



# 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  
International Conference

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countries: synergy and integration”

Part 2: Participants' reports in English

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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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# CONTENTS

## ECONOMICS

- 能源部门创新型节能项目经济效益评估标准  
Criteria for evaluating economic efficiency of innovative energy-saving projects in energy sector  
*Pyataeva Olga Alekseevna, Sharnopolsky Boris Petrovich*.....10
- 创新管理：本质，内容，分类，模型  
Innovation management: essence, content, classification, models  
*Ayad Fadhil Thabit Aldawoodi*.....16
- 国家创新体系中的知识产权  
Intellectual property in the national innovation system  
*Koroleva Elena Vladimirovna, Mukhopad Vladimir Ivanovich, Pyataeva Olga Alekseevna*.....23
- 使用受保护的（知识产权）和非受保护的创新为能源公司评估投资项目的有效性  
Evaluating effectiveness of investment projects using protected (intellectual property) and non- protected innovations for energy companies  
*Pyataeva Olga Alekseevna, Sharnopolsky Boris Petrovich, Kokurin Dmitry Ivanovich*.....29

## PEDAGOGICAL SCIENCES

- 形成合理的分析综合活动的教学条件，是学龄前儿童识字的先决条件  
Pedagogical conditions for the formation of sound analytic - synthetic activity as a prerequisite for literacy of children of preschool age  
*Galkina Irina Aleksandrovna, Galeyeva Elena Vladimirovna*.....34
- 在大学教育领域对海洋产业竞争专家进行专业培训  
Professional training of marine industry competitive specialist in the educational space of University  
*Dulia Alona Valentinovna, Sokol Alona Aleksandrovna*.....43
- 在设计体育课时要考虑到小学生的性别特征  
Designing a physical education lesson taking into account the gender characteristics of schoolchildren  
*Shchokin Anatoly Fedorovich, Zhuravleva Yulia Ivanovna, Yaroshenko Evgeniya Valeryevna*.....50
- 俄罗斯青少年媒体的媒体教育活动（以儿童和青年报纸“SAMI”为例，Barnaul）  
Media-educational activities of Russian juvenile media (on the example of the children's and youth newspaper "SAMI", Barnaul)  
*Yumasheva Natalya Vladimirovna*.....56

## **SOCIOLOGICAL SCIENCES**

- 新莫斯科斯克行政区居民对多功能中心提供公共服务活动的舆论  
Public opinion of the population of the Novomoskovsk administrative district on  
the activities of multifunctional centers for the provision of public services  
*Kirillov Vladimir Petrovich, Kirillova Galina Vladimirovna*.....62
- 关于文化, 培养, 教育  
About culture, upbringing, education  
*Demchenko Tamila Ivanovna, Demchenko V.I., Demchenko E.N.*.....70

## **MEDICAL SCIENCES**

- 慢性胃炎和胃及十二指肠消化性溃疡患者血清中IL-4和IL-8的动态  
Dynamics of IL-4 and IL-8 in the serum of patients with chronic gastritis and  
peptic ulcer of the stomach and duodenum  
*Gutkin Denis Sergeevich, Belaia Olga Fedorovna*.....79
- Perthes病髋关节各部分的血流动力学参数  
Hemodynamic parameters in the components of the hip joint in Perthes disease  
*Bunov Vyacheslav Sergeevich, Tepleny Mikhail Pavlovich,  
Oleinikov Evgenii Vladimirovich*.....85
- 秋明州地区居民的慢性扁桃体炎的流行及其临床特点  
Prevalence of chronic tonsillitis and peculiarities of its clinical current in residents  
of the Tyumen region  
*Izvin Alexandr Ivanovich, Khatskelevich Dmitrii Mikhailovich*.....94
- bishof-plus多矿物质成分对链脲佐菌素糖尿病大鼠中镁, 锌, 铁和铜缺乏症的  
纠正效果评估  
Evaluation of the efficiency of bishof-plus polymineral composition in correction  
of magnesium, zinc, iron and copper deficiency in rats with streptozotocin diabetes  
*Spasov Alexander Alekseevich, Bugayeva Lyubov Ivanovna,  
Lebedeva Svetlana Aleksandrovna*.....98

## **CHEMICAL SCIENCES**

- 研究单个和混合电解质溶液中的热导率  
To the study of thermal conductivity in solutions of individual and mixed  
electrolytes  
*Tanganov Boris Badmaevich, Bubeeva Irina Alexeevna*.....107
- 蒸馏方法对杨树芽精油成分的影响  
The effect of the distillation method on the composition of essential oils of poplar  
buds  
*Isaeva Elena Vladimirovna, Ryazanova Tatyana Vasilievna,  
Loskutov Sergey Redjinaldovich, Aniskina Antonina Aleksandrovna*.....113

## AGRICULTURAL SCIENCES

在油菜和芥末混合作物中播种春v子的种子和谷物饲料

Cultivation of spring vetch for seeds and grain fodder in mixed crops with rapeseed and mustard

*Bezgodov Andrey Viktorovich, Galimov Konstantin Arturovich.....118*

分析区域背景下土地资金状况的某些变化以及生态可持续土地利用的基本原则

Analysis of some changes in the state of the land fund and the fundamentals of ecologically sustainable land use in a regional context

*Dolmatova Lyudmila Georgievna.....128*

## 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”

能源部门创新型节能项目经济效益评估标准

**CRITERIA FOR EVALUATING ECONOMIC EFFICIENCY OF  
INNOVATIVE ENERGY-SAVING PROJECTS IN ENERGY SECTOR**

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抽象。 文章介绍了俄罗斯能源公司在不同级别和地区使用节能技术的理论规定和实践示例。 作者提出了评估标准,以评估节能措施的有效性。 本文包含了一些示例和实际情况,其中评估结果对能源行业和整个俄罗斯经济具有战略意义。

关键词: 节能, 效率评估, 创新经济, 节能技术。

**Abstract.** *An article presents theoretical provisions and practical examples of use energy-saving technologies in Russian energy companies on different levels and territories. The authors presented assessment criteria for evaluate effectiveness of energy-saving measures. The article contains examples and practical situations when the results of evaluation are strategically important for the energy industry and the Russian economy as a whole.*

**Keywords:** *energy saving, efficiency assessment, innovative economy, energy-saving technologies.*

Economic development of Russia is unreachable without solving a problem of reducing energy intensity. The most important condition for it is energy saving measure's implementation. Solution of this problem is, firstly, structural adjustment of Russian economy, development of knowledge-intensive industries and services. Secondly, legal, organizational and technological measures of energy conservation is also a way of energy saving implementation. All energy-saving measures, including restructuring of economy, should provide up to 3/4 of the expected increase in the demand for fuel and energy resources.

Implementation of measures to improve the economy's energy efficiency and energy saving will require huge investments in the fuel and energy sector, as well as in energy saving, local energy supply and non-traditional energy sources. Ac-

According to Energy strategy, the main source of financing for such colossal investments will be increase in energy prices, primarily in two natural monopolies: the gas industry and the electricity sector with district heating. The authors take the view that significant results in the field of energy saving can be obtained in a short time; only a small set of measures is required to create sustainable economic incentives for investors in energy-saving measures.

To assess the effectiveness of energy-saving projects, the authors propose to introduce and use a *coefficient of energy saving' economic efficiency*, equal to the ratio of saved energy resources costs to the profit that company can get if it will have lower energy costs:

$$Kf = \frac{\Delta S_1}{\Delta S}$$

where Kf is the *coefficient of energy saving' economic efficiency*,  
S - cost of saved energy resources.

Thus, the *coefficient of energy saving' economic efficiency* shows how much profit the company will receive for each ruble saved as a result of energy saving.

Accordingly, the higher of this coefficient is the higher of the energy-saving project efficiency. Since energy carriers make up a significant part of energy-producing companies' costs, the *coefficient of energy saving' economic efficiency* for energy sector will be significantly higher than for conventional production enterprises.

In addition to the high economic effect, environmental, social and political effects are quite significant for energy companies. This is due to a significant amount of pollution emissions into the environment; energy-saving projects help to reduce these emissions. Also, reducing harmful emissions and reducing the cost of energy production allows you to reduce tariffs, which in turn leads to a decrease in social tension.

For ordinary consumers of energy resources, especially for those whose share of energy resources in the structure of production costs is a small part, the economic and other effects of implementing energy-saving projects will be less. As a result, the interest in implementing such projects will also be less.

To illustrate the calculations of economic efficiency indicators of energy efficiency for manufacturers and consumers consider the energy saving for power plants, "Installation of variable frequency drives for feed pumps PAN – 7".

Characteristics of the powerhouse before the project implementation:

- Electricity generation – 961.7 million kWh per year;
- The total cost of electricity production – 511 237 thousand rubles;
- Cost of 1 kW \* h – 0.53 rubles;
- The price of selling electricity to consumers is 0.94 rubles /kWh.

Required investment for the project implementation is 14.36 million rubles.

The main economic effects of the project:

- Energy savings – 17.03 million kWh per year;
- Reduction of equipment and water repair costs - 346 thousand rubles per year.

Calculations of *coefficient of energy saving' economic efficiency* are given below.

Saving electricity and other costs in monetary terms per year:

$\Delta S = 17,030 \text{ thousand kWh} * 0.9486 \text{ rubles/kWh} + 346 \text{ thousand rubles} = 16,155 \text{ thousand rubles}$

The new cost of 1 kWh will be equal to:

$C = (511 \ 237 - 16 \ 155) \text{ thousand rubles} / 961,700 \text{ thousand kWh} = 0.5148 \text{ rubles.}$

We can use the saved amount to generate additional electricity at the new cost price:

$\Delta E = 16,155 \text{ thousand rubles} / 0,5148 \text{ rubles} = 31,381 \text{ thousand kWh}$

Then the additional profit from the sale of this electricity will be:

$Sr = 31,381 \text{ thousand kWh} * 0.9486 \text{ rubles/kWh} = 29,768 \text{ thousand rubles}$

and

$\Delta S1 = \Delta Sr - \Delta S = (29 \ 768 - 16 \ 155) \text{ thousand rubles} = 13,613 \text{ thousand rubles.}$

Then the *coefficient of energy saving' economic efficiency* for this project will be:

$$Kf1 = \frac{\Delta S1}{\Delta S} = \frac{13613}{16155} = 0,84$$

Further, the authors propose to consider classification categories of enterprises (producing energy resources, producing and consuming and purely consuming) and technologies (complex, closed, simple and composite) and determine the relationship that characterizes a degree of efficiency when using a particular technology for different enterprises.

This takes into account the following areas of energy saving: electricity, heat, gas consumption and improving efficiency of water supply (saving water for household and industrial needs).

Efficiency improvements can generally be achieved by saving energy, either by saving fuel, or by using renewable energy sources.

"Production of energy resources" as a process includes the following stages: (1) obtaining raw materials; (2) production (generation) of electric and thermal energy; (3) transport of electric and thermal energy; (4) consumption of electric and thermal energy; (5) waste disposal. Probably the number of these stages and their filling for different classification categories of enterprises will be different.

All enterprises in various economy sectors in terms of using energy resources can be divided into four categories:

*The 1st category.* Enterprises that only produce electricity and heat and do not consume energy produced by third-party consumers. These include alternative energy companies (wind power plants and solar power plants) that produce energy and transfer it to the grid without spending resources on their own needs. For them the process of producing energy resources will have a small form.

**Table 1 - Energy production process for the first category of enterprises**

<b>Stages of production process</b>	<b>Production</b>	<b>Transport</b>
<b>Energy saving Spheres</b>		
Wind and solar power plants	1.1	1.2

For this category composite or simple technologies will be covered two or more components of closed technology, such as solar buildings, local energy center based on wind energy, compressed air as a means of energy storage, etc.

- *The 2nd category* is enterprises that produce energy resources mainly for third-party consumers. Such enterprises have a high share of energy resources in the cost of production (50% or higher).

These group include traditional thermal, hydraulic and nuclear power plants, heat supply, electric and thermal networks that carry out a complex process of energy production and transfer it to the network, using part of the generated energy resources for their own needs. Probably for the second category of enterprises it will be applied composite and simple energy-saving technologies.

We can use the following matrix of energy production processes for this type of enterprises.

**Table 2 - Energy production process for the second category of enterprises**

<b>Stages of production process</b>	<b>Receiving raw materials</b>	<b>Production (generation)</b>	<b>Transport</b>	<b>Consumption</b>	<b>Utilization of wastes</b>
Electric energy	1.1	1.2	1.3	1.4	1.5
Heat	2.1	2.2	2.3	2.4	2.5
Water supply	3.1	3.2	3.3	3.4	3.5

The proposed type of matrix will be relevant for vertically integrated energy companies (power systems) – such as "Vladivostokenergo", "Dalenergo", etc.

The elements of the matrix (1.1, 1.2, etc.) show specific technologies, and in this case both closed, complex technologies, and simple and composite ones:

- for sub-processes 1.1 and 1.2 (the raw materials and the production of electricity):

- fuel-free installations for generating electricity, heat and cold on the basis of expander-generator units;
- introduction of new water treatment plants based on heat sources;
- replacing physically and morally outdated boilers with new ones, etc.
- for sub-processes 2.1 and 2.2 (obtaining raw materials and the production of thermal energy):
  - automation of the combustion regimes (maintaining the optimum ratio of fuel-air);
  - fuel-free installations for generating electricity, heat and cold on the basis of expander-generator units;
  - introduction of new water treatment plants based on heat sources;
  - replacing physically and morally outdated boilers with new ones, etc.
- for subprocess 1.3 (electricity transport):
  - reactive power compensation (CRM) in the structure of urban heat supply systems ("energy grid method");
  - energy-efficient operation of transformers, etc.
- for subprocess 1.4 (power consumption – in this case, for industrial needs):
  - replacing outdated transformers with modern ones;
  - replacing outdated electric motors with modern energy-efficient ones;
  - using variable frequency drives;
  - reactive power compensation (CRM) in the structure of urban heat supply systems ("energy grid method"), etc.

Similarly, we can identify the most effective list of technologies for a particular subprocess based on the remaining elements of the matrix listed on Table 2.

- *The 3rd category* is enterprises that produce energy resources mainly for their own needs, and consume energy resources produced by third-party producers.

For enterprises of this category, the same variant of the chain of subprocesses is applied as for the second category. The criteria by which the distinction will be made is the average share of energy resources in total cost of production.

In this case, complex technologies will continue to be used, covering all or the main areas of energy saving at once: electricity, heat, gas, water supply; as well as composite and simple technologies.

- *The 4th category* is enterprises that do not produce energy resources, but only consume them. Such enterprises have a low share of energy resources in total cost of production (less than 30%).

The main final consumers of energy resources are enterprises in all other sectors of economy. The technologies used at the enterprises of this type will be integrated (if we are dealing with large diversified business) a composite or simple.

**Table 3 - Energy production process for the fourth category of enterprises**

<b>Stages of production process</b>	<b>Receiving raw materials</b>	<b>Utilization of wastes</b>
<b>Energy saving Spheres</b>		
Electric energy	1.1	1.2
Heat	2.1	2.2
Water supply	3.1	3.2

This category of energy resources' consumers includes non-industrial objects and housing and communal services: administrative and public buildings and structures, apartments, private houses, non-residential, easily erected temporary structures, including commercial, General house systems, lighting systems, social institutions (schools, hospitals, kindergartens, etc.).

Special attention should be paid to the issue of cost accounting for implementation of a particular type of technology. Thus, a comprehensive technology appropriate to consider methods of collecting costs for items costing (by cost element, constituting a cost), while confined and composite technology for the elements of costs (by type of economic resource used for the implementation of production processes).

The higher share of energy resources in total cost of production, the higher effect of energy-saving technologies projects and the greater a profit will enterprise receive as a result of using energy-saving technologies.

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创新管理: 本质, 内容, 分类, 模型  
**INNOVATION MANAGEMENT: ESSENCE, CONTENT,  
CLASSIFICATION, MODELS**

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According to the Organization for Economic Cooperation and Development (OECD), large companies are the flagships of R&D in almost all countries of the world (Figure 1.1). In developed countries (USA, UK, Germany, Japan and Finland) more than 70% of R&D expenses are made by large corporations.

In the world economic literature, innovation (in the broad sense of the word) is characterized as the transformation of possible scientific and technological progress into new products and services. So, B. Twiss [10] characterizes innovation as a process where an invention or an idea acquires a certain economic content. The current global innovation market exceeds 2 trillion. US dollars, of which the US share is 39%, Japan - 30%, Germany - 16%, etc.

The great effect of innovation is that through a conscious innovative development, a modern corporation provides itself with effective survival and high growth rates in the long term. It is no coincidence that the number of publications related to innovation and the innovation process has been growing rapidly lately [11].

The field of science that studies various theories of innovation (for example, the creation of innovations, their dissemination, resistance to innovation, the development of innovative solutions) is innovation [1].

The basis for the survival and development of companies of various patterns of ownership and scale is the intensification of innovation.

It is generally recognized that the innovation sphere unites the activities of subjects of both science and production. It is focused on the creation of innovations (a new scientific and / or technical idea, invention, a new product that meets the needs at a qualitatively high level), bringing it to a result suitable for practical (commercial) use.

The concept of “innovation” as the newest economic category came into scientific circulation thanks to the work of the Austrian scientist Joseph Alois Schumpeter (J.A. Schumpeter, 1883–1950) in the first decade of the twentieth century. In his work “Theory of Economic Development”, the scientist for the first time explored new combinations of changes in development (ie, issues of innovation) and fully described the innovation process. Joseph Schumpeter noted that there are “five changes in development: the use of new technology, technological processes, or the latest market support for production; introduction of products with new properties; use of new raw materials; changes in the organization of production and its material and technical support; the emergence of new markets” [12].

At this time, as noted above, the role of innovations has greatly increased. This is due to the fact that in a market economy, innovations act as a weapon of confrontation, as their results may be a decline in production costs, revenue growth, the emergence of new needs, growth in the image (rating) of the manufacturer of new products, the creation and / or capture of new markets and other

The modern characteristic of innovations is based on international standards, the recommendations on which were adopted in the city of Oslo in 1992 - the “Oslo Manual” [9]. These standards include new products and latest processes, as well as their important technological changes. According to International Standards, innovation is the end result of innovative work that has been embodied in the form of the latest or improved product, advanced in the market, the latest or improved technological process used in practice, or in the newest approach to social services. In this regard, 2 types of technological innovations were adopted: product and process.

Product innovation covers the introduction of the latest or improved products, as a result of which product innovation can be divided into two types: basic product innovation and improved product innovation.

Process innovation is the assimilation of new forms and methods of organizing production when releasing new products. It should be borne in mind that it is possible to produce new products with existing technologies, equipment, energy resources and with the use of traditional methods of organizing production and management.

Despite the introduction of standard interpretations into the lexicon, there are still disagreements of a terminological and semantic nature regarding the results of the company's activity in the innovation sphere. So, in the specialized literature on this problem, the terms “innovation”, “innovation”, “innovation” are found.

Under the innovation, as a rule, they understand the result of fundamental and / or applied research, ready for design and implementation, as well as experimental design and experimental work in some field of activity, which are aimed at increasing its effectiveness.

The basis of the company's innovative work is the development (commercialization) of the latest types of products or methods of its production and distribution. In this context, a new (improved) product is a product, technical (technological) characteristics or options, the applications of which differ significantly from the products manufactured earlier in this organization. Similar innovations can be based on qualitatively new technologies, a combination of popular technologies, or be the result of the latest knowledge.

A new (improved) process is the promotion of production and management methods that are technologically fresh for a given organization, including methods for the separation of goods (their delivery to the place of consumption and sale). As is customary, process innovations are realized either when the latest products cannot be manufactured (sold) using methods traditional for this enterprise, or when a significant increase in the efficiency of economic activity is expected.

There is a significant range of factors that directly or indirectly determine both the cost of implementing innovative work and its economic efficiency, but the most significant, from a practical point of view, is the internal ability of corporations to implement innovations. This ability can be defined as the innovative development of corporations.

In modern conditions, the relevance of innovation is very high, due to a number of interrelated reasons. The volatility of labor markets, production and capital, limited natural resources, increased competition lead to the fact that only innovation allows corporations to function efficiently [2].

Innovation is not only a strategy that allows corporations to receive innovative rents and maintain a leading position in promising markets, but also a way to survive in today's competitive environment.

Innovation has both dynamic and static aspects. In the latter case, innovation represents the final result of the scientific and production cycle.

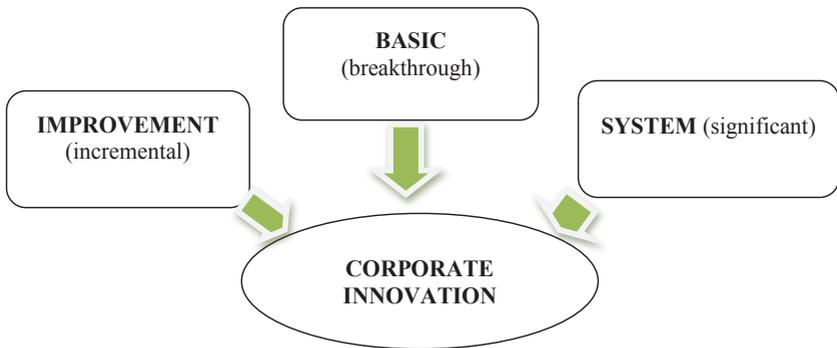
In the scientific literature there is an approach when innovation is understood as the process of their formation. For example, innovation is “a process in which an idea or invention acquires economic content” (B. Twiss) [10] or “a process that includes such types of work as research, planning and organization of production of the latest product, technology or system” (D. Messi, P. Quintas, D. Wilde and others) [5]. Undoubtedly, these concepts are closely interconnected with the term “innovation”, but for their characterization there is a very specific category - “innovation process”, which is in its most general form “the process of creating, mastering and disseminating innovations” [4].

The analysis of the definition of the term “innovation” presented in the economic literature demonstrates the breadth of views, which indicates its versatility, multicollinearity of the factors determining it. Its existing interpretations can be structured into four groups: as a system, as a process, as a result, as a change.

Innovations for reasons of occurrence are divided into two types: strategic and reactive. Jet innovations are focused on the survival of the company, they appear as a response to the radical innovation transformations implemented by competitive companies. Strategic innovation focuses on acquiring high competitive advantages in the future. Thus, using innovations, the company reduces costs, increases production scale, conquers sales markets, raises profits, contributes to increasing the effectiveness of entrepreneurship and the development of the national economy [8].

As shown in Figure 1.1, corporate innovation by degree of novelty is divided into:

- 1) basic (breakthrough) innovations - innovations formed on the basis of scientific inventions and discoveries, which are considered the basis for the development of modern developments and technologies (radical innovations);
- 2) systemic (significant) innovations - focused on creating the latest product and technologies of already mastered generations of equipment or various technologies that use (evolutionary innovations);
- 3) improving (incremental) innovations - continue the technical improvement of products (services) and apply to the application of basic and systemic innovations.



*Figure 1.1 - Classification of corporate innovation*

Currently, experts in the field of innovation offer a wide range of grounds for their classifications. The most detailed review of the existing classification approaches to the varieties of innovations is presented in the study of the author's team under the guidance of L.S. Maksimenko, where the compilation was performed on economic grounds, the scope of applications and development, the scale of the market, the reasons for its occurrence, the degree of novelty, effectiveness, efficiency, intensity, etc.

The definition of innovation serves as the basis for such a concept as “innovation potential”.

The difficulty in determining the innovative potential is due to the different understanding in the scientific literature of this term, as well as the lack of comprehensive research in this area. For the first time, the definition of “innovative potential” was introduced in the 1970-1980s. K. Freeman as a category that ensures the growth of the system due to innovations. Further theoretical and applied aspects, revealing the essence of innovative potential, are reflected in the works of P. Drucker. At the same time, existing views on this category can be differentiated within the framework of three approaches: structural and institutional, taking attention to the system of institutional entities engaged in innovative activities, as well as economic relations with its external areas - science and production; functional, revealing the features of the course of the innovation process in time from the moment of production of the innovation to the resumption of the cycle of the innovation process; resource, reflecting the probability of involving a unit of any resource in the innovation process.

The specific composition of the company's innovative potential is determined by the features of its innovative activity, which is a certain sequence of actions carried out in practice and associated with the development, production and commercialization of an innovative product (idea, technology, product, service). The key element of the corporation's innovation activity is the innovation process, which involves the transformation of unique knowledge, ideas and discoveries into a successfully commercialized innovative product through the cyclical passage of a number of stages:

- basic research aimed at studying patterns in a particular field of knowledge through the implementation of applied research and development (R&D) and the formulation of ideas based on identified problems;
- applied research, within the framework of which various options are identified for solving the identified problems in practice, within the framework of a specific production;
- marketing and market research, identifying opportunities for consumption and successful commercialization of the results of R&D by identifying the most attractive market segments with a sufficient level of accessibility, profitability and minimal intensity of competition;
- design developments, the result of which is a set of key parameters of innovation;
- the development of innovations involving the pilot production of the first sample and its testing, various kinds of tests, if necessary, adjustments to the original technical documentation based on their results;
- production of new items;

- sales, i.e. commercialization of innovation, its distribution, diffusion.

At the company level, the indicated sequence of stages can be implemented within five generations of models of the innovation process, developed in the process of corporate development over several decades, associated with its complexity and increased openness:

1) the model of “technological push” (or “black hole”) - 1950-mid-1960. - It is linear, because scientific research without ensuring a functional relationship with other divisions of the company was paramount;

2) the model of "pulling demand" - mid-1960 - early 1970. - the result of the shift of emphasis from scientific research to market demand research;

3) the “unifying” model - mid-1970 - mid-1980. - based on a combination of technological capabilities and capabilities and market needs;

4) “model of integration business processes” - beginning of 1980 - mid 1990. - involves the integration of R&D with production, partnership of suppliers with consumers, parallel implementation of projects on the basis of cross-functional teams;

5) network model - mid 1990s. - to the present - arose in response to the need to integrate with other sources of knowledge and technology, cooperation with which significantly increases corporate flexibility and competitiveness in the market.

The evolution of these models once again emphasizes a significant role in ensuring the competitiveness of the research base companies in the context of shortened product life cycles and high speed of technological changes, as well as its competent management.

The indisputability of this fact is proved by the evolutionary model of the innovation management paradigm of P. Bolvin and T. Kumpe [7], according to which the shift in the focus of management from achieving economic efficiency of the enterprise to providing new quality, strategic flexibility, innovative solutions and creating organizational knowledge requires scientifically based innovation management in corporations. Other authors point to the need for systematic management of innovative activity and innovative potential of companies [3].

Thus, on the one hand, complexity and, on the other hand, the need to manage innovation in large integrated business formations predetermine the further course of research on the features of constructing appropriate innovative systems that accelerate the transformation of their scientific and technical potential into innovations and the introduction of the latter into production activities of corporations.

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国家创新体系中的知识产权  
**INTELLECTUAL PROPERTY IN THE NATIONAL INNOVATION  
SYSTEM**

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抽象。 作者分析了创作知识产权对象的多维方面，例如相关权利的转让，分配和使用。 他们定义了知识产权在俄罗斯经济及其现代化中的关键作用，强调了首先要解决的关键管理任务。 作为审查的结果，提出了切实可行的解决经济和社会问题的科学和技术潜力的备选方案。

关键词：国家创新体系，知识产权，无形资产，知识产权对象。

***Abstract.** Authors analyze the multidimensional aspects of creation intellectual property objects, such as transfer, distribution and use of relevant rights. They defined a key role of intellectual property in Russian economy and its modernization, highlighted key management tasks that need to be solved first of all. As a result of review options for the practical implementation of scientific and technical potential for solving economic and social problems are presented.*

***Keywords:** national innovation system, intellectual property, intangible assets, intellectual property objects.*

In the OECD documentation (2009) the national innovation system is defined as "a set of institutions belonging to the private and public sectors that individually and in cooperation with each other determine the development and dissemination of new technologies within a particular state". The main goal of national innovation systems is to ensure sustainable economic development and improve quality of life by creating additional jobs both in science and in production and services, as well as increasing revenues to budgets of different levels by increasing the production of high-tech products.

The modern national innovation system (NIS) is formed based on the General state macroeconomic policy and the regulatory framework that ensures implementation of this policy. NIS includes the following subsystems: knowledge generation, education and training, production of products and services, innovation infrastructure, including financial support. It should be noted that the list does not highlight the place of intellectual property in NIS; however, it occupies an important place in each of its subsystems.

Recent decades have been characterized by a sharp increase in the intensity of innovation processes in the leading countries of the world, and the transformation of world economy towards a knowledge-based direction. At the same time, in industrialized countries, there is a multi-fold increase in the rate of creation of protected results of intellectual activity, their commercialization in the form of trade in patents and licenses, as well as high-tech products based on their use. Intellectual property, therefore, is becoming an increasingly important object of management of NIS subsystems; the share of protected innovations in comparison with unprotected ones is becoming more and more significant in the economies of industrialized countries. As a confirmation of the above thesis: in the second half of the XX century, the growth rates of world and national intellectual property markets exceeded the growth rates of traditional goods and services by 3-5 times. Thus, the production acquisition and sale of intellectual property becomes one of the key aspects of enterprises' activities in the scientific and innovative sphere.

Relations to creation of intellectual property objects, their transfer, distribution and use of relevant rights cover a wide range of subjects that make up the links of NIS: scientists and engineers, research institutes, universities, industrial firms, commercial formations, state structures, public organizations, etc. They include elements that differ both in legal status (individuals and legal entities, commercial and non-profit organizations), as well as in innovative motivations and areas of activity. The Central direction of intellectual property integration in national innovation system should be to improve patent and licensing mechanisms, legal protection and commercialization of intellectual property, use of their competitive advantages in the process of modernization.

The analysis of the measures taken to improve the mechanisms of activity of subsystems of the Russian national innovation system shows certain positive results in the field of intellectual property management. It is primarily the creation of a modern legislative regulatory framework of legal protection and use of intellectual property, internal national market of licenses, establishment of a separate infrastructure management in the field of intellectual property, training of patent specialists and other professionals in the field of legal protection and commercialization of intellectual property, development algorithms for of intellectual property objects accounting.

Production, acquisition and sale of intellectual property are becoming one of the key aspects of activities enterprises and organizations in the scientific, technical and industrial sphere. Through competitive intellectual property objects, mechanisms for generating, transferring and diffusing technology within the scientific and innovative cycle are served with high efficiency. The Institute of intellectual property makes it possible to integrate intellectual property and innovative activities organically into the General economic system, adapt the results of intellectual activity and means of individualization to the realities of market, and ensure a balance of interests between a creator of intellectual product and society. It should be emphasized that through the mechanisms and means of intellectual property in the national economy, the most profound forms of innovative integration are implemented, such as patent and licensing cooperation of firms, patent pools and alliances, a system of cross-licensing, etc.

In the structure of NIS, the Institute of intellectual property opens up broad prospects for integration into the innovative economy of small and medium-sized businesses.

The development of the intellectual property protection system expands the basis for direct individual participation in the NIS of creative individuals as owners of intellectual property results.

The special role of innovations in the history of mankind is determined primarily by the fact that scientific discoveries, inventions, improvements and other results of intellectual activity, due to their new properties, have always been the main engines of social and economic development. The specifics of these facilities are that they have a powerful potential that can create new or reconstruct existing production and successfully solve social and economic problems at different levels. The leading place among these objects is occupied by innovations that fall into the category of "intellectual property"; unlike traditional innovations in the scientific and technical sphere, intellectual property objects usually have an inventive level or are original, and their owners are protected by patent or copyright legislation from competitors and have monopoly rights to use them in market conditions.

The key role of intellectual property in the modernization of the Russian economy is determined by the fact that its products are a special multifunctional object of property. Traditional forms and methods of management, including innovative, is insufficient for them. In view of the above, ensuring that the state effectively uses the potential of intellectual property to solve social and economic problems requires the creation of a complete system and a single mechanism for managing intellectual property. This system, on the one hand, should have a multi - disciplinary, differentiated nature, focused on making management decisions at each stage of the "life cycle" of intellectual property; on the other hand, it should ensure the

integrity and systematic management of the entire process of this cycle and ensure high efficiency of the final result of using specific objects of the entire potential of intellectual property.

This system should take into account the multifunctional nature of intellectual property objects and provide for the solution of the following management tasks:

- recognition and consolidation of authorship, priority and property rights for developers of innovations. Ensuring the protection of the exclusive rights of IPO owners on the basis of patent and copyright legislation, as well as in the "know-how" mode;

- taking effective measures against violations of the rights of intellectual property rights holders and manufacturers of counterfeit products;

- the prevention of uncontrolled export intellectual property objects to other countries;

- carrying out inventory, putting on the balance sheet and accounting of intellectual property objects as intangible assets;

- involvement intellectual property objects in economic turnover, regulation of legal and commercial issues related using of IPOs by the enterprises;

- commercialization of intellectual property objects based on their effective use in their own production and application of modern forms and methods of patent and license management in the field of exchange;

- solving methodological aspects of commercialization and involvement intellectual property objects in economic turnover, including problems of its valuation;

- solving the personnel problem of training specialists-managers who can ensure rational and effective management of intellectual property objects at the Federal and municipal levels, as well as in economic structures of different scales and forms of ownership;

- priority and effective use the potential of intellectual property in the innovative development of countries to ensure economic growth and solve social problems.

It should be recognized that legal protection of intellectual property objects cannot become the ultimate goal of their use, and it should be considered only as a necessary condition for realizing the scientific and technical potential of innovations. All the presented areas of intellectual property management should be combined into a common system of intellectual property management in the country, the main priority of which should be to ensure the most effective use of the IPO for solving socio — economic problems.

An equally important priority of the state intellectual property management system was the "intangible assets" category, which was first introduced in Russian

legislation in 1992 and became a mandatory accounting unit in the balance sheets of domestic enterprises and an organization of all forms of ownership. Regulation on accounting 14/2007, approved by the Ministry of Finance of the Russian Federation on 27.12.2007 No. 153-N and its section "Accounting for intangible assets" provides for the registration on accounting and use in the economic activities of the enterprise until their complete disposal. The "intangible assets" category includes exclusive rights to inventions, industrial designs, utility models, selection achievements, computer programs, databases, and integrated circuit topologies. Intangible assets also include business reputation (goodwill) as well as organizational expenses related to formation of the enterprise as a legal entity. A mandatory requirement for classifying IPOs as "intangible assets" is use them in economic activities.

Currently, the "accounting" approach to intellectual property objects as intangible assets prevails in domestic economic structures. The main goal of using the latest technology, inventions and other intellectual property in economic activity, many do not see their role as the main means of modernization and technological re-equipment of companies and competitive products, and valuation of costs for creating or acquiring these objects, setting the balance to increase assets and share capital of the company and improve its financial performance. This distorts the main purpose and meaning of the policy to involve intellectual property in economic turnover.

This approach is practiced not only at individual enterprises, but is implemented as one of the main economic directions of using the IPO. The priority, but ineffective development of this direction in Russia can be illustrated by such contradictions as: increased attention to the assessment and accounting of IPOs as "intangible assets" in enterprises and their simultaneous "ignoring" in production as innovations; the increased attention to the training of specialists-accountants for IPOs and the simultaneous shortage of qualified innovation managers. It seems that this is an additional confirmation of the fact that IPOs are more or less "excluded" from the sphere of commercialization, where they act as independent products.

It makes sense to address issues of legal protection, accounting and balancing of intellectual property objects by enterprises only if they are related to the practical implementation of their scientific and technical potential for solving economic and social problems; in this regard, it seems that a systematic approach to intellectual property management at different levels should provide a system of preparatory and ensuring measures related to development, legal protection and accounting of the results of intellectual activity. Mandatory and priority condition for functioning of this system should be obtained the final economic effect from their implementation.

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使用受保护的（知识产权）和非受保护的创新为能源公司评估投资项目的有效性

**EVALUATING EFFECTIVENESS OF INVESTMENT PROJECTS  
USING PROTECTED (INTELLECTUAL PROPERTY) AND NON-  
PROTECTED INNOVATIONS FOR ENERGY COMPANIES**

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抽象。 本文概述了能源行业的现状，以及在能源企业中使用创新技术的相关性。 给出了根据保护能力标准对创新进行分类的方法，强调了使用保护型创新与未保护型创新相比的优势。 提出了使用受保护的（知识产权）和非受保护的创新为能源工业企业评估投资项目的比较有效性的方法。

关键词：能源部门，创新，创新经济，投资项目。

**Abstract.** *The article provides an overview of the current state of the energy industry, the relevance of the use of innovative technologies in energy enterprises. The classification of innovations according to the criterion of protection capacity is given, the advantages of using protected innovations in comparison with unprotected ones are highlighted. The method of evaluating the comparative effectiveness of investment projects using protected (intellectual property) and non-protected innovations for energy industry enterprises is presented.*

**Keywords:** *energy sector, innovation, innovative economy, investment projects.*

The relevance of this article is due to the fact that the current trends in technological development of Russia (in the period from 2009-2013 to present) are characterized by priority application of public-private partnership tools. The implementation of projects to create high-tech products and services, the initiation of innovative industries in cooperation with universities and scientific and technical centers, the formation of technological platforms and innovative development programs are new vectors of development in modern economy. Therefore, the

problems of technological development of enterprises, industries and complexes should be addressed as a priority.

It seems that the solution of above-mentioned problem is the development of mechanisms for improving innovation tools (especially in key industries), methodologies and methods for evaluating innovation and technological development. The energy sector should be declared as one of the main platforms for priority achievement of the set goals. Its importance for the country's economy and its system-forming role should not be questioned.

The development of mechanisms and tools for innovation in electric power industry, as we know, is a necessary condition for both the activities of energy companies as a whole (this condition is common to all economic systems) and ensuring their economic efficiency (a condition relevant to the modern economic system of Russian Federation). At the same time, innovative development of energy sector is more relevant for Russia than for countries with a smaller territory (in this regard, the corresponding mechanisms used in European countries are only partially applicable for Russian energy systems).

At the same time, due to the high investment capacity energy creates demand for innovative technologies and further supports it as the main activities (production, processing of raw materials, etc.) and consumers (rocket-space industry, metallurgy, etc.).

Another factor that actualizes the implementation of new mechanisms for innovative development of industries is the limited availability of energy resources. Forecasts in this regard are disappointing: according to experts, the world's oil reserves will last for 40 years, gas - for 60, and coal - for 270. The issues of "new energy" as an alternative to traditional energy are being considered by a number of foreign and Russian scientists and practitioners. Effective mechanisms for using potential of such technologies in Russia, however, introduced to date was not; it appears that the prospects for their creation are associated with bringing to market a new product or service, the introduction a production process, development a new business model and an innovation sector at whole.

It is important, then, that its scientific and technical significance and effects of innovation are either the intellectual property (protected innovation), or intellectual property not owned by specific entities or persons (unguarded innovation). The advantages of using innovations of the first type of them are the monopoly of rights holders and licenses; second, exemption from business restrictions related to the application of antitrust legislation; third, guaranteed on the basis of expertise inventive level, absolute novelty; fourth, the creation and development of new forms of business based on IPOs, including franchising (commercial concession), production cooperation on a license basis, joint ventures based on protected RID.

Finally, the inclusion of IPOs in the company's intangible assets leads to an increase in its value, as well as the rapid growth of business reputation (goodwill), image, popularity of trademarks and trade names, and their transformation into a brand. The advantages and expediency of introducing intellectual property objects as the most valuable legally protected technological developments in innovative projects should be illustrated by methods of quantitative assessment of these parameters.

Innovations in scientific, technical and industrial spheres is based on the developed investment projects. In this regard, the methodology of comparative effectiveness of them in energy sector when using protected (intellectual property) and unprotected innovation must be supplemented by some parameters presented in "Methodical recommendations on estimation of effectiveness of investment projects and their selection for financing".

The following indicators should be used as a basis: NPV - net present value; IRP - internal rate of profit; PBP - payback period of the project; P - profitability of the project. The assessment of additional value and comparative effectiveness of comparable projects for energy industry when using unprotected innovations and intellectual property objects can be carried out according to the following scheme.

$$\Delta E_{IPO} = NPV^f_{IPO} - NPV^T_{w/oIPO} = \sum_{tk}^{tf} (R_{IPO} - C_{IPO}) * K_{dr} - \sum_{tk}^{tf} (R_{w/oIPO} - C_{w/oIPO}) * K_{dr}$$

where

$NPV_{IPO}$  – net present value for the accounting period T, which provides when using IPO;

$NPV_{w/oIPO}$  – net present value for the accounting period T when using traditional technologies (without IPO);

$R_{IPO}$  and  $R_{w/oIPO}$  – received or planned revenues from the implementation of investment projects for the period T when using IPO ( $R_{IPO}$ ) or without the IPO ( $R_{w/oIPO}$ );

$C_{IPO}$  and  $C_{w/oIPO}$  – produced or planned costs for the implementation of investment projects when using IPO or without IPO;

$K_{dr}$  – cash flow discount rate used to bring non-recurring amounts of cash to the valuation date (current value);

$t_n$  – ordinal number of the initial year of billing period T;

$t_f$  – ordinal number of the final year of billing period.

Further, it is advisable to illustrate an example of a comparative calculation of the NPV for both investment projects based on presented methods.

**Table 1 - Calculation NPV of investment projects when using the IPO ( $NPV_{if}^I$ ) and without using IPO ( $NPV_{if}^{II}$ )**

№	Indicators	Год расчетного периода T						
		1 <sup>st</sup> year		2 <sup>nd</sup> year		...	T <sub>f</sub>	
		NPV <sub>IPO</sub> <sup>I</sup>	NPV w/o <sub>IPO</sub> <sup>II</sup>	NPV <sub>IPO</sub> <sup>I</sup>	NPV w/o <sub>IPO</sub> <sup>II</sup>		NPV <sub>IPO</sub> <sup>I</sup>	NPV w/o <sub>IPO</sub> <sup>II</sup>
1	Revenues, R <sub>f</sub>	R <sub>f</sub> <sup>I</sup>	R <sub>f</sub> <sup>II</sup>	R <sub>f</sub> <sup>I</sup>	R <sub>f</sub> <sup>II</sup>		R <sub>f</sub> <sup>I</sup>	R <sub>f</sub> <sup>II</sup>
2	Costs, C <sub>f</sub>	C <sub>f</sub> <sup>I</sup>	C <sub>f</sub> <sup>II</sup>	C <sub>f</sub> <sup>I</sup>	C <sub>f</sub> <sup>II</sup>		C <sub>f</sub> <sup>I</sup>	C <sub>f</sub> <sup>II</sup>
3	Profit before depreciation and taxation	R <sub>f</sub> <sup>I</sup> - C <sub>f</sub> <sup>I</sup>	R <sub>f</sub> <sup>II</sup> - C <sub>f</sub> <sup>II</sup>	R <sub>f</sub> <sup>I</sup> - C <sub>f</sub> <sup>I</sup>	R <sub>f</sub> <sup>II</sup> - C <sub>f</sub> <sup>II</sup>		R <sub>f</sub> <sup>I</sup> - C <sub>f</sub> <sup>I</sup>	R <sub>f</sub> <sup>II</sup> - C <sub>f</sub> <sup>II</sup>
4	Taxable profit (without depreciation)	(R <sub>f</sub> <sup>I</sup> - C <sub>f</sub> <sup>I</sup> ) - d <sub>f</sub>	(R <sub>f</sub> <sup>II</sup> - C <sub>f</sub> <sup>II</sup> ) - d <sub>f</sub>	(R <sub>f</sub> <sup>I</sup> - C <sub>f</sub> <sup>I</sup> ) - d <sub>f</sub>	(R <sub>f</sub> <sup>II</sup> - C <sub>f</sub> <sup>II</sup> ) - d <sub>f</sub>		(R <sub>f</sub> <sup>I</sup> - C <sub>f</sub> <sup>I</sup> ) - d <sub>f</sub>	(R <sub>f</sub> <sup>II</sup> - C <sub>f</sub> <sup>II</sup> ) - d <sub>f</sub>
5	Profit tax, Pt	Pt <sub>f</sub> <sup>I</sup>	Pt <sub>f</sub> <sup>II</sup>	Pt <sub>f</sub> <sup>I</sup>	Pt <sub>f</sub> <sup>II</sup>		Pt <sub>f</sub> <sup>I</sup>	Pt <sub>f</sub> <sup>II</sup>
6	Net profit, Np	Np <sub>f</sub> <sup>I</sup>	Np <sub>f</sub> <sup>II</sup>	Np <sub>f</sub> <sup>I</sup>	Np <sub>f</sub> <sup>II</sup>		Np <sub>f</sub> <sup>I</sup>	Np <sub>f</sub> <sup>II</sup>
7	Net profit and depreciation, Np + dt	Np <sub>f</sub> <sup>I</sup> + dt <sub>f</sub> <sup>I</sup>	Np <sub>f</sub> <sup>II</sup> + dt <sub>f</sub> <sup>II</sup>	Np <sub>f</sub> <sup>I</sup> + dt <sub>f</sub> <sup>I</sup>	Np <sub>f</sub> <sup>II</sup> + dt <sub>f</sub> <sup>II</sup>		Np <sub>f</sub> <sup>I</sup> + dt <sub>f</sub> <sup>I</sup>	Np <sub>f</sub> <sup>II</sup> + dt <sub>f</sub> <sup>II</sup>
8	Cash flow discount rate, Kdr	Kdr <sub>f</sub> <sup>I</sup>	Kdr <sub>f</sub> <sup>II</sup>	Kdr <sub>f</sub> <sup>I</sup>	Kdr <sub>f</sub> <sup>II</sup>		Kdr <sub>f</sub> <sup>I</sup>	Kdr <sub>f</sub> <sup>II</sup>
9	Net present value, NPV <sub>f</sub>	NPV <sub>f</sub> <sup>I</sup>	NPV <sub>f</sub> <sup>II</sup>	NPV <sub>f</sub> <sup>I</sup>	NPV <sub>f</sub> <sup>II</sup>		NPV <sub>f</sub> <sup>I</sup>	NPV <sub>f</sub> <sup>II</sup>

The values at intersections of rows and columns correspond to the performance indicators of innovative projects for energy companies:

- $R_{if}^I$  and  $R_{if}^{II}$  - respectively, the results obtained in year f when using the IPO ( $R_{if}^I$ ) and without using the IPO ( $R_{if}^{II}$ );
- $dt_{if}^I$  and  $dt_{if}^{II}$  - depreciation in the corresponding year f when using the IPO ( $dt_{if}^I$ ) and without using the IPO ( $dt_{if}^{II}$ );
- $Pt_{if}^I$  and  $Pt_{if}^{II}$  - profit tax in year f when using the IPO ( $Pt_{if}^I$ ) and without using the IPO ( $Pt_{if}^{II}$ );
- $Np_{if}^I$  and  $Np_{if}^{II}$  - net profit in year f when using the IPO ( $Np_{if}^I$ ) and without using the IPO ( $Np_{if}^{II}$ );
- $Kd_{if}^I$  and  $Kd_{if}^{II}$  - cash flow discount rate generated in projects when using IPO ( $Kd_{if}^I$ ) and without using IPO ( $Kd_{if}^{II}$ );
- $NPV_{if}^I$  and  $NPV_{if}^{II}$  - net present value from the implementation of investment projects in the corresponding year f when using the IPO ( $NPV_{if}^I$ ) and without using the IPO ( $NPV_{if}^{II}$ ).

The total net present value of investment project in energy industry when using the IPO for the calculation period f will be:

$$NPV^{IPO}_f = \sum_{tk}^{if} NPV_f^I = \sum_{tk}^{if} (Np_f^I + d_f^I) * Kdr_f^I$$

without using the OIS:

$$NPV^{w/o IPO}_f = \sum_{tk}^{if} NPV_f^{II} = \sum_{tk}^{if} (Np_f^{II} + d_f^{II}) * Kdr_f^{II}$$

The total economic effect or additional profit when using the IPO will be the following:

$$\Delta E_{IPO} = NPV_f^I - NPV_f^{II} = \sum_{tk}^{if} (Np_f^I + d_f^I) * Kdr_f^I - \sum_{tk}^{if} (Np_f^{II} + d_f^{II}) * Kdr_f^{II}$$

The economic efficiency of an investment project is defined as ratio of profit received from its implementation (R) to the costs incurred (C). Accordingly, the economic efficiency of using intellectual property in an investment project ( $E_{IPO}$ ) will be determined as follows:

$$E_{IPO} = \frac{1}{C_{IPO}} * (NPV_f^I - NPV_f^{II}) = \frac{1}{C_{IPO}} * \left[ \sum_{tk}^{if} (Np_f^I + d_f^I) * Kdr_f^I - \sum_{tk}^{if} (Np_f^{II} + d_f^{II}) * Kdr_f^{II} \right]$$

This method allows us to determine economic efficiency of individual investment projects for energy enterprises when using intellectual property objects.

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形成合理的分析综合活动的教学条件,是学龄前儿童识字的先决条件  
**PEDAGOGICAL CONDITIONS FOR FORMING AUDIO ANALYTIC-  
SYNTHETIC ACTIVITY AS A BACKGROUND TO TEACHING THE  
LITERACY OF CHILDREN OF PRESCHOOL AGE**

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注解。 本文介绍了使用各种形式提高教师,学龄前教育组织的父母对学龄前儿童言语能力发展的专业能力的研究结果,并考虑了一种与儿童合作的系统,旨在发展良好的分析能力和 学龄前儿童的综合活动。 确定了在联邦州教育标准条件下有效的教师方法支持技术以及与父母的工作形式。 研究了现代学前教育中声音分析合成活动的形成机理和有效的言语互动组织方法。

关键词: 声音, 分析, 合成, 阅读, 写作, 声音字母法, 声音分析合成活动, 学龄前年龄。

**Annotation.** *The article presents the results of a study on the use of various forms of increasing the professional competence of teachers, parents of a preschool educational organization on the speech development of preschool children, and considers a system of working with children aimed at developing sound analytical and synthetic activity of older preschool children. The technologies of effective methodological support of teachers and forms of work with parents in the conditions of the Federal State Educational Standard are determined. The mechanisms of formation of sound analytic - synthetic activity and the methods of organizing effective speech interaction in modern preschool education are studied*

**Keywords word:** *sound, analysis, synthesis, reading, writing, sound-alphabetical method, sound analytic-synthetic activity, preschool age.*

For a long time, one of the most debatable issues in the methodology of speech development has been the issue of teaching children to read and write.

At the present stage, the system of preschool education has undergone significant changes, on the pages of modern programs we can see such an aspect in the section preparing children for literacy as the formation of sound analytical and synthetic activity, as the prerequisites for literacy.

On the Zaitsev [1] notes that the following prerequisites contribute to the successful and rapid formation of sound analytical-synthetic activity: improvement of phonemic processes, expansion of lexical and grammatical representations and development of a dictionary, development of coherent speech, development of fine motor skills and visual-motor coordination, formation of sound analysis of a word.

Sound analytic - synthetic activity in this aspect occupies one of the dominant positions, since the mechanisms of reading and writing in modern psychology are encoding and decoding of oral speech. In oral speech, the meaning of each word is encoded in a specific set of speech sounds. And Russian writing is basically based on sound - the letter principle, the process of recoding in it is provided by sound-letter analysis of words.

Considering the reading process F.A. Sokhin [2] notes that this is a mechanism involving the process of reconstructing the sound form of words from their graphic image. In this process, the basis is knowledge of the sound side of the language and the ability to recreate the sound form of a word, without which the child can read or understand what is read.

The low formation of sound analytic and synthetic activity leads to the fact that children experience difficulties in mastering the letter.

In modern methods, there are many concepts, theories of teaching reading and writing, these provisions can be seen in the studies of DB Elkonin [3], V.G. Goretsky [4], L.E. Zhurova [5], N.A. Zaitsev [1] and others, which are used today in the system of work with children.

Sound analytics - a synthetic method was developed by DB Elkonin [3] and has been successfully applied in modern programs for the education and development of preschool children. The very name of the method indicates that it is based on the analysis and synthesis of phonemes, or the sound side of speech.

An analysis of this method shows that children should acquire the following skills and abilities, such as a child should have a clear pronunciation of all the sounds of the Russian language, a child should have a high level of phonemic hearing, phonemic perception, phonemic processes, i.e., skill hear, distinguish and differentiate the sounds of the native language, readiness for sound-letter analysis and synthesis, i.e. the ability to distinguish the initial vowel from the composition of the word; do vowel sound analysis; reverse syllable analysis; hear and highlight the first and last consonant in a word.

Referring to the research of K.D.Ushinsky, I.A. Goryacheva claims that it was this researcher who introduced the analytical-synthetic method in the 19th century.

[6], in his opinion, “analysis is the decomposition of a word into syllables, syllables into sounds, it is necessary that the student is aware of the sound structure of the word, synthesis is the combination of sounds into syllables, and syllables into words. “So that children can translate letters into sounds, and sounds into syllables and words.”

Based on the analysis of psychological and pedagogical literature on the research problem, we made the following conclusions:

- literacy is a complex psycho physiological process that aims to decipher and understand the written message.

- in the sixth year of life, certain prerequisites are formed in children for the formation of a sound analytic-synthetic activity: the development of the sound-producing side of speech, phonemic perception, visual analysis and synthesis, visual memory, spatial representations, intellectual development.

- the formation of sound analytic and synthetic activity in older preschool children can be facilitated by the implementation of the following pedagogical conditions: the creation of an educational environment in a group that stimulates interest in literacy in children through the inclusion of didactic materials, games, and pedagogical stimulation of children's activity; development of long-term planning, revealing the content, methods and techniques for the formation of sound analytical-synthetic activity and reflecting the implementation of the conditions for the formation of sound analytical-synthetic activity; the formation of teachers' readiness for the formation of sound analytical-synthetic activity in children of preschool age.

To determine the effective pedagogical conditions for the formation of a sound analyst - the synthetic activity of older preschool children, we conducted a stating experiment.

The results of the ascertaining stage showed that the resource capabilities of pedagogical conditions are reduced the prevailing level of cognitive component formation is a low level. A high level was found in 25% of teachers. The average level of the cognitive component was found in 25% of teachers. A low level was found in 50% of teachers.

Teachers with a high level of cognitive component formation are characterized by the fact that they correctly determine the value of sound analytical-synthetic activity for the development of a preschooler. They reveal the essence of the concept of “sound analytic and synthetic activity”, highlight the prerequisites for mastering literacy in older preschool age, and correctly describe the methods and techniques that are used to develop sound analytic and synthetic activity in children and the conditions that are important for the development of sound analytics-synthetic activity.

For teachers with an average level, we revealed that teachers have a basic

idea of the development of sound analytical and synthetic activity of older preschool children, the process and its significance, as well as the importance of the formation of prerequisites for literacy, and teachers identify some methods and techniques for the development of sound analytics -synthetic activity of children of older preschool age, have difficulty in determining the conditions that are important for the development of sound analytical-synthetic activity and children of senior preschool age.

Teachers with a low level differ from teachers of previous groups in that they have not formed enough ideas about the development of sound analytic and synthetic activity, its importance as a prerequisite for literacy in older preschool children, teachers with a low level cannot distinguish methods and techniques used in the development of sound analytic and synthetic activity in children and find it difficult to disclose techniques for the development of sound analytical and synthetic activity.

As the results showed, the prevailing level of formation of motivational readiness among teachers is the average level (50%). A high level among teachers was not found. The number of teachers with a low level was 50%.

We found that the motivational component of teachers' readiness for the development of sound analytic-synthetic activity in older preschool children is slightly better formed than the cognitive component. At the same time, both of these components of teacher preparedness need further development. The motivation of teachers to increase the level of their professional knowledge and skills on the development of sound analytic and synthetic activity in older children of preschool age must be maintained and strengthened through the formation of the necessary knowledge, skills and abilities in them.

The prevailing level of activity component formation is a low level (75%.) A high level of activity component among teachers has not been identified. The average level of formation of the activity component is observed in 25% of teachers.

According to the results of the analysis of the teachers' calendar plans, teachers with an average level were characterized by the fact that they noted the presence in the plans of the types of work associated with the development of sound analytical-synthetic activity in children. This work was planned with a certain periodicity, while insufficient attention was paid to creating conditions for the development of sound analytical-synthetic activity in children, namely to enrich the developmental environment, organize interaction with parents, and also carry out individual work.

In the calendar plans of teachers with a low level, we noted the lack of a holistic approach to the organization of work, the presence of isolated types of work to develop sound analytical and synthetic activity, in addition, teachers did not pay attention to using the resource capabilities of the developing environment, organization of work with parents.

The competence of parents in the development of sound analytical-synthetic activity of children is formed mainly at an average and low level. According to the diagnostic results, most parents are characterized by the fact that they partially understand the need for the development of sound analytic and synthetic activity of a child, but do not pay enough attention to the development of sound analytic and synthetic activity in preschool age, and show interest in working with a teacher on this issue.

In the course of carrying out diagnostic techniques with children, which were aimed at identifying significant prerequisites for mastering literacy and sound analytical and synthetic activities, such as phonemic perception, phonemic representations and skills of phonemic analysis. We obtained the following results on the level of formation of the phonemic analysis; high indicators are observed in 12% of children in the experimental group and 16% of children in the control group. High-level older preschool children did not experience difficulties in the process of phonemic analysis, correctly distinguished the first sound in a word, determined the number of sounds, the place of sounds in a word, and they did not show errors. For example: Arina P. correctly named the first sounds in all words.

The average level of formation of skills of phonemic analysis is presented in 40% of children in the experimental group and 40% of children in the control group. For children of this group, some errors were characteristic when determining the location of sound in a word, counting the number of sounds in a word. Also, preschool children with an average level performed tasks at a slower pace, spent more time thinking about the situation and analyzing. For example: Gleb N. said that the word “cat” has four sounds”.

We found a low level in 48% of children in the experimental group and 44% of children in the control group. Preschoolers with a low level of formation of phonemic analysis skills experienced difficulties in the process of completing tasks, when determining the first sound in a word, determining the number of sounds and the position of the sound. The insufficient formation of the skills of phonemic analysis indicates that children as a whole have insufficiently formed phonemic representations and this can complicate the formation of analytical and synthetic activity and literacy. For example: Mark E. could not name the location of sounds in words.

Preschoolers with a high level of formation of phonemic representations showed that they easily invent words with a given sound, correctly find sounds in a word, they generally have formed ideas about sounds, they are clear and correct, which allows children to easily navigate and find the sounds they need.

For example: thinking up words with the sound “C”, Vanya P. named the following: elephant, chair, sugar, bag, glass.

The average level of formation of phonemic representations was identified by us in 44% of children in the experimental group and 44% of children in the control group. For preschoolers with an average level, there were certain difficulties in highlighting the necessary sounds in words, they turned to an adult for help, the hardest thing for them was to invent words starting with a certain sound.

For example: when differentiating sounds, Sonia B. made a few mistakes and gave the teacher cards with the sound "Z".

We found a low level in 48% of children in the experimental group and 44% of children in the control group. A characteristic feature of children performing tasks at a low level was that they could not complete the task on their own, turned to the help of an adult, and were difficult to determine the sounds that begin the words, the selection of words, the definition of sound in a word.

For example: Danil M. could not name the words. Which begin with the sound "B".

the number of preschoolers with a high level of phonemic hearing was 12% of the experimental group and 12% of children in the control group. Preschoolers with a high level of development of phonemic hearing in the process of completing assignments correctly repeated syllables with opposition sounds, they made no mistakes when repeating them. This means that children successfully differentiate sounds close and different in sound, correctly reproduce them in speech. For example: Maxim L. repeated the syllables "Ta - ka - ta" without errors as "Ta - ka - ta".

The average level of development of phonemic hearing was detected in 44% of children in the experimental group and 48% of children in the control group. For preschoolers with an average level, the following features of the development of phonemic hearing were characteristic. During the assignment, children of preschool age, assigned to the middle level, made some mistakes when playing syllables similar in sound and different in sound, they mixed sounds. Moreover, more often such errors nevertheless arose in syllables close in sound. In syllables that varied in sound, the children differentiated correctly. For example: Vika O. repeated the syllables "Ba-ta-ba" as "Ba-ba-ta".

The results of assessing the level of formation of phonemic hearing in older preschool children made it possible to identify children with different levels of development.

A low level of phonemic hearing formation was detected in 44% of children in the experimental group and 40% of children in the control group. Low-level older preschool children made mistakes when repeating syllables: they repeated syllables either incorrectly or pronounced another syllable, as a result of which we noted that these children have differentiated sound differentiation, they incorrectly determine the sound by ear, they mix sounds. For example: Danil Z. Repeated the syllables "Ma - da - ma" as "ma - ma".

As a series of tasks for assessing phonemic hearing showed, in children of preschool age, a predominance of the average level of formation of phonemic hearing is noted, which is generally insufficient for literacy and it is necessary to improve the phonemic hearing of children.

He results obtained indicated the need for a formative experiment

The purpose of the formative stage: to test the pedagogical conditions for the formation of sound analytical-synthetic activity as children of preschool age.

The tasks of the forming stage:

- to organize advisory and practical work on the methodological support of teachers aimed at increasing the level of readiness for the formation of sound analytical and synthetic activity as a prerequisite for teaching literacy to children of preschool age;

- to organize pedagogical education of parents on the issues of the formation of sound analytical and synthetic activity as a prerequisite for teaching literacy to children of preschool age;

- organize work on the enrichment of the developing subject-spatial environment of the group for the formation of sound analytical-synthetic activity as a prerequisite for teaching literacy to children of preschool age.

The results obtained at the ascertaining stage of the experiment allowed us to determine the individual characteristics of the formation of sound analytic-synthetic activity of each child in the experimental group, as well as to distribute the children according to the level of formation of sound analytic-synthetic activity.

In working with children, which we attributed to the low level of formation of sound analytic-synthetic activity, we focused on determining the first sound in a word, determining the number of sounds and the position of the sound.

In work with children, which we attributed to the average level of formation of sound analytic-synthetic activity, we focused on finding sound in a word (first, in the middle, at the end of a word), counting the number of sounds in a word; tasks for them contained a certain complication, stimulating the formation of sound analytical-synthetic activity.

We carried out work with children that we assigned to a high level of formation of sound analytic and synthetic activity, taking into account the development of structural components of sound analytic and synthetic activity, and their interest in phonemic games.

As part of the formative stage, we have built a consistent (phased) system of work for the formation of sound analytical and synthetic activity of children of preschool age. At this stage, we developed a workbook that includes game assignments in all directions - this is working with sound, finding its position in a word, distinguishing sounding phonemes, getting to know the syllabic structure of a word, sentence, getting to know graphic signs.

The organization of the training of teachers for the formation of sound analytical and synthetic activity of children of preschool age was carried out by a tutor, in the role of a researcher. In the role structure of the group, the tasks of the tutor were: preparation and conduct of a seminar, workshop and open classes with teachers on the formation of sound analytical and synthetic activity of children of preschool age; assistance to teachers in the development of classes using phonemic games that contribute to the formation of sound analytical and synthetic activity of children of preschool age.

The system of work for the formation of sound analysis and synthesis included the use of game exercises, they were selected in accordance with the difficulties of children and their ability levels, aimed at developing phonemic perception, that is, at differentiating phonemes that have similar characteristics in the pronunciation and auditory plan, involving the allocation of sound against the background of a syllable, determining the presence and place of sound in a word, determining the place of sound in relation to others (what is the sound of the sound, after which sound is pronounced, before which sound com is heard in a word), the selection of sound in a sentence, in the text.

At the final stage of our work, we carried out a re-examination with the aim of comparative analysis and confirmation of the results, for this purpose we re-diagnosed organizational and pedagogical conditions and assessed the level of formation of sound analytical-synthetic activity in older preschoolers, the results indicate the effectiveness of our work.

Conclusions: thus, the system of work we organized that includes the teacher's interaction with children, this teacher's interaction with children aimed at developing phonemic processes (analysis, synthesis, differentiation of sounds), familiarity with the syllabic structure of words, sentences, familiarity with graphic characters, practical work with teachers and parents aimed at developing readiness for the formation of sound analytic and synthetic activity in older preschool children as a prerequisite for literacy and learning The creation of a "speech development center", a "literary center", specially selected games, as well as game aids, didactic material, game tasks, a workbook aimed at forming sound analytic and synthetic activity in older preschool children improved the quality of the educational process and increased the level competencies of parents and teachers in this field of knowledge and increase the level of development of sound analytical - synthetic activity of older children preschool of age.

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在大学教育领域对海洋产业竞争专家进行专业培训  
**PROFESSIONAL TRAINING OF MARINE INDUSTRY  
COMPETITIVE SPECIALIST IN THE EDUCATIONAL SPACE  
OF UNIVERSITY**

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注解。 本文讨论了针对海洋行业专家的培训系统的改进，以及从基于胜任力的方法出发的竞争专家的形成。

关键词：职业培训，模拟器培训，学术培训，能力，能力。

**Annotation.** *The article discusses the improvement of the training system for specialists in the marine industry, the formation of a competitive specialist from the position of a competency-based approach.*

**Keywords:** *vocational training, simulator training, academic training, competence, competencies.*

The marine merchant fleet is one of the developed sectors of the global economy. With the increasing complexity of the equipment used on ships and the global consequences of maritime disasters, the tension in world shipping increases, and as a result, the requirements for a modern specialist. The main criterion in ensuring the safety of navigation is the human factor. Given the specifics of working on ships at sea, it is necessary to improve the quality of vocational training of cadets, introducing the latest technologies into the educational process and training them to competently carry out professional activities.

Therefore, the educational institutions of the system of higher professional education (HPE) today have a task to increase the effectiveness of the formation of competitive graduates who must meet modern labor requirements.

The analysis of scientific and methodological literature showed that the issue of vocational training of graduates of higher educational institutions was studied by such authors as G. Danilova, L. Danilenko, V. Maslov, O. Ovcharuk, V. Oleinik, E. Pometun, Z. Slobunova, E. Sokolova, V. Kraevsky, A. Khutorsky. The formation of professional competencies of future boatmasters in the study of special disciplines of the marine profile in their dissertation research was analyzed by I. Sokola, M. Babyshena, the formation of sociocultural competencies in the process of studying social and humanitarian disciplines are studying by V. Lipshits, A. Romensky.

The problem of vocational training of a competitive graduate of higher education institutions of a marine profile has not yet been studied. Therefore, the purpose of our article is to consider the formation of a competitive specialist by improving the training system for specialists in the maritime industry from the position of a competency-based approach.

Today, the concept of "competence" is at the epicenter of world opinion because it reveals a qualitatively new perspective on understanding the mission of the school and the life results of educational activities.

In domestic pedagogy, the concept of competence as a term that describes the end result of training begins to be used only at the end of the twentieth century. Competence, according to many researchers, is a derivative of the concept of competence and determines the scope of knowledge, abilities and skills of a person, while competence is the primary category and represents their combination, system, certain knowledge [4].

In the dictionary "Pedagogical Education", competence (from Latin *competens* - appropriate) is defined as the combination of knowledge and skills that are necessary for effective professional activity: the ability to analyze, anticipate the consequences of professional activity, use information [9].

According to E. Sokolova, the importance of competence lies in the individual's ability not only to navigate his business, to work efficiently, autonomously and efficiently for his chosen specialty, but also to adequately respond to the emergence of various extraordinary situations during the work [6]. Z. Slobunov believes that competence is the ability to apply what is learned in practice, that is, the ability to apply knowledge in certain situations [8].

One of the first who introduced the concept of "key competencies" in Russian scientific and pedagogical literature is O. Khutorsky. It determines the list of key competencies, based on the leading goals of general education, personality experience, as well as the main types of student activities: general cultural, educational, informative, informational, communicative, social and labor, personal self-improvement competence [10].

The competency-based approach in education, according to O. Pometun, is associated with personality-oriented and active approaches to learning. It requires

the transformation of the content of education. Its transformation, respectively, to the competency-based approach, is primarily determined by fundamentally different principles of selection and structuring, which are aimed at the end result of the educational process - the acquisition of competencies by students [4].

Note that competencies are acquired in the learning process, and also accumulate in the process of practical activity and social life. In this regard, it is customary to talk about the quality of competencies formed as a result of professional training. The leading competencies for the training of specialists in the maritime industry are recognized as: general, professional and key.

General competencies are basic knowledge that is mandatory for a wide range of professions in a given direction. They oblige to possess such a level of knowledge, skills that would give future qualified employees easy to navigate in modern technologies, equipment, materials; quickly switch from one type of activity to another; be creative. General competencies are formed from childhood, are fixed during schooling and continue to develop in higher education institutions [5].

The professional competencies of seafarers are formed during the period of higher education. It should be emphasized that the combination of knowledge, skills, personal qualities and experience in the field of professional activity is of great importance in the training of skilled workers in professional competencies. Each specific specialty provides its own set of competencies, without which adaptation and successful implementation of professional activities are impossible.

Professional competence as an integral personality quality, according to domestic researchers L. Danilenko, V. Maslov, V. Oleinik, has its own structure and allows the specialist to effectively carry out their activities, and also contributes to self-development and self-improvement [7].

A competency-based approach involves not only the formation of future specialists of a high level of professionalism, but also the development of professionally important qualities in them. Namely: professional culture, independence, the ability to make responsible decisions, to complete the work begun, a creative approach to professional activity, flexibility, originality of thinking, sociability, the ability to learn, continuous training, the ability to conduct dialogue, creatively interact in a professional environment and etc. Professional competence is provided for by the fact that every future qualified employee must master specific competencies. Achieving the highest level of development of professional competencies of a graduate of a higher educational institution is the main task of modern education.

Key competencies are equally important in the preparation of a future marine specialist. These include skills that are necessary for successful functioning in society, as well as for continuous mastery of the content of professional education

in the process of life. These include social skills, in particular: the ability to cooperate, take initiative, be creative in professional activities, learn to perceive and transmit information, show tolerance for another culture, respect the work of others, etc. [5].

According to G. Danilova, a real professional can be a person who develops exclusively as a subject of labor. The higher the level of professionalism, the more individual and personal in it [1].

From this, we can conclude that the professional competence of a graduate of a higher educational institution in the marine profile is defined as a combination of the following components: general cultural, functional, motivational, social.

One of the main groups of competencies is general cultural (communicative) - the ability to communicate verbally, in writing, in one's native and foreign languages; to develop and implement strategies for activities in the context of intercultural interaction; analyze and evaluate the important achievements of national and world culture; interact with other people, with environmental objects and its information flows.

Functional competence is considered as the highest level of intellectual activity of thinking; dynamism of psychological processes; speed of decision making in non-standard situations; readiness and high motivation for creative activity; ability to adapt to the growing flow of information; the ability to operate with knowledge in training, professional activity and in general in life; the ability to plan, monitor and evaluate work.

Motivational competence involves the ability to define one's own goals, to overcome difficulties in work, as well as the ability to learn throughout life. In the process of training, professional disciplines help future maritime industry specialists to form a positive attitude to the chosen profession, inclination and interest in it, a desire to improve their training, satisfy material and spiritual needs, while working in a particular industry.

Social competence lies in the ability of the graduate to cooperate and understand each other, the ability to take on social and aesthetic obligations, and the ethics of business communication.

Strengthening general scientific and vocational training ensures the integrity of the perception of future professional activity, an understanding of the laws, the relationship of factors and phenomena that are characteristic of general professional knowledge, both within the field of training and in a particular specialty. As a result, the potential field of activity, competitiveness and social protection of graduates are expanding.

The generalized (reference) model of professional competence of a graduate of a higher educational institution is presented as a component of the industry standard of higher education - educational and qualification characteristics of a specialist.

It assumes the end result, that is, the training of a specialist who has mastered the necessary knowledge, skills, and creative activity skills; has the corresponding horizons and erudition, intellectual level; acquired self-education skills; which has formed professional qualities, moral, aesthetic and environmental culture.

O. Ovcharuk focuses on the fact that today it is the student's competencies that are indicators that allow him to determine his readiness for personal development, professional and social life. She believes that the labor market dictates such rules according to which a graduate must possess technologies and knowledge, and they, in turn, must satisfy the needs of the information society, prepare it for new roles in society [2].

When training specialists in the marine profile, of course, it is necessary to take into account the extremeness of work at sea. The activities of maritime educational institutions are regulated by national laws in the field of education, departmental regulations that are subject to decrees of the International Maritime Organization (IMO) and the European Commission.

In order to improve vocational training, it is necessary: to adjust the curriculum, curriculum of all cycles in accordance with the requirements of the competency-based approach, create a list of academic disciplines of the variable part, adjust the educational and methodical complexes of all academic disciplines, and revise approaches to the organization of practical training.

The formation of professional competence is carried out in interconnected and complementary directions, namely: academic training in the walls of educational institutions and simulator training in the corresponding training centers [3].

Academic training combines theoretical and practical training of a professional direction. Important is not only the amount of knowledge, but also the ability to use it. Exactly training centers provide the practical use of acquired knowledge and skills, the consolidation of skills when performing operations on board the vessel. Training training is aimed at the formation of candidates for a certain position of highly professional knowledge and skills. Professional competencies can only be formed through the effective combination of the two types of training, which gives the result that the employer is counting on today.

Thus, the formation of a competitive graduate of marine educational institutions is possible by improving the vocational education system, namely:

- Creation of a specialist competency model;
- determination of the goals and objectives of training courses based on the competency model of a specialist;
- development of competency-based programs of special disciplines, where each module is provided with a list of competencies or competencies;
- designing by the teacher of the educational process, which provides for the development of the content of lectures, practical and laboratory classes,

assignments for independent work of cadets, educational projects of a problem nature (problem education technology);

- the introduction of simulator training in the respective simulator centers, which is aimed at instilling in the candidates for the occupation of the relevant position highly professional knowledge and skills [5].

So, the requirements of modernity are aimed at the need to achieve the highest results in the professional activity of a specialist, provide for the focus of educational activities on self-improvement of the personality of a future specialist. It is the development of professional competencies that can give the future maritime industry specialist orientation in modern society, the information space, further education, that is, be competitive and meet the demands of the labor market and the requirements of the International Maritime Organization (IMO), which are set out in the international code for the certification of seafarers and carrying watches.

However, it should be noted that in modern conditions it is advisable to continue to improve the training system for specialists in the maritime industry in order to form a competitive specialist from the position of a competency-based approach. This may be the subject of further scientific research.

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在设计体育课时要考虑到小学生的性别特征  
**DESIGNING A PHYSICAL EDUCATION LESSON TAKING  
INTO ACCOUNT THE GENDER CHARACTERISTICS OF  
SCHOOLCHILDREN**

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注解。本文介绍了一项研究的结果，该研究的目的是根据小学生性别特征设计体育课，这是基于招标方法的主要规定。在教学实验中获得的结果以及经过仔细分析后得出的结果清楚地证明了这种体育锻炼的显著优势。

该研究表明，更新学龄儿童的性别角色非常重要，这有必要为在普通教育机构中组织体育课创造特殊条件。除上述内容外，本文还介绍了在实施旨在提高小学生运动创造力的教学实验的同时，根据学生的性别特征组织教育过程的具体结果。

关键词：性别方法，性别角色，体育，运动创造力，性别识别，兴趣的心理基础，更新性别角色。

**Annotation.** *The article presents the results of a study whose goal was to design a physical education lesson taking into account the gender characteristics of schoolchildren, which is based on the main provisions of the tender approach. The results obtained during the pedagogical experiment and interpreted through careful analysis clearly demonstrate the significant advantages of such an organization of physical exercises.*

*The study showed the importance of updating the gender roles of schoolchildren, which necessitates the creation of special conditions for the organization of lessons in physical education in a general educational institution. In addition to the aforementioned, this article presents specific results obtained during the implementation of a pedagogical experiment aimed at the development of motor creativity in schoolchildren while organizing the educational process based on the gender characteristics of students.*

**Key words:** *gender approach, gender roles, physical education, motor creativity, gender identification, the psychic basis of interest, updating gender roles.*

### **The relevance of research**

In the era of global transformations caused by socio-economic reforms and technological progress, all the constituent aspects of social relations, including education, are subject to changes that can have both positive and negative character. In this study, in view of the multidimensional nature of modern issues in the field of education that require an immediate search for ways to resolve them, we focused on the study, from our point of view, of a pressing issue - the ways to implement a gender approach in the educational process. The choice of the research topic was determined by the problem of erasing the natural differences between the male and female factors revealed during the theoretical analysis of numerous studies, which leads to significant violations in the interaction of the sexes, to leveling, and to changing the gender roles of the person [2, 5, 8, 9].

Based on the foregoing, it can be assumed that one of the most optimal ways to solve the identified problems of our time can be to create certain conditions of human life, exacerbating the stereotypes of male and female behavior, which ultimately is able to actualize the gender roles of the individual. In addition to the aforementioned, it should be emphasized the importance of taking into account gender characteristics in the context of physical education lessons in a general educational institution, which is due to their pronounced severity in the process of performing physical activities. Thus, as one of the solutions to the problems of our time that we have identified, there can be innovative transformations of the methodological basis for the design of the educational process at physical education lessons in a general educational institution, the foundation of which will lay the main provisions of the gender approach.

**The aim of the study** was to design a physical education lesson taking into account the gender characteristics of students.

**Research methods:** 1) a theoretical analysis of literary sources on the subject of this study; 2) survey; 3) pedagogical experiment.

### **Introduction**

The organization and direct implementation of physical education lessons, within the framework of the provisions of the gender approach, should be built taking into account the main gender characteristics of all subjects of the educa-

tional process. Thus, we will be able to achieve optimization of the gender roles of the younger generation, contributing to the formation of a conscious identity in a socially significant group, the destinations of men and women in society [1, p. 85]. It is not by chance that we have noted the importance of involving all subjects of the educational process in the construction of the pedagogical process, since an important role in this activity is assigned not only to the teacher, who has knowledge of the gender characteristics of schoolchildren and is able to carry out "subtle" differentiation of gender roles during the lessons, but and parents who contribute to the formation of an adequate, social personality.

In addition, it should be noted that it is necessary to organize separate classes with boys and girls, which is due to their differences in the need for physical activity [6, p. 127]. The desire of boys to become strong, courageous and resilient determines the leading need, and the difference with the needs of girls, who pay great attention to the emotional richness and aesthetic orientation of the lesson in physical education. Summarizing the above, we can conclude that there are differences in the motives for exercising.

#### **Theoretical analysis of the research problem**

Based on the results obtained in the course of psychological and pedagogical research [3, 4, 7, 10], we can formulate another distinctive feature, which lies in the prevailing sphere of interests of boys and girls. While girls are interested in the fundamental novelty of each lesson in physical education, boys are interested in developing the skills that they have already formed at the current time.

Based on the foregoing, it becomes clear the reason for the problem arising from the organization of mixed lessons in physical education. In this case, quite often there is a drop in interest in students doing physical exercises. The explanation for this is quite simple - the orientation of classes on the "asexual" subject.

In the course of this study, a survey was conducted among students of a general educational institution. The results of the survey clearly demonstrate that the physical development of schoolchildren is understood as diametrically different. So, about 64% of boys under the physical development understand the development of bodily and motor qualities, while about 73% of girls have hopes for improving their aesthetic appearance through physical exercises.

The foregoing once again confirms our assumption that there is a violation of gender orientation in the educational process of the school, since physical education lessons are more aimed at satisfying the value orientations of boys, almost ignoring the satisfaction of the current needs of girls.

From our point of view, reorganization of the organization of lessons in physical education in a general educational institution should be carried out by focusing on the potential opportunities inherent in physical education, determined by its specific features and regulatory mechanisms.

### The course of study

During the experimental part of the study, separate lessons in physical education were conducted. The total number of schoolchildren who took part in the experimental part of the study was 84 people, the average age of which was 15 0.3 years, including 52 girls and 32 boys. The participants in the pedagogical experiment were divided into groups: experimental groups: EG<sub>B</sub> (n = 16) and EG<sub>G</sub> (n = 26), control groups: CG<sub>B</sub> (n = 16) and QG<sub>G</sub> (n = 26). When building physical education lessons (2 times a week), aimed at *developing motor creativity* (developing physical and motor qualities and improving the aesthetic appearance), and planning the forms of its organization and volume, we relied on the specific gender characteristics of students, age restrictions, and current level of their physical development.

The named process - the development of motor creativity, was built in accordance with the requirements for it, one of which is the observance of the sequence of stages: the first stage is reproductive; the second stage is normative, the third stage is creative, characterized by the combination of the impact on the intellectual and motor functions of the student during physical exercises.

During classes with girls, we used musical accompaniment, acting as a rhythmic and emotogenic stimulus. In the process of performing motor tasks, which included mini-complexes of rhythmic gymnastics, built taking into account the age capabilities of students, we noted an increase in creative activity, emotional mood of those involved in performing activities in the lesson.

As a result, already in the third lesson the independence shown by the girls, expressed in the improvisation of motor actions, was noted. It should be noted that the mini-complexes used in the lessons were periodically changed (once a week), due to which the novelty and, correspondingly, increase in the level of the emotional color of the lesson were achieved.

When constructing and directly organizing physical education lessons with boys, the main emphasis was placed on training and forecasting tactical combinations in various types of sports games.

In the process of pedagogical observations, we noted that a high level of emotional response in boys was caused by various types of competitions, during which the novelty of motor actions was regulated by changing tactical combinations - the most effective factor contributing to the development of motor creativity. It is a well-known fact that victories achieved by competitors contribute to increasing self-esteem. In turn, the emotional background accompanying the competition creates a positive emotional background, which in turn helps to increase interest in physical education lessons.

### Research results

In the process of comparative analysis of the results obtained during the implementation of the experimental part of the study (ascertaining (September 2018)

and forming (May 2019) stages of the pedagogical experiment), a number of features of the manifestation of motor creativity in schoolchildren of both sexes of the experimental groups (EG<sub>B</sub>, EG<sub>G</sub>) were revealed.

At the same time, EG girls, in comparison with CG classmates, had a higher level of creativity, expressed in the freedom of improvisation of motor activity (creative aspect), dedication and interest in the process of performing motor tasks (educational and cognitive aspect). In the boys of the experimental groups, we observed an interest in motor activity, which was of a playful nature and was distinguished by the presence of a specific orientation. However, during the pedagogical experiment, the fact of selectivity of the motor activity offered by him, manifested by the boys, was revealed, while the girls tried to be included in the entire motor program proposed by him.

### **Conclusion**

In accordance with the results of the pedagogical experiment, the proposed and tested assumption about the significance and necessity of designing lessons in physical education taking into account the gender characteristics of schoolchildren was confirmed. Taking into account the gender characteristics of schoolchildren in the process of organizing physical activity classes in a general educational institution leads to significant changes in the development indicators of motor creativity, combining many aspects of the student's personality development. In particular, increasing motivation for engaging in motor activity, developing initiative, independence, self-organization, motor activity, determination, self-control, endurance, perseverance in achieving the goal and a higher level of realization of cognitive abilities of students.

Summarizing the foregoing, it should be noted that the design of the educational process in the lessons of physical education, relying on a gender approach, can have a significant impact on the physical-motor and psychological characteristics of the development of schoolchildren, contributing to their gender identification in a socially significant group for them, reinforcing stereotypes of gender roles.

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俄罗斯青少年媒体的媒体教育活动 (以儿童和青年报纸“SAMI”为例, Barnaul)

**MEDIA-EDUCATIONAL ACTIVITIES OF RUSSIAN JUVENILE MEDIA (ON THE EXAMPLE OF THE CHILDREN'S AND YOUTH NEWSPAPER "SAMI", BARNAUL)**

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注解。 本文提出了提高中小学生媒体能力水平的问题, 考察了青少年媒体的媒体教育活动的经验。 描述了儿童和青年报纸“SAMI”(Barnaul)的编辑处关于使用多媒体格式在学童的媒体中呈现信息的教育活动。

关键字: 新闻业, 多媒体, 少年媒体, 媒体教育, 媒体能力, 附加教育

**Annotation.** *The article raises the problem of increasing the level of media competence of schoolchildren, examines the experience of media educational activities of juvenile media. The educational activity of the editorial office of the children's and youth newspaper "SAMI" (Barnaul) on the use of multimedia formats for presenting information in schoolchildren's media is described.*

**Keywords:** *journalism, multimedia, juvenile media, media education, media competence, additional education*

The rapid formation of an informational, post-industrial society, the informational richness of all social processes, the digitalization of a significant number of spheres of life require the person to be able to navigate a wide variety of information resources, verify, critically perceive, adequately interpret and use the received information productively. The formation of these competencies predetermines, in modern conditions, at least security, at the maximum, the success of personal self-realization in almost all spheres of life. The media competence of the individual from the subject of scientific understanding has moved into the field of urgent tasks of the education system. The relevance of media education is growing due to the fact that the formation of competencies in the field of information and communication activities is becoming an urgent need of the individual.

Meanwhile, in Russian school education at the present stage, media education is practically not represented. This state of affairs is due to a number of reasons, among them the unpreparedness of teachers for professional activities in shaping the media culture of students, the non-inclusion of this area of educational activity by state educational standards, the low dynamism of the meaningful development of school education, etc.

In this context, the importance of juvenile journalism is growing as a field of activity that forms media companies among teenagers in practical activities to collect and analyze information, prepare media texts and interact with the audience. The urgent need for the formation of media competencies is determined by the fact that in a modern domestic school, in the absence of a state program, a media education system is spontaneously developing. It is carried out in various forms, the most common and having strong roots in domestic education is the publication in the educational institutions of amateur children and youth media.

In practical activities, collecting, analyzing and processing information, publishing their own texts and receiving “feedback” from the audience, students master the laws of the functioning of information systems and the rules for interacting with them, gain skills in both searching and interpreting information, and creating their own information products, - In a word, the competencies are formed in students, without which it is difficult today to be successful in any field of activity. The pedagogical community's understanding of the importance of amateur publications in the formation of students' information culture determines the development of this phenomenon in the Russian education system, a sharp increase in the number of youth media in the first decade of the 21st century. In addition, at the beginning of the XXI century. the processes of modernization of Russian education have significantly improved the material and technical base of schools, which expanded the possibilities for publishing newspapers, magazines, almanacs, and created the prerequisites for the growth of their professional level. With the development of electronic media in the last decade, the possibilities of the population, including students, to find, receive, disseminate information, exchange it, and participate in a multilateral dialogue on a topic that is relevant to them have expanded. Thus, the working conditions of media educators, the socio-pedagogical context of their activities to create youth media have changed significantly, the range of opportunities has expanded significantly. This led to a significant development of the juvenile media system, the expansion of their educational impact on students.

However, the development of the juvenile journalism system in Russia is carried out outside the framework of the comprehensive school program; to a large extent, this area of teenagers' self-realization can be considered as a leisure sphere. If we talk about the educational component, juvenile journalism is more likely to be in the field of further education, regardless of the educational institution within

which it is implemented: within the framework of a comprehensive school or institution of additional education. The scope of further education is not as regulated as secondary education, and, due to these circumstances, is more dynamic and varied. In creative associations focused on the production of juvenile media, the formation of competencies necessary for successful adaptation of adolescents to today's society, and even preventive preparation for tomorrow's society, takes place. In the editorial offices of juvenile media, not only is mastering of technological skills, but also the civic formation of adolescents, the formation of ideological qualities, personal culture.

Additional education is the sphere of unregulated self-realization of adolescents. Their activities there are not subject to mandatory standardized assessment, even attending classes in the field of additional education is not as mandatory as in a secondary school. Meanwhile, creative media associations operating in the field of further education fulfill an important function of forming media competence of at least a part of the young generation.

The creative association "Editorial office of the children's and youth newspaper "SAMI" was created in Barnaul in 1991 and continues to bear this name, paying tribute to the most reputable media product created by it - the newspaper, which has been published for almost three decades and has repeatedly won victories in the All-Russian and international competitions of journalistic skills, including professional ones, leaving behind colleagues from the "adult" editorial offices. However, in addition to newspaper texts, over the course of many years, "SAMI"'s training editors create content for the site <http://gazetasami.ru>, shoot videos, record radio programs, podcasts, lead groups on social networks VKontakte and Facebook, have an Instagram account and a channel on YouTube. The development of multimedia formats and the development of projects based on them have become an integral part of the educational program of the association.

Work on multimedia formats contributes to the most effective formation of competencies in the field of structuring, systematization and interpretation of information, its segmentation and explication. In turn, for a teenage audience, multimedia formats can perform both entertaining and educational functions, which is typical by combining them. Information obtained through multimedia formats is easier and more firmly assimilated by schoolchildren due to the fact that the process of obtaining it, on the one hand, is pleasing due to its gaming nature, on the other hand, it is accompanied by intellectual efforts spent on passing the test, following an interactive map, etc.

To a significant degree, the implementation of socially significant projects supported by grants of the President of the Russian Federation for the development of civil society contributes to a widening of the range of educational activities of the Sami newspaper Editorial Board:

2017-18 - “Citizens of the Information Society”;

2019-20 - “The history of Altai through the eyes of the digital generation”;

2020-21 - “The multimedia history of the military “Artek”.

The projects are simultaneously focused on increasing the media competence of adolescents and on intensifying the interest of the young generation in the history of their small homeland, the formation of motivation to study and comprehend the historical past of their native village, town, city, to preserve memory and transfer knowledge about historical events, prominent countrymen, significant places and dates. Local history work in many educational organizations and cultural institutions is carried out in old, archaic forms that are not able to attract and captivate young people, so the younger generation often does not know the past of their small homeland, and therefore does not feel responsible for its present and does not connect their future with it. Projects implemented by the Editorial Board of the “SAMI” newspaper include teaching students (distance and intramural) multimedia technologies, understanding the history of their homeland in modern, popular formats, placing their multimedia products of historical and regional studies on the Internet, creating a large database of village history and the cities of the region, which will serve to preserve historical memory, will become a virtual local history tool, demanded by adolescents and children of the Altai Territory.

In particular, in the framework of the project “The history of Altai through the eyes of the digital generation”, a study was organized by schoolchildren, first of all, senior students involved in journalism and collaborating with the newspaper “SAMI” (including remotely living outside Barnaul) of multimedia that are now very popular among young people formats. The correspondence school of multimedia journalism involves the fulfillment of tasks related to the history of the small homeland, with the study of its past and present and the embodiment of the results in today's relevant formats (timeline, longread, interactive map, etc.). The results of the assignments are posted on the site "SAMI" - <http://gazesami.ru>.

The launch event of the project was the regional profile shift “Journalistic Plein Air”, where, under the guidance of experienced trainers, students studied the past and present of the Zmeinogorsky district, in which the history of Altai as a mountain district began, and the embodiment of the information received in multimedia formats. The materials were posted on the “SAMI” website, as well as in the format of augmented reality in a special issue of the “SAMI” newspaper, which by editorial subscription was delivered to all schools in the Altai Territory.

In November 2019, an inter-regional media forum was held in Biysk, the objects of research and implementation in multimedia formats were the villages of Srostki (the birthplace of Vasily Shukshin), Bystry Istok (the birthplace of Valery Zolotukhin), Kosiha (the birthplace of Robert Rozhdestvensky), the city of Biysk (the place of residence and active Vitaly Bianchi) and Belokurikha (the place of

evacuation of Konstantin Paustovsky during the Great Patriotic War). A media resource was created dedicated to the life and work of writers, whose biography is associated with Altai. It uses interactive tests, timelines, “was / became” sliders, infographics. The resource is actively in demand by visitors.

From September 2019 to March 2020, systematic work was going on to create multimedia projects of a local history character. Within the framework of the project, a resource is created and posted on the network dedicated to the 75th anniversary of the victory in the Great Patriotic War and dedicated to the history of Altai in the war years: the work of industrial and agricultural enterprises, hospitals in the region, the fate of home front workers. It will be available to the widest audience and will present it with information in modern, popular formats. This will be an interactive map on which the objects of the rear that worked during the Great Patriotic War for the needs of the front will be marked: hospitals, enterprises manufacturing products for the front, primarily those evacuated to Barnaul in the early forties. An information card is compiled about each of the objects. Each object is illustrated with photographic materials, if possible - reflecting both the current and historical appearance of the object.

A number of interactive maps created by students of the creative association “Editorial Board of the “SAMI” Newspaper” are available on the Internet, statistics of visits demonstrate their relevance to the audience. By May 9, 2018, an interactive map of the streets of Barnaul was created, named after the heroes of the Great Patriotic War. By May 9, 2019, the samists created an interactive map of the streets of Barnaul, named after the hero cities.

The city map is combined with tear-off cards: by clicking on the marker of a street, you can see a portrait of a hero of the Great Patriotic War, read a laconic curriculum vitae. Or find out the history of battles in the hero city, after which the street is named. The format is convenient for familiarization, accessible not only from a computer, but also from a smartphone, can be used while walking around the city, in a lesson. An interactive map allows the user to interact with the project and independently decide what to read and to what extent, select objects for familiarization and the sequence of acquaintance with them, as well as visually see a map of the city and correlate new knowledge with it.

All users of the network have free access to the project; it can be used in local history studies, when Barnaul schoolchildren study the history of their native city, and more broadly - the history of Russia. It can be recommended as a tourist guide for the guests of Barnaul who want not only to get acquainted with the city, but to deepen their knowledge about it.

The project has the main educational value, of course, for students of the Sami newspaper. In the process of creating the map, the juniors learned the skills of working with maps and learned new facts about Barnaul streets and heroes-coun

trymen. Schoolchildren used the methods of collecting information obtained in the classes of the teachers of the newspaper “SAMI” to find photographs, stories of people and cities, and then implemented their plans in the chosen format: they mastered new information and communication technologies.

The experience of a juvenile publication - the children's and youth newspaper “SAMI”, published in Barnaul on the basis of an institution of additional education - allows us to conclude that the development by teenagers of the tools used by modern multimedia journalism helps to increase the media competence of students, their successful creative self-realization, personal growth, creates the conditions for enhancing the interest of a wide range of adolescents both in modern information and communication technologies, and in the history of the Fatherland.

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新莫斯科斯克行政区居民对多功能中心提供公共服务活动的舆论  
**PUBLIC OPINION OF THE POPULATION OF THE  
NOVOMOSKOVSK ADMINISTRATIVE DISTRICT ON THE  
ACTIVITIES OF MULTIFUNCTIONAL CENTERS FOR THE  
PROVISION OF PUBLIC SERVICES**

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注解。 官方提供的州和市政服务有助于满足人民的需求,并对该国社会经济关系的性质产生积极影响。自2007年以来,为了优化该程序,该国组织了多功能中心(MFCs)的活动,以“一站式服务”的基础向公民提供公共服务。

在过去的13年中,他们的工作积累了丰富的经验。同时,对民意的研究有助于发现不足之处,并提出建议,以改善向民众提供国家和市政服务的过程。

关键字: 州和市政服务,提供服务的多功能中心,舆论,所提供服务质量的评价,提高MFC员工活动质量的建议。

**Annotation.** *The official provision of state and municipal services contributes to meeting the needs of the population and has a positive impact on the nature of socio-economic relations in the country. Since 2007, in the interest of optimizing this process, the country organized the activities of multifunctional centers (MFCs) to provide citizens with public services on a “one-stop-shop” basis.*

*Over the past 13 years, considerable experience has been accumulated in their work. At the same time, the study of public opinion helped to identify shortcomings and formulate proposals for improving the process of providing state and municipal services to the population.*

**Keywords:** *state and municipal services, multifunctional centers for the provision of services, public opinion, assessment of the quality of services provided, proposals to improve the quality of activities of MFC employees.*

## Introduction

The implementation of a single set of measures aimed at providing state and municipal services to the population was provided for by the concept of the administrative reform of the Russian Federation and an action plan for its implementation for 2006 - 2010 [1, p. 3-37]. Since 2007, the creation of multifunctional centers for the provision of public services began, the activities of which were regulated by laws [2] and resolutions of the Government of the Russian Federation [3]. They settled relations on the provision of services on a “one-stop shop” basis, which contributed to improving the quality and accessibility of state and municipal services and improving the socio-economic situation in the country.

Within 13 years, 2870 MFCs were opened in the country, which covered more than 90% of the territory of the Russian Federation and annually provided services to 380 or more million applicants [4, p. 32]. Since 2012, with the formation of the Novomoskovsk Administrative District (NAD), the creation of the MFC began to meet the requests of new Muscovites in obtaining state and municipal services.

The relevance of the article is due to:

- a) the need to determine the quality of work of MFC NAD by studying the public opinion of its residents;
- b) the need to identify positive experiences and shortcomings in the provision of official services to the public;

The aim of the work is: on the basis of studying public opinion of the population and employees of MFC NAD to identify best practices and shortcomings in their work.

Based on this, the tasks are set:

- analyze the main results of a study of public opinion on the work of MFC;
- identify positive experiences and weaknesses in the provision of public services to the public;

The object of the study is social relations arising in the provision of public services to consumers. The subject of the study is public opinion about the activities of MFC on the example of NAD in Moscow

The scientific novelty of the article lies in the results of a study of the opinions of citizens, analysis of shortcomings and positive work experience of MFC employees.

The practical significance of the work lies in the possibility of using the obtained results in the preparation of bachelors and masters in the direction of the State Medical University, in teaching activities in higher and secondary specialized educational institutions, in the work of beginning specialists in the field of rendering official services to the population.

### **Positive MFC Experience**

Based on the Law "On Amendments to the Law of the City of Moscow" [5, p. 3-13], the Novomoskovsk administrative district was formed, which included 11 cities and towns with a population of 259,682 people. To meet the demands of new Muscovites, 11 multifunctional centers for the provision of public services were created.

Over 8 years, a certain positive experience has been accumulated, worthy of dissemination. First of all, this was reflected in the productive use of the practice of the Moscow administration, which allowed us to avoid earlier mistakes. What are the results of the interviewing of the heads of municipalities, which unanimously (97.3%) expressed their gratitude to the Moscow Mayor and her government for providing consultative, documentary and organizational assistance.

Secondly, the systematic and consistent activities of the heads of the okrug and municipalities in organizing the activities of the newly formed centers played a positive role. What is confirmed by the results of the analysis of annual action plans for the preparation and provision of public services [6, p. 111-116]. This confirms the opinion of SMO and MFC experts, who in their majority (91.0%) noted the positive role of implementing proven plans for the deployment of service centers.

Thirdly, the most important factor was the rational use of regulatory support for the activities of MFC, which allowed us to successfully commission and ensure the activities of these organizations. Among them are the decisions of the Moscow government on organizing the activities of multifunctional centers, orders of the Ministry of Economic Development on approval of methodological recommendations on the creation and maintenance of the MFC [7].

Fourth, special care was taken in the material support of the centers: a conveniently located, functional building, equipped premises, the availability of modern technology, stable communication with departments of ministries and departments and the presence of other elements that contribute to the establishment of productive work of MFC.

Fifth, the methodically timely step to expand the capabilities of MFC was the introduction of the experience of a single portal Gosuslugi.ru. On which such sections were presented as: "service catalog", "help and support", "MFC for business", "useful resources", "for service providers", "our projects", "feedback" "payment", and also emergency phone numbers. In this regard, the definition of public services has changed, which began to include the totality of electronic services provided to citizens to solve educational, medical, property, social and other problems.

Sixth, the implementation of practical recommendations for the selection, training and placement of MFC personnel. The selection of graduates of universi

ties and secondary specialized educational institutions, the use of the possibilities of institutions of further education and retraining, continuing education courses and vocational training courses on vocational training and other activities contributed to the fact that 84% of employees have higher professional education, 18% of them have two higher education, which meets the qualification requirements for filling posts in this service profile.

Seventh, a survey of citizens who applied for help at the MFC showed that 92.1% express gratitude for the quality of the service provided. And among people who used the electronic system for assessing the quality of work of employees “Your Control”, 94.6% of users gave good and excellent ratings to employees.

Eighth, with experience, MFC staff has learned that public services are government actions that must be performed with respect to citizens who are entitled to require this from the state by law. As a result of this, citizens, having felt the real help of the administration, began to actively contact the MFC for official services. The data on the number of MFC services provided in NAD for 2019 is shown in Figure 1.

The data presented show that the number of citizens applying for public services over the past 3 years increased by 15-17% annually and in 2019 amounted to almost 600 thousand.

Thus, these and some other factors not only contributed to the improvement of MFC's activities, but also practically ensured the introduction of progressive changes in such areas as education, healthcare, labor, family, marriage, legal relations, and contributed to the development of the entire spectrum of individual, collective, and social relations in the country [10, p. 243]

### **Deficiencies in MFC**

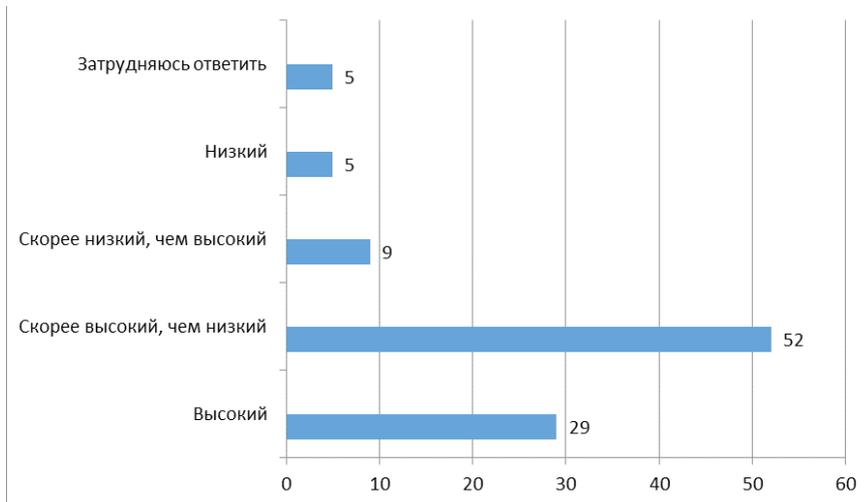
1) Assessment of the quality of services provided by MFC is carried out annually as part of monitoring conducted by the Ministry of Economic Development. It is expressed in general indicators for the Russian Federation, which is quite consistent with the results of our study. However, he faced specific tasks to identify the shortcomings of MFC in the Novomoskovsk administrative district. The study showed that only 94.6% of respondents gave excellent and good marks. 5.4% - poor and very poor grades for the quality of work.

2) Surveys of applicants applying for services at the MFC revealed the following problems:

3) The most common difficulty is large queues that exceed the standard waiting time by two or more times. The number of unsatisfactory ratings for this parameter is 33.2%. The reasons for the respondents mentioned the difficulty of filling out official forms (15,7%), the requirement for excessive information (15,8%), the inability to get free advice (12,4%), the reluctance of managers to help with paperwork (13.4%), delaying the time for receiving the service (19.7%),

violation of the Rules for organizing the activities of MFC (10,3%), extortion attempts (10.0%).

4) The problem of customer orientation of MFC personnel is recognized as insufficiently resolved. 81% of service consumers rated its level as quite high. 19% rated it as low or refused to give an answer (see: Figure 1). The difficulty of overcoming this drawback is that the result of the analysis of staff self-esteem is extremely high.



*Figure 1. MFC Employee Self-Assessment Indicators*

89% of employees rate their activities “excellent”, 9% - “good” and only 2% - “satisfactory”. While 18% of the staff were faced with repeated appeals of citizens on the same insufficiently developed issue, 12% of the employees received written complaints, and 7% came into conflict with unsatisfied visitors. Which indicates the shortcomings in the work of the staff.

5) The insufficiently deep and often poor-quality study of the population’s requests for public services leads to the fact that for some problems the applicant has to contact the MFC several times. A survey at NAD showed that 19,0% apply for services only once every few years, 22,0% - once every six months, 49% of respondents visit the center at least once a quarter. The high frequency of visits indicates serious miscalculations of the MFC.

6) According to the age criterion, the most active clients are people aged 31 years to 50 years (49.25%), in second place are people over 50 years old (31,5%) and in third place are young people from 18 to 30 years old (19,25%). Based on the low computer literacy of the elderly, it follows the need to maintain the traditional

forms of counseling for this category of applicants and the provision of services through personal contact.

7) The above reasons are the basis for the formation of a certain opinion of citizens about the quality of services provided. Averaged results show that 70% of respondents are fully or mostly satisfied with the quality of services provided. 20% - not satisfied with services. Against the background of averaged indicators, a low level of satisfaction of applicants in the settlements of Voskresenskoye, Sosenskoye and Mosrentgen is highlighted, where 58% of respondents said they were unsatisfied with the provision of public services. An analysis of the test results in these villages is shown in Figure 2.

8) It can be seen from the above results that the satisfaction of citizens with the work of MFC employees fully or mainly amounted to 42,0%. And more than half of the respondents (58%) expressed dissatisfaction with the work of MFC. The reasons for the low rates are recorded in the books of applications and proposals of citizens and named by the residents of these villages during personal conversations. They are caused by a large number of domestic inconveniences caused by the construction of residential complexes, relocation and registration of the right of certifying documents by new settlers. The analysis showed that, having conceived a claim to the essence of the service, citizens automatically project a negative attitude towards this process onto the nature of the MFC's activities. Nevertheless, these indicators should serve as the basis for improving the provision of public services.



**Figure 2.** Assessment of the degree of satisfaction of citizens of the settlements of Voskresenskoye, Sosenskoye and Mosrentgen with the work of MFC

It can be seen from the above results that the satisfaction of citizens with the work of MFC employees fully or mainly amounted to 42.0%. And more than half of the respondents (58%) expressed dissatisfaction with their work. The reasons for the low rates are recorded in the books of applications and proposals of citizens and named by the residents of these villages during personal conversations. They are caused by a large number of domestic inconveniences caused by the

construction of residential complexes, relocation and registration of the right to establish documents by new settlers. Often, having claims to the essence of the service, citizens automatically project their negative attitude on the activities of MFC. Nevertheless, these indicators should serve as the basis for improving public services.

9) According to MFC employees, one of the reasons for the slow development of new services to the population is the low salary of staff, which does not always motivate the desire to improve the quality of services provided. Specialists receive 48 210 rubles .; administrators - 40 050, employees of the administrative department - 34 500.

According to managers, the reason for this is insufficient cash receipts for the provision of paid services, which monthly fall behind the planned by 8 - 10%. This makes it difficult to stimulate MFC employees with additional payments of bonuses, complexity allowances, and special working conditions. This vicious circle is to be broken by improving interdepartmental relations, using the opportunities of the digital economy and successfully overcoming the period of disorder in these settlements.

Overcoming these and some other shortcomings identified during the study and submitted to the administrative bodies of the Novomoskovsk administrative district will greatly contribute to improving the process of providing public services, increasing confidence in government and improving the socio-economic situation in the district.

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关于文化, 培养, 教育  
**ABOUT CULTURE, UPBRINGING, EDUCATION**

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注解。文章指出, 公共生活的资本化削弱了文化, 养育, 教育的作用, 决定了他们在参与市场关系, 形成消费者态度方面的实际取向。这种教育取向可以激发低级头脑, 旨在使年轻人竞争, 成功的职业活动, 经商, 赚钱和数钱的能力做好准在不同的层面上, 有人认为俄罗斯的进一步发展需要大规模的转变。但是, 如果不改变对民族文化的态度, 对知识的获取, 养育, 旨在鼓励为人民服务, 做善事的态度, 就不可能实施这些政策。它们与将要进行这些转变的人们的形成, 发展, 进步有关。

关键词: 文化, 教育, 养育, 教育资本化, 大规模转型, 民族特色, 民族感情, 世界诚信, 理想。

**Annotation.** *The article states that the capitalization of public life has diminished the role of culture, upbringing, education, determined their practical orientation on participation in market relations, on the formation of consumer attitudes. This orientation in education stimulates the lower mind, aims at preparing young people for competitive, successful, career activities, for doing business, the ability to earn and count money. Financial literacy is of particular importance. As a result, what is called knowledge today is nothing more than a combination of facts, it is half-knowledge.*

*At different levels, it is argued that the further development of Russia requires large-scale transformations. But their implementation is impossible without changing the attitude to the national culture, to the acquisition of knowledge, upbringing, designed to encourage to serve his people, to do good deeds. They are associated with the formation, development, improvement of people who are to carry out these transformations.*

**Key words:** *culture, education, upbringing, capitalization of education, large-scale transformations, national characteristics, national feelings, the integrity of the world, ideal.*

The transformations made in Russia in the 1990s in accordance with Western liberal democratic ideas have become the focus of scientific thought and practice. These transformations have once again shown the destructiveness of the foreign influence of Western ideas and the passion for foreign culture. Numerous negative consequences in Russian life are associated with them. They led to the crowding out of their own national culture, morality, their way of life, upbringing, education.

Discussing the historical fate of the state and law, M.N. Marchenko refers to the judgment of the Roman historian of the 1st century BC Gaia Sallustia Crispa in his work “The Catelina Conspiracy,” which among the reasons for the fall of Rome, includes the thirst for money, power, profit, ambition, arrogance, cruelty. As a warning, the words of M.N. Marchenko that this can happen in any state<sup>1</sup>.

The events taking place in our country testify to the unlearned lessons of history. Money, success, gain characterize modern life, in which arrogant officials compete in choosing forms of distortion of reality and humiliation of the people.

These consequences of moral decay negatively affected the younger generation, education, and upbringing. The capitalization of Russian life, including education, called a service, has led to the introduction of events, new-fangled educational technologies that lead away from a true worldview, from real doctrine.

Today, the task of educating a cultural person with associative, panoramic thinking, who is able to holistically perceive the world around him and himself in it, analyze the past and present, see their inextricable connection and perspective, determine the trends of their national state and legal development is not set.

The practical orientation characterizing the modern education system stimulates the lower mind, aimed at empirical reality, at participation in market relations, at the formation of consumer attitudes. This orientation aims at preparing young people for competitive, successful, career activities, for doing business, the ability to earn and count money. Financial literacy is of particular importance.

There is no time for true knowledge, good breeding, or culture. The volume of modern knowledge is reduced to a set of factual information converted into capital. Apparently, this explains the fragmentation of the leading disciplines produced in higher education, designed to form a worldview, to develop the theoretical knowledge necessary for making specific decisions. As a result, what is called knowledge today is nothing more than a combination of facts, there is half-knowledge.

Further development of Russia requires large-scale transformations. The next message from the President of Russia to the Federal Assembly, announced on

<sup>1</sup>See: Marchenko M.N. Theory of State and Law. Textbook. - M., 2008. p. 108-109.

January 15, speaks of social, economic, and technological tasks. The solution of these current problems, the more so the implementation of large-scale transformations is impossible without changing the attitude to culture, to the acquisition of knowledge, education. They are associated with the formation, development, improvement of people who are to carry out these transformations.

Wise thinkers understood the inextricable connection of upbringing, education, science with art, as a whole with culture, as the highest forms of comprehension and reflection in various forms of the surrounding world and man himself, saw their huge role in a fair, high-quality structure of life and its improvement.

In ancient times, a cultured, educated man was called a noble man (Confucius), a virtuous man (Socrates, Plato, Aristotle). Aristotle said that the state requires certain virtues from a citizen, without which it is impossible to achieve the well-being of society. He called the virtues related to mental, intellectual, ethical activity, associated them with the character of a person, his feelings, emotions.

A method of solving pressing problems and improving the existing world is associated with scientific education. In art, a certain way is seen to ensure the existential integrity of the personality, which has numerous aspects of manifestation. They are in the ecstatic awe of the soul, in the harmonious sound of nature, in the color combination of heavenly and earthly, in figurative thinking.

Mysterious streams of emotional energy that are born in the depths of the human soul determine the emergence of a person's ability to feel feelings and through them cognize himself, the existing world, harmonize it and create in it, portray, organize, and transform it.

The highest arts include: architecture, sculpture, music, painting, which contribute to the knowledge of the integrity of life, its harmony. Art education is called the foundation of the formation of art, which contributes to the transformation of man himself. The highest art was called politics.

In the mirror of sounds and colors, the human heart learns to feel and feel, cognize, understand and harmonize itself, nature, the world, wrote W.H. Wackenroder (representative of German romanticism of the XVIII century.). Art, which brings harmony to humanity and to the bearer of art, is the most subtle way to approach the ideal<sup>2</sup>, which is developed in the unity of art and science, the whole culture.

Understanding their subtle connection, V.F. Odoevsky (representative of Russian philosophical, political and legal thought, writer, leader of any wisdom society) in the unfinished science fiction novel "4338" depicted an ideal model of social structure in which the state is governed by representatives of science and art, which, by state of mind, soul, thought and feeling, are few differ among themselves.

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<sup>2</sup>See: Wackenroder W.H. *Fantasy about art*. M., 1977. p. 15, 17, 74-75, 183 and others.

An understanding of this subtle connection between upbringing, art, and education was determined by the fact that a vast block of disciplines of the aesthetic and artistic cycle dominates in China's school education. Even in small cities there are higher educational institutions, the main focus of which is to form students' aesthetic, artistic perceptions of the world and train specialists in this field to work with schoolchildren. It is possible to assume that this fact plays an important role in the rapid development of the country, in the rise of the nation, of the state.

The Russian type of thinking is focused on the cultural ideal, including the ideas of righteousness, justice, beauty, honor, conscience, dignity, responsibility. This is a kind of national code that determined the people's claims to the originality and independence of their spiritual, moral, national-cultural, state-legal, entire social life and having many-sided forms of its reflection in folklore, philosophy, science, art. He led away from a one-sided-rational perception of the world, a gross fact, from frivolous borrowing of other people's ideas, lifestyle.

Ignoring our wisdom, being carried away by higher circles and the liberal-minded part of Russian society with other people's ideas, often imposed from the outside, influenced by both Russian culture and education, led to the fact that the ideal thought did not coincide with concrete historical reality. As a result, there were dissonances, critical situations that called into question the existence of Russia.

For a long time, foreigners played the main role in Russian education: in the church - the Greeks, in the home - the French, in the state, created in the XVIII century<sup>3</sup> - Germans. Catherine II invited the Jesuits to create an exemplary school system.

Ethics with elements of Western jurisprudence and politics was taught at the Naryshkinsky College. In the college of cadets - along with the Law of God, foreign languages: French, German, Latin. In the cadet corps there are civil and political sciences: arithmetic, geometry, drawing, law, morality, etc. At Moscow University, for the first ten years, F.G. Diltthey, Doctor of Law, University of Vienna, who lectured in French, feudal, state law in French.

The content of education was mainly the assimilation of the results of Western jurisprudence based on a rational worldview. The main subject of attention at the Faculty of Law was natural law, which F.G. Diltthey set out according to S. Pufendorf, who were considered in the West, especially in Germany, as an indisputable authority.

The official installation was aimed at ensuring that the first Russian professors (S.E. Desnitsky, I.A. Tretyakov, A.Ya. Polenov) worked in the same direction, alien to the historical soil. This installation, the general atmosphere in the country, in management, legislation, which N.M. Korkunov called utter confusion, the in-

<sup>3</sup>The Naryshkin School was created in 1703, the college of cadets in 1721, the Academy of Sciences in 1725, the cadet corps in 1732, Moscow University in 1755. Later, universities in Kharkov, Kazan, and St. Petersburg.

trigues that reigned in educational institutions led to the emergence of a struggle with foreign. They impeded the activities of Russian scientists who did not submit to the influence of Western ideas.

A.Ya. Polenov, persisting in proving to academics the need for a lawyer of historical education, was forced to leave the academy. S.E. Desnitsky took up the theoretical study of the Russian state, state power, law, the first to begin to give lectures in Russian and Russian law. Under the influence of lectures S.E. Desnitsky Z.A. Goryushkin, wrote N.M. Korkunov, realized "the fuss of one practical study of jurisprudence"<sup>4</sup>.

Art, including the field of fine arts, was also subject to Western influence. The revitalization of the image of the material world during the Renaissance led to the fact that it became the defining focus of this type of art in Europe and became the subject of attention of artists who paid close attention to composition, anatomy, technology, craft. These problems were solved in the 17th century. academies in Italy, France, Germany, whose students studied art crafts mainly on the basis of biblical subjects.

Before the era of Peter I, Russia did not have secular painting. Art served as an adornment of temples where the harsh image of the miraculous Spass and dominant towers dominated. The formation of secular art education in the country is also to some extent related to biblical subjects and icon traditions used in the church environment.

In the Chancellery of Buildings, which later became the center of art education and which inherited most of the state, especially the painters of the closed Armory, the cognitive possibilities of drawing were studied, paintings depicting alien nature, portraits of Western, mainly Italian masters were copied, their writing technique was used. The imitation of the European system was carried out, which formed Western-oriented artisans.

In the Academy of Sciences, opened in 1724, foreigners are taught painting and sculpture. In the Russian Imperial Academy of Arts, created in 1757, of the three arts: architecture, sculpture and painting, the first professors are French foreigners, who, in the words of I.I. Shuvalov, President of the Academy, enriched and left. The training was based on the rules developed by the Italian school. The existing teaching system separated Russian painting and artists from the real life of Russian society. S. Shchedrin, who wrote many paintings depicting the Italian landscape, practically did not leave pictures of his native nature. O. Kiprensky died out under the Roman sky.

In 1856, starting preparations for the upcoming 100th anniversary of the Academy of Arts, the Academy Council for the competition for a large gold medal in historical painting chose the plot of the Scandinavian sagas.

<sup>4</sup>See: Korkunov N.M. The philosophy of law. - St. Petersburg, 1903. P. 265, 269, 270, 275, 276, 279, 280.

This caused a collective protest of fourteen students of the Academy, headed by I.N. Kramsky. Their competitive works contained a new, folk theme. They believed that the artist could not look at the world through the eyes of others, demanded a different attitude to academic education and to Russian painting, in which they saw a huge educational role.

A movement arose, called “Wanderers”, which reflected both a **critical view** of Russian reality and a romantic image of it. A national artist appeared, a master with practical skills and the ability to generalize knowledge about art and real life.

Russian masters came to the Academy, centralization of training was in progress. Combined historical and portrait classes, battle and landscape painting. A single pedagogical method was developed. The curriculum included the Theory of Fine Arts, aimed at summarizing knowledge of art and reflected life. There is a definite connection with scientific knowledge.

The development of one's own view of fine art is characteristic of the Moscow School of Painting, Sculpture and Architecture, created in 1843, thanks in large part to A.G. Venetsianov and his school.

The powerful flowering of Russian fine art at the end of the 19th - beginning of the 20th centuries, associated with the names of V.A. Serova, V.A. Vrubel, V.V. Kandinsky, K.S. Malevich and other masters of the brush, created an aura of holiness and fine art, and his academic education. However, the introduction of a formal and thematic experiment in the visual arts, technical discoveries (daguerreotype, silent cinema) led to a “crisis” in the visual arts, which affected art education.

Conceptual and structural changes in the visual arts, in art education, in the general system of education and science occurred in the first half of the 20th century. They are connected with the Soviet period, in the conditions of which their main task was to reflect the struggle for a new life, which should arise as a result of the implementation of communist ideals.

In all this connection of education, art, science, a serious conservative factor was seen, designed to justify the spiritual and moral state of society and the harmonious structure of state and legal life. The philosophical and legal literature stated: the higher the level of culture, education, upbringing, morality, spirituality, the stronger the society<sup>5</sup>. A.S. Pushkin linked the negative consequences of political changes with a lack of education, upbringing, morality, and positive knowledge<sup>6</sup>

In the modern conditions of globalization, unification that characterize modern social development, including the development of general, higher, scientific and artistic education in Russia, the imposition of a different culture is imposed once

<sup>5</sup>See, for example, Korkunov N.M. History of philosophy of law. The manual for lectures. Third Edition. - St. Petersburg, 1903. P. 259, 261.

<sup>6</sup>See: Pushkin A.S. About public education. *Sobr. Op.* in ten volumes. Volume Seven. - M., 1976. p. 307-312.

again, the introduction of factual material, often distorting historical facts, and the essence of national culture<sup>7</sup>.

This again led to a conflict of cultures<sup>8</sup>, to the deformation of the national culture of the people and the consciousness of its specific carriers<sup>9</sup>, which are the result of the pragmatization of social life, the destruction of national culture, the system of upbringing and education.

Speaking about the different spheres of human activity, we proceed from the deep understanding of life that led wise thinkers to conclude that the educational process, the research spirit of serious sciences and the spirit of fine art, culture in general, would seem to be different, have a secret relationship and inner spiritual conditioning.

This internal, spiritual determines both rational conclusions and sensual imaginations, creates political and legal, artistic images that become a guideline for knowing oneself, the world and the urge to create, to harmonious arrangement of external life. Inner, spiritual, said I.A. Ilyin, decides on the dignity of the external, material<sup>10</sup>. Speaking about the world of colors, Goethe said that they are the actions and sufferings of light.

Reasonable knowledge, ideas are acquired in the learning process, the ability to draw conclusions about the past and present, constantly changing phenomenal world, and are used to influence this world. In order for this activity to be not destructive, but creative, it must be moral. It is shaped by culture. It is developed in the process of communication with high art, deepened by education.

Culture in the broad sense is the eternal foundation that determines the nature of political and legal, aesthetic, artistic upbringing and education, as the cultivation and exaltation of a person in accordance with a certain cult, ideal, image. The enormous role of the image in this activity was discussed by the Soviet philosopher A. V. Gulyga<sup>11</sup>.

The cultivation, exaltation of a person is carried out both through a spatial expansion of knowledge, and through an increase in consciousness to an understanding of the proper, ideal that embodies the integrity of being developed by the national culture. It is also associated with non-verbal perception of the world, with the comprehension of the beauty of color, sound, energy, spiritual essence of consciousness.

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<sup>7</sup>See: Moiseev N.N. The fate of civilization. The path of the mind. - M., 1988. p. 152.

<sup>8</sup>See: Lukashova E.A. Human rights: a conflict of cultures // Our difficult path to law: materials of philosophical and legal readings in memory of academician V.S. Nersesyantsy. - M., 2006. p. 254.

<sup>9</sup>The consciousness of officials who, intoxicated by the proclaimed (but not understood) freedom and the prevailing irresponsibility, are competing in demonstrating a negative attitude towards Russian culture, the Russian people, is recognized as extremely deformed. In the media this has been defined as a postmodernist phenomenon, the main symbol of which, as you know, is a simulacrum. See: Demchenko V.I. Metaphor in postmodernism. – Stavropol, 2007.

<sup>10</sup>See Ilyin I.A. The basics of Christian culture. Collection. Volume 1. - M., 1993. p. 301.

<sup>11</sup>See: A. Gulyga. Creators of the Russian idea. - M., 2006. p. 218.

This implies a change in attitude towards the understanding of educational and educational activities, as a joint, spiritual, intellectual, emotional work of a teacher and student. In the process of it, the formation of the personality according to the model and likeness to the ideal, the person's comprehension of the essence of being, the acquisition of true knowledge about the unity of the material, manifested, conditional, transitory and spiritual, unmanifest, unconditional world, i.e. knowledge of the integrity of the world, its unity.

E.N. Trubetskoy, arguing about unity, believed that it is realized through self-deepening, self-knowledge. We meet this idea in the pre-Slavic and Indian Vedas, with Socrates, Hegel, N.A. Berdyaev and other thinkers. All-unity, in the understanding of E.N. Trubetskoy, there is an introduction to omniscience<sup>12</sup>.

The idea of unity was developed in the scientific principle of co-evolution, aimed at the holistic perception of man and the world around him, at the joint, harmonious development of man, nature, society, at the coordination of the strategy of their development<sup>13</sup>. This principle should be the basis of modern education and upbringing in the conditions of national culture. At the same time, according to domestic teachers, the teacher, educator himself must be educated, he must be a carrier of deep knowledge and high culture.

Assuming the great mission of cultivating the human soul, the teacher should be aware that the basis of education and upbringing of a person is not only intellectual, but also emotional, sensual, supersensible, intuitive perceptions of reality, which give initial, instinctive and experienced ideas, are determined by inexperienced penetration into the essence of being. This complex comprehension permeates all stages of the formation of personality and the forms of cognition, reflection, image of reality: those that are called art, and those in which knowledge takes on an abstract form of science.

He should know that education and upbringing, all types of art are called upon to form knowledge about the national characteristics of his people, to inflame national feelings, to arouse the emotional thrill of pride in a country, native nature, to instill in man a nobility<sup>14</sup>, encourage him to do good deeds, patriotic deeds.

Such an approach should underlie the formulation of general programmatic provisions for goal-setting, the content and directions of educational activity. General program provisions should focus on the comprehension of a holistic picture of the world, on the development of strategies and trends in social development in the future. They should correspond to national culture, ideal, state ideology, state policy in the field of education and upbringing.

<sup>12</sup>See: Trubetskoy E.N. Selected works. - Rostov-on-Don. 1998. p. 74-75.

<sup>13</sup>See: Moiseev N. Modern rationalism and worldview paradigms // Social sciences and the present. - 1994. - No. 3.

<sup>14</sup>См.: Ясперс К. Смысл и назначение истории. М., 1994. С. 339.

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慢性胃炎和胃及十二指肠消化性溃疡患者血清中IL-4和IL-8的动态  
**DYNAMICS OF IL-4 AND IL-8 IN THE SERUM OF PATIENTS WITH  
CHRONIC GASTRITIS AND PEPTIC ULCER OF THE STOMACH  
AND DUODENUM<sup>1</sup>**

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抽象。幽门螺杆菌感染(Hp)的特征是胃粘膜局部发炎,嗜中性粒细胞和特定淋巴细胞对其浸润以及免疫调节细胞因子产生的增加。其中,最重要的调节细胞因子是IL-4,它在大量的免疫和非免疫功能中起主要的消炎作用。IL-8是强大的血管生成因子和化学引诱剂。它在循环系统中的存在会对身体产生全身性促炎作用。在幽门螺杆菌感染中,这些白介素尚未被很好地理解。

这项工作的目的是确定患有慢性胃炎以及胃和十二指肠消化性溃疡的患者的血清IL-4和IL-8水平。

总共检查了95名在胃肠病科住院诊断为慢性活动性胃炎(CAG)和42例诊断为消化性溃疡(PU)的患者。

**Abstract.** *H. pylori infection (Hp) is characterized by local inflammation of the gastric mucosa, its infiltration by neutrophils and specific lymphocytes, and an increase in the production of immunoregulatory cytokines. Among them, the most important regulatory cytokine, which plays a predominantly anti-inflammatory role in a huge number of immune and non-immune functions, is IL-4. IL-8 is a powerful angiogenic factor and chemoattractant; its presence in the circulation can have a systemic pro-inflammatory effect on the body. In H. pylori infection, these interleukins are not well understood.*

*The purpose of the work was to identify serum levels of IL-4 and IL-8 in patients with chronic gastritis and peptic ulcer of the stomach and duodenum.*

*A total of 95 patients were examined who were hospitalized in the gastroenterological department with a diagnosis of chronic active gastritis (CAG) and 42 with a diagnosis of peptic ulcer (PU).*

<sup>1</sup>Supported by the "Project to improve the competitiveness of leading Russian universities among the world's leading scientific and educational centers."

**Results.** Elevated levels of IL-4 in paired sera were detected in only 50.7% of patients, with the same frequency in patients with CAG and PU, and IL-8 (above 0.062 ng/ml) in most patients (90%), with the highest IL-8 levels were detected in patients with PU with confirmation of Hp infection by traditional methods.

In 1 serum analysis, 31% of patients had elevated levels of IL-8 in the absence of IL-4, while in analysis 2, they were already twice as large ( $p \leq 0.01$ ). This indicated a significant drop in IL-4 levels in just a few days between the two tests.

**Conclusion.** Considering that an increase in serum levels of IL-8 was found in a greater number of patients than IL-4, and, in addition, IL-4 earlier ceases to be detected in serum, it can be assumed that the production and anti-inflammatory effect of IL-4 are insufficient in some patients with gastritis and peptic ulcer.

This can support inflammation due to the action of elevated levels of IL-8, as well as reduce the effectiveness of eradication therapy.

关键词: 慢性胃炎, 消化性溃疡, 幽门螺杆菌感染, 白介素4, 白介素8

**Keywords:** chronic gastritis, peptic ulcer, *H. pylori* infection, interleukin 4, interleukin 8

*H. pylori* is usually acquired in childhood and persists in the human stomach for decades [1]. *H. pylori* infection leads to the involvement of immune and inflammatory cells in the stomach [2], causing an inflammatory response, while the production of immunoregulatory, pro- and anti-inflammatory cytokines increases [3]. This leads to the development of various pathological conditions (gastritis, peptic ulcers and cancer of the stomach) [1,4-6].

Along with this, an extensive cytokine network triggers a complex of local defense reactions, involves all types of effector cells in the elimination of the pathogen and restoration of cell integrity, regulates the processes of proliferation and differentiation in the body [7, 8].

Interleukin-4 is an important multifunctional, mainly with anti-inflammatory effect, cytokine, many types of cells respond to it [9]. IL-4 is the most important regulatory cytokine, playing a role in a huge number of immune and non-immune functions [10]. The overproduction of IL-4 enhances susceptibility to intracellular microbial pathogens, upsetting the TH1/TH2 balance in the host [11].

IL-8 is a powerful angiogenic factor and chemoattractant, a key mediator of the Th1-type immune response and is overexpressed in gastric epithelial cells exposed to *H. pylori* [12, 13]. IL-8 is even more actively secreted by *H. pylori*-infected endothelial cells [14]. Therefore, its presence in the circulation can have a systemic pro-inflammatory effect on the body. The mechanism of stimulation of IL-8 when exposed to *H. pylori* is not fully understood. Data on the levels of IL-8 in various diseases are scarce and sometimes contradictory [15-20].

**Purpose of the study** – identify serum levels of IL-4 and IL-8 in patients with chronic gastritis and peptic ulcer of the stomach and duodenum

### **Materials and methods**

A total of 95 patients were examined who were hospitalized in the gastroenterological department with a diagnosis of chronic active gastritis (CAG-53 patients) and 42 with a diagnosis of peptic ulcer (PU) (average age - 59 years).

To confirm the diagnosis in patients, the following laboratory and instrumental methods of research were carried out: clinical and biochemical blood tests, blood type and Rh factor, coprological examination of feces, fecal occult blood test, HELPIL (form) in a biopsy (LLC "AMA", Russia), urease breath test, fibrogastroduodenoscopy (Olympus xq40, Japan) with cytological examination of biopsy material, ultrasound examination of abdominal organs (Sonoscape s8, China, GE Vivid 7, USA). A comprehensive examination of patients confirmed the presence of *H. pylori* in 33.3% of patients with CAG and in 61.7% of patients with PU. The presence and level of IL-4 and IL-8 were determined by ELISA (LLC "Cytokine").

In the treatment of diseases, proton pump inhibitors (PPI), antacids, and H2-histamine receptor blockers were used, and eradication therapy was prescribed according to the National Recommendations when *H. pylori* infection was confirmed [21].

The levels of IL-4 and IL-8 were tested in paired blood serum (upon admission from the hospital and after 3-4 days).

All patients gave informed consent for examination and treatment while they were in the hospital. Data privacy was reserved.

Statistical processing of digital material was carried out by generally accepted methods of variation statistics with the calculation of t student criterion and  $\chi^2$  using Microsoft Word and Microsoft Excel.

### **Results**

An increase in serum levels of IL-4 (above 10 pg/ml) was observed in all 50.7% of patients, with approximately the same frequency in patients with CAG (54.5%) and PU (45.6%), without significant differences in gender and regardless of the presence of Hp according to traditional methods.

In contrast to IL-4, elevated levels of serum IL-8 (above 0.062 ng/ml) were observed in most patients (90%). The highest levels of serum IL-8 were detected in patients with PU+Hp (Hp infection was confirmed by traditional methods), including in the first stool analysis, in comparison with other patient subgroups ( $p \leq 0.05$ ) - PU, CAG and CAG+Hp.

In the first analysis of blood serum, 31% of patients had elevated levels of IL-8 in the absence of IL-4, while in the second analysis, twice as much ( $p \leq 0.01$ ). This indicated that in many patients, IL-4 ceased to be determined by the second analysis while maintaining elevated levels of IL-8.

The average levels of IL-4 in the examined patients was  $17.3 \pm 1.8$ , without a significant difference in the levels in patients with PU and CAG, as well as in men and women.

The levels of IL-4 in patients with PU did not differ in serum 1 and 2 tests, while in patients with PU+Hp and CAG they almost halved, but also without significant differences.

The average levels of IL-8 were  $0.3 \pm 0.02$ , without differences in patients with PU and CAG ( $0.32 \pm 0.03$  and  $0.3 \pm 0.03$ , respectively). In the first and second stool tests, the average levels of IL-8 in different subgroups of patients did not significantly differ, apparently, due to the short time interval between them (3-4 days), no differences were found between men and women. The highest levels of serum IL-8 were detected in patients with PU + Hp (including in the first stool analysis), in comparison with other subgroups of patients ( $p \leq 0.05$ ) (PU and CAG). The lowest levels of IL-8 were found in CAG patients (without detection of Hp by conventional methods).

### Conclusion

Thus, in general, the obtained data on the average levels of serum IL-4 and IL-8 indicate that they were increased in many patients - in 50% of patients with chronic gastritis and 90% of patients with peptic ulcer. That is, elevated levels of IL-8 were detected twice as often as IL-4. The ratio of the average levels of these cytokines in different subgroups of patients was similar, but was more pronounced in IL-8, for the average levels of which there were significant differences in some subgroups, in particular, significantly higher levels of IL-8 in the subgroup of patients with PU+Hp. At the same time, in the dynamics of the examination, in just a few days, the number of patients who did not determine IL-4, but increased levels of IL-8, continued to be detected.

Considering that an increase in serum levels of IL-8 was found in a larger number of patients than IL-4, which, in addition, had previously ceased to be detected in serum, it can be assumed that the production and anti-inflammatory effect of IL-4 are insufficient in some patients with gastritis and peptic ulcer. This may explain the maintenance of inflammation due to the action of elevated levels of IL-8 in most patients, and may also indicate a decrease in the effectiveness of eradication therapy.

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Perthes病髋关节各部分的血流动力学参数  
**HEMODYNAMIC PARAMETERS IN THE COMPONENTS OF THE  
HIP JOINT IN PERTHES DISEASE**

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抽象。 这项研究的目的是确定Perthes病髋关节组件的骨内和骨旁组织中的脉冲血供参数。 使用电极针和流变血管造影术，记录髋臼顶和股骨近端的骨和骨内组织的脉冲血供。 确定患者人群中血液供应的脉搏波的参数（疾病特征），以识别与骨病理学特定变异相关的偏差。

关键词：Perthes病，血液循环，髋关节组成。

**Abstract.** *The purpose of this study was to determine the parameters of pulse blood supply in the intraosseous and paraossal tissues of the components of the hip joint in Perthes disease. Using electrode-needles and rheovasography, pulse blood supply was recorded for the paraossal and intraosseous tissues of the roof of the acetabulum and the proximal femur. The parameters of the pulse wave of blood supply in the patient population, characteristic of the disease, were determined to identify deviations associated with a particular variant of bone pathology.*

**Keywords:** *Perthes disease, blood circulation, components of the hip joint.*

### **Introduction**

In Perthes disease, the cause of aseptic necrosis of the femoral head tissue is acute ischemia, which leads to thrombosis of the vascular bed [1]. Predisposing factors include autonomy of the vascular systems of the pineal gland and metaphy-

sis of the bone due to the proximal metaepiphyseal growth zone between them, the absence of a developed anastomotic network connecting the peripheral bed of arteries, and latent ischemia due to vascular dysplasia [2-7]. And since after thrombosis of the vascular bed area the influence of predisposing factors remains, the regeneration of the tissues of the femoral head and age-related development of the components of the hip joint occur under conditions of latent ischemia.

It is known that pulse blood flow is one of the main characteristics of blood circulation, pulse wave parameters characterize pulse blood supply, as well as the state of the walls of the vessels of the studied tissue site [9]. And in the FSBI "RISCR TO" named after academician G.A. Ilizarov developed and tested with the help of ultrasound a method of introducing needles for transosseous osteosynthesis, which provides registration of a pulse wave of blood filling in the tissues of the proximal femur [10,11,12].

Purpose of the study: to determine the parameters of pulse blood supply in the bone and paraossal tissues of the hip joint in Perthes disease.

#### **Material and methods**

A pulse wave of blood supply was recorded in the components of the hip joint of 54 patients aged 5-11 years, of which 14 (26%) were girls. The study was carried out in accordance with the ethical standards of the Helsinki Declaration of the World Medical Association as amended by the Ministry of Health of the Russian Federation with the informed written consent of the patient's parents to conduct the study without identification.

Inclusion criteria: unilateral and stage II disease according to Waldenstrom, III-IV group according to Catterall, group B/C, C according to Herring.

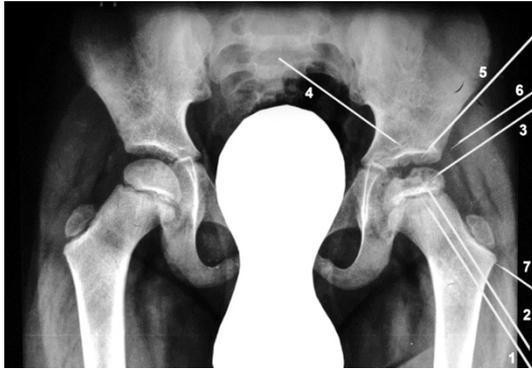
The parameters of the pulse wave were recorded in the operating room before applying the Ilizarov apparatus for decompression of the hip joint. Patients were under endotracheal anesthesia.

Using an RGPA-6/12 REAN-POLI polyanalyzer (MEDICOM-MTD, Russia, Taganrog), impedance, electrocardiograms, rheovasograms of intraosseous and paraossal tissues and their first derivatives were simultaneously first recorded in the head, then in the neck of the femur, and in the ilium. The sounding current was 1.5 mA, frequency 56 Hz.

To register the pulmonary blood filling of the intraosseous tissues, we used needles with a diameter of 1.8 mm. Using an electric drill, the needles were introduced so that the distance between their ends in the bone cavities was 5 or more times smaller than between the segments in paraossal tissues (Figure 1).

First, a needle (1) was inserted from the outside into the neck of the femur so that its sharp end was outside the metaepiphyseal growth zone, then a second needle (2) so that it passed through the growth zone and its end was immersed in the femoral head. A third needle (3) was inserted into the femoral head from the front.

Then, needles 4 and 5 were introduced outside the ilium near the acetabulum. To register pulse blood filling in the paraossal tissues, the needle 6 was inserted all the way into the ilium, and the needle 7 was pressed into the femur. The impedance and parameters of pulse blood supply were recorded outside the proximal metaepiphyseal zone of femoral growth using needles 1 and 3, in the femoral head - needles 2 and 3, in the ilium - needles 4 and 5, in paraossal ileal tissue - needles 4-6, above the proximal femur - needles 3-7. Needles 3 and 4 served as common electrodes for registering a pulse wave in paraossal and intraosseous tissues.



*Fig. 1. The roentgenogram. Patient B., 7 years old. Osteochondropathy of the head of the left femur. Scheme. Needles for research have been introduced*

For statistical processing, the following parameters of the pulse wave in digital expression were derived [12,13].

1. RR, s – ECG cardiocycle duration.
2. BI, Ohm - basic impedance (resistance to probing alternating electric current). Blood serum has the highest electrical conductivity, so the basic impedance is proportional to the blood vessels in the study area.
3. PTPW, s - the propagation time of the pulse wave to the studied tissues on the basis of the segment from the Q wave of the ECG to the beginning of the pulse wave. In children, it is directly proportional to the length of the main arteries.
4. TRBF, s - time of rapid blood filling of the pulse wave (full opening of the organ artery) of the studied tissues. The higher the tone of the walls, the more time is required to increase the lumen of the artery under pressure of the systolic blood volume.
5. TSBF, s - time of slow blood filling of the pulse wave (full opening of intra-organ arteries).
6. TMSF – time of maximum systolic blood filling (full opening of the arteries of the studied tissues, the sum of TRBF and TSBF).

7. RVP, Ohm/s – relative volumetric pulse (equivalent to the volume of blood involved in pulse changes in blood supply. The ratio of the rheographic index to the base impedance in ppm ( $RVP = RI \cdot 1000 / BI$ ). Norm is 0,6-0,8.

8. ARBF, Ohm – the amplitude of the rapid blood filling to the pulse wave (the equivalent of the pulse blood supply to the organ arteries of the studied tissues). The ratio of the amplitude of the first systolic wave (Ohm) to the calibration signal of 0.1 Ohm.

9. ASBF, Ohm - the amplitude of the slow blood filling of the pulse wave (the equivalent of the pulse blood supply of the intraorgan arteries,  $ASBF = RI - ARBF$ ).

10. RI, Ohm — reographic index (equivalent to pulse blood filling of the arteries of the tissue site). The ratio of the amplitude of the second systolic wave (rheovasogram amplitude, Ohm) to the height of the calibration signal of 0.1 Ohm. In adults, an RI of more than 0.05 Ohm is the norm, less than 0.05 Ohm is an indicator of moderate decline, less than 0.04 Ohm (80%) is a decrease indicator, less than 0.03 Ohm (60%) is an indicator of a sharp decrease, 0, 02 Ohm (40%) - an indicator of the beginning of decompensation of pulse blood supply.

To take into account the relationships between the parameters of blood filling were calculated:

11. AsRBF, Ohm/s – average speed of rapid blood filling of the pulse wave (speed of blood supply to organ arteries,  $ARBF/TRBF$ ).

12. AsSBF, Ohm/s – the average speed of slow blood filling of the pulse wave (speed of blood supply to the intraorgan arteries,  $ASBF/TSBF$ .)

13. AsBF, Ohm/s – average speed of blood filling of the pulse wave (blood velocity of the arteries of the studied tissue site,  $RI / TMSF$ ).

14. IPVR, Ohm/s – indicator of peripheral vascular resistance (resistance to the blood flow of the microvasculature, the ratio of the amplitude of the lower point of incisura to the amplitude of the rapid blood supply of the pulse wave). Norm is 20-55%.

15. DCI, Ohm/s – dicrotic index. (an indicator of the tone of resistive vessels, the ratio of the amplitude of the lower point of incisura to RI). Norm is 40–70%.

16. DSI, % – diastolic index (an indicator of the predominance of the inflow over the outflow of blood, venous tone. The ratio of the amplitude of the dicrotic wave to RI). Norm is 75%.

From the quantitative data, unweighted variational series were compiled. Calculated  $M$  – the arithmetic mean of the variation series  $\sigma$  – the standard deviation;  $m$  – the error of the average value based on  $n$  – the number of observations. Confidence intervals were considered the range of functional changes in the parameter; differences between the means were estimated using the nonparametric Wilcoxon-Mann-Whitney test. Analysis was performed using Microsoft Excel 2013.

## Results

Comparisons showed that, due to a reduction in the interelectrode distance, BI of intraosseous tissues was always less than BI of paraossal tissues (Table 1).

*Table 1. Pulse blood filling parameters in the components of the hip joints in Perthes disease.*

№	Parameters	Paraossal tis- sues of the ac- etabular roof	Intraosseous tissue of the ac- etabulum roof	Paraossal tissue of the femur	Intraosseous tissue of the femoral head	Intraosseous tissue outside the metaepiph- yseal growth zone
		1	2	3	4	5
1	RR, s	0,5538 ± 0,0112	0,5538 ± 0,0112	0,5480 ± 0,0156	0,5480 ± 0,0156	0,5480 ± 0,0156
2	BI, Ohm	101,1 ± 5,3	70,8 ± 4,9	101,1 ± 5,3	68,7 ± 5,6	70,8 ± 70,8
3	PTPW, s	0,1838 ± 0,0045	0,1788 ± 0,0046	0,1838 ± 0,0045	0,1808 ± 0,0052	0,1788 ± 0,1788
4	TRBF, s	0,3696 ± 0,0264	0,3759 ± 0,0262	0,3901 ± 0,0305	0,3687 ± 0,0657	0,4059 ± 0,4059
5	TSBF, s	0,0161 ± 0,0013	0,0108 ± 0,0012	0,0161 ± 0,0013	0,0104 ± 0,0017	0,0130 ± 0,0130
6	TMSF, s	0,0205 ± 0,0016	0,0151 ± 0,0015	0,0240 ± 0,0036	0,0140 ± 0,0019	0,0154 ± 0,0154
7	ARBF, Ohm	0,0366 ± 0,0028	0,0259 ± 0,0024	0,0391 ± 0,0029	0,0245 ± 0,0035	0,0284 ± 0,0284
8	ASBF, Ohm	0,0537 ± 0,0012	0,0509 ± 0,0012	0,0537 ± 0,0012	0,0505 ± 0,0010	0,0518 ± 0,0518
9	RI, Ohm	0,0616 ± 0,0018	0,0598 ± 0,0020	0,0616 ± 0,0018	0,0566 ± 0,0032	0,0598 ± 0,0598
10	RVP, ppm	0,1153 ± 0,0024	0,1106 ± 0,0026	0,1153 ± 0,0024	0,1071 ± 0,0038	0,1116 ± 0,1116
11	AsRBF, Ohm/s	0,2955 ± 0,0219	0,2252 ± 0,0285	0,2955 ± 0,0219	0,2026 ± 0,0317	0,2514 ± 0,2514
12	AsSBF, Ohm/s	0,3428 ± 0,0278	0,2541 ± 0,0243	0,3922 ± 0,0394	0,2567 ± 0,0372	0,2676 ± 0,2676
13	AsBF, Ohm/s	0,3178 ± 0,0240	0,2425 ± 0,0257	0,0343 ± 0,0258	0,2291 ± 0,0335	0,2579 ± 0,2579
14	IPVR, %	74,7 ± 2,8	92,5 ± 3,7	73,2 ± 2,8	84,0 ± 3,8	90,6 ± 90,6
15	DCI, %	49,2 ± 4,3	54,8 ± 4,5	49,2 ± 4,3	46,1 ± 6,2	52 ± 52
16	DSI, %	56,5 ± 6,2	65,5 ± 4,7	56,5 ± 6,2	58,5 ± 5,8	65,5 ± 65,5

There were no statistically significant differences between the temporal parameters of the pulse wave (PTPW, TRBF, TSBF, TMSF) of the intraosseous and paraossal tissues of the acetabular roof, as well as the intraosseous tissues of the head and outside of the proximal metaepiphyseal zone of femoral growth and paraossal tissues of the proximal femur (table 2).

In paraossal tissues of the acetabular roof, the amplitude of slow pulse wave blood filling (ASBF), rheographic index (RI), relative volumetric pulse (RVP), average slow (AsSBF) and total (AsBF) pulse wave blood filling, and peripheral vascular resistance (IPVR) exceeded similar parameters in the intraosseous tissues.

In the paraossal tissues of the proximal femur, the amplitude of the slow pulse wave blood filling (ASBF), the rheographic index (RI), the relative volume pulse (RVP), the average speed of the fast (ARBF) slow (AsSBF) and the general (AsBF) pulse blood filling exceeded the similar parameters in the intraosseous tissues of the femoral head.

In paraossal tissues of the proximal femur, the rheographic index (RI), relative volumetric pulse (RVP), average slow (AsSBF) and general (AsBF) blood filling, and peripheral vascular resistance (IPVR) exceeded the same parameters in the intraosseous tissues outside of the proximal metaepiphyseal growth zone.

**Table 2.** The level of statistical significance of the differences ( $p <$ ) between the parameters of pulse blood supply in patients with Perthes disease.

№	Parameters	Iliac Intraosseous/ paraossal Tissues		Femoral head intraosseous/ paraossal tissue		Femoral growth area, intraosseous/ paraossal tissue	
		1		2		3	
		p<	%	p<	%	p<	%
1	BI, Ohm	0,001	143	0,01	147	0,001	143
2	PTPW, s		103		102		103
3	TRBF, s		106		106		104
4	TSBF, s		103		109		103
5	TMSF, s		104		108		103
6	ARBF, Ohm		98		106		96
7	ASBF, Ohm	0,01	149	0,05	155		124
8	RI, Ohm	0,05	136	0,05	171	0,05	156
9	RVP, ppm	0,01	141	0,05	160	0,05	138
10	AsRBF, Ohm/s		131	0,05	146		118
11	AsSBF, Ohm/s	0,05	135	0,05	153	0,05	147
12	AsBF, Ohm/s	0,05	131	0,05	150	0,001	133
13	IPVR, %	0,001	81	0,05	87	0,001	81
14	DCI, %		90		107		95
15	DSI, %		86		97		86

**Discussion**

Patients were hospitalized at the stage of fragmentation of the proximal epiphysis of the femur, therefore, occlusion of the vascular bed and related pathological changes occurred, blood circulation in the tissues studied was “stabilized”. However, the conditions of latent (not clinically apparent) chronic ischemia associated with arterial dysplasia remained, and had an impact on the regeneration of head tissue and the development of components of the hip joint. And since the variants of arterial dysplasia are different, the pulse wave parameters of all patients, regard-

less of age, were combined to identify their confidence intervals in Perthes disease in order to compare the values in patients with a certain pathology in the future.

Anesthesia conditions excluded redistribution of blood circulation due to functional loads, therefore, confidence intervals of mean changes were considered as a range of changes in pulse wave parameters at rest, and statistically significant differences between means were considered to be the indicator of differences in pulse blood supply.

Paraossal tissues included the periosteum and soft tissues between the needles above the bone, and the soft tissues of the cancellous cavities to the intraosseous tissues. A probe electric current propagates through all electrolytes between tissues having a relatively high electrical resistance, which include, in particular, fascia and bone substance. Its distribution goes from the needle to the hematoma around it, then through the blood contained in the microvasculature, to the contents of the lumen of large arteries, then in the reverse order to the second needle. In a section with relatively low resistance, it closes and its changes occur depending on the pulse changes in the blood filling of the vessels. In order for the electric current to close in the intraosseous tissues, the distance between their ends was reduced relative to the distance between the needles outside the bone. To register the pulse blood filling of the paraossal tissues, individual needles were introduced.

Studies have shown that the tone of the walls of the main, organ and intraorgan arteries of the paraossal and intraosseous tissues of the roof of the acetabulum, paraossal tissues of the proximal femur, head and outside of the proximal metaphyseal zone of femoral growth did not have statistically significant differences.

The amplitude of the rapid blood supply to the pulse wave, determined by the tone of the organ arteries of the studied tissues, also did not have statistically significant differences.

Moreover, the blood supply to the intraorgan arteries (based on ASBF) and the entire arterial bed (based on RI), as well as the relative volumetric pulse (RVP) in the intraosseous tissues were less than in paraossal tissues. The rate of blood supply to the intraorgan arteries (based on AsSBF) and the entire arterial bed (based on AsBF) in the intraosseous tissues was also lower than in paraossal tissues. The reason was, based on IPVR, lower resistance to the blood flow of the microvasculature of paraossal tissues. Comparisons did not reveal statistically significant differences between the confidence intervals of the pulse wave parameters in the paraossal ileum and the proximal femur, as well as between the confidence intervals of the pulse wave parameters in the intraosseous tissue of the ilium, the femoral head and outside of the proximal metaepiphyseal growth zone, respectively. It follows that the identification of statistically significant differences between the parameters of the pulse blood supply in these tissues is an indicator of changes in blood circulation due to pathology.

## Conclusions

The parameters of the pulse wave of blood supply in the intraosseous and paraossal tissues of the components of the hip joints in patients with Perthes disease were determined. The totality includes patients of different ages, regardless of the course of tissue regeneration in the femoral head. It was revealed that in the patient population there were no statistically significant differences between the confidence intervals of the pulse wave parameters in the paraossal ileum and proximal femur, as well as in the intraosseous tissues of the ileum, the femoral head and outside of the proximal metaepiphyseal growth zone, respectively. In this case, the parameters of the pulse wave of blood supply in the paraossal tissues exceed the similar parameters in the intraosseous tissues. As a result, it was possible to compare the parameters of the pulse wave of blood supply to patients with options for bone pathology with the parameters of the pulse wave of the population of patients to identify the characteristic features of the pathology of blood circulation and damage to the vascular bed.

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秋明州地区居民的慢性扁扁桃体炎的流行及其临床特点  
**PREVALENCE OF CHRONIC TONSILLITIS AND PECULIARITIES  
OF ITS CLINICAL CURRENT IN RESIDENTS OF THE TYUMEN  
REGION**

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抽象。 本文介绍了过去四年(2015-2018年)俄罗斯北部地区(秋明州地区)儿童,青少年和成人的慢性扁扁桃体炎(CT)的患病率。 结果表明,在所有研究组中,该地区国家地区儿童的化学疗法发生率是儿童的3倍,青少年是2倍。 整个地区成年人的发病率有所不同。 对106位接受化疗的患者的门诊病历图的分析表明,只有20.8%的患者曾有过喉咙痛的病史,更多的情况是患者担心从腔隙塞中排出的东西有难闻的气味(64.2%)和喉咙不适。 延长的亚热状态(分别为83、3和87.7)。 在21.7%的患者中,已证实复发性扁扁桃体旁脓肿无心绞痛病史。

关键词: 慢性扁扁桃体炎; 发病率; 俄罗斯北部地区

**Abstract.** *The article presents the prevalence of chronic tonsillitis (CT) in children, adolescents and adults in the northern region of Russia (Tyumen region) over the past 4 years (2015-2018). It was shown that in all studied groups the incidence of chemotherapy is 3 times higher in children and 2 times higher in adolescents in the national districts of the region. The incidence among adults throughout the region varies in the same numbers. An analysis of 106 outpatient charts of patients with chemotherapy revealed that only 20.8% of patients had a history of previously experienced sore throats, more often patients were concerned about discharge from lacunar plugs with an unpleasant odor (64.2%) and discomfort in the throat with prolonged subfebrile condition (83, 3 and 87.7, respectively). In 21.7% of patients, a recurrent paratonsillar abscess was verified without a history of angina.*

**Keywords:** *chronic tonsillitis, incidence, northern region of Russia*

**Introduction.** WHO declared 2019 the year of tonsillar pathology, and this is no accident, because chronic tonsillitis (CT) and is currently a common disease, both among various population groups and their place of residence. Thus,

the prevalence of chemotherapy according to various authors is from 0.8 to 45% [1,2,3,4,]. In the harsh climate of Siberia, chronic diseases of the tonsils are found in 25-42% of the population [6]. In certain age groups in adults and children, this indicator reaches 230 and 190 cases per 1000 persons of the corresponding age. Thomson C. et al., (1996) revealed the highest incidence in the age group of 16–20 years, explaining this by the increased virulence of microorganisms and a decrease in the reactivity of the organism [7].

**Materials and methods.** The incidence of chronic tonsillitis was studied among various population groups in the northern region of Russia: children (D), adolescents (P) and adults (B) over the past five years (2014 - 2018), living in the Tyumen region, the territory of which extends from Of the Arctic Ocean to the border with Kazakhstan (Table 1).

The incidence of chronic tonsillitis among various age groups of the Tyumen region

**Table 1**

State	2014			2015			2016			2017			2018		
	Ch.	Ad.	A	Ch.	Ad.	A	Ch.	Ad.	A	Ch.	Ad.	A	Ch.	Ad.	A
Yamal	931 2,1	169 0,32	306 1,6	1000 2,0	155 0,3	310 1,6	2005 4,0	205 0,4	402 0,6	2240 4,2	280 0,5	480 0,7	503 0,9	296 0,6	443 0,8
KMAO	2910 2,2	307 0,3	620 0,5	2992 2,1	350 0,3	790 0,6	2854 2,1	350 0,3	1008 0,8	3100 2,4	408 0,4	1200 0,4	2946 0,9	768 0,2	1185 0,1
Tyumen	1461 2,7	182 0,4	623 1,2	1567 2,8	260 0,5	727 1,3	1488 2,7	189 0,3	768 1,4	1581 2,1	280 0,5	794 1,4	694 0,9	193 0,8	418 0,7
South of state	642 0,6	240 0,2	511 0,6	912 1,1	261 0,3	562 0,7	719 0,9	241 0,3	545 0,7	810 1,0	251 0,3	560 0,7	762 0,6	404 0,4	530 0,5

Remark: Ch. – children, Ad. – adolescents, A – adults, KMAO - Khanty-Mansi Autonomous Okrug,

**Results and discussion.** The results (Table 1) show that there is an increase in the incidence of chronic tonsillitis over the years both in all studied groups and throughout the region. However, the largest increase in the incidence is observed in the autonomous national districts (Yamal-Nenets Autonomous Okrug and Khanty-Mansi Autonomous Okrug), which, compared with the south of the region, is more than three times higher in children and two times in adolescents. The incidence among adults throughout the region varies in the same numbers.

We are inclined to explain the high incidence of chronic tonsillitis among residents in the northern districts of the region due to the severe climatic conditions of the latter, the leading among which is cold. It is known that cooling reduces the body's resistance to infection and, ultimately, leads to inhibition of immunological reactivity. That is why, tonsils, being in essence their "first line of defense", are most often involved in the pathological process.

At the same time, beginning in 2014, residents of the south of the region, in all age groups, also have a tendency to increase the number of patients with chronic tonsillitis, which is due, in our opinion, to the migration of part of the population from the northern districts to their permanent residence in the agricultural areas of the south of the region.

It should be noted that in recent decades, the clinical course of almost all diseases known to medicine has changed. The latter circumstance is especially significant for chronic tonsillitis as an infectious-allergic disease. To clarify the features of the clinical course of chronic tonsillitis in people living in extreme conditions of the North of Siberia, we analyzed case histories and outpatient records in 106 patients with chronic heart disease aged 17 years and older who came to the ENT clinic.

The analysis showed that only 20.8% of patients had a previous history of angina. But much more often, patients with HT were worried about discharge from lacunar plugs with an unpleasant odor (64.2%) and unpleasant sensations in the throat with prolonged subfebrile condition (83.3 and 87.7, respectively). Quite often (21.7%), a recurrent paratonsillar abscess was verified without a history of angina, which is obviously due to the latent course of the so-called “non-angina” form of chemotherapy. The observed group of patients underwent, as a rule, conservative treatment of chemotherapy in the form of low-frequency ultrasound (NUZ-therapy) using the Tonsillor apparatus. As a local immunotherapy, the biologically active preparation Tonsilgon N of the German company Bionorisa was prescribed 25 drops once a day for 2 weeks, in the absence of the effect of conservative treatment, a bilateral tonsillectomy was performed.

**Conclusions.** The revealed features of the clinical course of chemotherapy are associated, in our opinion, primarily with changes in the environment - environmental degradation, which entails a change in the state of immunity, as well as the uncontrolled use of antibiotics, which leads to the emergence of mutable and more resistant strains of microorganisms. All this together leads to a change in the clinical picture of the disease.

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bishof-plus多矿物质成分对链脲佐菌素糖尿病大鼠中镁, 锌, 铁和铜缺乏症的纠正效果评估

**EVALUATION OF THE EFFICIENCY OF BISHOF-PLUS  
POLYMINERAL COMPOSITION IN CORRECTION OF  
MAGNESIUM, ZINC, IRON AND COPPER DEFICIENCY IN RATS  
WITH STREPTOZOTOCIN DIABETES**

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抽象。在大鼠实验中, 雄性通过静脉内注射剂量为50 mg / kg的链脲佐菌素模拟糖尿病的病理。在4周后的大鼠中, 观察到了持续性病理的发展(血浆葡萄糖显着增加, 伴随着一般状况的恶化, 行为反应的抑制, 血液和红细胞中镁的减少以及多滑性的发展)。对这些大鼠进行为期6周的胃内引入多矿物质成分bishof-plus不会影响血浆葡萄糖水平, 但同时明显促进了多性性交动力学的降低; 改善了动物的整体状况, 行为反应, 低血镁水平在动物血液和器官中的含量, 以及在器官和组织中其他生物金属的含量。

关键字: 链脲佐菌素糖尿病, 雄性大鼠, 葡萄糖, 血液, 多精症, 多矿物质组成bishof-plus, 补偿。

**Abstract.** *In experiments on rats, males modeled the pathology of diabetes with a single intravenous injection of streptozotocin at a dose of 50 mg/kg. The development of persistent pathology (significant increase in glucose in blood plasma with the accompanying deterioration of the general condition, suppression of behavioral reactions, decrease in magnesium in the blood and red blood cells and the development of polysplenicity) was observed in rats after 4 weeks. Course 6-week intragastric introduction of these rats polymineral composition bishof-plus did not affect blood plasma glucose levels, but at the same time clearly contributed to the decrease in the dynamics of polysexizos: improved the overall condition of animals, behavioral reactions, leveled hypomagnesemia in the blood and organs of animals, as well as the content of other biometals in organs and tissues.*

**Keywords:** *streptozotocin diabetes, male rats, glucose, blood, polysplenicity, polymineral composition bishof-plus, compensation.*

### **Introduction**

In endocrine diseases an important role is assigned to concomitant changes associated with impaired metabolism [4; 7], which often makes it difficult to choose a drug. It has been shown that in patients with diabetes mellitus, zinc-deficient and iron-deficient conditions can be observed [8], as well as insufficiency of a number of such biometals such as magnesium and copper. These nutrients are important components of the regulation of carbohydrate metabolism [2; 8] affect glucose metabolism and insulin reactions.

For the prevention and correction of polymicroelementoses, mainly foreign multicomponent preparations with erganizers that increase the bioavailability of the main component (Magne B6), as well as Calcemin advance, Beresh-plus drops, which also include magnesium, are mainly used. Over the years, the Volgograd State Medical University has been actively developing and researching new polymineral compositions created on the basis of a standardized bischofite solution [5, 6]. One of these is the low-toxic polymineral composition Bishof -plus, which contains a standardized solution of bischofite with the addition of salts of Fe (II), Cu, Zn, Mg. Pharmacological studies in this composition revealed a high degree of compensation for nutritional deficiency of magnesium, as well as compensation of copper and zinc in rats with a deficiency of copper and zinc [2]. Given the presented data, it was considered appropriate to study the effectiveness of the Bishof -plus polymineral composition in rats with experimental streptozotocin diabetes and with the concomitant development of a deficiency of a number of biometals (such as zinc, copper, magnesium, iron).

The purpose of the study was to evaluate the effectiveness of the use of the bishof-plus polymineral composition against the background of a deficiency of magnesium, zinc, copper and iron in rats with streptozotocin diabetes.

### **Research methods**

The experiments were carried out on 70 male rats 3.5-4 months of age, delivered from the nursery of the Federal State Unitary Enterprise "Research Institute of Hygiene, Toxicology and Occupational Pathology" of the Federal Medical and Biological Agency (Volgograd), and passed 2-week quarantine. Keeping animals and conducting research was in accordance with the rules of laboratory practice of the Russian Federation (Order of the Ministry of Health of the Russian Federation dated 06.06.2003, № 267, and the international recommendations of the European convention for the protection of vertebrate animals used in experimental studies [3]. After quarantine, animals were divided into 2 groups: the first group was an intact control, in which there were 10 male rats, the second group was 60 male rats, an experimental one, on which experimental diabetes was simulated. When forming the groups, the general condition and weight of the animals was taken into account (the spread in weight in the groups was no more than 10%).

Modeling of diabetes was carried out in two stages.

At the first stage, in experimental male rats, after daily food deprivation, streptozotocin (N-nitroso derivatives of glucosamine, gross formula C<sub>8</sub>H<sub>15</sub>N<sub>3</sub>O<sub>7</sub>) (Sigma, USA) was administered once intravenously (in the tail vein) at a dose of 50 mg/kg [9;10]. On the second day, in the blood plasma of these rats, the glucose level was measured. For subsequent participation in the experiment, only those rats were selected whose plasma glucose level was more than 7 mmol/l. Based on the measurement data, 50 male diabetic rats were selected, which were subsequently divided into 2 equal groups (25 individuals) of control and experimental diabetics. During the experiment, animals (the intact group, as well as the control and experimental groups of diabetics) were housed in standard polycarbonate cages of 5 animals each with free access to water and food [D12451 "The Original High-Fat Diet"].

Rat observations were performed daily for the first 4 weeks. Noted: general condition, water and feed intake. In males of all groups, plasma glucose levels were measured weekly (enzymatic method using the Bio-La Test Czech Republic, Lahema diagnostic kits) and magnesium (spectrophotometric method by color reaction with titanium yellow). At the end of 4 weeks in the blood plasma in animals, the copper content was additionally examined by the color reaction with batocuproin, the total iron binding capacity and transferrin saturation coefficient (Sigma USA kits were used). When detecting the concentration of magnesium in red blood cells below 1.7 mmol/l, animals (5 individuals from each group) were subjected to euthanasia (method of decapitation on the guillotine) and necropsy with the release of: heart, skeletal muscle of the leg, kidney, liver. In these organs, the levels of magnesium, zinc, iron and copper were measured by atomic absorption spectrophotometry (spectrophotometer SF-115-M1).

At the 2nd stage, the experimental group of rat male diabetics was injected intragastrically from 5 to 11 weeks with the bishof-plus polymineral composition at a dose of 1 ml/kg [2] with the addition of ascorbic acid at a dose of 1 mg/kg. The control groups of rats of males diabetic and intact were not exposed to any substances. At the end of the bishof-plus course (6 weeks), studies similar to those of the 4th week of the experiment were conducted.

The research results were subjected to statistical processing using the Microsoft Excel and Statistica 6.0 software package and one-way analysis of variance. Reliability was evaluated using Student's t-test and Bonferroni correction.

### Results and discussion

During the first stage of the experiment, it was found that one day after the administration of streptozotocin to rats, the plasma glucose level in 50 individuals increased relative to the intact control by 67.9% ( $p < 0.05$ ). For a subsequent experiment, these rats were divided into 2 groups (25 animals each): 1st group — control of diabetics; 2nd group — test of diabetics. In 4-week observation of the condition in diabetic rats, the following was noted: deterioration of the coat, which became hard, dull with an unkempt yellowish-grayish tint; decreased mobility and reactions to external stimuli. Food activity practically did not change, while drinking activity increased 2.5 times ( $p < 0.05$ ). The dynamics of changes in body weight in diabetic rats throughout the experiment (despite the fact that all animals were on a high-calorie diet) was negative (over a 4-week period, their body weight decreased by 25.2% relative to the initial data ( $p < 0.05$ ), whereas during this period in intact control, the increase in body weight was 15.6%,  $p < 0.05$ ).

According to the results of glucose measurements (table 1), it was noted that in the blood plasma of intact rats its level was  $4.5 \pm 0.30$  mmol/l, and in rats in the experimental group of diabetics it was  $7.3 \pm 0.19$  mmol/l. The increase in glucose in these rats was subsequently noted. At the 2nd and 4th week, plasma glucose levels were: in the control diabetics,  $21.1 \pm 2.23$  mmol/l ( $p < 0.05$ ) and  $30.8 \pm 2.91$  mmol/l ( $p < 0.05$ ), and in experimental -  $23.0 \pm 1.93$  ( $p < 0.05$ ) and  $32.9 \pm 2.42$  ( $p < 0.05$ ), respectively. In the same periods of measurements (2 and 4 weeks of the experiment) in diabetic rats, relative to the intact control, a decrease in the level of magnesium in blood plasma was recorded, respectively, by 45.6% ( $p < 0.05$ ) and 39.3% ( $p < 0.05$ ) and erythrocytes — by 22.8% ( $p < 0.05$ ) and 26.7% ( $p < 0.05$ ) (tab. 2).

A study of ferrokinetics (end of the 4th week of the experiment) in diabetic rats (tab. 4) revealed: an increase in the total iron binding capacity in the blood by 17.1% ( $p > 0.05$ ) and a decrease in the transferrin saturation coefficient by 2.2% ( $p > 0.05$ ). According to the results of measurements of their content of magnesium, copper, zinc and iron in organs and tissues isolated after euthanasia, the following was recorded: a decrease in magnesium - in the heart muscle by 10.8% ( $p < 0.05$ ), in the liver - by 18.8% ( $p < 0.05$ ), in the skeletal muscle of the leg, by

9.4 ( $p > 0.05$ ) compared to the intact control; a decrease in copper in the heart was 19.1% ( $p < 0.05$ ), in the skeletal muscle of the leg by 24.5% ( $p < 0.05$ ); a decrease in zinc in the heart - by 22.6% ( $p < 0.05$ ), in the skeletal muscle of the lower leg - by 40.3% ( $p < 0.05$ ), in plasma - by 17.6% ( $p < 0.05$ ). Moreover, the iron levels in the studied organs in these rats were not unambiguous without statistically significant intergroup differences.

**Table 1.** Plasma glucose level (mol/l) in male rats with experimental streptozotocin diabetes who received intragastrically from 5 to 11 weeks of the experiment, the composition "Bishof-plus" at a dose of 1.0 ml/kg ( $M \pm m$ )

Measurement period (weeks)	Control (intact)	Streptozotocin 45 mg/kg (once)	
		Control -1	Experiment ♦
Start of experiment	4,5±0,29	7,3±0,18	7,7±0,15
2	4,8±0,31	21,1±2,23*	23,0±1,93*
4	5,1±0,59	30,8±2,91*	32,9±2,42*
5	5,3±0,44	30,9±2,78*	34,9±2,83*
8	4,5±0,05	32,7±3,21*	39,6±1,48*
10	4,4±0,05	33,8±4,18*	38,5±3,14*
11	5,2±0,41	34,1±4,62*	39,2±2,91*

Note:

\* – statistically significant in relation to the group of intact animals, with  $P < 0,05$ .

Thus, based on the results obtained at the first stage of the research, we can conclude that animals with a single exposure to streptozotocin have persistent dynamics of experimental diabetes mellitus development with concomitant polymeroelementosis of varying severity. In this regard, at the second stage, starting from the 5th week of the experiment and ending with the 11th week, the experimental group of male diabetic rats was intragastrically administered 6 times a week with the bishof-plus polymineral composition at a dose of 1.0 ml/kg with the addition of ascorbic acid. The results of observations of animals revealed that, in comparison with the control group of male diabetics, the experimental group of male diabetics against the background of the preparation of the bishof-plus polymineral composition with the addition of ascorbic acid, the body weight dynamics also continued to be negative, but their mobility was activated and reactions to external stimuli increased. According to the results of body mass measurements, it was noted that by the end of the course of administration of the polymineral composition, the total weight loss in male diabetics in the experimental group was 26.3% ( $p < 0.05$ ), whereas in the control group of males with diabetes -34.8% ( $p < 0.05$ ). When measuring the glucose level, no differences were found in rats

in the groups of experimental and control diabetics (tab. 1), but with respect to the intact control, they were significantly higher by 7.5 times. At the same time, in male rats in the experimental group, a gradual increase in the level of magnesium in blood plasma and in erythrocytes was also recorded (tab. 2). A distinct dynamics of this increase in experimental animals was recorded at the 3rd week of administration of the bishof-plus polymineral composition and by the end of the experiment, while the level of magnesium in the blood plasma in the experimental group increased by 84% ( $p<0.05$ ) relative to the control group of diabetics and almost completely consistent with the control data intact. Over the same period, the level of erythrocyte magnesium in experimental diabetic rats increased by 15.1% ( $p<0.05$ ) after 3 weeks of administration of the polymineral composition, and its full restoration to intact control was recorded at the end of the experiment.

**Table 2.** The level of magnesium in the plasma and red blood cells (mol/l) of male rats with experimental streptozotocin diabetes, who received intragastrically from 5 to 11 weeks of the experiment, the composition "Bishof-plus" at a dose of 1.0 ml/kg ( $M\pm m$ )

Measurement period (weeks)	Control (intact)	Streptozotocin 45 mg/kg (once)	
		Control -1	Experiment ♦
<i>Plasma</i>			
Start of experiment	1,29±0,05	1,31±0,03	1,30±0,03
2	1,30±0,07	0,72±0,03*	0,79±0,03*
4	1,22±0,04	0,74±0,03*	0,67±0,02*
5	1,18±0,04	0,67±0,05*	0,64±0,04*
8	1,33±0,11	0,77±0,82*	0,95±0,12*
10	1,25±0,09	0,57±0,04*	1,05±0,11**
11	1,21±0,07	0,45±0,05*	1,29±0,08**
<i>Erythrocytes</i>			
Start of experiment	2,03±0,04	2,04±0,02	2,05±0,03
2	2,02±0,06	1,56±0,03*	1,56±0,03*
4	2,02±0,04	1,48±0,03*	1,47±0,02*
5	1,98±0,04	1,44±0,02*	1,42±0,03*
8	1,97±0,09	1,39±0,03*	1,60±0,04*,**
10	1,97±0,02	1,33±0,02*	1,68±0,04*,**
11	1,93±0,04	1,25±0,05*	2,01±0,08**

**Table 3**

The content of magnesium, zinc, copper in the organs of male rats (mg/kg) with experimental streptozotocin diabetes, who received intragastrically from 5 to 11 weeks of the experiment, the composition "Bishof-plus" at a dose of 1.0 ml/kg ( $M \pm m$ )

Studied parameters		Frequency of measurement (weeks)	Control (intact)	Streptozotocin 45 mg/kg (once)	
				Control -1	Experiment ♦
Magnesium	Heart	5	161,24±	143,75±	138,80±
		11	170,04±	132,87±	163,07±
	Muscle	5	115,46±	104,58±	108,93±
		11	117,32±	92,75±	128,03±
	Kidney	5	106,68±	109,75±	113,35±
		11	114,42±	91,93±	116,83±
Liver	5	155,24±	126,10±	129,55±	
	11	157,26±	119,25±	159,32±	
Copper	Heart	5	7,32±	5,92±	5,84±
		11	8,27±	5,47±	8,42±
	Muscle	5	5,95±	4,49±	4,52±
		11	6,87±	4,55±	6,94±
Zinc	Heart	5	18,79±	14,55±	13,90±
		11	19,38±	12,98±	19,03±
	Muscle	5	8,49±	5,07±	4,99±
		11	9,51±	4,28±	8,45±
zinc	Plasma (µmol/l)	5	14,90±	12,28±	10,85±
		11	15,54±	10,30±	13,68±
Iron	Total iron binding capacity (µmol/l)	5	85,62±	100,25±	103,16±
		11	95,63±	107,77±	100,91±
	Transferrin saturation coefficient (µmol/l)	5	44,80±	43,81±	42,49±
		11	45,81±	44,75±	45,83±

Note: \* – differences are statistically significant in relation to the group of intact animals, with  $P < 0,05$ ; \*\* – differences are statistically significant in relation to the control group of animals, with  $P < 0,05$ .

After animal euthanasia and necropsy performed at the end of the course administration of the bishof-plus polymineral composition, it was found that in the animals in the experimental group, the iron binding ability and transferrin saturation coefficient did not differ significantly from the control groups (table 3). According to the results of quantitative measurements of the content of macro- and microelements in organs, it was found that in the group of experimental rats diabetics relative to the control group of diabetics, the level of magnesium increased: in the heart by 22.7% ( $p < 0.05$ ), in the skeletal muscle of the leg, by 38, 0% ( $p < 0.05$ ), in the kidneys - by 27.1% ( $p < 0.05$ ), in the liver - by 33.6% ( $p < 0.05$ ). The copper content in the experimental group of diabetics significantly increased in plasma by 2.7%. In the heart and skeletal muscle, the level of copper in experimental males did not differ from the data of intact control, but was significantly higher than in the control group of diabetics: in the heart - by 53.9% ( $p < 0.05$ ), in skeletal muscles - by 52.5 % ( $p < 0.05$ ), in erythrocytes - by 18.9% ( $p < 0.05$ ), in the liver and kidneys by 18.6% ( $p > 0.05$ ) and 3.7% ( $p > 0,05$ ), respectively. The content of zinc in plasma, kidneys and liver for the same period of time in the experimental group of males did not statistically significantly differ from the values of the intact group of animals, while relative to the control group of diabetics it increased: in the heart by 46.6% ( $p < 0.05$ ) and skeletal muscle of the leg - by 97.4% ( $p < 0.05$ ). The iron content in the organs of experimental rats did not change in comparison with the control group of diabetics.

### Conclusions

In male rats, after a single administration of streptozotocin (at a dose of 45 mg/kg) for 4 weeks, a clear dynamics of the development of diabetes mellitus was observed. This pathology was accompanied by: a deterioration in the general condition of animals, weight loss and a distinct increase in glucose levels in blood plasma and red blood cells, the presence of polymicroelementoses. In the organs of diabetic rats, the content of such nutrients as zinc, copper, magnesium and iron was disturbed. The course administration for 6 weeks to rats with experimental diabetes mellitus of the bishof-plus polymineral composition at a dose of 1 ml/kg with the addition of ascorbic acid did not affect plasma glucose and erythrocytes. With the introduction of the studied polymineral composition to diabetic rats, the dynamics of the manifestations of polymicroelementoses were revealed, namely, an improvement in the general condition of animals, activation of behavior, compensation of hypomagnesemia in the blood and organs, as well as the content of other biometals in organs and tissues.

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研究单个和混合电解质溶液中的热导率  
**TO THE STUDY OF THERMAL CONDUCTIVITY IN SOLUTIONS  
OF INDIVIDUAL AND MIXED ELECTROLYTES**

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抽象。作为电解质水溶液的等离子体-流体动力学概念的一部分，提出了用于估计热导率的理论模型。所提供的模型使您可以获取各种浓度和温度范围内的各种电解质及其混合物的导热系数值。

关键词：热导率，等离子体流体力学理论，电解质，传输性质，电解质混合物。

**Abstract.** *A theoretical model for estimating the thermal conductivity is presented as part of the plasma-hydrodynamic concept of aqueous electrolyte solutions. The presented model allows you to get the values of the thermal conductivity coefficient of individual electrolytes and their mixtures in a wide range of concentrations and temperatures.*

**Keywords:** *thermal conductivity, plasma-hydrodynamic theory, electrolytes, transport proper-ties, mixtures of electrolytes.*

### **Introduction**

The plasma-hydrodynamic concept of aqueous solutions of electrolytes was developed at the Department of Inorganic and Analytical Chemistry of the East Siberian State University of Technology and Management by Professor Baldanov M.M. and Professor Tanganov B.B. [1-5]. At pre-sent, the theoretical model is being developed and expanded by one of the co-authors of this work in relation to strong and weak electrolytes, not only in aqueous solution, but in many organic sol-vents [6-7].

### **Purpose of the study**

Electrolyte solutions are widely used in many industries. The available values of the thermal conductivity coefficients of electrolytes are given in small ranges of temperatures and concentra-tions. Information on the values of

thermal conductivity of electrolyte mixtures is practically absent. Therefore, the study of the characteristics of electrolytes and their mixtures requires further detailed study.

**Research methods**

The concept of a plasma-like state of ions in electrolyte solutions is applicable for assessing the thermal conductivity of aqueous solutions of electrolytes and their mixtures [8–9]. The transfer of the amount of energy in aqueous solutions of individual electrolytes is based on the ion-dipole interaction, which is taken into account in the equations for estimating the solvation numbers of ions with known radii, masses and radii of solvated ions. To solve the problem of assessing the thermal conductivity of multicomponent aqueous solutions of electrolytes, the reduced masses of solvated and non-solvated ions were taken into account [10-14]. That made it possible to theoretically determine the coefficient of thermal conductivity of aqueous solutions of a mixture of electrolytes:

$$\lambda = \frac{\left(\frac{5}{2}RT - 2\hbar\omega\right) \times N_A}{6\pi \times \mu_{(cm)} \times r_{s(cm)} \times b \times \left(1 + \frac{r_{s(cm)}}{r_d}\right)},$$

where R - gas constant; T - temperature, K;  $\hbar\omega = \sqrt{\frac{4\pi \times z_i^2 \times e^2 \times \hbar^2 \times C \times N_A}{1000\mu}}$

- oscillation process energy " association - dissociation ";  $z_i$  elemental charge;  $\hbar$  Planck constant; C - solution concentration, mol/l;  $N_A$  - Avogadro constant;

$\mu = \frac{m_{Kt} \times m_{An}}{m_{Kt} + m_{An}}$  - reduced mass of unsolvated ions;  $m_i$

- mass of unsolvated ion;  $r_{s(cm)} = \frac{r_{s1} \times r_{s2}}{r_{s1} + r_{s2}}$  - radius of solvated ions of

an electrolyte mixture;  $r_s = \frac{N_1}{r_{s1}} + \frac{N_2}{r_{s2}}$  - reduced radius of solvated ions;

$r_s = \sqrt[3]{\frac{25z_i \times e \times p \times \hbar^2 \times n_s}{3M \times R_s \times k_B^2 \times T^2}}$  - radius of solvated electrolyte ions; p - the

dipole moment of a solvent molecule;  $n_s = \frac{z_i e \times R_s^2}{r_i \times p} - \frac{5k_B \times T \times \varepsilon \times R_s^2}{2e \times p}$

- ion solvation number;  $R_s$  - solvent molecule radius;  $r_i$  - ion radius;  $k_B$  - Boltzmann constant;  $\varepsilon$  - dielectric constant;  $M$  - molar mass of solvent;

$b = \frac{z_i^2 \times e^2}{4\varepsilon \times \Delta H^2} \sqrt{\frac{2}{\mu_s} \left( \frac{5}{2} RT - 2\hbar\omega \right)}$  - ion mobility;  $\Delta H$  - energy of intermo-

lecular solvent inter-actions – hydrogen bond energy;  $\mu_s = \frac{m_{s(Kt)} \times m_{s(An)}}{m_{s(Kt)} + m_{s(An)}}$

- reduced mass of solvated ions;  $m_s = m + n_s \times M$  - mass of a solvated ion;

$f = \exp\left(-\sqrt{\frac{4\pi \times z_i^2 \times e^2 \times C \times N_A \times \hbar^2}{1000\mu \times k_B^2 \times T^2}}\right)$  - Maxwellian velocity dis-

tribution function of ions;  $r_d = \sqrt{\frac{1000\varepsilon \times k_B \times T}{4\pi \times z_i^2 \times e^2 \times C \times N_A}}$  Debye screening radius.

### Experimental part

This calculation model made it possible to obtain data on the thermal conductivity coefficient of a large number of individual electrolytes and their mixtures. Below are the data on the thermal conductivity of aqueous solutions of two electrolytes and their mixtures. The presented range of temperatures and concentrations of electrolyte solutions is explained by the fact that this range is convenient for experimental study.

Tables 1 and 2 show the values of the thermal conductivity coefficients of aqueous solutions of individual electrolytes.

**Table 1**  
Thermal conductivity  $\lambda \times 10^3$  [W/(m·K)] of water solution of  $(NH_4)_2SO_4$

C, mol/l	Temperature, K							
	288	293	298	303	308	313	318	323
3	532	538	543	547	555	561	566	572
2	554	559	565	568	575	581	586	591
1	568	573	577	580	587	591	596	600
0,5	590	594	598	601	607	611	615	619
0,1	624	628	631	633	638	641	644	648

**Table 2**
*Thermal conductivity  $\lambda \times 10^3$  [W/(m·K)] of water solution of BaCl<sub>2</sub>*

C, mol/l	Temperature, K							
	288	293	298	303	308	313	318	323
3	543	550	557	563	570	577	584	591
2	570	576	583	589	596	602	609	616
1	587	593	599	605	611	617	623	629
0,5	596	601	607	612	617	622	628	633
0,1	611	616	620	624	628	632	637	641

The problem of thermal conductivity was solved not only for individual electrolytes, but also for aqueous solutions of a mixture of electrolytes with different concentrations. Tables 3 and 4 pre-sent the thermal conductivity data of aqueous solutions of a mixture of two electrolytes.

**Table 3**
*Thermal conductivity  $\lambda \times 10^3$  [W/(m·K)] of an aqueous solution of a mixture of electrolytes (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub> and KBr*

C <sub>1</sub> , mol/l	C <sub>2</sub> , mol/l	Temperature, K							
		288	293	298	303	308	313	318	323
2,5	0,5	577	577	576	576	576	575	575	575
2,0	1,0	572	572	572	572	573	572	573	573
1,5	1,5	559	559	560	560	561	561	563	564
1,0	2,0	538	539	541	542	543	544	546	548
0,5	2,5	510	512	514	516	518	520	523	525

**Table 4**
*Thermal conductivity  $\lambda \times 10^3$  [W/(m·K)] of an aqueous solution of a mixture of electrolytes BaCl<sub>2</sub> and KBr*

C <sub>1</sub> , mol/l	C <sub>2</sub> , mol/l	Temperature, K							
		288	293	298	303	308	313	318	323
2,5	0,5	564	565	567	569	571	572	574	576
2,0	1,0	551	553	555	556	558	560	562	564
1,5	1,5	547	549	551	553	555	556	559	561
1,0	2,0	538	540	542	545	547	549	552	554
0,5	2,5	524	526	528	531	534	536	539	542

The data obtained in the range of concentrations (0.001–3.0 mol/L) and temperatures (288–323 K) were confirmed by the experimental values obtained in the developed and tested apparatus for determining the thermal conductivity of aqueous electrolyte solutions [15]. The experimental setup made it possible to study aqueous solutions of various symmetric and asymmetric electrolytes. In addition, the coefficients of thermal conductivity of aqueous solutions of mixtures

of halides, nitrates and sulfates of mono-, di-, trivalent metals and ammonium were experimentally determined.

### Discussion of the results

Thus, the presented model for calculating the thermal conductivity coefficient in the framework of a plasma-like concept allows one to theoretically evaluate the thermal conductivity of individual and multicomponent electrolyte solutions. The data obtained are in satisfactory agreement with the experimentally obtained and available literary values in the range of concentrations and temperatures. In addition, the calculated and experimental data lie in the range of thermal conductivities characteristic of aqueous solutions of electrolytes [16].

### Conclusions

The proposed model for assessing thermal conductivity allows us to predict values for unexplored electrolytes and their mixtures. The developed set of calculation methods can be used to assess the thermal conductivity of electrolyte solutions in an extended range of concentrations and temperatures in the presence of limited experimental data, as well as in its absence. The calculation model makes it possible to evaluate the thermal conductivity of three-component mixtures of symmetric and asymmetric electrolytes. And in the future, the developed model will allow theoretical estimates of the temperature and concentration dependence of the thermal conductivity of electrolytes in mixed solvents.

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蒸馏方法对杨树芽精油成分的影响

**THE EFFECT OF THE DISTILLATION METHOD ON THE  
COMPOSITION OF ESSENTIAL OILS OF POPLAR BUDS**

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注解。已经进行了实验研究，以使用小型植物从香脂杨树芽中获得香精油，所获得产品的质量取决于油蒸馏的方法。

关键词：香脂杨树芽，加氢蒸馏，精油，成分。

**Annotation.** *Experimental studies have been carried out to obtain essential oil from balsamic poplar buds using a small-sized plant, the quality of the products obtained is estimated depending on the method of oil distillation.*

**Keywords:** *balsamic poplar buds, hydrodistillation, essential oil, composition.*

**Introduction**

Currently, the rapidly growing demand for physiologically and biologically active substances for the needs of medicine, perfumery, the feed and food industries, and the simultaneous depletion of traditional resources of plant raw materials makes more attention to be paid to the problems of finding new raw materials. Moreover, they often turn to the idea of using such parts of plants, which until recently were considered as waste. In forestry and industry, such raw mate-

rials include wood greens, which contain many biologically active components - proteins, lipids, carbohydrates, vitamins, hormones, volatile production. In this regard, measures are being taken to increase the productivity of plantations and reduce the time for growing marketable wood through the use of fast-growing species, among which the first place belongs to poplar.

Buds of poplars growing in the Krasnoyarsk Territory and Khakassia may be promising raw materials for the isolation of essential oils. The content of essential oils in different parts of poplar biomass varies and is on average 4-5% for buds, in shoots with buds they are 2-2.5 times less, in leaves 0.48% [1]. No balsamic essential oils were found in poplar wood; its content is found in trace amounts in lignified shoots and bark. Thus, the main source of essential oils is the kidneys. By the content of essential oil, the vegetative part of balsamic poplar is not inferior to coniferous wood greenery (pine - up to 1.5%, cedar - up to 2.5%, fir - up to 5%), traditionally used to obtain them [2].

The volatile components of poplar are a mixture of substances belonging to different classes of organic compounds. The essential oil of the vegetative part of balsamic poplar growing in the Krasnoyarsk Territory is characterized by a high content of sesquiterpenes (35% of the total volatiles) and sesquiterpene alcohols such as bisabolol (15%) and eudesmole (23%), about 9% of the volatile components 2-phenyl-2-methyl butanoate [3].

Our data show that the essential oils of buds, shoots and poplar leaves have almost the same composition, but a different ratio of components. The total content of sesquiterpenoids in the essential oil of various balsamic poplar tissues was: in the kidneys - 94%, shoots - 93%, leaves - 68% of the total essential oil [1]. For example, in coniferous woody plants, sesquiterpenes account for 5-6%, with the exception of common pine, where their content can reach 16-30% of the sum of essential oils [4].

Among sesquiterpenoids, bisabolene and its oxygen-containing derivatives, as well as eudesmole, are of interest. Sesquiterpene alcohols have antifungal, antibacterial, antitumor, and juvenile activity [5, 6]. This group of compounds is also characteristic of balsamic poplar essential oils of other regions, but their content there is 3-5 times lower [7, 8].

This report presents the results of the isolation of essential oils from poplar buds by distillation in a small-sized plant developed at the Reshetnev Siberian State University of Science and Technology. The distillation method is based on the property of essential oils - to be distilled off with water vapor. Oils under the influence of temperature and moisture pass from the plant material to the vapor phase and are further extracted from distillation waters by various methods, in particular, sedimentation. During steam distillation, part of the essential oil comes into direct contact with the steam supplied for

processing, and in the vapor state it enters the steam stream. Part of the essential oil remaining in the plant tissue undergoes hydrodiffusion due to water, which is located both inside the cells and on the surface, due to condensation of water vapor on the feed.

### **Research methods**

Essential oils were isolated from balsamic poplar buds collected in the vicinity of Krasnoyarsk in March 2018 by hydrodistillation in a pilot plant. The installation is mobile and allows you to use it without reference to the terrain and the room. The installation scheme is given in [9].

The selection of essential oil was carried out from crushed to 3-5 mm of raw material. The distillation was carried out in two stages. The first stage lasted for three hours. Next, the installation was turned off, the raw materials were not unloaded from the installation, a natural process of cooling the installation along with the contents took place. The second stage was carried out a day later, steam stripping continued for another three hours.

Qualitative determination of the component composition of the obtained samples was carried out on an Agilent 5975C-7890A chromatography-mass spectrometer (Agilent, USA) using an Agilent 7683 automatic sampler for liquid samples. A 30-m quartz HP-5 column was used (copolymer of 5% diphenyl- 95% dimethylsiloxane) with an inner diameter of 0.25 mm. The carrier gas is helium with a constant flow of 1.1 ml / min. Column temperature: initial isothermal section 50 C, temperature rise at a speed of 4 C / min from 50 to 200 C (0 min), 10 C / min to 220 C (0 min). The volume of the injected sample is 0.2  $\mu$ l. The evaporator temperature is 280 ° C, the temperature of the ionization chamber is 170 ° C, and the ionization energy is 70 eV. The components were identified by comparison, by the presence and ratio of characteristic fragment ions using a database of standard samples from the NIST05-L mass spectral library, linear retention indices and the AMDIS data processing program (The Automated Mass Spectral Deconvolution and Identification System). The analysis was performed at the Krasnoyarsk regional center for collective use of the Federal Research Center of the Krasnoyarsk Science Center of the SB RAS

### **Research results**

Essential oil of poplar buds according to organoleptic indicators is a clear liquid of light yellow color, has a characteristic poplar smell. It has the following physicochemical characteristics: density 0.97 g/cm<sup>3</sup> at 20 °C, refractive index at 20 °C - 1.48, acid number - 0.98 mg KOH per 1 g of product.

The results of the chromatography-mass spectrometric study indicate that in the process of distillation, the fractions of the essential oil are depleted in monoterpene hydrocarbons and enriched in sesquiterpenoids (table 1).

**Table 1 - Composition of terpheoids of poplar essential oil**

Retention time, min	Total oil content, %		Chemical formula	
	First distillation	Second distillation		
7,979	0,16	-	3-Hexanol	$C_6H_{14}O$
13,213	0,35	-	Linalool	$C_{10}H_{18}O$
15,021	0,33	-	Valeric acid, 3-methylbut-2-enylester	$C_{10}H_{18}O_2$
15,536	-	6,71	Borneol	$C_{10}H_{18}O$
18,113	-	2,56	6,7-Dimethyl-1,2,3,5,8,8a-hexahydronaphthalene	$C_{12}H_{18}$
19,656	0,30	8,08	Benzene, 1,2,4-triethyl	$C_{12}H_{18}$
22,535	0,64	-	Ylangene	$C_{15}H_{24}$
23,295	0,95	-	2-Phenylethyl butanoate	$C_{17}H_{26}O_2$
23,926	0,47	-	a-Bergamotene	$C_{15}H_{24}$
24,077	1,67	16,53	Caryophyllene	$C_{15}H_{24}$
24,572	1,58	1,89	trans-a-Bergamotene	$C_{15}H_{24}$
24,814	0,31	-	Aristolene	$C_{15}H_{24}$
25,142	0,31	24,26	Humulene	$C_{15}H_{24}$
25,214	0,42	1,20	b-Farnesene	$C_{15}H_{24}$
25,536	0,31	-	Acoradien	$C_{15}H_{24}$
25,945	9,06	2,70	a-Amorphene	$C_{15}H_{24}$
26,026	2,71	2,33	a-Curcumene	$C_{15}H_{24}$
26,410	1,40	1,67	Eremophillene	$C_{15}H_{24}$
26,788	2,45	-	Cadinene	$C_{15}H_{24}$
26,904	1,36	-	4-Isopropyl-1,6-dimethyl-1,2,3,4,4a,7-hexahydronaphthalene	$C_{15}H_{24}$
27,256	1,17	1,87	Delta-Cadinene	$C_{15}H_{24}$
27,330	0,43	-	b-Cadinene	$C_{15}H_{24}$
27,834	1,78	-	a-Calacorene	$C_{15}H_{24}$
30,352	2,30	-	Cubenol	$C_{15}H_{26}O$
30,408	6,91	6,84	$\gamma$ -Eudesmol	$C_{15}H_{26}O$
30,620	0,74	-	Hinesol	$C_{15}H_{26}O$
30,934	7,32	5,76	b-Eudesmol	$C_{15}H_{26}O$
31,014	8,11	7,23	a-Eudesmol	$C_{15}H_{26}O$
31,83	11,13	6,39	a-Bisabolol	$C_{15}H_{26}O$

In the first fraction of essential oils, 65% of the compounds were identified, in the second - 96%. From the results of table 1 it can be seen that the fraction of volatile components obtained during the first three hours of distillation consisted of 26% of sesquiterpenoids and 36% of sesquiterpene alcohols, of which 67% was the eudesmole group. Ylangen, bergamotene, cadinene, eremoligenol, and chine-sol were completely distilled off.

In the second fraction, the proportion of sesquiterpenes increased (52.4%), the main components were humulene (24.3%) and kafioffilen (16.5%). The proportion of sesquiterpene alcohols was 26%, of which 76% was the eudeslol group. It should be noted that in the second fraction due to oxidation processes that occurred during the aging of the feed, the proportion of compounds C<sub>10</sub>-C<sub>12</sub> increased. Borneol appeared in the composition of the fraction (6.7% of the total volatile matter).

An analysis of the data showed that steam distillation at the used pilot plant may be appropriate, since it allows fractionation of essential oils during their separation.

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在油菜和芥末混合作物中播种春v子的种子和谷物饲料

## CULTIVATION OF SPRING VETCH FOR SEEDS AND GRAIN FODDER IN MIXED CROPS WITH RAPESEED AND MUSTARD

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抽象。研究的目的是调查在春季油菜混合作物中生长春v菜的割草和谷物饲料品种的方法对种子产量，产量结构和种子播种质量的影响。结果。每公顷播种1.3、0.8、0.6和0.4百万发芽种子的春etch菜与油菜籽混合，导致形成的谷物单产大大超过单种etch菜的单产。对使用耕地（LER）的有效性的评估表明，施用紫菜油菜作物时，1公顷耕地的生产力显著提高：-Lgovskaya 91品种的1.89–2.02倍；Lugovskaya品种的1.82–1.98倍98。通过两种作物的相互作用及其在农耕活动中增强的竞争力，实现了耕地利用的有效性。播种率为40万/公顷，而播种率为130万/公顷，根据品种不同，紫v侵略系数提高了1.59–2.0倍。科学的新颖性。在中乌拉尔条件下，揭示了在油菜籽混合作物中紫v的高效栽培，建立了播种量变化对紫etch种子产量和播种质量的影响。

关键词：紫云英，春季油菜籽，白芥末，混合作物，种子生长，抗倒伏性，生产力，化感作用，土地当量比，竞争系数，侵略性系数，种子质量。

**Abstract. Purpose of the study** - is the investigation of the effect of the method of growing mowing and grain feed varieties of spring vetch in mixed crops with spring rapeseed on seed yield, yield structure, sowing quality of seeds.

**Results.** Sowing spring vetch with a seeding rate of 1.3, 0.8, 0.6, and 0.4 million germinating seeds per hectare mixed with rapeseed leads to the formation of a grain yield significantly exceeding the yield for single-species sowing of vetch. Evaluation of the effectiveness of the use of arable land (LER) shows that when applying vetch-rapeseed crops, the productivity of 1 ha of arable land increases significantly: - 1.89 - 2.02 times in variety Lgovskaya 91; 1.82-1.98

*times in variety Lugovskaya 98. The effectiveness of the use of arable land is achieved through the interaction of both crops and their increased competitiveness in agrocenosis. At a seeding rate of 0.4 million/ha, compared to a sowing rate of 1.3 million/ha, the vetch aggression coefficient, depending on the variety, increases by 1.59 - 2.0 times.*

**Scientific novelty.** *In the conditions of the Middle Urals, a high efficiency of the cultivation of vetch in mixed crops with rapeseed was revealed, the influence of a change in the seeding rate on the yield and sowing quality of vetch seeds was established.*

**Keywords:** *spring vetch, spring rapeseed, white mustard, mixed crops, seed growing, lodging resistance, productivity, allelopathy, ratio of land equivalents, competitiveness coefficient, aggressiveness coefficient, seed quality.*

### **Formulation of the problem**

The growth in livestock production is directly related to the provision of high-protein feed. The country's need for fodder grain of such crops is about 6.0 million tons. Currently, these are produced 4 times less, only 1.6 million tons [1]. One of the little-used areas for increasing the production of concentrated high-protein fodder is expanding crops and increasing the yield of rare leguminous crops, and in particular spring vetch sowing.

Sowing spring vetch - is an annual bean crop grown to produce green mass, hay, haylage and grain, which is almost as good as clover and alfalfa in forage value. On average, vetch seeds contain from 27 to 35% protein, while in straw - 6-10%, in hay - 18-22%, green mass - 3.5%. Compared to other leguminous crops, vetch green mass contains less fiber, does not coarse for a long time, and is readily eaten by animals. The vetch protein is characterized by a high digestibility coefficient, it is well balanced by essential amino acids, including lysine and tryptophan. The high feed productivity of the culture is evidenced by the high availability of 1 un. raw (187-223 g) and digestible (164-196 g) protein [2, 3].

The modern breeding process with spring vetch is aimed at expanding the use of vetch grain in feeding farm animals. New varieties have high productivity with a low content of hydrocyanic acid in the grains protein with an acceptable amount of trypsin inhibitors [4, 5, 6, 7, 8].

When grown on grain, vetch seed plants are prone to lodging. When harvesting them for seeds, certain difficulties arise, that is, this culture needs a densifying, supportive culture, in which the agrophytocenosis will reduce vetch root rot and leaf diseases in wet years, and in the dry years environmental plasticity and stress resistance will increase. In production, this problem has not been solved as for today.

In mixed crops of spring vetch with barley, wheat and oats, the cereal component dominates the bean and the yield of the bean component, compared with single-species crops, is significantly reduced. In this case, the problem of lodging plants and losses during threshing is partially solved.

White mustard and spring rapeseed may be an alternative to the cereal component in mixed crops with vetch. These cabbage crops have a stronger stalk and at the moment of seed ripening in the pods, their leaf apparatus completely dies, which contributes to a greater absorption of solar energy by the second component.

Our previous studies showed that in order to increase the seed yield of spring vetch sowing mowing, it is possible to grow it in mixed crops with spring rapeseed and white mustard, even with a decrease in the seed sowing rate by 55 - 70%. In such agrophytocenoses, the dominant component was vetch, with the ability to intensively grow and capture the aboveground space, and this advantage was especially manifested in conditions of deficit of precipitation at elevated air temperatures [9 p. 78].

### **Methodology and research methods**

The studies were carried out in the FSBSI UFARC of UB RAS within the framework of the State Order of the FASO of Russia in direction 151 and the FSR program on the topic “Theory and principles of the development and formation of cultivation technologies for economically significant crops for the construction of highly productive agrophytocenoses and agroecosystems”.

Field experiments were carried out on dark gray forest loamy soil with a content of: humus 3.91%, N<sub>lh</sub> - 96 mg/kg, P<sub>2</sub>O<sub>5</sub> - 205 mg/kg, K<sub>2</sub>O - 82 mg/kg of soil, pH-5.5, N<sub>G</sub> - 5.85 mmol/100 g of soil, S of the absorbed bases - 27.4 mmol/00 g of soil. The accounting plot area is 13.5 m<sup>2</sup>, the repetition - three times. Complex fertilizer (N<sub>30</sub>P<sub>30</sub>K<sub>30</sub>) was applied during pre-sowing cultivation.

The test was carried out on the vetch variety Lgovskaya 91, and the grain variety Lugovskaya 98. 1.3 million germinating seeds were taken for 100% seed rate per truck. Spring rapeseed (variety Luch) and white mustard (variety Rhapsody) were sown with a norm of 1.25 million germinating seeds per ha. Sowing (May 13-15) was carried out with rolling and subsequent application of the soil herbicide Algorithm at a dose of 200 g/ha (AI clomazone). To control pests, seeds (vetch and rapeseed) were treated with an insecticidal agent and a single insecticidal treatment by vegetation in the budding phase - the beginning of rapeseed flowering.

### **Results**

The weather conditions of 2017 and 2018 were significantly different. 2017 was characterized by arid conditions against the background of elevated temperatures throughout the growing season, while in 2018 the growing season was characterized by a lack of temperatures with excessive moisture. Nevertheless, regard-

less of weather conditions, the single-species crops of the studied vetch varieties were completely dying by the time of ripening, which made it difficult to thresh them.

In polymorphic vetch crops, a decrease in the degree of lodging of plants was noted with a decrease in the rate of seeding of the bean component in the mixture. At the same time, the degree of lodging also depended on the level of the formed crop by bean culture. It should be noted that lodging vetch in polymorphic crops is fundamentally different from lodging in monosowing. The presence of rapeseed and mustard plants in two component mixes prevents the vetch plants from laying on the ground. Between the soil and plants, due to the plasticity of rapeseed and mustard stems, there remains an air cushion with a height of 20 to 30 cm, which does not lead to rotting of the vetch beans and does not complicate the harvesting.

The yield of vetch grain in the Lgovskaya 91 variety in polymorphic crops with rapeseed was 17.2 - 30.6% higher than in single-crop sowing and was at the level of 2.45 - 2.73 t/ha. When sowing vetch with a norm of 0.4 million, the yield of vetch grain was at the control level (table 1).

*Table 1 – Productivity of the spring vetch mowing variety Lgovskaya 91 in polymorphic sowing, 2017-2018*

Variation	Resistance to lodging, score	Productivity, t/ha					
		total	$S_{\bar{x}}$	vetch	$S_{\bar{x}}$	Densifying culture	$S_{\bar{x}}$
1.3 million (contr.)	1	2,09	0,50	2,09	0,44	-	-
1,3 million + rapeseed	2	3,44	0,18	2,73	0,26	0,71	0,08
0,8 million + rapeseed	3	3,38	0,07	2,64	0,54	0,89	0,14
0,6 million + rapeseed	4	3,47	0,11	2,45	0,55	1,02	0,13
0,4 million + rapeseed	4	2,91	0,13	1,98	0,48	0,93	0,16
Rapeseed 1,25 million	5	1,21	0,07	-	-	1,21	0,18
1,3 million + mustard	3	3,59	0,26	2,71	0,30	0,88	0,51
0,8 million + mustard	4	2,93	0,37	1,95	0,14	0,99	0,35
0,6 million + mustard	5	2,99	0,21	1,81	0,14	1,17	0,27
0,4 million + mustard	5	2,86	0,24	1,51	0,11	1,35	0,21
Mustard 1,25 million	5	1,65	0,23	-	-	1,65	0,26
NAV <sub>05</sub>		0,19		0,19		0,11	

There is a trend of decreasing vetch productivity and increasing rapeseed productivity with a decrease in the proportion of bean component in polymorphic crops, but the total gross grain yield per hectare increases significantly. However, mathematical processing of the research results shows that sowing vetch varieties of Lgovskaya 91 with a sowing rate of 1.3, 8.8 and 0.6 million germinating seeds per hectare mixed with rapeseed leads to the formation of an equivalent grain yield.

The yield of vetch grain from the Lgovskaya 91 variety in crops with mustard, with the exception of sowing with a norm of 1.3 million/ha, did not exceed its productivity in single-species sowing, despite the increase in the total yield of the compound.

Assessment of spring vetch grain varieties during cultivation in the conditions of the Middle Urals has not previously been carried out.

The yield and varietal reaction of the Lgovskaya 98 grain-feed variety mixed with rapeseed was at the level of yield and varietal reaction of the Lgovskaya 91 mowing litter. In mixed crops of this variety, In mixed crops of this variety with sowing of 0.8 -1.3 million, yields of vetch 2.21 - 2.23 t/ha were obtained, which is 33.5 - 35.6% higher, with sowing 0.4 - 0.6 million - 1.83 - 1.99 t/ha, 9.6 - 19.2% higher. The total yield of bicomponent mixes ranged from 2.83 to 3.10 t/ha, which is higher than 1.16 - 1.43 t/ha or 69.5 - 85.6% compared to monosowing (table 2).

**Table 2 – Yield of the spring vetch grain-feed variety Lgovskaya 98 in polymorphic sowing, 2017-2018**

Variation	Resistance to lodging, score	Productivity, t/ha					
		total	$S_{\bar{x}}$	vetch	$S_{\bar{x}}$	Densifying culture	$S_{\bar{x}}$
1,3 million (contr.)	1	1,67	0,39	1,67	0,25	-	-
1,3 million + rapeseed	2	2,88	0,13	2,21	0,31	0,67	0,09
0,8 million + rapeseed	3	3,10	0,29	2,23	0,27	0,87	0,14
0,6 million + rapeseed	4	2,83	0,18	1,99	0,26	0,84	0,17
0,4 million + rapeseed	4	2,89	0,20	1,83	0,37	1,07	0,18
Rapeseed 1,25 million	5	1,34	0,37	-	-	1,34	0,14
1,3 million + mustard	3	3,42	0,42	2,65	0,27	0,77	0,48
0,8 million + mustard	4	2,82	0,36	2,05	0,24	0,77	0,36
0,6 million + mustard	4	2,75	0,43	1,93	0,38	0,83	0,33
0,4 million + mustard	5	2,97	0,57	1,83	0,41	1,13	0,20
Mustard 1,25 million	5	1,69	0,31	-		1,69	0,31
NAV <sub>05</sub>		0,18		0,21		0,15	

Sowing vetch variety Lgovskaya 98 mixed with mustard with a sowing rate of 1.3, 8.8 and 0.6 million germinating seeds per hectare leads to the formation of a vetch grain yield exceeding that in monosowing.

The most complete idea of the effectiveness of mixes and the causes of changes occurring within mixed sowing is given by such indicators as the intensity of land use - Land Equivalent Ratio (LER), Competitiveness ratio (CR) and Coefficient of Agressivity (CA) [10].

The LER is used to evaluate the biological effectiveness of mixed sowings. It shows the ratio of the estimated land area required to obtain the same crop yield of each culture in monosowing that was formed on a unit area of mixed sowing. For this,

the crop yield of culture A in a mixed sowing with culture B (Yab) is divided by the crop yield of culture A in a clean sowing (Yaa). The Yab: Yaa ratio shows how much land would be required to produce a Yab crop if culture A were grown in clean sowing. This ratio is also calculated for culture B. The LER criterion can be calculated by the formula:  $LER = LERa + LERb$ , where  $LERa = Yab:Yaa$ ,  $LERb = Yba:Ybb$ .

The competitiveness factor CR is the ratio of the LER of the two component cultures, but taking into account the proportions in which the cultures were seeded.  $CRab = (LERa : LERb) * (Zba : Zab)$ ,  $CRba = (LERb : LERa) * (Zab : Zba)$ , where CRab – the competitiveness coefficient of culture A mixed with culture B; CRba – the competitiveness coefficient of culture B mixed with culture A; Zab and Zba – the ratio of cultures A and B in the mix, expressed in% [10, p.43].

Evaluation of the effectiveness of the use of arable land (LER) shows that with the use of polymorphic rapeseed crops, the productivity of 1 hectare of arable land increases significantly: - 1.89 - 2.02 times for the variety Lgovskaya 91; 1.82-1.98 times for the variety Lugovskaya 98. Such results are achieved due to the lack of antagonism of vetch and rapeseed plants in agrocenosis, and, possibly, due to the presence of positive plant allelopathy (table 3).

**Table 3** – Evaluation of the effectiveness, competitiveness and aggressiveness of crops and changes occurring in mixed sowing, 2017-2018

Variation	LERab, vetch	LERba, rapeseed	LER	CRab vetch	CRba rapeseed	CAab vetch	CAb rapeseed
Lgovskaya 91							
1,3 million + rapeseed	1,31	0,59	1,89	2,23	0,45	1,57	-1,57
0,8 million + rapeseed	1,26	0,74	2,00	2,79	0,95	2,03	-2,03
0,6 million + rapeseed	1,17	0,84	2,02	3,02	1,56	2,42	-2,42
0,4 million + rapeseed	0,95	0,77	1,72	4,00	2,63	2,94	-2,94
$t_{05} \times S_{\bar{x}}$	0,40	0,16	0,48	0,16	0,11	0,16	0,11
1,3 million + mustard	1,33	0,53	1,86	2,49	0,40	0,80	-0,80
0,8 million + mustard	0,96	0,60	1,56	2,59	1,02	0,95	-0,95
0,6 million + mustard	0,89	0,71	1,60	2,71	1,73	1,22	-1,22
0,4 million + mustard	0,74	0,82	1,56	2,94	3,59	1,59	-1,59
$t_{05} \times S_{\bar{x}}$	0,17	0,41	0,51	0,10	0,21	0,10	0,21
Lugovskaya 98							
1,3 million + rapeseed	1,32	0,50	1,82	2,65	0,38	1,75	-1,75
0,8 million + rapeseed	1,34	0,65	1,98	3,34	0,79	2,36	-2,36
0,6 million + rapeseed	1,19	0,63	1,82	4,12	1,14	2,80	-2,80

Variation	LERab, vetch	LERba, rapeseed	LER	CRab vetch	CRba rapeseed	CAab vetch	CAba rapeseed
0,4 million + rapeseed	1,10	0,80	1,89	4,46	2,37	3,51	-3,51
$t_{05} \times S_{\bar{x}}$	0,13	0,09	0,10	0,07	0,06	0,07	0,06
1,3 million + mustard	1,48	0,46	1,94	3,25	0,31	1,02	-1,02
0,8 million + mustard	1,15	0,46	1,60	4,09	0,65	1,41	-1,41
0,6 million + mustard	1,08	0,49	1,57	4,76	0,99	1,85	-1,85
0,4 million + mustard	1,02	0,67	1,69	4,96	2,12	2,65	-2,65
$t_{05} \times S_{\bar{x}}$	0,20	0,39	0,50	0,11	0,23	0,11	0,23

In terms of LER, vetch polymorphic sowings with mustard were inferior to vetch crops with rapeseed.

In mixed crops, when sowing vetch with a norm of 0.6 - 1.3 million germinating seeds per hectare, spring vetch (LERab) makes the main contribution to increasing the efficiency of arable land use due to its predominant competitiveness in agrocenosis (CRab). By lowering the vetch sowing rate to 0.4 million/ha, an increase in yield and arable land efficiency is achieved due to the interaction of both crops (LERad + LERba) and increased competitiveness in the agrocenosis of each crop (CRab and CRba), which probably indicates an increase in the positive plant allelopathy with sparse vetch sowing.

The coefficient of aggressiveness CA is determined based on the change in the yields of both components in the mixture to their expected yield.  $CAab = Yab: (Yaa * Zab) - Yba: (Ybb * Zba)$ . The larger the numerical value of CA, the greater the difference in the competitive ability of the components of the mixture. Both components will have the same CA value, but the sign for the more aggressive component of the mixture will be positive. [10, p. 42-43].

Analyzing the dynamics of changes in the aggressiveness of culture in agrocenosis with rapeseed, an increase in the coefficient of aggressiveness is observed with a decrease in the seeding rate of the vetch. In more sparse vetch crops in an agrocenosis with rapeseed plants, favorable conditions are formed for both crops, but it is the vetch plants that dominate. So at a sowing rate of 0.4 million/ha, compared with a sowing rate of 1.3 million/ha, the coefficient of crop aggressiveness increases in the variety Lgovskaya 91 - 1.87 times (from 1.57 to 2.94), in the variety Lgovskaya 98 - 2.0 times (from 1.75 to 3.51). A similar pattern with less pronounced aggressiveness of vetch is observed in vetch-mustard mixed crops.

The sum of the coefficients of biological effectiveness, competitiveness and aggressiveness (LER + CR + CA) separately for each culture allows us to give a comprehensive assessment of the actual and expected behavior of crops in agrocenosis with a change in the ratio of components.

An assessment of vetch varieties with different vegetation periods and biological features shows the actual dominance of vetch when grown for grain in both vetch rapeseed and vetch mustard crops.

Regardless of the variety, the most unfavorable conditions for the development of rapeseed and mustard will form in the thickened vetch crops, and in sparse sowings, positive allelopathy of the development of rapeseed, mustard and vetch plants is observed. Thus, one can expect lodging in sowing with vetch with a norm of 1.3 million/ha and expect a slight decrease in the yield of vetch grain due to an increase in the yield of cabbage crops in its sparse sowings (0.4 million/ha).

The analysis of the obtained spring vetch sowing seed material showed that, regardless of weather conditions, seeds that meet the requirements of GOST RF 52325-2005 can be obtained annually (table 4). At the same time, in comparison with single-species sowing of a vetch, there is a tendency to increase germination energy, germination and seed weight with a slight decrease in the protein content in vetch grain at its minimum sowing rate.

*Table 4 – Quality of spring vetch seeds in polymorphic crops, 2017 - 2018*

<b>Culture, variety, sowing norm</b>	<b>Energy, %</b>	<b>Germination, %</b>	<b>Mass of 1000 seeds, g</b>	<b>Protein, %</b>
Sowing spring vetch variety Lgovskaya 91				
1,3 million	77	96	67,81	-
1,3 million + rapeseed	78	97	67,05	-
0,8 million + rapeseed	78	96	71,41	-
0,6 million + rapeseed	80	96	69,79	-
0,4 million + rapeseed	71	99	72,13	-
1,3 million + mustard	72	99	65,40	-
0,8 million + mustard	69	99	70,39	-
0,6 million + mustard	72	99	71,85	-
0,4 million + mustard	82	98	72,14	-
Sowing spring vetch variety Lugovskaya 98				
1,3 million	78	98	64,57	29,7
1,3 million. + rapeseed	78	97	63,36	29,5
0,8 million + rapeseed	78	98	63,34	29,9
0,6 million + rapeseed	80	98	64,17	28,8
0,4 million + rapeseed	80	100	64,75	28,3
1,3 million + mustard	88	99	65,96	30,4
0,8 million + mustard	88	100	67,32	30,4
0,6 million + mustard	79	98	67,19	30,8
0,4 million + mustard	80	98	67,43	29,9

The results show that, compared with single-species sowing, in the polymorphic crops, the seed multiplication rate increases significantly, which, when sowing vetch of 0.4 million seeds per hectare, reaches from 73 (Lugovskaya 98) to 81 (Lgovskaya 91). This indicator is higher than the control variant by 3.5 and 3.1 times, respectively (table 5).

**Table 5 – Reproduction rate by vetch variety, 2017-2018**

Variation	Sowing rate, kg/ha	Breeding rate (by grain)	Sowing rate, kg/ha	Breeding rate (by grain)
	Lgovskaya 91		Lugovskaya 98	
1,3 million	79,7	26	81,0	21
1,3 million + rapeseed	79,7	34	81,0	27
0,8 million + rapeseed	49,1	54	49,8	45
0,6 million + rapeseed	36,8	67	37,4	53
0,4 million + rapeseed	24,5	81	24,9	73
1,3 million + mustard	79,7	34	81,0	33
0,8 million + mustard	49,1	40	49,8	41
0,6 million + mustard	36,8	49	37,4	52
0,4 million + mustard	24,5	62	24,9	73

### Discussion and conclusions

The cultivation of rapeseed agrophytocenoses can be an affordable and cheap way to produce feed grain and vetch seeds. The proposed technology in the conditions of the Sverdlovsk Oblast allows you to stably obtain vetch seeds and feed grain with a protein content of 28.3 - 30.8%. At the same time, the productivity of 1 hectare of arable land during the cultivation of rapeseed mixes increases by 1.72 - 2.0 times, and of vetch mustard mixes - by 1.56 - 1.94 times. The process of seed production accelerates significantly due to the increased reproduction rate of seeds ( $K = 27 \dots 81$ ).

The cultivation of vetch grain varieties with a high protein content in the grain, exceeding peas, in mixed crops with rapeseed can be a significant support in the production of feed protein in the Sverdlovsk Oblast and other regions.

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分析区域背景下土地资金状况的某些变化以及生态可持续土地利用的基本原则

**ANALYSIS OF SOME CHANGES IN THE STATE OF THE LAND  
FUND AND THE FUNDAMENTALS OF ECOLOGICALLY  
SUSTAINABLE LAND USE IN A REGIONAL CONTEXT**

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注解。俄罗斯联邦和罗斯托夫地区的农业用地动态分析。分析了该地区土壤肥力的状况及其影响因素。我要指出，农工综合体是罗斯托夫地区国民经济的主要部门之一。它的领土上拥有最丰富的农业土地资源和最肥沃的土壤-黑钙土，因此该地区在农业生产方面处于领先地位。本文还讨论了市场关系发展中土地使用的可持续环境和经济机制的形成。当前，整合经济和环境问题比以往任何时候都更加困难。通过实施对环境和经济无害的概念或综合农业，即土地综合利用，可以实现与保护环境相结合的高效农业生产。

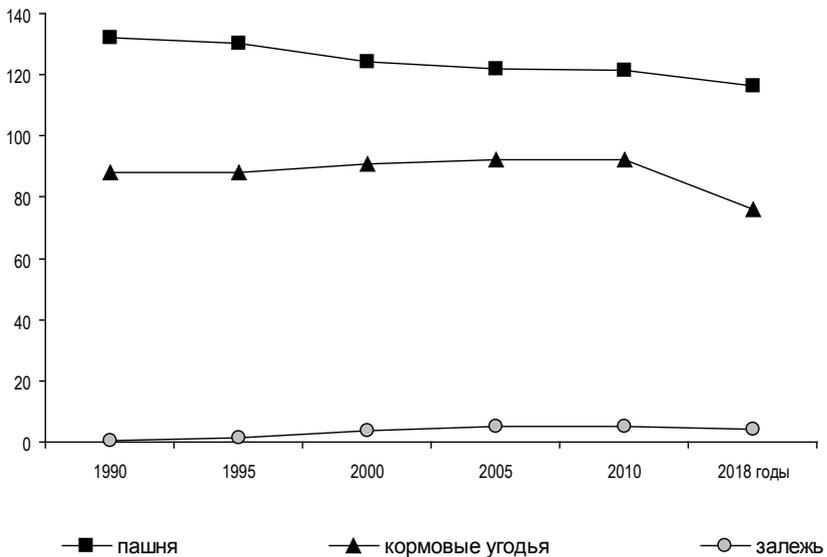
关键词：土地资源，农业转型，变化，农田，土壤，生态状况，经济因素，可持续发展，措施，分析。

**Annotation.** *The analysis of the dynamics of agricultural land in the Russian Federation and the Rostov region. The condition of soil fertility of the region and the factors affecting its decline are analyzed. I would like to note that the agro-industrial complex is one of the main sectors of the national economy of the Rostov region. On its territory are the richest resources of agricultural land and the most fertile soils - chernozems, thanks to which the region occupies a leading position in terms of agricultural production. The article also discusses the formation of a sustainable environmental and economic mechanism of land use in the development of market relations. At present, more than ever, there are difficulties in integrating economic and environmental issues. Efficient agricultural production in unity with protecting the environment can be achieved by implementing the concept of environmentally and economically sound, or integrated agriculture, that is, integrated land use.*

**Keywords:** *land resources, agrarian transformations, changes, agricultural lands, soils, ecological state, economic factors, sustainable development, measures, analysis.*

Over the past decades, as a result of land transformations in the Russian Federation, significant changes have occurred in land relations, legal and organizational and territorial forms of land use, land ownership. These changes also affected the lands occupied by agricultural lands, which are the basis of all agricultural production of the country.

According to the Federal Service for State Registration, Cadastre and Cartography (Rosreestr) (1,2) the area of arable land, which is the most valuable and intensively used agricultural land, for the period 1990-2018. constantly declining (Fig. 1).



**Figure 1** - Dynamics of agricultural land of the Russian Federation for the period 1990-2018, million ha

At the same time, the area of fodder land and deposits decreased. So, a decrease in the area of all the most valuable lands began after 2011. This process took place against the background of a decrease in the area of agricultural land as a whole, which during the period under review changed by 24.7 million hectares (from 222.4 to 197.7 million hectares).

An analysis of the state statistical reporting data shows that the redistribution of areas of all land categories continues in the Russian Federation, which is associated with land transformations being carried out in the country. Over the years, the

loss of agricultural land from circulation was observed within the borders of the Russian Federation while reducing the total area of arable land. But, fluctuations in valuable land over the years were not uniform. In 2011 and 2013, there was a slight increase in the area of arable land due to previously abandoned areas, and in 2012, and by 2018, a decrease. Significant areas of former arable land were converted to fodder land, fallow land, and reserve land, and some of the former arable land that had previously been drained was swampy. In addition, agricultural land within the boundaries of settlements is also involved in development, as these lands are often the most attractive, which leads to a reduction in their area throughout the country. In turn, from the composition of fodder lands (hayfields and pastures) annually areas are eliminated as a result of overgrowing with shrubs and light forests, which are subsequently removed from agricultural land and fall into the forest land category.

These processes are also characteristic of the southern regions of the Russian Federation. Consider the use of land resources on the example of the Rostov region.

Agriculture is one of the main sectors of the national economy of the Rostov region. On its territory are the richest resources of agricultural land and the most fertile soils - chernozems, thanks to which the region occupies a leading position in terms of agricultural production.

The agro-industrial complex of the Rostov region, represented by diversified agricultural and processing enterprises with developed infrastructure, is the largest producer and supplier of agricultural products and raw materials in Russia. According to state accounting in the Rostov region, as of January 1, 2019, agricultural lands occupied 8865.3 thousand ha (87.8% of the oblast's land fund) (3.4). Here, 1.6 thousand agricultural organizations, over 11 thousand peasant (farmer) farms, and over 600 thousand personal farms of citizens are engaged in agricultural production. In total, about 14% of the number employed in the economy is employed in agriculture (5).

The basis of agricultural production in the Rostov region is fertile soil occupied by agricultural land, the most important of which is arable land - land systematically cultivated and used for growing crops. The presence of agricultural land in the Rostov region in 2011 and 2018. given in table. 1.

**Table 1 - Availability of agricultural land in 2011 and 2018 \*, thousand ha**

Region	Total area	Farmland				
		total	в том числе			
			arable land	lode	perennial plantings	forage land
Rostov region	10096,7	8512,4	5866,9	0,0	58,5	2587,0
	10096,7	8211,1	5807,5	0,0	34,3	2369,3

\* In the numerator - data from 2011, in the denominator - 2018.

An analysis of the data shows that the area of these lands has undergone changes during the period under review. In the Rostov region, the area of agricultural land decreased by 29.9 thousand hectares, i.e. by 3.5% of the area in 2011.

The area of arable land slightly decreased - by 59.4 thousand ha (1%), and the area of perennial plantings and fodder land (hayfields and pastures) for the seven-year period in the Rostov region decreased significantly - by 24.2 thousand ha (41.3% ) and, accordingly, on 217.7 thousand ha (8.4%) of the area. In addition, in the Rostov region there was an increase in the area of agricultural land, which is associated with the refinement of information on land plots in the regions. According to the data of land reports of previous years, they were in the category of reserve lands, and according to the Automated Information System of the State Real Estate Cadastre - in agricultural lands, therefore they were transferred to the category of agricultural lands.

One of the major problems of modern land use is the deterioration of the environmental situation and the growth of land degradation in the form of dehumification, increased processes of water and wind erosion, desertification, waterlogging and other negative factors. At the same time, there are no data on monitoring soil fertility, development of agricultural land degradation processes, and geobotanical surveys over the past decades for the territories under consideration. Many materials are outdated and require adjustment.

The analysis of materials characterizing the quality of land showed that the average humus content in the soils of the Rostov region ranges from 3.2 - 3.5% and corresponds to the gradation of slightly humus soils. The data presented allow us to conclude that, over the past 30 years, the humus content in the soils of five of the six agricultural zones of the region decreased by 6% in the southern agricultural zone to 17% in the north-western agricultural zone relative to its initial value. Among most regions of Russia, the Rostov Region also has the largest number of arable land with a humus content less than the minimum - 21.1 thousand ha (82.1%). A significant role in reducing the content of humus in soils is played by the processes of water and wind erosion. The main reasons for the development of erosion processes are, first of all, a high degree of agricultural land development, intensive soil cultivation. Insufficient application of organic and mineral fertilizers, non-observance of the structure of sown areas and anti-erosion agrotechnics lead to land degumification, an increase in alkalinity and carbonate content of soils.

Monitoring data on the state and use of land in the Rostov Region, obtained in 2018, show that, despite the set of measures created in previous years, aimed at protecting land from degradation and maintaining soil fertility, soil-destruction processes in the region continue to expand and progress.

Soil fertility can be maintained and restored only by observing scientifically based farming systems and technological proportions of production, applying organic fertilizers, increasing the area of perennial grasses, resuming drainage, irrigation, reconstruction of existing land reclamation systems and other measures aimed at achieving economic stability and favorable environmental conditions in the field of agricultural production.

The necessary ecological restructuring presents new requirements for environmentally sound agricultural land use. The environmental problem, the problem of saving irreplaceable natural resources are among the basic problems, the solution of which is the most important condition not only for the country to get out of deadlocks, but also for its further development along the path of economic and social progress. On the other hand, environmental imbalance has a negative effect not only on the productive forces of society, but also on production relations, and on the system of organizing economic relations. At the same time, the foundations of agriculture are being undermined and production costs are rising.

At present, more than ever, difficulties are observed in the integration of economic and environmental issues. First of all, this applies to those farms that were subject to stringent state planning mechanisms and now must simultaneously carry out a transition to the market and environmental restructuring. Market economy and competitiveness of agricultural enterprises require the highest productivity, efficiency, low costs and rational use of all available resources.

Efficient agricultural production in unity with protecting the environment can be achieved by implementing the concept of environmentally and economically sound, or integrated agriculture, that is, integrated land use. This principle determines the need for measures to establish within the territory of a specific land use (business entity) a reliable, long-term balance between economic aspirations associated with the use of land resources and other production facilities inextricably linked to the land and the ecological condition of the territory: its natural resources, as means production, operating conditions, conservation and development of natural functions. In other words, at the same time as ensuring efficient production of crop and livestock products, issues of protecting soils, water and landscape in agroecosystems should be addressed. (6).

To take into account environmental restrictions in the market mechanism and an adequate reaction of economic entities to environmental protection, it is necessary to develop appropriate methods and means of managing limited environmental resources, which should be an addition to the tools for managing economic resources without replacing them. Economic limitedness refers to capital in the form of limited material, financial, technological and labor resources, and environmental limitedness is associated with environmental capital in the form of natural resources and their reproduction.

Recognition of the equivalence of environmental and economic interests in the results of economic activities necessitates considering agricultural production as an object of environmental management, since agricultural enterprises are connected not only by production and technological processes, but also by shared natural resources, and the effectiveness of environmental protection. This indicates the importance of creating a sustainability factor and a system of requirements for the environmentally balanced use of natural resources in agriculture, ensuring high living standards of the population and the level of environmental protection.

Among the priority problems of environmental support for agricultural production should be highlighted:

- determination of the ecological potential of agriculture in the country and individual territories;
- forecasts of the ecological status of agricultural regions;
- An assessment of the environmental compatibility of the main agricultural sector development programs.

Thus, the formation of a sustainable economic mechanism for land use in the development of market relations should occur in the following main areas:

- accounting and socio-economic assessment of the natural resource potential and ecological condition of the territory;
- planning of environmental protection and rational use of natural resources;
- financial and credit mechanism for environmental management;
- environmental insurance;
- economic incentives;
- the formation of a market for environmental work and services;
- payment for land use;
- economic impact on violators of environmental laws;
- improvement of organizational and economic methods of land use;
- taking into account environmental factors during privatization, etc.

Thus, any enterprise will be able to best secure long-term success for itself if it evenly distributes responsibility between the economic and environmental spheres, so that results in one sphere cannot be maximized to the detriment of another. According to this concept, the attention of business entities is concentrated on managing the balance between these areas. The question is to create a mechanism for resolving conflicts between them that would facilitate the adoption of decisions that meet the general goals of the agro-industrial complex.

Therefore, based on the foregoing, it can be concluded that, subject to the principles of sustainable land use, the activities of the enterprise should be aimed at optimal interaction between humans and the environment, without disturbing the internal balance of the ecosystem, and without reducing the safety of production, but rather increasing its sustainability, competitiveness and stability functioning.

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