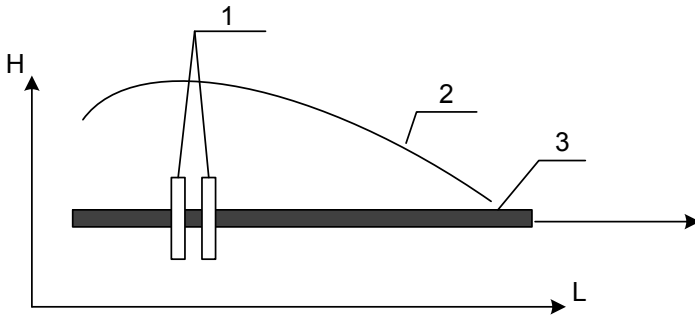
Currently, in rail rolling plants, to eliminate magnetic spots along the length of the rail, the method of continuous demagnetizing processing of the rail using the URR-1 or URR-2 installation is used. Its principle is based on the passage of single hysteresis loops, by applying one of two methods (Fig. 5), implemented using Helmholtz rings.

The operation of the installation is based on the principle of demagnetization in a smoothly varying alternating magnetic field. An alternating magnetic field is created by two coaxial solenoids. As a result, the magnetization of the rail decreases as it passes through the installation (Fig. 6).



**Figure 5** - Alternating magnetic field with damped amplitude (left) and a pulsed magnetic field with variable polarity and damped amplitude (right)





**Figure 6** - Reducing the magnetic field in the rail during processing by the installation URR-2 (1 - solenoids; 2 - magnetic field; 3 - rail)

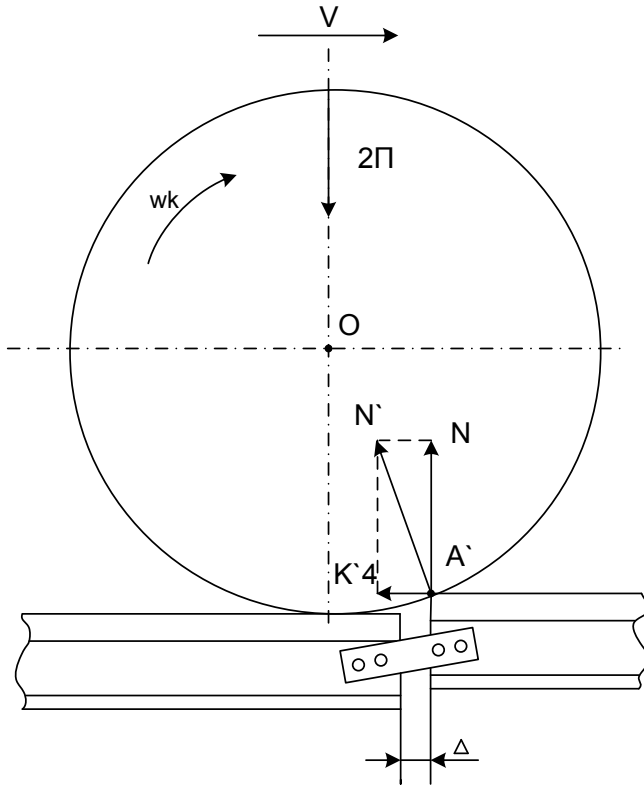
Removing the magnetization in the factory, the question remains unrelated to the fact that in the processes of loading and unloading rails and their subsequent stacking, powerful electromagnets are used that leave magnetization spots in several places along the length of the rail. As a result, several areas with excess magnetization remain on the rail. In addition, as you know, the railway is the source of an extremely large number of electromagnetic fields [5], which affect both each other and adjacent structures and lines, which leads to additional magnetization of the rail.

It is proved that the magnetization of products made of ferromagnetic materials (which include the rail) can be detected when they are exposed to a weak constant magnetic field and cyclic alternating mechanical loads that lead to bending or tension [6-8]. Under railway operating conditions, these loads are frequent and constant.

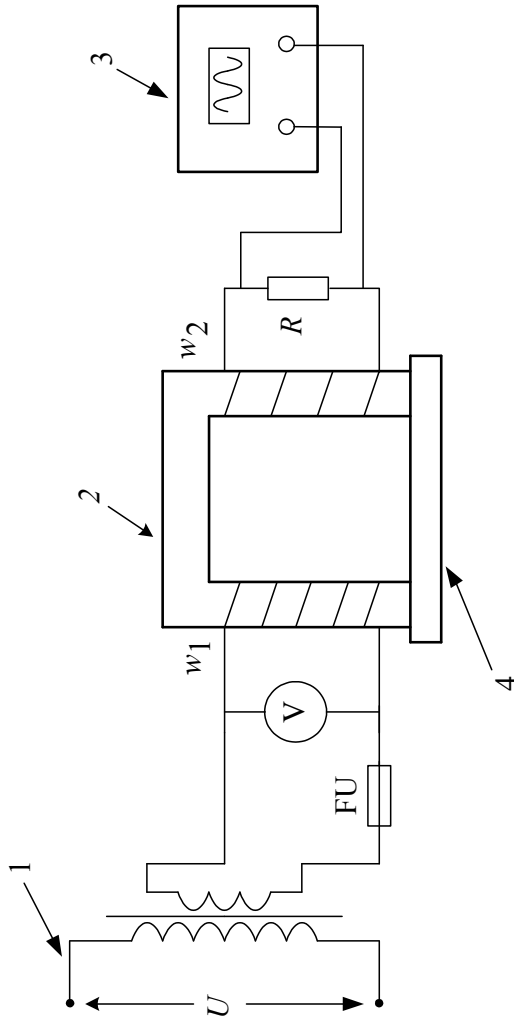
So, considering interactions in the wheel-rail system (Fig. 7), we can conclude that the shock effects of the wheel pair when the rail joint wobble lead to negative effects on rail joints, the ballast layer and, as was said above, lead to self-magnetization of the ends rails.

### Conclusion

Thus, the need to develop a dynamic method for stable and deep demagnetization of rails is an extremely urgent task that requires the phased development of a technological installation, which will begin with the creation of a laboratory sample. With its help, it will be possible to determine the optimal ratio of the operating parameters of the installation and subsequently, based on the similarity method, create a full-fledged industrial installation (Fig. 8).



**Figure 7** - Distribution of forces and moments during the passage of the wheel rail joint ( $V$  – train speed;  $\Delta$  – distance between rails;  $w_k$  – angular velocity;  $N'$  – resultant rail reaction;  $K'4$  – drag force from a pair of wheels at the junction of the rails;  $N$  – rail reaction component;  $A'$  – point of impact of a pair of wheels on a rail joint;  $2\Pi$  – pressing force of pair of wheels on a rail)



**Figure 8** - Simplified diagram of the experimental setup  
(1 - generator; 2 - magnetic circuit; 3 - oscilloscope; 4 - rail steel)

The laboratory sample of the installation will include a P-type magnetic circuit, two windings, an oscilloscope, a generator / transformer and a rail steel plate cut from the rail, which will undergo magnetization until it is saturated and then demagnetized. An important point is that it is necessary to use rail steel, due to its specific magnetic and physical properties.

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基于卫星图像分析，建立大气中杂质传输问题的求解区域模型  
**BUILDING A MODEL OF THE SOLUTION AREA  
FOR THE PROBLEM OF TRANSPORTING IMPURITIES  
IN THE ATMOSPHERE BASED ON THE ANALYSIS  
OF SATELLITE IMAGES**

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抽象。 本文基于使用机器学习对卫星图像的分析，讨论了构建用于解决大气中杂质传输问题的域模型的方法。 真实区域的航拍照片用作来源。 使用卷积神经网络的YOLO分类器执行对象识别。 在构建的模型上，执行数值计算。

关键字：卫星图像，数值模拟，YOLO，神经网络，机器学习。

**Abstract.** *The article discusses the approach to constructing a model of the domain for solving the problem of transporting impurities in the atmosphere based on the analysis of satellite images using machine learning. Aerial photographs of the real area are used as sources. Object recognition is performed using the YOLO classifier using a convolutional neural network. On the constructed model, a numerical calculation is performed.*

**Keywords:** *satellite imagery, numerical simulation, YOLO, neural network, machine learning.*

The process of numerical modeling of the ecological state of the environment includes several stages: setting up a mathematical model, building a modeling area, a numerical experiment and analysis (interpretation) of the results. Currently, more and more researchers are using specialized software in the form of software packages aimed at solving a range of similar problems. However, a number of problems

still remain: the user must have high levels of proficiency in mathematical and numerical modeling, and high competencies in the fields of knowledge to which the problem being solved belongs. This approach leads to the fact that a wide circle of engineers and researchers who do not know the "secrets" of mathematical modeling and numerical methods cannot effectively use specialized software. One of the possible solutions to this problem, according to the authors, may be the creation of high-tech services that partially automate the process of solving problems using specialized software. In particular, the process of building a simulation area. [1]

The article proposes an approach to constructing a model of the area for solving the problem of transporting impurities in the atmosphere based on the analysis of satellite images.

The specialized software tool for which it is necessary to generate model files is the PHOENICS software package of computational fluid dynamics. Modeling is performed on the entire area specified by the user, which, in turn, allows one to obtain various numerical and vector characteristics of flows both outside the investigated object located on the area and inside of it.

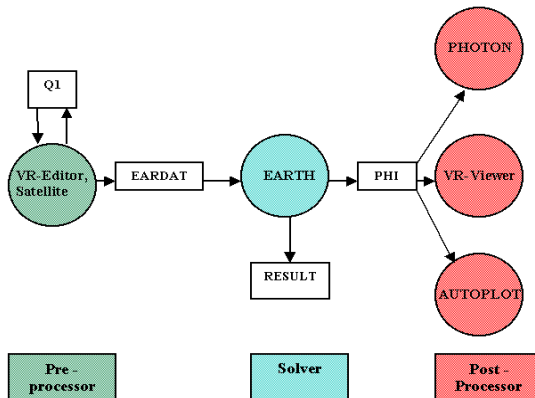


Fig. 1. Interaction of PHOENICS modules

To solve the problems of computational fluid dynamics using PHOENICS, it is necessary to consistently perform actions that are divided into three stages in their logical structure:

1. The preparatory stage, at which the formulation of the problem occurs, followed by interpretation in the form of a model of the initial region. The initial and boundary conditions of the differential equations are set, the grid is constructed, and the step of partitioning by space and time is selected, and parameters that affect the speed and accuracy of the convergence process are set.

2. The calculation stage, during which the iterative process of numerically solving the systems of differential equations describing the model constructed at the preparatory stage is performed.

3. The stage of presenting the calculation results implies viewing the results: in the form of a RESULT file containing a text-graphical representation of the results of numerical modeling or in the built-in visualization tool VR-Viewer. [2]

The indicated steps for solving the problem are implemented by three main modules: SATELLITE, EARTH and PHOTON. The relationship of the modules is shown in the figure. 1.

The EARTH module receives input data stored in a specialized file Q1, which has a clear structure by the way it is filled. However, this particular feature allows you to use third-party model files (created without using VR-Viewer), which in turn allows you to create these files in automatic mode.

To build models of the initial region, it is necessary to use some data that describe the landscape of the studied area. The source data can be terrain images obtained using aerospace photography.

When obtaining satellite images, the scanner method prevails when the transverse scan (perpendicular to the satellite's travel path) is provided by a scanning (swinging mechanically or providing electronic scan) mechanism that transmits electromagnetic pulses to the sensor of a specialized receiving device, and the longitudinal scan (along the motion path) ensures the satellite's movement itself.

As an example of calculating environmental indicators, the area shown in the image was selected (Figure 2).



*Fig. 2. Image of the study area*

Due to the fact that the objects studied in the images have large geometric dimensions (the minimum pipe height is 20 meters), it is economically viable to use free online services that provide processed satellite images of sufficient accuracy, which will be used for research purposes.

However, not all satellite images provided on a free basis are suitable for use in work. Due to the peculiarities of aerospace photography, initially only data in specific ranges (NIR, SWIR, etc.) are received in data centers, and to determine the objects depicted in the image, you must use the image obtained by combining images taken in red, blue and green ranges. Moreover, the color of the image does not play a special role, since objects in the image will be distinguishable even in grayscale.

The two most commonly used satellite families for remote sensing of the Earth are Sentinel-2 and Landsat 7/8. The satellites of the Sentinel-2 family use a multispectral camera with a spatial resolution of up to 10 meters as a device for collecting data on the Earth's surface, receiving data in the ranges from 443 to 2190 nanometers [3].

The Landsat 7/8 family of satellites has on board an enhanced thematic scanner (Enhanced Thematic Mapper Plus), which allows you to receive data using both the OLI telescope (Operational Land Imager) and the TIRS (Thermal Infrared Sensor) instrument. The resolution of the satellites of this family is 80 meters, but the relatively low resolution is offset by higher data refresh rates (Landsat 7/8 satellites fly at a higher altitude than the Sentinel-2 satellites, which will allow more satellites to be safely placed) [4]. Thus, we will use satellite imagery from Landsat 7/8 family of satellites as sources, implying that the use of more relevant imagery is prioritized, provided that the satellite's resolution is sufficient for use in future work.

We will use chimneys as polluting facilities when building model files. A chimney is a vertically arranged pipe device for removing combustion products into the atmosphere. According to the current SNiP [5], the height of the chimneys should be assigned in a unified series: 30, 45, 60, 75, 90, 105, 120 m and then after 30 m and should not be used for brick, reinforced brick and steel free-standing (frameless) pipes more than 120 m.

Since the construction of the region model file should be done without using the graphical interface, the only possible way is to use the Q1 file as the source. A detailed study of the file provided information that you can record data about the generated area in groups 13 and 24. To record information about recognized objects in group 13, you need to use a specially developed addition to the PIL language - In-Form.

To implement a software tool that generates files of the studied area from satellite images for interaction with the PHOENICS package, the following tools were used: Python 3.6 (interpreted high-level general-purpose programming language) and Visual Studio Code (source code editor).



The developed tool has a modular structure and consists of modules:

- selection of input geodata - tools that allow you to select a picture using cartographic web services and indicate the location of pollutants;
- pollutant recognizer - a tool for recognizing pollutants in an image and then generating a Q1 file;
- the main module - the component connecting the developed modules between themselves and the PHOENICS package.

Contaminants are detected using a convolutional neural network in its implementation in the form of the YOLO library. This classifier was chosen mainly because of the high accuracy of object recognition in the image at low recognition time. [6]

The recognizer operation algorithm begins by dividing the source image into a grid of size  $S$  by  $S$ . The center of the object should fall into the grid cell, which is responsible for detecting this object. Each grid cell predicts  $B$  bounding boxes and confidence estimates that reflect how confident the model is that the block contains the object, and how accurate it considers the block that it predicts.

Formally, reliability is estimated as  $Prob = Pr(obj) * IOU_{pred}^{truth}$ , where:  $Pr(obj)$  – the probability that the object belongs to the selected class;  $IOU_{pred}^{truth}$  – the ratio of the intersection of the areas of the predicted object and the area of the recognized blocks with confidence intervals to their association.

YOLO produces recognition using regression models. In this case, at the output, a three-dimensional tensor of size  $S \times S \times (B * 5 + C)$  is generated. For example, with  $S = 7$ , the tensor size is  $7 \times 7 \times 30$ . [7]

The architecture of such a network is depicted in Figure 3 and consists of 24 convolutional layers, followed by two fully connected layers. Alternating convolutional layers  $1 \times 1$  reduce the number of residual features from previous layers, thereby “filtering” each subsequent layer. The number of layers of subsampling (MaxpoolLayer) does not exceed  $B * B + B$  layers.

The last layer predicts both class probabilities and coordinates of the bounding box. Normalizing the width and height of the bounding box allows you to find its offset relative to the upper left corner in the range from 0 to 1.

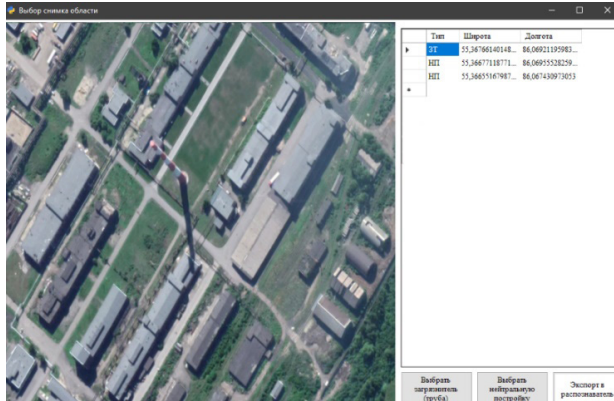
A linear function is used as the activation function for the last layer, and a rectifying linear activation function is used for the remaining layers:

$$\phi(x) = \begin{cases} x, & \text{if } x > 0 \\ 0.1x, & \text{in any other case} \end{cases}$$

In each case under consideration, the image is “covered” with grid cells that do not contain any objects. This lowers the reliability of the estimate, often suppressing the gradient from cells that contain objects, which can lead to model instability. [8]

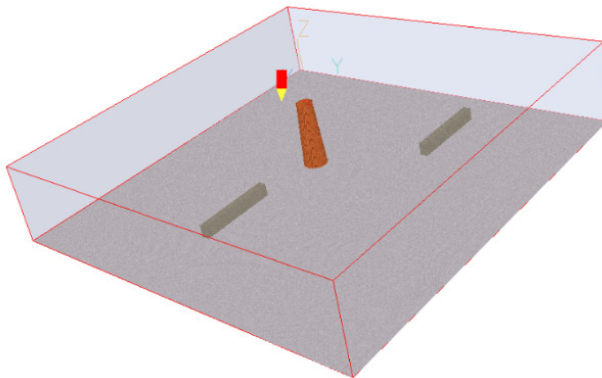


To use the recognizer, it is necessary to carry out the process of training a convolutional neural network on a set of training data: a file containing information about objects belonging to any recognizable class of objects with the coordinates of their bounding box. The result of the work are ready-made software modules for selecting an area containing pollutants, object recognition in the image and a connecting module, which are called in batch mode.



*Fig. 4. Graphical interface of the area snapshot selection module*

The result of the recognizer module operation is the file of the Q1 region, which contains data on objects located in the region and the parameters required by FLAIR for numerical simulation. The model file open for viewing in VR-Viewer is shown in Figure 5. It is worth noting the high accuracy of building models of real objects with the repetition of their geometric dimensions.



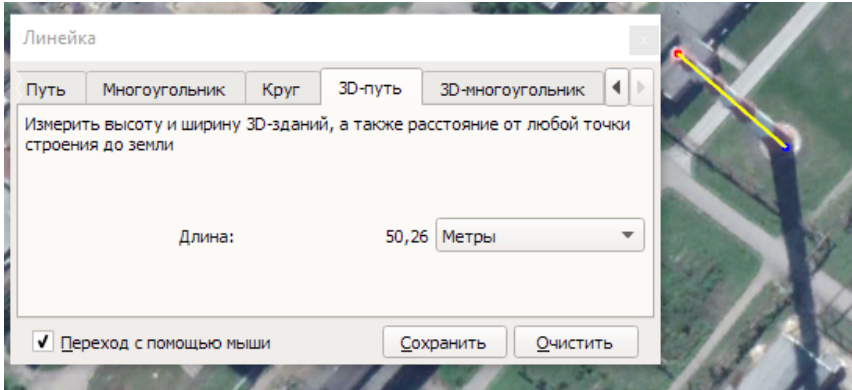
*Fig. 5. Visual representation of the generated file Q1*

To do this, one can compare the size of the pipe in the photograph and in the constructed model of the studied area. We will use the “3D Path” tool of the Google Earth Pro application to obtain the geometric dimensions of a real object. The results obtained are illustrated in images 6 and 7, which confirms the high accuracy when constructing models of real objects from an aerial photograph of the studied area.

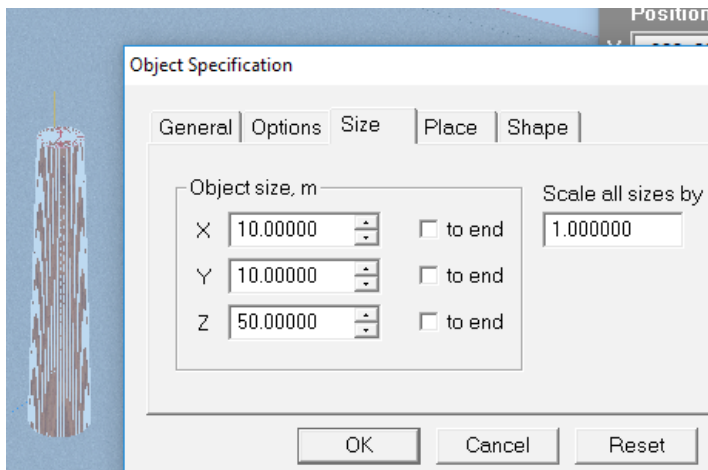
The sequential launch of all modules results in RESULT and PHI files, which contain the results of the numerical simulation.

Thus, the paper presents one of the possible approaches to building a model of the studied area, which was generated automatically using machine learning. This approach reduces the necessary knowledge threshold required for numerical modeling – the user does not need to know the intricacies of building files with data areas.

The results can be used to monitor various areas, including unauthorized deforestation or illegal construction, and the solution itself can be implemented in the development of computing portals [9] as a scalable embedded solution or used as an independent set of usable modules.



*Fig. 6. 3D Path Tool for GoogleEarthPro*



*Fig. 7. Object inspector window*

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俄罗斯远东地区北极地区发展中的环境和经济利益平衡  
**THE BALANCE OF ENVIRONMENTAL AND ECONOMIC  
INTERESTS IN THE DEVELOPMENT  
OF THE ARCTIC TERRITORIES OF THE RUSSIAN FAR EAST**

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注解。在北部地区的发展中利益的激活和增长形成了选择最合理，平衡的发展方案的问题。这项研究的目的是分析这些地区的环境和经济状况，并确定自然与工业关系的可能变化。使用统计分析，图形和制图的方法，得出了结果：确定了环境问题的原因，生态状况的特征和环境保护的经济支持，并给出了可能的环境后果。提出的研究是针对所考虑的领土进行的第一次研究。

关键词：远东北极带；生态状况；经济活动；矿产原料基础；经济充足指数。

**Annotation.** *The activation and growth of interests in the development of the northern territories formed the problem of choosing the most reasonable, balanced scenario for their development. The purpose of this study is to analyze the environmental and economic situation in these territories and identify possible changes in natural-industrial relations. Using the method of statistical analysis, graphic and cartographic methods, the results were obtained: the causes of environmental problems were determined, the characteristic of the ecological state and economic support of environmental protection, the possible environmental consequences are given. The presented study was performed for the first time for the territories under consideration.*

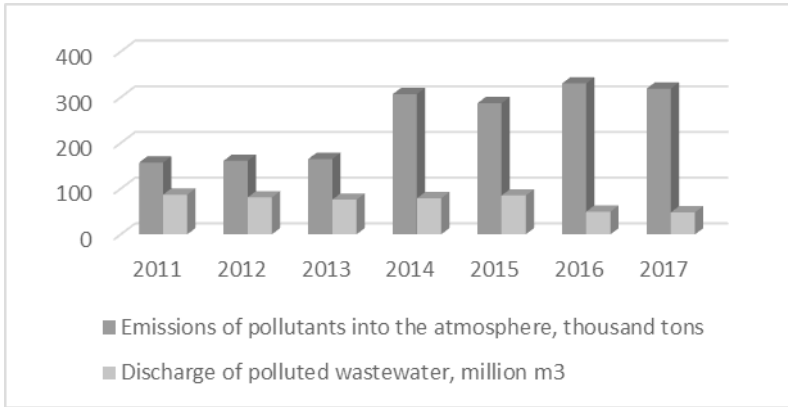
**Key words:** *Far East Arctic zone, ecological situation, economic activity, mineral raw material base, economic sufficiency index.*

**Introduction.** Regions of the Far Eastern Arctic differ by the high vulnerability of the natural environment to the anthropogenic impacts and low rate of the restoring the damage of both separate components and natural environment as a whole. An analysis of information on environmental condition of the Chukotka AR and Republic of Sakha (Yakutia) allows us to make a conclusion of the unfavorable environmental situation in the regions. At present time, the arctic zone of RF is under the heavy anthropogenic impact in the areas of developing the reserves of the most important mineral resources, first of all, natural gas and oil [1,2,5 and many others]. Based on results of the Russian Federation regions ranking in respect of the quality of life [6], where the indicators of environmental quality were included along with the socio-economic indices, the Republic of Sakha (Yakutia) and Chukotka AR have occupied 72/65 and 79/80 places in 2015/2014 among considered 85 regions. In this regard, in addition to the economic interest in the development of the Far Eastern Arctic of Russia, the problem of balancing environmental and economic interests and preserving these unique territories is becoming urgent for the world community.

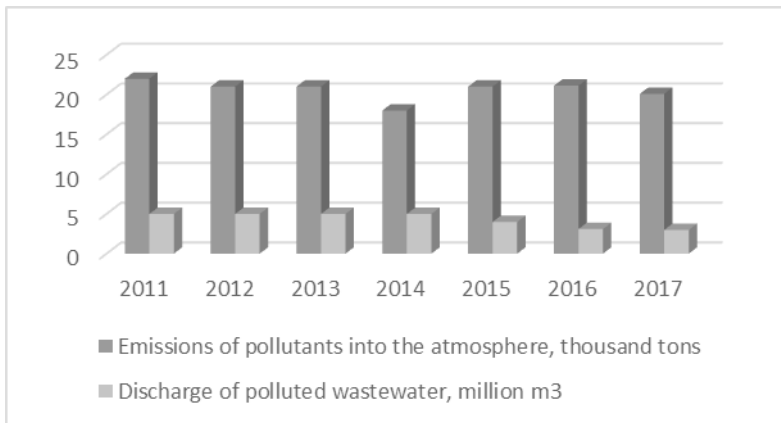
**Materials and methods.** The work was carried out on the territory of the uluses of a certain and approved at the time of the study of the Arctic zone of Sakha (Yakutia): Allaikhovsky, Anabarsky, Bulunsky, Ust-Yansky and Nizhnekolymsky and all municipal areas of the Chukotka Autonomous Region (Anadyrsky, Bilibinsky, Chukotsky, Iultinsky (now UD Egvekinot) districts, urban districts Providensky and Pevek). The official statistics were used (Federal State Statistics Service, Russian Geological Fund), as well as the economic optimum of environmental costs calculated by the author, an indicator of the economic sufficiency of environmental protection measures, the schemes compiled by the authors and a map of the differentiation and density of mineral deposits. The time period is 2007-2017. for the analysis of the dynamics of the process, for comparative analysis - individual years. This choice was determined by recessions and ups in the economy, as well as the availability of comparable information.

**Research results.** The major constituents of the environmental condition on the territories under consideration include pollution of air and water, production of industrial and household waste and contamination by them of territories as well as radiation pollution. According to data of the Federal Service for Hydro-meteorology and Environmental Monitoring, the radiation background on these territories is within normal limits and atmospheric air pollution has also significantly decreased [1].





**Figure 1.** Dynamics of some ecological indicators of the Republic of Sakha (Yakutia) (compiled according to official statistics [5])



**Figure 2.** Dynamics of some ecological indicators of the Chukotka Autonomous Okrug (compiled according to official statistics [5])

Today the river waters were rated as “polluted” and “much polluted”. The priority pollutants were the organic substances, compounds of iron, copper, zinc and manganese, phenols and oil products. And, despite the fact that the volumes of discharged polluted wastewaters did not practically increase (Figs.1-2), according to the State report on the environmental situation in the Republic of Sakha (Yakutia) [1], the state of surface waters degrades. This is explained by the fact that the majority of working wastewater treatment facilities was constructed more than 30-40 years ago. The technical condition of many of them is unsatisfactory, treatment technology is obsolete and, often, the facilities of only mechanical treatment function and, therefore, the operated facilities do not provide the standard sewage water treatment. The undertaken earlier investigations showed that only 2 districts in the Chukotka Autonomous Region - Anadyrsky and Iultinsky - were subjected to partial limitation of the water-intensive enterprises functioning in connection with pollution of water resources in the Arctic territories of the Russian Far East. The rest of districts of Chukotka (Bilibinsky, Chukotsky, UD Providensky, UD Pevek) have no limitations.

The other significant problems for the Arctic territories of the Far East are production and storage of solid industrial and household waste as well as formation of unsanctioned landfills, which results in pollution of territories, underground and surface waters, disturbance of landscapes etc.

Apart from the economic activity, the efficiency of nature management is also formed by the environment-related activity. The efficiency of the environment-related activity in these regions is very low (Table 1) and, according to our calculations and official statistics [5,7], these tendencies retain also in current times.

In view of the financial maintenance of the activity aimed at the reduction in negative impact of the production on the environment, the current cost, investments for the environment protection (EP) and sustainable nature management as well their structure do not meet the necessary ones [7] (Table 1). The actual volumes of investment in the EP are enormously small as compared to the economic optimum, which proposed by S.I. Kolesnikov and must comply with 8% of GRP (Gross Regional Product) [3]. This is evidenced by the index of economic sufficiency (IES) of the environment-related activity, which is defined by the ratio of the actual volumes of financing the EP and sustainable nature management and economic optimum at the optimal value of IES-1.

**Table 1**  
*Efficiency of the environment-related activity\**

Subjects	$\Sigma$ current cost + investments in equity for EP and sustainable nature management, million rub. 2014/2017	Economic optimum million rub. (8% of GRP) 2014/2017	Index of economic sufficiency of enviro-related activity (actual/optimum)2014/2017.	$\Sigma$ current cost + investments in equity for EP and sustainable nature management, million rub. 2007/2010 гг.	Economic optimum million rub. (8% of GRP) 2007/2010	Index of economic sufficiency of enviro-related activity (actual/optimum) 2007/2010.
Republic of Sakha	10772.3/ 11667.2	52812.0/ 73321.5	0.2/0.16	7260.8/5811.7	19717.5/ 30778.1	0.4/0.1
Chukotka AR	452.3/ 849.3	4524.5/ 5498.3	0.1/0.16	40.8/39.0	1697.8/ 3357.9	0.02/0.01

\* current cost, investments in equity for EP and sustainable nature management taken from [5]; economic optimum and Index of economic sufficiency proposed and calculated Stepanko N.G.

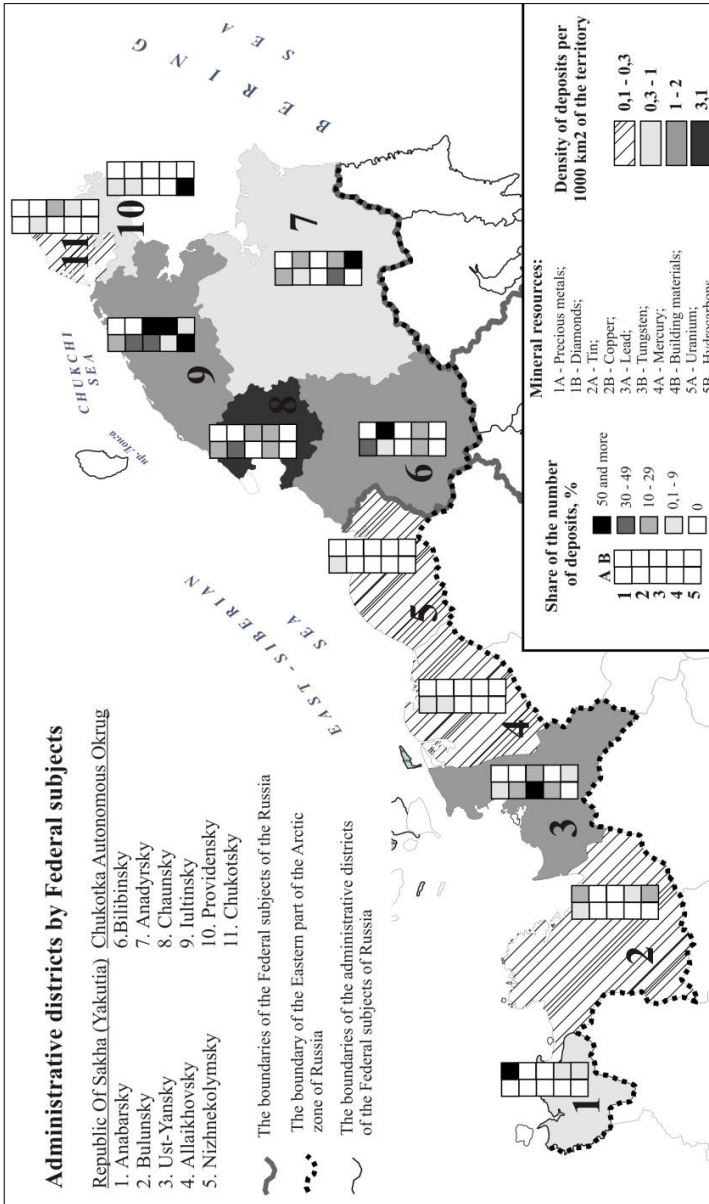


Figure 3. Territorial differentiation and density of deposits on the Arctic territories of the Far East (compiled according to official datas [4] Tkachenko G.G.)

In its arctic zone, 1115 deposits and sectors of the solid mineral raw materials and hydrocarbons were revealed and some of deposits are developed [4]. 77% of deposits located in the East of the Russian arctic zone fall on the Chukotka Autonomous Region. Their maximum number was registered in the Bilibinsky, Iultinsky and Chaunsky districts of Chukotka as well as in Ust-Jansky district of Yakutia [4].

The leaders by the variety of deposit types are the Iultinsky district of the Chukotka AR and Ust-Jansky district of Yakutia because, in each of them, 8 of 11 basic mineral-resource groups are presented. More than half of the tungsten, uranium and common commercial minerals deposits and one third of the tin and lead ones in the Far-Eastern arctic zone fall on the Iultinsky district of Chukotka AR. In the Ust-Jansky district of Yakutia, two thirds of lead deposits and fourth of mercury deposits are concentrated. One can also identify such districts of Chukotka as Anadyrsky (more than 70% of hydrocarbons deposits), Bilibinsky (80% of copper deposits and 42% of noble metal ones), Chaunsky (40% of tin deposits). In the group of districts with poor variety of deposits, one can note the Providensky district where, nevertheless, a half of uranium deposits was discovered and Anabarsky district of Yakutia on which three fourths of diamond deposits of the Far-Eastern arctic zone fall (Fig.3) [10].

Therefore, one can identify the crucial significance of the extractive sectors in the industrial structure of the Far-Eastern arctic zone. To them, the prospects for the development of these regions are related which is confirmed by the basic tendency (extraction and processing) of the investment projects under consideration: Anabarsky ulus (oil, gas), Bulunsky ulus (oil, gas), Allankhovskiy ulus (construction raw materials, in particular, broken stone), Ust - Jansky ulus (tin, gold) in Sakha (Yakutia) and Anadyrsky ulus (Beringovskiy settlement) (underground and quarry mining, enrichment and transshipment of sintering coal; copper, gold, silver) in the Chukotka AR [8,9]. And only three projects are characterized by the environment-oriented trend: "Ecologically-safe conservation of the tailing dump of the Deputatskiy ore mining and processing enterprise" (Ust-Jansky ulus, Yakutia), "Construction of the mini-plant for recycling of the municipal solid waste in the settlement of Chokurdakh" (Allankhovskiy ulus, Yakutia) and "Production of clean water in the settlement of Chokurdakh" (Allankhovskiy ulus, Yakutia) [based on materials "Strategy ..." [8,9].

**Discussion.** In accordance with the purpose of this work and the objectives he performed research has shown that:

1. considered territories have great possibilities for the further development and are attractive to investors;

2. in current times, the arctic territories of the RFE have suffered changes as a result of the negative man-caused impact the basic consequences of which are air and water pollution, generation of industrial and household wastes and pollution of the territories by them;

3. in this connection and also as a result of the low resistance and regenerative capability, they are exposed to significant risks posed by a realization of the assumed kinds of economic activity up to irreversible subsequences and causing the material damage to the life-sustaining activity of people;

4. for realization of prospects for development of these territories, the measures to elimination of the existing adverse pollutions and disturbances as well as the landscape restoration should be high-priority.

In that respect, in our opinion, a realization of the following measures is of great importance:

1. When developing the investment projects (including with involvement of the foreign companies) as well as programs of prospective development, the high-priority measures should include establishing the structures intended for nature protection purposes. In the short term, the development of the territories in question, in our opinion, should not be based on extractive industries, but on economically sound and environmentally sound types of economic activity:

2. Development of alternative energy:

- biofuel (made of the agricultural waste and wood raw materials);
- helioenergetis;
- wind power plants;

3. Development of environment-oriented and simultaneously economically sound technologies:

- introduction of the modern building methods with the use of new kinds of construction materials;
- manufacture of ecologically pure products;

4. Development of traditional types of activity and breeding of traditional species of plants and animals (especially, for traditional indigenous habitats):

- traditional kinds of agriculture;
- traditional types of the northern people activity;
- eco-tourism;

5. Activation of the forest-protection and reafforestation works;

6. Reduction of emissions and discharges;

7. Waste utilization as the secondary raw material;

8. Land reclamation (depletion, disturbance, pollution);

9. Organic agriculture;

10. Cost-effective use of resources.

When preparing the programs of developing the arctic territories of the Russian Far East, the results of the research conducted and conclusions can be used by the appropriate administrative arrangements of different hierarchical levels and also organizations of the environmental orientation. In addition to it, we plan to give consideration to the existing structure of nature management and determine the possible structure, tendencies and consequences of the production-nature relations in accordance with the planned investment projects of developing these territories.

**Conclusions.** In the Strategy of the sustainable development of the arctic uluses [8,9], it is emphasized that “The long-time benchmark of developing the arctic uluses and areas of compact settlement of the indigenous minority of the North is a provision of the transition to the effective model of development, namely, balanced solving the problems of developing the industry and traditional kinds of economic management of the North nationalities under the conditions of obligatory preservation of the natural ecological systems and biological diversity”. Concerning the balanced state in general and for the territories under consideration in particular, it will be difficult to combine the development of industry (mainly, extractive and greatly affecting ones) with the preservation of the natural ecological systems and biological diversity“. We consider that the ecological balance of the nature management should have a primacy. Certainly, the development of traditional kinds of economic management the indigenous minority of the North is one of the main components of this model. Apart from that, the realization of the environmental projects and use of innovative technologies are necessary. The successful sustainable development of the arctic territories is possible only with the government assistance and economic regulation including the organization of hunting, fishery, deer farming and other national businesses as well as activation of the real, essential to the arctic territories activity in the field of environmental protection and efficient use of natural resources. A successful development of the Far-Eastern North territories on the principles of the “green economy” depends upon the active position of the federal and regional governments, granting tax exemptions and other preferences for the “green” business and, most importantly, on strict control of its accomplishment and adoption of effective sanctions as provided for in the legislation.

#### **Acknowledgements**

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使用地球物理监测方法降低从沃斯托奇尼宇宙飞船发射航天器时的环境危害程度

**REDUCING THE LEVEL OF ENVIRONMENTAL HAZARD WHEN  
LAUNCHING SPACECRAFT  
FROM THE VOSTOCHNY COSMODROME USING GEOPHYSICAL  
MONITORING METHODS**

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抽象。位于远东联邦区的新俄罗斯“东方号”宇宙飞船于2016年开始运营。由于严格的环境要求，以及为了最大程度地减少太空火箭发射对环境的负面影响，最大程度地快速探测分离火箭的任务常规坠落区的机载部件和紧急情况下的火箭碎片都变得迫在眉睫。尽管现代火箭发射器具有相对较高的可靠性，但所有发射中有2%以上是紧急事件。如果在发射后的最初几秒钟内发生事故，则失败的阶段以及助推器和航天器将沿着发射路径落到地球表面。此类事故可能对环境造成重大伤害，因此紧急任务是迅速搜寻并及时对区域进行消毒。同时，可能跌落的区域沿发射路线延展了数百公里，沿其延展了数十公里，地形上有高低不平，森林，湖泊和沼泽，这给寻找喀麦隆的位置带来了很大的困难。秋天。

本文表明，地球物理监测综合体（地震和次声定位综合体）的使用可以显著减少对运载火箭下落碎片的预期搜索区域，从而减少了搜索和处置它们的时间和成本，从而减少了太空火箭产业对环境的负面影响程度。

关键词：“东方”宇宙飞船，运载火箭，生态学，次声监测，地震监测，地震台站，影响区，统一地球物理服务。

**Abstract.** *The new Russian "Vostochny" cosmodrome, located in the Far Eastern Federal District, began operations in 2016. Due to strict environmental requirements and in order to minimize the negative impact of space rocket launches on the environment, the task of maximally quickly detecting separating rocket*

*carrier parts in regular fall areas and rocket fragments in emergency situations becomes urgent. Despite the relatively high reliability of modern rocket launchers, more than 2% of all launches are emergency. If accidents occur in the first tens of seconds after the launch, then the failed stages together with the booster block and the spacecraft fall to the earth's surface along the launch path. Such accidents can cause significant harm to the environment, so the urgent task is to quickly search and timely disinfect the territory. At the same time, the territory of a possible fall is stretched several hundred kilometers along the launch route and several tens of kilometers along it, the terrain has elevations and depressions, forests, lakes and swamps, which creates significant difficulties in finding the place of the fall.*

*In this paper, it is shown that the use of geophysical monitoring complexes (seismic and infrasound location complexes) can significantly reduce the prospective search area for fallen fragments of launch vehicles, reducing the time and cost of searching and disposing of them, and thus reduce the level of negative impact of the space rocket industry to the environment.*

**Keywords:** "Vostochny" cosmodrome, launch vehicle, ecology, infrasound monitoring, seismic monitoring, seismic station, impact area, Unified Geophysical Service.

On April 28, 2016, the first launch of the rocket from the new "Vostochny" cosmodrome in the Amur Region took place. The "Soyuz-2.1a" launch vehicle successfully launched three scientific satellites into orbit - the university satellites Lomonosov and "Aist-2D," as well as the "SamSat-218" nanosatellite.

The launch of any spacecraft, including these, is accompanied by the fall on the earth of the separating parts (SP) of launch vehicles (LV) (spent stages, head fairings, connecting compartments, etc.), ensuring their launch into orbits. The sizes and location of the areas of incidence (AI) of these parts for each launch vehicle are determined by the requirements for the orbits of spacecraft (SC), their mass, and the energy characteristics of LV. They try to locate sites of fall areas in localities that are least populated and with no or minimal business activity. The use of SP LV fall areas is carried out in accordance with Decrees of the Government of the Russian Federation dated May 31, 1995 № 536 "On the procedure and conditions for the occasional use of the fall regions of the separated parts of missiles" and dated March 24, 1998 № 350 "On amendments and additions to Decree of the Government of the Russian Federation dated May 31, 1995 № 536" and on the terms of contracts concluded by the Federal Space Agency with the executive authorities of the constituent entities of the Russian Federation in whose territory these areas are located. The terms of the agreements stipulate at each LV launch that measures will be taken in the fall areas to ensure human safety, environmental monitoring, environmental protection, etc.

In order to comply with the requirements of AI lease agreements to minimize the negative impact of space rocket launches on the environment, the urgent task is to detect SP LV as quickly as possible in regular fall areas, as well as rocket fragments in emergency situations. In the event of an accident in the first tens of seconds after the launch, the failed stages together with the spacecraft fall to the earth's surface along the launch path. Such accidents cause significant harm to the environment; therefore, the task of prompt search and timely disinfection of the territory is very urgent. In addition, the technology and equipment of spacecraft are a military or commercial secret, therefore, it is necessary to ensure the safety and secrecy of parts of spacecraft as soon as possible, collect them on the ground and deliver the launch to the customer. The territory of a possible fall is also stretched several hundred kilometers along the launch route and several tens of kilometers across it, has a difficult terrain, has hills and valleys, forests, lakes and swamps, which creates significant difficulties in finding places of falls using traditional air reconnaissance, especially during adverse weather conditions [6]. The problem of the operational search for fallen fragments of spacecraft is important for all terrestrial areas of impact. It is more or less successfully solved in Kazakhstan, where large fragments of the first steps are clearly visible in the steppe. But the remains of the steps falling in the mountains of Altai, in the Tomsk region and in the Komi Republic are rare and with great difficulty. They are much smaller in size, fall in hard-to-reach areas (taiga, mountains, swamps) and are poorly visible from the air. A similar situation arises in the Far East when rockets are launched from the "Vostochny" cosmodrome.

To reduce the search time for fallen fragments, it is possible and necessary to use geophysical registration methods, which should solve the following problems:

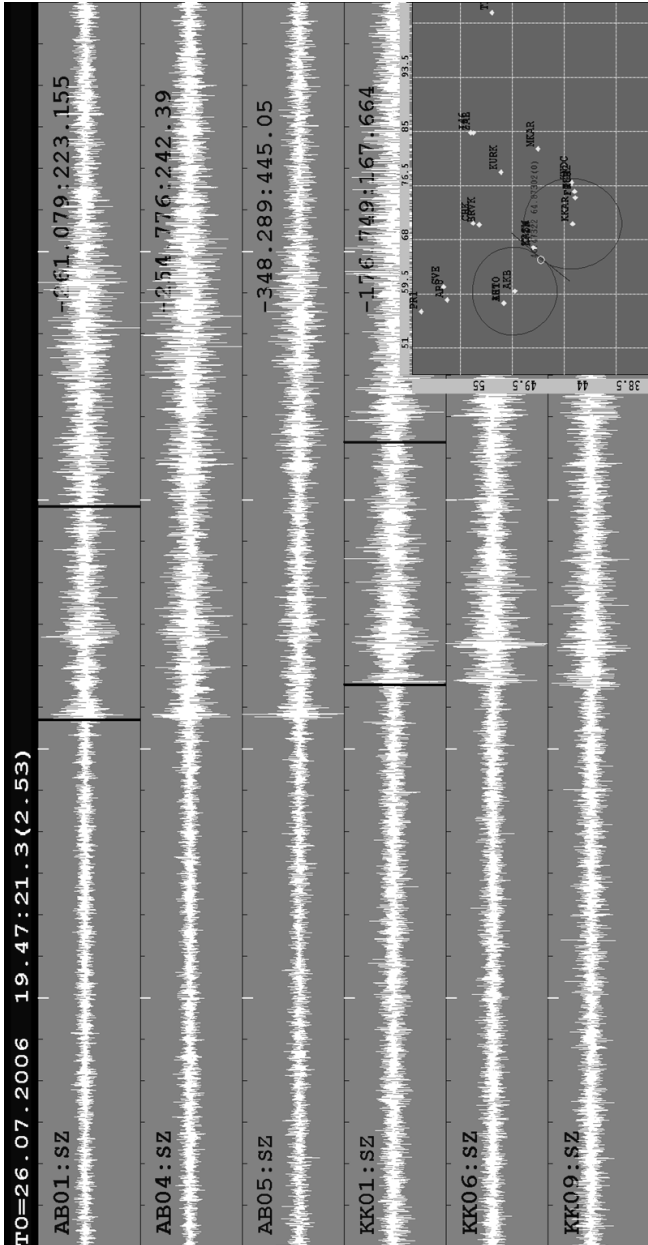
1. Provide location of the places where SP LV falls in regular fall areas of 1 and 2 steps with an accuracy of  $\pm 2$  km, for an operative search for fallen fragments, their safety and timely disposal, and prevention of possible emergencies (fires, fuel spills).

2. Ensure the location of the places of impact of fragments of launch vehicles and spacecraft in case of accidents at launch, with an accuracy of  $\pm 10$  km, for the operational search of fallen fragments, and ensure their safety.

It should be emphasized that only objective control means allow us to establish causal relationships between various factors affecting the size of the fragment dispersion zone, as well as verify the methods, theoretical methods and mathematical models used by ballistics for calculations [4]. In addition, reliable determination of the coordinates of the points of incidence of fragments of the separating parts of launch vehicles increases the efficiency of their search, disposal, localization and elimination of the results of negative environmental impacts, which together significantly reduces material costs.

Currently, the main objective control method used in real conditions is the visual control method, which is very inaccurate and often cannot be used due to poor visibility due to launching at night or in adverse weather conditions. More advanced and very accurate is the radar method [6], which was used to determine the “Soyuz” LV first-stage crash sites at the first launch from Vostochny Cosmodrome, but its use also has a number of limitations: very high cost, the need to prepare a special concrete platform for equipment installation, high volatility, extremely low transportability. Also, radar stations cannot be used in a number of cases when there is a danger of damage to the payload electronically transmitted by the carrier rocket by radio emission. For the initial aiming of the radar station, sufficiently accurate trajectory information is required (ideally, obtained at the flight pace of LV, for which a channel for transmitting external track information “board-radar station” is necessary). In the case of an insufficiently accurate aiming, the task of tracking down decreasing fragments can not only not be solved, but, on the contrary, the output payload can be harmed. For the operation of the radar station, a special supporting infrastructure is required that allows the equipment and personnel to work in severe climatic and weather conditions. It is obvious that in this case the autonomy of the radar station is not ensured under any conditions. In addition, the cost of a radar station with supporting infrastructure is extremely high (the price range for Weibel Scientific A/S radar stations starts at 4.5 million euros). In this regard, the development of alternative, inexpensive methods of objective control is still an urgent task.

The fact that the first stages of rockets and especially emergency rocket launchers, which have a significant mass and a high fall rate, generate sufficiently strong seismic waves upon contact with the earth's surface, which makes it possible to use instrumental methods of seismic location to quickly determine the coordinates of the place of impact [2,3]. The work carried out by specialists of the Kola branch of the Federal Research Center “Unified Geophysical Service of the Russian Academy of Sciences” (COF of the Federal Center for Science and Geology of the Russian Academy of Sciences) in the fall regions of the first stage LV “Proton” and analysis of seismograms of the existing seismic network of the Kazakh National Data Center (KNDC) showed the fundamental possibility of such a location and allowed us to develop methodological approaches for the development and creation of a complex of seismic monitoring of launch routes, described below. Figure 1 shows an example of the location of the LV “DNIPR” crash site during an emergency launch on July 26, 2006. The location was carried out at the 2 stations closest to the point of impact of the KNDC “Akbulak” and “Karatau”, located 550 km northwest and 610 km southeast of the place of fall, respectively. Although the signals recorded by seismic stations were rather weak, the P-wave arrival fronts are clearly distinguished in the high-frequency spectrum, and S-waves on horizontal channels, which made it possible to calculate with sufficient accuracy the epicenter of the signal excitation source, which turned out to be at the point with coordinates 46, 47° N and 64.87° in. (the coordinates of the semi-automatic location are shown on the insert in the lower right corner of the picture).



*Fig. 1 Location of the event at two stations of the seismic network of the Kazakh National Data Center: "Akbulak" station - 550 km distance, "Karatau" station - 610 km distance. The inset in the lower right corner displays the seismic network stations and the result of the semi-automatic location is a point with coordinates 46.47° n.lat and 64.87° e.long.*

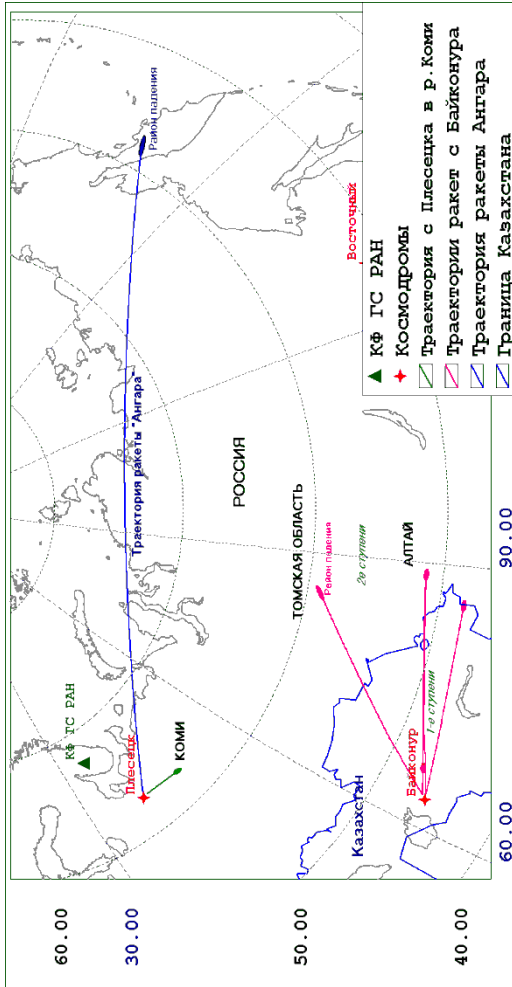
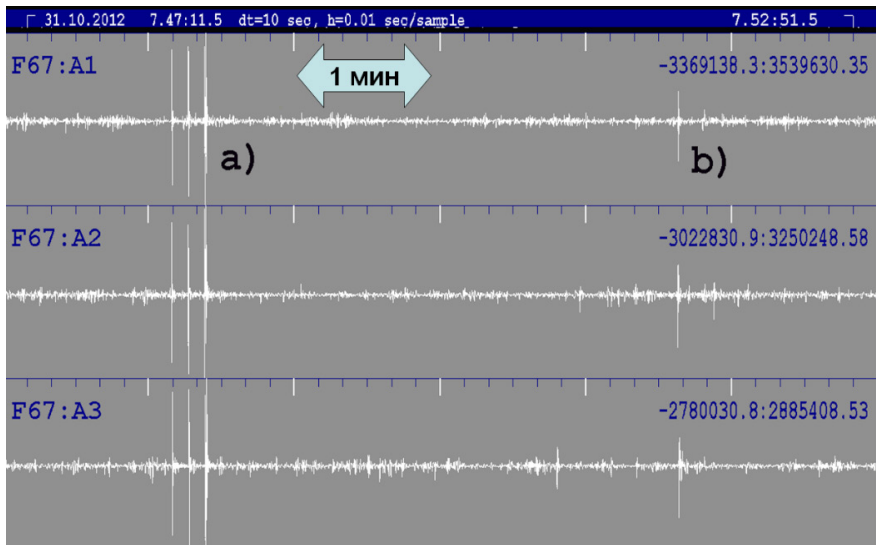


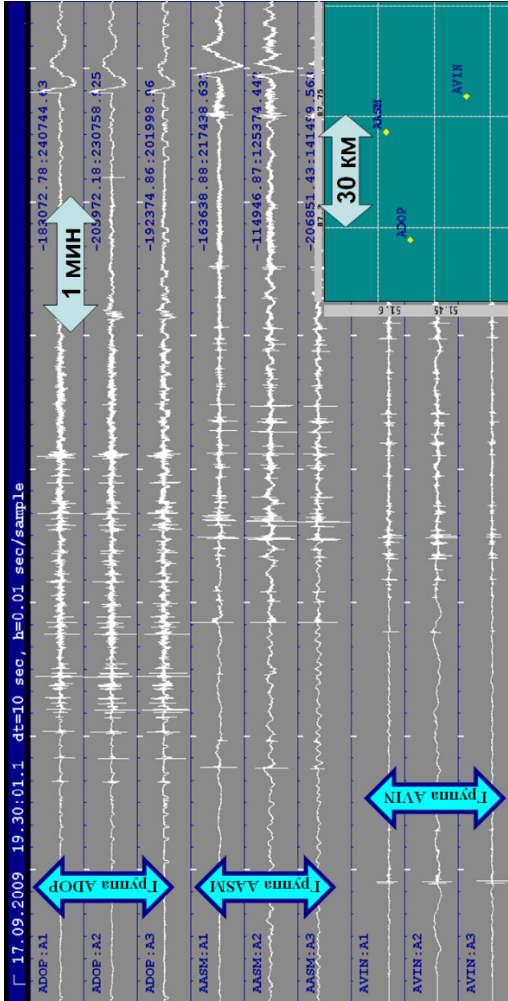
Fig. 2. Trajectories of missiles and areas of incidence, in which the registration of infrasound signals

Since 2002, in the COF of the FIC of the EGS RAS observations have been made of the propagation of infrasound fields in the atmosphere using stationary seismic-infrasound complexes [1-3.5]. During this period, an extensive catalog of infrasound signals of natural and man-made origin was compiled, such as industrial explosions, infrasound from supersonic airplanes, meteors, northern lights, avalanches and others. During 2009-2014 employees of the SC GS RAS carried out registration of infrasound signals at 14 launches of the “Proton”, “Soyuz” and “Angara” launch vehicles, where using the mobile infrasound groups they worked out the technique of infrasonic location of places of impact [4]. The geography of work is presented in Figure 2.

As it turned out, the signals generated by the falls of the first and second stages differ significantly. When the first steps fall on the records, a small number of powerful pulses are visible, generated by large fragments (as a rule, whole marching engines falling). In addition, secondary impulses generated by impacts of heavy fragments on the ground are sometimes observed (Fig. 3).



*Fig. 3. Infrasound signals during the fall of the first stage of the “Soyuz” launch vehicle, Kazakhstan, 2012. a) shock waves from engine falls, b) secondary signal from ground impact*

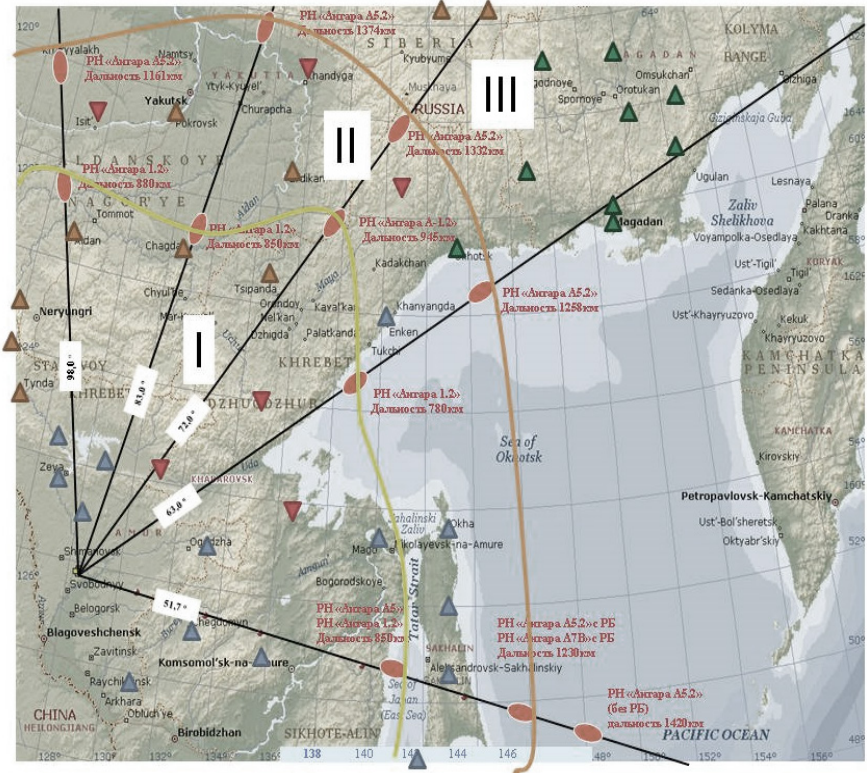


**Fig. 4.** Infrasound signals during the fall of the “Proton” launch vehicle, Altai Republic, 2009.

Record with three infrasound groups (configuration on the inset map).  
 Each short impulse is generated by a shock wave from one fragment



Схема расположения РП ОУ 1-х ступени и ГО РН «Ангара» при запуске с космодрома «Восточный»



*Fig. 5. Launch routes of the LV “Angara” from the “Vostochny” Cosmodrome and the network of available (triangles standing on the base) and planned to be installed (triangles standing on top) seismic stations of the FIC EGS RAS, which will be used to monitor launches of launch vehicles. The ovals indicate the agreed areas of falls of the spent 1st and 2nd steps of the LV “Angara”*

Unlike the first, the second steps usually fall into tens, and even hundreds of small fragments, each of which generates its own shock wave (Fig. 4).

To solve the problem of searching for the first stages and emergency LVs, it is proposed to use the existing network of seismic stations of the FIC EGS RAS. At present, more than 40 modern seismic stations, 25 of which can be used for these purposes (Fig. 5) [5], are operated in the Far East along the proposed LV “Soyuz” and “Angara” launch routes. Stations located in zone I in Figure 2 can be used without any modifications, as they have uninterrupted power and reliable data transfer. The seismic stations located in zone II in Figure 2 should be supplemented with infrasound surveillance channels and telemetry data transmission, it is possible to install 5-6 new stations in order to ensure reliable location of emergency LVs with an accuracy of  $\pm 10$  km. It is advisable to install mobile infrasound location complexes, described above, directly in the areas where the fragments of the 2 stages of LV are located, which have been shown to be effective at the first launches of the newest LV Angara [4].

Thus, the following is shown:

- special attention is currently being paid to improving the technical and environmental safety of space activities;
- the seismic and infrasonic observation method allows with sufficient accuracy to locate the places where the fragments of launch vehicles fall in the regular areas of the falls, as well as reliably determine the places of emergency sites of falls;
- when designing an integrated system of geophysical monitoring of the launch and passage of missiles from the “Vostochny” cosmodrome, it is advisable to use the existing network of seismic stations of the FIC EGS RAS.
- the creation of a similar network of geophysical monitoring would be appropriate at other Russian cosmodromes.

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中国的边境地区和俄罗斯远东地区的南部地区  
**THE BORDER TERRITORIES OF CHINA AND  
THE SOUTHERN ZONE OF THE RUSSIAN FAR EAST**

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抽象。在现代世界中，跨境（跨界）地区对于优化该国及其单个地区的经济以及实现其国际空间中的国家利益具有特殊意义。任何经济活动都与自然的利用，新的或旧的生产和自然关系的出现有关，这不可避免地产生一系列问题，并形成该领土的生态状态。在本文中，我们考虑了黑龙江省的边境县和远东南部地区。收集并分析了有关被研究领土的自然资源潜力及其经济活动的材料。此外，还给出了领土生态状况的特征，以及一些计算出的指标（根据现有的必要统计信息），这些指标表征了自然保护活动的生态状况和经济上的充足性。揭示了远东和黑龙江省地区边界领土的经济发展不平衡，从而揭示了这些领土的经济活动对环境的平等影响。显然，有许多因素决定了进一步的有效合作。同时指出，需要在统一阅读自然管理规则和卫生规范的基础上开展旨在发展方法学的联合项目。除经济联合项目外，跨境领土还必须制定和实施联合项目，以保护环境和合理利用自然资源，这一点也非常重要。

关键词：边疆地区，远东地区，黑龙江省，生产自然关系，自然保护活动的经济充足。

**Abstract.** *In the modern world, cross-border (transboundary) regions acquire special significance for optimizing the economy of the country and its individual regions, as well as for realizing its national interests in the international space. Any economic activity is associated with the use of nature, with the emergence of new or the development of old production and natural relations, which inevitably generate a complex of problems and form the ecological state of the territory. In this paper, we consider the border counties of Heilongjiang Province and the regions of the southern regions of the Far East. The material on the natural-resource potential of the studied territories, their economic activities was collected and analyzed. In addition, the characteristic of the ecological situation of the territories, as well as some calculated indicators (according to the necessary statistical information available), characterizing the ecological status and economic sufficiency of nature protection activity are given. The uneven economic development of the border territories of the regions of the Far East and Heilongjiang Province and, consequently, the unequal*

*impact of the economic activities of the considered territories on the environment are revealed. It is obvious that there are many factors that determine the further effective cooperation. At the same time, it is pointed out the need for joint projects aimed at methodological development on the basis of a uniform reading of the rules of nature management and sanitary norms. It is also extremely important for cross-border territories, in addition to economic joint projects, to formulate and implement joint projects for the protection of the environment and rational use of natural resources.*

**Keywords:** *frontier territories, regions of the Far East, Heilongjiang province, production-natural relations, economic sufficiency of nature protection activity.*

Cross-border territories have a certain specificity, the integral part of which is the unity, the continuity of the geographical environment, the unity of the links of the economic infrastructure, as well as the unity of the ecological condition of the territories, as a result of the functioning of territorial-economic structures. Considering the transboundary territories as a whole, it is necessary to study the border areas, because they concentrate in themselves the results of interaction and mutual influence in various fields. At the regional level, the border areas are separate administrative units. A characteristic cross-border territory is the south of the Far East. The zone under consideration includes: Russia - the western regions of the Primorsky krai, the southern territories of the Khabarovsk krai, the Amur oblast and the JAO. This is the most economically developed part of the Far East. The basis of the economy of the southern zone is sea-, forest- and mining complexes. Currently, there is a development along the path of combining the leading industries with the service industries and agriculture; China - the northeastern territories of Heilongjiang. The province has large reserves of resources: oil, marble, basalt, graphite, coal, etc. The largest coal deposits are in Northeast China. The annual income from mining is also one of the highest in the country. Heilongjiang Province is the most forested area and the largest timber production base in China. Four industries provide the bulk of revenue: engineering, petrochemicals, energy, and the food industry, reflecting low diversification of the economy. Significant livestock, fishing, vegetable growing. The province is one of the leading agricultural producers in China. Heilongjiang gold and graphite deposits are the largest in China. Also in the province there are large deposits of silver, copper, lead, tungsten, zinc, molybdenum, oil, coal, soda, quartz, marble and mica [3].

For analysis, we examined the border areas and counties of the southern regions of the Far East and Heilongjiang Province of the PRC, namely: the natural resource potential and the types of economic activity that currently exist. The collected and analyzed material (Table 1) allows us to draw the following conclusions: the considered border territories of Russia and China have a significant and diverse natural resource potential; the natural resources of Heilongjiang are used more significantly than in the border areas of the south of the Russian Far East; accordingly, economic activity in the territory of Heilongjiang is more diverse and significant.

Economic reforms in Russia have led to a change in the territorial and economic structures, as well as to changes in nature management. Firstly, changes in the production structure have led to changes in the directions and degree of anthropogenic impact and changes in the dynamics of the use of natural resource potential. Secondly, when creating new enterprises, using new technologies, replacing some resources with others, there is also a change in the dynamics of the use of natural resource potential. And thirdly, the destruction of internal relations, a change in the domestic market led to contacts with distant foreign countries (mainly the Asia-Pacific countries and, to a greater extent, the PRC that is, there was a need somewhere, to either share resources or sell them, which, in turn, led to a change in the quality, quantity and directions of anthropogenic impact, as well as a change in the dynamics of resource consumption and the dynamics of natural resource potential [6].

In addition, the concept of “border region” or “border district” implies that the territory included in it experiences a significant influence of the state border, the main functions of which are: barrier, filtering and contact [2]. And, if until the nineties the border territories of the regions performed mainly barrier and filtering functions, then from the middle of this period a contact function also appeared. Border checkpoints have appeared, border trade zones are being formed. In this regard, there was a need to change transport routes, engineering structures, reorientation of the economy and, as a result, there were changes in the regime, forms and directions of nature management, the nature of production and natural relations.

The main activities in transboundary territories are: forest management, agriculture, mining of mineral resources. The transformation of these territories is estimated from moderately transformed to strongly transformed. In addition, protected areas are located in these territories, and recreation and tourism, which are promising for both states, have also been developed [1].

China is ahead of us in terms of the diversity of activities and production indicators of the main activities in transboundary territories. Moreover, the types of economic activity in the border areas of China are mainly more impacting on the environment than in Russia (Fig. 1). Due to the impossibility of providing detailed information in the context of municipal districts of the territories and regions of the Far East of Russia and counties of the Heilongjiang Province of China (too voluminous table), information is given in the context of territories, regions and districts (Table 1). In the border territories of the Primorsky krai, economic activity is more diverse compared to the adjacent territory of the PRC in the Khasansky district (Fig. 1), in the JAO- in the Leninsky district, in the Amur oblast out of 10 border regions in three of them (Skovorodinsky, Bureysky, Arkharinsky) activities are more diverse and the impact on environmental protection is stronger. In the border areas of the Khabarovsk krai, economic activity is more significant than in the adjacent territories of the Heilongjiang province (Fig. 1). Environmental indicators are heterogeneous: China dominates in emissions into the atmosphere, and Russian regions in waste water discharge.

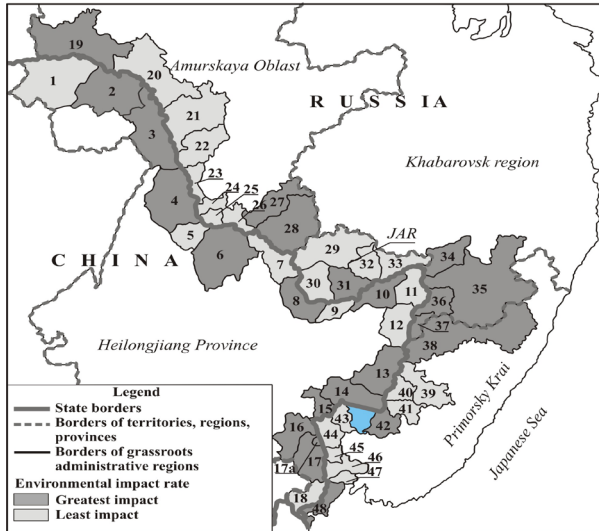
*Table 1  
Resource and economic characteristics of the border areas of the southern zone of the Far East of Russia and China*

Regions, areas (Russia)	Natural resource potential	Types of economic activity	Types of economic activity	Natural resource potential	Regions, countries (PRC)
<i>Primorsky Krai</i>	agricultural land, forest resources, coal, building materials, peat, mining raw materials, precious metals, marble, porcelain stone, limestone, sand; healing mud, recreational resources, mineral waters, SPNA (reserves).	agricultural, food, forestry and woodworking, coal mining and beneficiation, energy, mining and enrichment of tungsten, building industry (mining and construction materials), electrical, mechanical repair, pulp and paper production, ext. and processing of marine bioreources ship repair, railway transport ; recreational tourism activities production of mineral water "Swallow", sanatorium complex; the formation of ADT (so far one enterprise for the production of plastic);bc*: Markovo-Hulin, Turly Rog-Mishan, Kraskino-Hun Chun (China), Hassan - Tumangan (DPRK), Sosnovaya Pad-Suifenhe, Poltavka-Dunin.	aquaculture breeding, agricultural, heavy industry, fishing, processing and breeding, forestry and processing, mining industry, heavy and light industry, transport and logistics center: Hunchun export processing zone, Hunchun trade Russian-Chinese zone.	Agricultural land, titanium, nickel, coal, building materials, forest resources, water bioreources, phosphorus, loose gold, oil and gas fields, marble, iron, silicates, non-ferrous metals: copper, tungsten, lead, zinc, tin; non-metal ore: belt-bearing, pottery, diatom, marble, basalt, granite; SPNA (reserves).	Jixi Mudanjiang Shuanshan Yanbian County <i>Korean AO regions of Jilin province</i>
<i>Khabarovsk Krai</i>	agricultural land, forest resources, building materials, colored stones, river biological resources, promising manifestations of gold, silver, tungsten, tin, copper, amethysts, peat and brown coal, protected areas (reserve)	agricultural, forestry, and processing, food, production of building materials, light, railway transport, mining, gold mining; bc. Pokrovka-Zhaohe	fishing and processing, light, agricultural.	agricultural land, aquatic biological resources	Jiamusi, Shuanshan regions

Regions, areas (Russia)	Natural resource potential	Types of economic activity	Types of economic activity	Natural resource potential	Regions, countries (PRC)
JAO	agricultural land, manganese ore, forest, iron ores, tin, graphite, alluvial gold, brucite, magnesites, mineral paints, peat, mineral waters, lignite, building materials (sand, clay, sand and gravel mixtures, pebble, building stone, limestone.), forest, protected areas (reserves, wildlife preserves)	agricultural, beekeeping, hunting and forestry; food, production of building materials, light industry, forestry and woodworking, mechanical engineering, railway transport, production and distribution of electric energy and water, mining and processing of mineral raw materials, gold mining, spa treatment; bc.-Amurzet Lobey	fishing and processing, woodworking, mining, agricultural, heavy, light industry	bulk gold, iron, limestones, building clays, aquatic biological resources, agricultural land, coal, copper, tungsten, forest resources	Hagan, Jiamusi regions
Amur Oblast	agricultural land, building raw materials, forest reserves, gold, forest reserves, protected areas (reserves, nature reserve, national park) brown coal, non-ferrous metals, precious and ornamental stones, iron ores, mineral waters, (many resources are underdeveloped)	agricultural, food, mining and production of strict materials, heat and electricity, gold mining, logging and processing, coal mining, processing of ferrous scrap, machine building; bc.: Blagoveshchensk-Heihe, Jalinda-Mohe (reconst.), Poyarkovo-Xunhe	agricultural, light industry, mining, forestry, fishing and processing	agricultural land, nickel, copper, iron ore, tungsten, titanium, coal, loose gold, graphite, oil and gas areas, forest resources, water bioreresources.	Daxinanling, Haihe, Yichun, Hagan regions

\* bc - border crossing





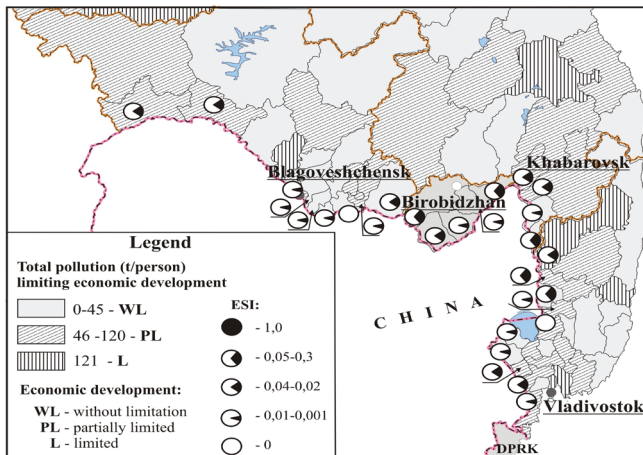
**Fig. 1.** The intensity of the impact of economic activities of the border areas of the south of the Russian Far East and China on the environment

Districts and counties:

- 1 – Mohexian, 2 – Tahexian, 3 – Humaxian, 4 – Aihuixian, 5 – Sunwxyxian, 6 – Xunkexian, 7 – Jiayinxian, 8 – Luobeixian, 9 – Suibinxian, 10 – Tongjiangshi, 11 – Fuyuanxian, 12 – Raohexian, 13 – Hulinxian, 14 – Mishanshi, 15 – Jidongxian, 16 – Mulingshi, 17 – Dongningxian, 17a – Suifenheshi, 18 - Hunchun xian, 19 – Skovorodinsky, 20 – Magdagachinsky, 21 – Shimanovsky, 22 – Svobodnensky, 23 – Blagoveshchensky, 24 – Tambovsky, 25 – Konstantinovsky, 26 – Mikhailovsky, 27 – Bureysky, 28 – Arkharinsky, 29 – Obluchensky, 30 – Octobersky, 31 – Leninsky, 32 – Birobidzhansky, 33 – Smidovichsky, 34 – Khabarovsk, 35 - named Lazo, 36 – Vyazemsky, 37 – Bikinsky, 38 – Pozharsky, 39 – Dalnerechensky, 40 – Lesozavodsky, 41 – Kirovsky, 42 – Spassky, 43 – Hankaisky, 44 – Boundary, 45 – Octobersky, 46 – Ussurisky, 47 – Nadezhdinsky, 48 – Hasansky.

From the point of view of the ecological state, all the considered regions of the south of the Far East cannot be called favorable and this situation is caused by air and water pollution. Earlier assessments of the restriction of economic activity in terms of total pollution per person grouped these areas into three groups (Fig. 2): eleven of them were included in the “partial restriction” group (these restrictions apply either to water-intensive industries or that have significant air emissions) ; two districts (the eastern part of the Pozharsky district of Primorsky Krai and the Blagoveshchensky MD and GO of the Amur oblast) were included in the group of “total restrictions”. The rest of the districts were included in the “no limit” group. These are mainly agricultural production areas, as well as wildlife sanctuaries.

Speaking of ecological and economic balance, we can conclude that neither the current costs of environmental protection and rational environmental management, nor investments in environmental protection, nor their structure correspond to the necessary ones (Fig. 2). The Economic Sufficiency Index (ESI) [6], which is found from the ratio of the sum of current costs plus investments in environmental protection and the economic optimum of environmental costs (8% of GRP [4]), ranges from 0 to 0.3 with an optimal value of 1.



*Fig. 2. Economic security of environmental activities in the border areas of the south of the Far East*

Of course, for a more complete assessment of the economic opportunities and environmental restrictions on the development of border areas, as well as the prospects for mutually beneficial cooperation between the RFE and the PRC, an analysis of the environmental and economic situation in Chinese border counties is necessary. Due to the lack of necessary information on the counties of the provinces of the PRC under consideration, an environmental profile is given in the context of Heilongjiang province.

The materials “On the environmental situation in Heilongjiang Province” [5] indicate that the environmental situation in large cities and Heilongjiang province is generally good, and is considered one of the best in the country. The water resources in Heilongjiang Province are small, although all the rivers in the Sungari basin are somewhat contaminated. Among solid industrial wastes, 33.23% belongs to coal waste, 24.9% - to the ash of combusted coal. In cities of district level and higher, the share of days with “good” and “satisfactory” air quality increased by 2.1% compared to 2015. The share of water bodies of category III and above increased by 1.8%, and the share of water bodies of a level below category V decreased by 1.1% compared to the same indicator in 2015 [5]. On the whole, a fairly active policy is being pursued in the PRC in the field of environmental protection and rational environmental management in the country.

The conducted study allows us to draw the following conclusions:

1. In the neighboring territories of the south of the Far East and Heilongjiang Province of the PRC, two different-sized economies have developed. Heilongjiang province is dominant, which is associated with a number of factors: a disproportionately large density and population in comparison with the Russian regions, the presence of a relatively developed transport infrastructure and industrial production, and natural and resource potential.

2. Economic activity in the border areas of China is more diverse in structure and is more impacting on the environment, which means it most actively and intensively forms the ecological situation in the cross-border territories.

3. The analysis of measures taken in the field of environmental protection and rational use of natural resources, as well as their economic security in the territory of Heilongjiang Province of China is much higher than in the territories of the southern zone of the Far East.

Cooperation between Heilongjiang and the south of the Russian Far East is growing every year and has high potential for growth. The current practice of substantiating business projects and activities shows that it is still mainly based on criteria of economic efficiency. And the lack of the necessary coordinated environmental component, as well as the inconsistency of interests and actions of the bordering states and the presence of differences in environmental management rules and sanitary norms will create new and exacerbate old environmental problems. Therefore, the priority tasks should be joint projects, developments to unify the rules of environmental management and sanitary standards. It is also imperative for cross-border territories, in addition to economic joint projects, to form and implement joint projects on environmental protection and rational nature management.

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山区河流山谷土地利用前景  
**PROSPECTS FOR THE USE OF LAND  
OF MOUNTAIN RIVER VALLEYS**

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抽象。 本文介绍了滨海边疆区Partizanskaya河谷土壤覆盖率的研究结果。描述了这些地区考虑到其侵蚀危险而用于农业的可能性：开发了洪水期间侵蚀的洪泛区土壤的分类，评估洪泛区土壤洪灾损害的分类器，以及开发了山区河流山谷的土壤复垦区划。

关键词：滨海边疆区，土壤覆盖，山区河流的山谷，侵蚀，土地开垦措施，区域化。

**Abstract.** *The article presents the results of studies of the soil cover of the Partizanskaya river valley of Primorsky Krai. The possibility of agricultural use of these territories taking into account their erosion hazard is described: a classification of floodplain soils eroded during floods, a classifier for assessing flood damages for floodplain soils, and soil-reclamation zoning of mountain river valleys are developed.*

**Keywords:** *Primorsky Krai, soil cover, valleys of mountain rivers, erosion, land reclamation measures, regionalization.*

Floodplain soils are highly fertile. In the Primorsky krai, they occupy small areas. To obtain stable yields in the monsoon climate of the region, characterized by uneven soil moisture during the growing season, reclamation systems of double regulation were built. The practice of reclamation construction has shown positive results in the development of the floodplain lands of the rivers of the Prikhankaisk lowland. At the same time, in the floodplains of mountain rivers, reclamation measures were not effective.

The valleys of mountain rivers, possessing potentially fertile soils and favorable temperature conditions, due to the protection from the cold winds of the spurs of the mountains, have all the conditions for growing a wide variety of crops. However, anthropogenic pressures on these natural ecosystems have caused imbalance and cyclical disturbance in the biosphere.

As a result of felling in the upper reaches of large forests, the hydrological regime was violated. The maximum river flow during a significant amount of precipitation in a short period of time exceeds the capacity of their channels, and the valleys are flooded. With a large fall of mountain rivers and a significant flow velocity (1.4-3.3 m/s), an increase in runoff led to the development of erosion processes in river valleys: partial or complete soil erosion by flood waters, development of a ravine network. These processes also intensified as a result of plowing of slope lands and irrational agricultural production on floodplain lands, which led to a change in the potential resistance of soils to degradation.

For the rational use of these territories, their regionalization is necessary taking into account the erosion hazard. Partisan River Valley, which is located in the south of Primorsky Krai, was chosen as the object of soil-reclamation zoning. On the territory of the Partizanskaya mountain river basin, extensive studies of the soil cover, erosion processes, and related river deformations of the river were carried out. The identified floodplain soils are systematized and their diagnostic features by location [6]. lithological features [4], occupancy regimen and alluvial processes [5] are given.

However, for ameliorative assessment of the soil cover of mountain river valleys, along with agrochemical and water-physical indicators of soils, account must also be taken of erosion processes, the intensity of which increases every year. As a result of floods, soils are exposed to waterlogging and flushing-washing by flood waters. The consequences of this are a decrease in agricultural land productivity. An objective assessment of the negative consequences was carried out to determine the optimal engineering, land reclamation and water management measures in order to reduce flood damage.

Within the Partizanskaya river valley, 6 soil types and 8 soil complexes were identified. Soil names are given according to the classification of soils of the Primorsky Territory developed at the Biological and Soil Institute of the Far Eastern Branch of the Russian Academy of Sciences [3]. A variety of landforms, hydrogeological conditions, lithology of soils, horizontal and vertical differentiation of the vegetation cover, anthropogenic influence, erosion processes determined the difference in the distribution of precipitation on the surface and caused the presence of a large number (186) soil varieties, which creates great difficulties for land development and use, obtaining stable high crop yields.

Poimozems occupy a large part of the valley. In the Partizanskaya river valley, subtypes are distinguished: underdeveloped, layered, residual, and granular. In total, 123 variants of floodplains were identified in the valley. The granulometric composition of floodplain soils is heterogeneous vertically and horizontally. Near the channel, sandy loamy floodplains prevail; in the near-terraces of the floodplain - easy and medium loamy. Down the profile of these soils, the percentage of sand increases. Fraction of fine sand (0.25-0.05 mm) - 22-49% and coarse dust (0.05-

0.01 mm) - 17-43% prevail in the soil profile of residual and layered floodplains. Significant sand content provides good air and water permeability of floodplain soils, but low absorption capacity. They have free internal drainage, quickly thaw out and are warmed up by the sun. A large percentage of coarse dust determines the ability of these soils to spray in the dry state and to float in the wet.

Partizanskaya river valley is an important agricultural area of the Primorsky krai. Carrying out cultural and agro-reclamation work without a radical transformation of the water regime led to differentiation of the soil mass horizontally and vertically. New, small in area, areas of technogenic soils arose.

For qualitative improvement of land resources in the monsoon climate of Primorye, reclamation systems were built that made it possible to introduce new lands into the agricultural circulation. The excessive nature of the moistening of the soil cover of the flat lowlands determined the conduct of drainage reclamation on them. In the Partizanskaya valley, on an area of 5014 hectares, there are 11 draining, 6 draining drainage, and drainage and humidification reclamation systems.

Drainage reclamation changed the conditions for the formation of groundwater and the distribution of runoff volumes not only of this territory, but also adjacent to it, which altered the structure of the soil cover of the entire river valley and increased its diversity. In order to improve the effectiveness of the operation of drainage systems with an open channel network and closed drainage, a surface layout was carried out. When leveling the surface, part of the humus layer was cut off and mixed with less fertile underlying horizons (technogenic layer). As a result, soil fertility decreased, their density increased, and the water-conducting ability of the subsoil layers decreased.

To analyze the erosion resistance of soils, a soil-erosion survey of the Partizanskaya river valley in the areas of the Sergeevskaya irrigation and drainage system, the villages of Frolovka, Novitskoe, Peretino, Vladimir-Aleksandrovskoe was carried out. During the soil erosion survey, the sections and the corresponding digs were laid on natural soils and their anthropogenic variations: old arable lands and reclamation systems - "Nikolaev DOS", "Sergeevskaya OS", "Taiga OS".

7 benchmark sections with undisturbed soil profile were laid. On the eroded floodplain soils, 23 excavations were laid, 40 samples were taken to determine the agrochemical properties of these soils.

Laboratory studies have confirmed the correctness of the field determination of the degree of erosion of the floodplains. Slightly washed away variants of floodplain soils were determined by a decrease in the thickness of the subsoil layer by 30-60% (for soils with different particle size distribution and thickness) due to its plowing to the humus horizon after a partial washing out of this horizon by flood waters. At the same time, the content of humus and nutrients decreases slightly. The higher content of nutrients in relation to control, noted in some cases, can probably be explained by the introduction of fertilizers, since floodplain soils are intensively used in agriculture.

When analyzing the state of the soil cover, slightly eroded soil varieties were revealed: gleyous burozems, glue-borozem-meadow, gley-bleached garnet-meadow. On glezems, peat, and granular floodplains, erosion processes do not develop so much due to their location and agrophysical properties (heavy loamy, clayey particle size distribution). Poimozems are most susceptible to erosion, among which weak, medium, and strongly eroded variants are identified.

As a result of the studies, it was found that eroded soils in the Partizanskaya river valley occupy 2441.4 ha. There is a risk of soil fertility decrease or loss. 72.7% of the total area of floodplain lands may be subject to varying degrees of erosion processes.

To determine the optimal engineering, land reclamation and water management measures to reduce flood damage, a classification of floodplain soils eroded during floods has been developed, based on the degree of loss of humus reserves of reference soils in 1 m thick. Graduations are taken according to a previously developed system [1]. The following are taken as criteria: non-washed away soils - losses make up no more than 10%, slightly washed away - 10–20%, medium washed away - 25–50%, strongly washed away 50–75%, catastrophically washed away - more than 75%. In developing the classification of eroded soils, a database of properties of reference soils was created for the following indicators: genetic horizon power (cm), humus content (%), bulk mass ( $\text{g/cm}^3$ ), humus reserves (t/ha). Based on these data, the statistical parameters of reference and, to varying degrees, eroded soils were calculated according to EA Dmitriev [2]. To determine the diagnosis on the ground, diagnostic signs of soils of varying degrees of erosion have been developed, which are characterized by the presence or absence of horizons or their parts, as well as the thickness of the profile to the diagnostic horizon.

Existing methods for calculating flood damage are designed only to determine the loss of direct costs for cultivating fields, the death or deterioration of the quality of agricultural products, and infrastructure violations. At the same time, losses of soil fertility during washing away of the arable, humus horizon or completely soil cover of a certain territory are not taken into account, while the real value of soils is determined by the accumulated reserves of humus and plant nutrients accumulated in it over a millennium.

To develop insurance premiums and determine measures for the rational use of land, an assessment was made of the damage from loss of soil fertility (humus, mobile forms of nutrients) in physical and economic indicators. To assess land damage and loss of soil fertility in river valleys from floods, statistical data was collected on agrochemical indicators of floodplain soils: total nitrogen content (%), mobile phosphorus, potassium content (mg/100 g, kg/ha). A classifier developed by statistical indicators for assessing flood damage to floodplain soils was tested on independent material. Damage due to the loss of fertility of varying



degrees of eroded flood plains of the Partizanskaya river valley was calculated. In addition to the classifier, losses from the decrease in the content of humus and its reserves in reclaimed varieties as a result of the washing out of the upper most fertile layer of floodplain soils were determined.

The presence of a large number of varieties of soils creates significant difficulties for the formulation of recommendations for the development and use of land. Based on the studies, soil-reclamation zoning of mountain river valleys has been developed. Four levels are distinguished (tab.).

**Table**  
*General scheme of soil-reclamation typological zoning*

Levels	Basic units of zoning	Number of selected units	Signs of selection
I	Zone	5	degree (frequency of flooding)
II	Subzone	5	modern erosion
III	area	23	combination of degree and nature of waterlogging *
IV	Subarea	5	by potential erosion hazard

Note. \* for drainage purposes

Due to the fact that one of the most important factors in the formation of soil cover in the valleys of mountain rivers is channel and drainage processes, the largest zoning units - zones are identified by the degree (frequency) of flooding by flood waters. In the first zone there are soils that are not flooded by flood waters: burozems, brown-bleached soils. Burozemno-meadow soils are located in the second zone - they are prone to floods of 1% coverage. In the III zone there are soils flooded during floods of 10% provision - burozems on alluvium. Residual and layered floodplains are located in the fourth zone, flooded with floods of 20% coverage. Gleezems, meadow and floodplain peat, primitive floodplains are located in the V zone, flooded with floods of 50% of the supply.

**Subzones** are sorted by the degree of modern soil erosion: weak, medium, highly eroded. Basically, floodplains are subject to erosion processes, therefore, in the river valley, their variants are eroded to varying degrees.

When carrying out land reclamation measures in mountain river valleys, it is necessary to take into account the potential erosion hazard. According to this indicator, similarly to subzones, 5 subareas are distinguished: non-erosion-hazardous, slightly erosion-hazardous, medium-erosion-hazardous, highly erosion-hazardous, catastrophically erosion-hazardous. They are determined during modeling, taking into account a comparison of the flow rates during the flood period with certain non-blurring water flow velocities.

When developing drainage reclamation, an assessment is given of the degree and causes of waterlogging, as it determines the need, degree and technical features of drainage. Therefore, soil-reclamation groups are distinguished by the degree of overmoistening — not overmoistened, short-term excess, temporary excess, long-term excess, permanent excess; groups by types of water supply - precipitation; slope overmoistening; swampy with alluvial river waters; atmospheric and soil waterlogging; slope and soil-pressure waterlogging; reclaimed, soil and soil-pressure overmoistening. In the Partizanskaya river valley, 23 districts are distinguished by a combination of these features.

According to the results of the research, a soil-reclamation map M 1: 25 000 was compiled, on which reclamation groups of soils were distinguished according to the degree (duration) of moisture, the reasons of moisture. Measures have been developed for the use of land within the allocated areas.

Thus, the planning of reclamation and agricultural work according to this soil-reclamation zoning will lead to the rational use of the lands of mountain river valleys.

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