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

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这些会议文集结合了会议的材料 – 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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These Conference Proceedings combine materials of the conference – research papers and thesis reports of scientific workers. They examine technical, juridical and sociological aspects of research issues. Some articles deal with theoretical and methodological approaches and principles of research questions of personality professionalization.

Authors are responsible for the accuracy of cited publications, facts, figures, quotations, statistics, proper names and other information.

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AGRICULTURAL SCIENCES

在区域教育机构的活动中采用综合方法
USING AN INTEGRATED APPROACH IN THE ACTIVITIES OF REGIONAL EDUCATIONAL STRUCTURES

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注解。 本文探讨了教育结构区域一体化的组成部分和类型、教育组织从加入一体化结构中获得的收益、教育经济领域区域一体化结构的形成阶段以及教育经济区域一体化结构的组织和管理机制。 现代条件下教育部门综合结构的工作。
关键词: 区域一体化、一体化方法、教育部门、区域。

Annotation. *The article examines the components and types of regional integration between educational structures, the benefits received by educational organizations from joining integrated structures, the stages of formation of regional integrated structures in the educational sector of the economy, as well as the organizational and managerial mechanism of work of an integrated structure in the educational sector in modern conditions.*

Keywords: *regional integration, integrated approach, educational sector, region.*

In the modern world, with the intensive development of the economy, educational structures need to focus their development on optimizing activities, thereby ensuring the opportunity to compete in both domestic and foreign markets in providing clients with quality education [1].

The development of integrated education in the educational sector of the economy is gaining great importance. This is due to the fact that the level of competition in education is very high due to the provision of similar educational services. Educational structures have to strive to attract clients, develop new educational programs and trajectories, take part in the creation of integrated educational platforms focused on the development and implementation of effective educational projects [2].

Integration between regional educational structures is based on the following components:

- high level of interaction, specification and quantitative assessment of connections;

- life cycle analysis: development strategy, research, technology and stages of project activities, implementation of educational projects, etc.;

- management interaction at all stages for the effective functioning of educational structures in integrated associations.

Currently, there are main types of regional integration used in the educational sector of the economy [3], presented in the figure 1.
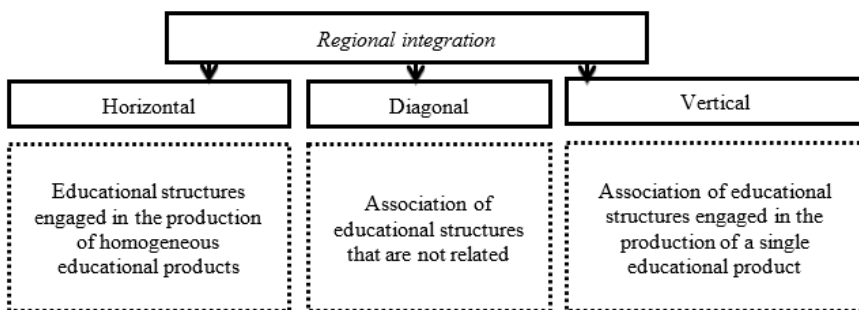
Figure 1. *Types of regional integration used in the educational sector of the economy*

Educational organizations that are part of integrated associations have great potential for development. Thanks to the use of various types of regional integration, they can share some of the functions among themselves for more productive project activities.

The creation of integrated unions in the educational sector helps to increase the efficiency of project activities of educational structures included in these associations [4].

Benefits received by educational structures from joining integrated structures:

- increasing the competitiveness and financial sustainability of educational institutions;

- attracting investment capital, both from the state and the private sector;

- availability of modern equipment and educational platforms;

- growth of design and innovation activity of educational organizations included in this association;

- intensification of scientific research and development of innovative educational programs and projects;

- organizing and conducting advanced training and professional retraining programs for teachers and staff.

Particular attention in regional integrated entities must be paid to the control function. After all, thanks to timely adjustments and additions to the existing program, you can create the desired result.

An integrated approach allows you to establish effective connections within an integrated association. Therefore, integration provides all systems (educational-project, scientific-research, socio-cultural) with competitiveness, since there is long-term promising cooperation [2].

The formation of regional integrated structures in the educational sector of the economy should include the following stages:

1. Determination of the composition of educational organizations included in regional integrated education.

2. Creation of variable relationships between participants in a regional integrated association.

3. Design analysis of all possible options for the integration process.

4. Organizational and economic analysis of the costs of implementing the integration strategy.

5. Creation of an educational product.

6. Evaluating the effectiveness of design and educational activities.

7. Project risk assessment.

8. Summing up, achieving the integration goal.

One of the fundamental conditions for the formation of regional integrated structures in the educational sector is the identification of the main and additional organizations in the interaction model, as well as the presence of an established work mechanism and corresponding conditions and restrictions.

In integrated educational associations, great importance should be given to the integration and management mechanism, which allows planning, organizing, coordinating, and motivating the actions of the association's participants.

The integration and management mechanism in the educational sector of the economy should be understood as many different mechanisms capable of creating, in the interests of an integrated association, its effective activity, adapting to the constantly changing conditions of the external environment [5]. The organizational and managerial mechanism for the operation of an integrated structure in the educational sector can be represented in the form of a system model shown in Figure 2.

There are three most well-known mechanisms of interaction: educational-project, scientific-research, socio-cultural. The most significant integration and management mechanism in the educational sector of the economy is the educational-project one. The educational-project model is the study of certain types of activ-

ities that are closely involved in obtaining and reproducing new knowledge, skills and abilities, as well as their competent implementation [6]. One of the reasons for the development of the educational project model is to increase the level of competitiveness and demand for educational projects and products in the educational services market [6].
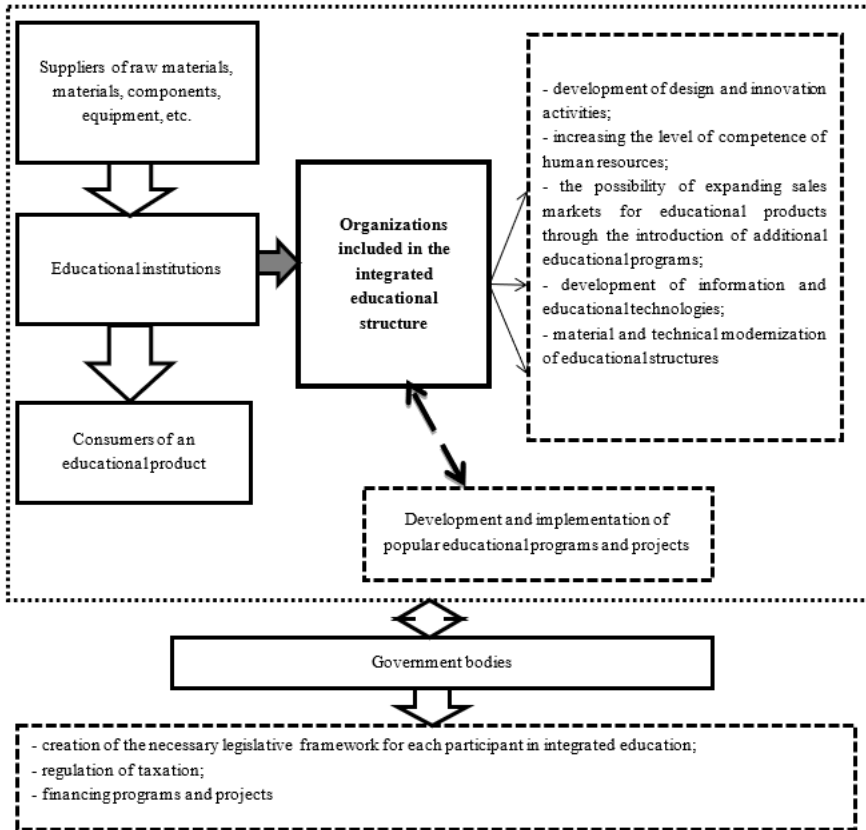
Figure 2. *Organizational and managerial mechanism of work of the integrated structure in the educational sector*

An integrated structure in the educational sector may include two main participants in the educational process. This may include direct educational structures, information services, scientific complexes and laboratories, business incubators, project sites, etc. Each of the participants, as a result of integrated interaction, makes a certain contribution to the result of the joint educational process.

The processes of educational integration of participants directly correlate with the educational programs and projects being developed and implemented. According to E.A. Kolodina, integration means "the interweaving, interpenetration and merging of the reproductive processes of various subjects of educational activity, separated in space, transforming them into an integral, internally fused economic mechanism" [7].

Educational integration is a kind of convergence of educational structures in order to solve important educational problems in the region through the implementation of popular programs and projects. Also, the product of educational integration is the created structural association with the presence of project business connections between its participants. These business connections manifest themselves in a number of ways:

- accumulation of educational resources and impact on them;
- formation of unified educational chains and interaction mechanisms;
- consolidation of organizational structures in integrated associations.

A significant goal of integrated interaction is the possibility of implementing combined protective and economic functions, which form a kind of shield that allows reducing the level of risk and dependence on negative influences from the external environment. The joint efforts of educational structures ensure the preservation of the educational ecosystem, as well as support for its stable and long-term development.

Based on the study, we can conclude that the effect of educational integration is manifested in the development of regional innovation platforms focused on achieving a certain educational result through the implementation of a design-innovation approach. Organizations included in the integrated educational structure are interested in the development and implementation of educational innovative products, accumulating research potential aimed at supporting project activities.

Thus, an integrated approach in the development of the educational sector of the economy plays a significant role, ensuring the modernization of the education sector, the introduction of modern educational programs and technologies, the consistency and balance of joint activities, the intensification of scientific research and development of educational projects, increasing the competitiveness and financial sustainability of educational institutions, attracting additional capital, both from the state and the private sector of the economy.

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金砖国家框架内的数字化改进和全球供应链最佳效率的探索
DIGITAL IMPROVEMENT AND SEARCH FOR OPTIMAL EFFICIENCY OF GLOBAL SUPPLY CHAINS WITHIN THE BRICS FRAMEWORK

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抽象的。 本文概述了金砖国家组织内供应链的现状。 介绍了与该领域相关的主要项目，分析了组织的文章和官方文件，并确定了供应链形成中的主要问题。

关键词：金砖国家、供应链、供应链、物流、中国、俄罗斯、"一带一路"、"南北"。

Abstract. The article offers a general overview of the current state of supply chains within the BRICS organization. The main projects related to this area are presented, articles and official documents of the organization are analyzed, and the main problems in the formation of supply chains are identified.

Keywords: BRICS, supply chains, supply chains, logistics, China, Russia, "One Belt – One Road", "North – South".

In 2024, BRICS moved to a new stage of its development. The entry of new members into the association led to a general increase in economic indicators within the organization. The combined GDP of the participating countries is 26% of the world, and the total population reaches almost 50%.[1]

This sharp growth undoubtedly leads to the emergence of new difficulties and contradictions in the conduct of the organization's activities. Despite the fact that the association itself is not formalized and does not have preferential trade regimes in a multilateral format, which creates difficulties for the introduction of legal and

trade measures that could facilitate the exchange of goods and services between countries.

The BRICS countries are united mostly ideologically rather than economically or politically. Their union forms a new type of association that is ready to work together, where all actions are carried out on a voluntary basis and the desire of states for common development. This idea leads to the use of existing projects and ideas to achieve set goals. An example of this is the North-South project, which will connect the seaports of the Baltic, Persian Gulf and Indian Ocean. This project will connect several members of the association, intersecting with the One Belt – One Road initiative, which will further integrate the BRICS countries and multiply trade effects in mutual trade.

As mentioned earlier, the lack of formalization of the association leads to a certain kind of conflict. This problem can be seen within the framework of the MERCOSUR-EU agreement[2]. Brazil, being simultaneously a member of two associations, MERCOSUR and BRICS, is in a difficult situation. Establishing strong and friendly relations with the two warring parties is becoming a new challenge for the largest country in the region. Despite the complex nature of building relations within the framework of the agreement, both sides are interested in further cooperation and liberalization of trade between the two countries, but the creation of a free trade zone threatens the internal competition of the Latin American association, also putting trade within the BRICS at risk.

Another problem in the formation of supply chains within the association is the very focus of the participating countries on organizing trade in BRICS. Analyzing the Johannesburg Declaration II[3], which is currently the last joint statement of the formation countries, it can be understood that trade at this stage of development is not a primary goal. This is confirmed by the general references to trade in the above-mentioned declaration:

1) The deteriorating economic outlook associated with the fragmentation of the world market (paragraph 26);

2) Trade is one of the main points requiring intensified joint efforts (paragraph 28);

3) The importance of trade and investment potential in the new industrial transition (paragraph 33);

4) The need to implement the African Continental Free Trade Area (AfCFTA) (paragraphs 33-35);

5) The importance of information exchange within the framework of the development of micro, small and medium-sized enterprises (MSMEs) to increase their participation in international trade (paragraph 37);

6) The need to use national currencies when making payments between BRICS member countries (clause 44);

7) The problem of illegal trade in wildlife (paragraph 54);

8) Protest against the use of unjustified barriers to trade within the WTO (paragraph 63);

9) The significance of the decision to monitor all trade flows between the BRICS countries (paragraph 77).

Thus, we can say that trade, although it remains an important aspect for member countries, is regulated entirely within the WTO. The member countries themselves only support the basic principles, emphasizing the importance of free trade and focusing on problematic issues that are particularly important for the organization. A possible obstacle to the creation of special trade measures and the facilitation of its conduct may be the lack of legal personality of the organization, which would better allow it to regulate and control legislation within countries and the development of regions.

Considering the joint statistical publications of the BRICS countries (BRICS Joint Statistical Publication)[4], another type of document issued within the framework of the association, one can also see that domestic trade is not the main priority of the participating countries, since this collection does not have a column for domestic trade, paying attention to only trade with third countries. Based on the data provided in the above-mentioned collection, BRICS targets more social and industrial issues, paying particular attention to indicators such as population, labor force, production and energy indicators, as well as other general economic indicators.

The current lack of accurate recording of material flows on the part of BRICS and the impact of the decisions of the participating countries within the framework of the association does not make it possible to accurately determine the effectiveness of the actions taken to implement corrective actions. But in this case, one should turn to other types of flows in supply chains: information, financial and service flows. The latter, like material ones, are practically not tracked and are not the main priority in the discourse within the association, which cannot be said about the other two.

The movement of information in building and maintaining supply chains is an important part of the modern BRICS agenda. The creation of new joint information centers makes it possible to monitor the required parameters and influence decision-making with greater efficiency. This type of exchange allows minimizing transaction costs and increasing the throughput of transport hubs. Therefore, the creation of digital transport platforms is important for the stable operation of the entire logistics infrastructure. Therefore, the creation of a joint platform between the SCO and BRICS will make it possible to create a "seamless logistics" system, using end-to-end information exchange to ensure interstate exchange of accompanying documentation.[5] Unification and standardization allows us to obtain not

only an increase in the level of efficiency at the intercountry level within an association, but also an increase in this indicator at the level of associations, which makes it possible to create an unhindered system of exchange of goods to an even greater extent.

But due to the increase in the amount of processed data, the question arises about the security of data transmission. The increase in the number of threats in cyberspace leads to difficulties in implementing the above and other platforms. The interaction of the BRICS countries on this issue within the BRICS Rapid Information Security Channel makes it possible to quickly exchange critical information and deal with all types of threats in the shortest possible time.[6] One of the most important goals of this project is to update the regulatory frameworks of the countries involved. This measure will help avoid a large number of collisions and disagreements in the process of forming new projects.

The financial component is also in its active phase. The interaction of countries along this line is occurring at the fastest pace to counter the built-up hegemony of the dollar on the world stage. The creation of an increasing number of digital currencies on the territory of the BRICS countries makes it possible to carry out the required payments and carry out transactions in the shortest possible time. In addition, it is planned to create an intercountry financial information exchange system built on the blockchain system, which will create an independent BRICS settlement system.[7]

The transport component is increasingly becoming the main one when discussing priorities. This category, like the financial one, can already be traced within statistical collections and is becoming increasingly important. The transport component of supplies within the framework of the increasing sanctions policy of Western countries leads to new fluctuations within associations, partly increasing the influence of countries on each other within the formation. A decrease in supplies to third countries leads to a redistribution of trade towards friendly countries, therefore the creation of new transport corridors makes it possible to most effectively redistribute old and create new material flows. A gradual increase in the total length of transport infrastructure makes it possible to create new transport hubs, which are the above-mentioned North-South and One Belt – One Road projects.

Based on published research in the field of transport and transportation within the BRICS, much attention is paid to the innovative component of transportation. Due to the fact that the participating countries are located at a great distance from each other, great emphasis is placed on the creation of high-speed communication chains, their economic and economic potential. Often, it is the last criterion that begins to become decisive when making decisions on critical issues. An example of this is the gasification projects of international transport corridors.[8] Such developments make it possible to increase the economic efficiency of existing and new

supply chains, while simultaneously increasing environmental friendliness, which in turn makes it possible to attract more funds not only from government budgets, but also from private funds.

Another example is plans for the electrification of international transport networks, where the leading player is China, which is a leader in the field of electrification of the economy, including the transport component. Despite the fact that the volume of electrified infrastructure in this area is only 4%, this is ten times higher than similar indicators in the United States[9], and tax incentives, the use of which has been extended until 2027, make it possible to create a competitive environment for the electric vehicle market. The proliferation of Chinese electric vehicles allows existing infrastructure to be tweaked for more efficient trading. In Russia, this expansion is characterized by the obligation of all new electric vehicle charging stations to have the Chinese charger standard, making the European one optional.[10]

Similar changes are happening in other BRICS countries. For example, in India, the Chinese conglomerate BYD is almost two times ahead of Tesla, planning to further capture the electric vehicle market[11], and in Brazil it is planned to open a new production facility for this brand to create a hub in the region.[12]

Increasing the use of electric vehicles is becoming increasingly possible as the BRICS countries have the ability to power so many vehicles with electricity. At the moment, most of the electricity is generated using traditional energy sources, which, although it leaves the issue of environmental friendliness, makes it possible to increase the economic efficiency of electric transport and improve the transport infrastructure in the association. Such a transition is difficult in Western countries, since almost half of all oil production in the world comes from the BRICS countries[13], which does not allow other countries to achieve a similar level of electricity production. This combination of circumstances leads to a decrease in demand, which jeopardizes plans for a complete transition to electric vehicles by 2035.

The formation of supply chains at the present stage of formation is becoming a difficult task, especially for such a formation as BRICS. Despite the fact that China is the largest economy both in the union and in the world, it does not allow achieving the desired results. All BRICS trade is extremely dependent on China and its volumes are mostly accounted for by this country. All supply chains are highly dependent on this country and are almost always the origin of many goods.

New ways are characterized by different categories than before, their efficiency becomes higher, and the requirements of suppliers and consumers change in a different direction. At the moment, it is not only economic interest that is beginning to drive large transnational corporations, which are beginning to introduce an increasing number of new technologies that can influence the buyer's choice. Logistics at this stage begins to change to suit the needs of the consumer [11]. But

in such an association as BRICS, the issue of logistics and trade itself is currently in its infancy. At the moment, it cannot be said that the countries are planning to form new trade routes that would be formed specifically for the needs of the unification. One of the main obstacles in this case is the lack of international legal personality, which does not allow the trade potential of the association to be fully realized. Each of the participating countries is unique and has its own set of unique products, the joint use of which has made it possible to develop at an even greater pace.

In 2024, we should expect new projects in the field of logistics, as Russia becomes the chairman country, and for it the problems of moving goods over long distances are a key problem [12].

BRICS currently pursues other goals, which, although related to the formation of new supply chains, are united only indirectly, and all interaction in this area takes place only on the basis of other international organizations, which limits the possibilities for liberalizing trade and creating their own "rules of the game." "[13] which the world, tired of colonialism and hegemonism, is waiting for [14].

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开发利用虚拟现实创建旅游路线图的投资解决方案
DEVELOPMENT OF AN INVESTMENT SOLUTION FOR THE CREATION OF TOURIST ROUTE MAPS USING VIRTUAL REALITY

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抽象的。 在现代世界发展旅游业时，必须考虑到信息社会形成的主要方向，例如：信息社会人类潜力的开发； 旅游可用性信息； 开发专门的电子媒体旅游； 其中考虑到了文化多样性、身份和不同语言的重点和发展。

在形势不断变化的背景下，旅游公司意识到需要向市场推出新产品和服务。如今，旅游领域的创新是提高竞争力、提高客户兴趣和实现经济增长的主要途径。

关键词：旅游部门的投资政策、旅游部门的特点和问题、创建旅游路线的算法的开发。

Abstract. When developing the tourism sector in the modern world, it is necessary to take into account the main directions of the formation of the information society, such as: development of human potential of the information society; tour availability information; development of specialized electronic media tour; there taken into account the focus and development of cultural diversity, identity and different languages.

Against the backdrop of changing conditions, travel companies are realizing the need to introduce new products and services to the market. Innovation in the field of tourism, today, is the main way to increase competitiveness, increase the level of clientele interest, and achieve economic growth.

Keywords: investment policy in the tourism sector, features and problems of the tourism sector, development of an algorithm for creating tourist routes.

The tourism product is very specific, like the entire tourism services market. The tourism product itself is a whole complex of material and immaterial units

that a traveler needs [1]. There are four main elements of a tourism product: the tour itself, excursion services, goods for tourists, and necessary consumer goods. What distinguishes tourism products is that they are intangible, do not require storage, are very dependent on many factors that are poorly controlled or not at all controlled by humans, and are static. Also, their feature is the large difference in time between the sale of a service and its consumption, as well as the long distances that the client needs to overcome to receive a tourist service. As a result, the features of marketing in the field of tourism services are as follows: The service is a whole complex. Much attention is paid to protecting consumer rights. Focus on managing demand rather than stimulating it. The need for a high level of reliability of the information provided. Management and coordination of marketing activities of participants in the tourism services market. Taking into account the behavioral characteristics of the target audience. During the off-season period, marketing in tourism becomes of great importance, because it is then that there is a special need for diversification of the tourism product.

Route development, in the classical sense of the process, is a complex multi-stage procedure that requires fairly high qualifications and is the main element of tourist service technology. This procedure is time-consuming and sometimes takes several months. If the route is custom (one-time), then the procedure for creating it is simplified, with the exception of security measures.

When developing routes, the following steps are followed:

1. Research of tourist resources along the proposed route.
2. Identification of restrictions on the consumption of tourism resources.
3. Marketing the market for tourist services along this route.
4. Determining the type of route.
5. Construction of a sketch model of the route.
6. Construction of the route route.
7. Drawing up a travel calendar and group movement schedule.
8. Linking the route to life support points.
9. Development of a safety scheme along the route.
10. Development of a route passport.
11. Coordination of the passport with the relevant services.
12. Test hike along the route.
13. Making changes to the route scheme.
14. Review and approval of the route.

When developing a route, various materials are used: reference books, guidebooks and other local history literature, cartographic material. The development of the route ends with the approval and approval of the route passport. The route passport is used when creating tours [2].

Creating custom itineraries does not require as many steps because custom itineraries have the characteristics of family or friend advice rather than a formal

itinerary designed by a professional agency. It is precisely these routes (tips) that the new generation of tourists, and almost all modern tourists, use.

The existing algorithm is quite complex, so when developing new algorithms it is necessary to try to simplify this process. In the development of custom tourist routes, some stages will be reduced and new ones will be created, however, before releasing these routes to the public, the routes will be moderated and reviewed. To simplify the moderation process, it is planned to introduce a user rating system in which tourists using or considering the route can give their rating using a 5-point system.

The development of professional routes allows you to simplify the most important stage - creating routes, and focus on completing the remaining stages; most of the remaining stages will be completed at the final stage of the algorithm - during the creation of the route passport.

When considering general principles, one should not ignore such a component as tourism marketing. It is difficult to overestimate the role of marketing in the tourism sector. Huge competition among producers of similar services, as well as great dependence on a number of external factors, increases its importance. The main task of tourism marketing is to meet the needs of consumers by creating and marketing the highest quality tourism product.

Marketing in the field of tourism is a system of actions aimed at promoting and selling a tourism product, in particular a trip and a full range of services sold to tourists. In other words, tourism marketing refers to the planning and organization of marketing activities for firms operating in the tourism sector [3].

It includes:

1) development of services taking into account customer needs;

2) formation of a tourism product;

3) product launch and promotion.

To achieve success in this area, it is necessary to pay attention not only to the basic needs of the consumer, but also to the quality of the service itself. The progress of marketing activities in the field of tourism is examined from different angles, taking into account all factors influencing the development, promotion and sale of a tourism product. The subject of marketing in this case is not only the company itself offering a particular service, but also the legislative bodies in the field of tourism, as well as the territory in question. We can distinguish three components of the tourism marketing system: the functional part, the structural part and the subjective part.

Among the functions of marketing in tourism, there are three most significant:

1) Forming contact with the clientele.

2) Development process.

3) Exercising control.

4) The essence of the first is to interest and convince the future consumer that the quality of the service meets his expectations. The second involves the development of new services that can potentially attract the client's attention and meet his needs. We are also talking about improving the quality of existing services. The third function includes analysis of the tourism market and monitoring the process of product sales.

Development of custom route maps

In order to create an algorithm for creating tourist route maps for the average user, it is necessary to compile a list of tools available to this user [4]. First of all, it is worth mentioning that the available tools are divided into two parts: tools available to the user on a free basis and tools available to the user by subscription. Tools for creating tourist route maps for ordinary users include:

1) Maps of the area. The user will have access to maps of the area taken from royalty-free sources, on which the user can place other objects. At the initial stages of the project, only maps of urban areas will be available, however, in subsequent stages it is planned to introduce terrain maps for natural tourist sites (the size and number of which will be strictly limited and subject to more thorough verification for user safety reasons). Subscribers will be able to segment existing maps to create their own or use other template maps available only through the subscription system. These templates and cards are stored on the company's server, but subscriber users can save the resulting templates on their device. The storage size of templates on the server is also limited, and subscriber users can get extended storage space.

2) Libraries of marks and signs. To create tourist routes, users will use libraries of signs and tags with which they can place, highlight and label points of interest that the user-creator thinks the user-tourist should visit. Such libraries include, for example, labels of public catering outlets, various types of stores, hotels, cinemas, etc. Also, these libraries include various markings for marking roads (road, pedestrian, bicycle, etc.) and traffic signs to improve the safety of tourists. Checking for the presence of traffic signs is one of the most important verification stages.

3) VR and AR tags. The main feature of the project, these tags will improve the tourist experience through enhanced immersion in the chosen place for tourist recreation. VR tags allow the user to view a panorama of a selected point in the city. At some of these points, accessible to all users, VR guides are placed - objects, people or other forms of 3D models that act as a narrator or guide to the selected place. AR tags have similar functionality, but perform a slightly different role. AR tags are planned to be used for information summaries of places of interest. Free and subscription users will have different levels of permission to post these tags. Free users will have at their disposal the main places of tourist interest in cities and points with information on the most important places in the history of cities. An

expanded set of tags will be available to subscriber users, which includes leisure centers and popular tourist destinations. Also, subscriber users can post text messages or low-resolution photographs on these tags.

These tools and the presence of a smartphone or personal computer will allow the user to create their own tourist route. These routes do not require additional documentation or permits, since they are not official tourist routes and are more of a "friendly advice" character. The user can share these routes directly with other people through the application. This will ensure relatively stable growth in the number of users, since viewing routes requires the presence of this application. Subscriber users will be able to directly send a file with an offline version of the tourist route, which another user can download and also use offline, regardless of whether this user has a subscription.

Development of algorithms.

Algorithm for physical persons

(regular users)

- Easy to understand

- The resulting route has the character

"Friendly advice", does not require compliance

standard.

- Routes are created from more limited

set of tools

- As a quality control method assessment through a set of criteria and custom ratings is planned

Algorithm for legal entities persons (travel agencies)

- Complex

- Requires compliance with state regulations

standard

- Multi-stage route development

- Requires supporting document

(route passport)

- Licensed and compliant with

local authorities involved in tourism

Creating a route for the average user is a relatively simple 4-step process.

1) Create a template. The user selects a section of the map of the locality along which he wants to draw a route. After selecting an area, the template is automatically saved.

2) Building a route. At this stage, the user, using a library of labels, builds a route that another user will follow. The user can build a route of almost any shape.

3) Filling the template with objects. At this stage, the user places objects of interest for himself or another user. The user can highlight restaurants, museums,

galleries, theaters and other points of tourist interest. Also, the user can activate VR and AR tags if the route laid out passes through or near them.

4) Route verification. At this stage, the user's route is checked by experts who check whether the routes have sufficient security and whether they contain reliable information. Also, at this stage, the route is assigned one of various user categories, and the route creator can provide background information on his route, for example: target audience, duration of the route, seasonality of the route, time intervals for visiting this route, etc.

This algorithm will be provided as user instructions for developing routes and the work of the route editor is based on this algorithm. This algorithm is also presented in Appendix X as an algorithm in the Idef0 system. Now it's worth paying attention to professional routes, as they come with more conditions. Route verification results:

Patency

We are going through the route. The main reason for the passability is that the route is built on sidewalks located along major roads.

Safety

The route is safe. In order to complete the route, you do not need to violate traffic rules. All road crossings for vehicles along the route are equipped with zebra crossings or underground crossings. The route does not pass through parts of the city that may be unsafe.

Duration

It took 43 minutes to complete the route at a slow walking pace, inspecting the surrounding buildings.

Seasonality The route is suitable for all 4 seasons.

Testing of the tourist algorithm and its success, since both the route itself and the map must be acceptable for use, thereby confirming the effectiveness of the proposed solution.

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俄罗斯扩大对中国市场食品出口的问题
PROBLEMS OF EXPANDING RUSSIAN PROMISING FOOD EXPORTS TO THE CHINESE MARKET

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注解。 撰写本文旨在实现以下目标：在分析专家意见和研究成果的基础上，识别和总结决定俄罗斯食品对中国市场出口发展的关键因素，并提出促进俄罗斯出口的解决方案。 。 在研究过程中，确定了中俄双方促进和限制对华粮食供应增加的因素，并确定了有前景的商品及其需求特征。 在促进食品出口的措施中，建议通过创建强大的民族品牌来保持俄罗斯产品的质量。
关键词：中国、俄罗斯、中国食品市场； 货物出口； 消费者偏好、竞争力、促销、品牌。

Annotation. *The writing of this article was aimed at achieving the following goal − based on an analysis of expert opinions and research results, to identify and summarize the key factors determining the development of Russian food exports to the Chinese market and propose some solutions to promote Russian exports. In the course of the study, factors promoting and constraining the increase in food supplies to the China, both from the Chinese and Russian sides, were identified, as well as promising goods and its demand characteristics were determined. Among the measures to promote food exports, it is recommended to maintain the quality of Russian products by creating strong national brands.*

Keywords: *China, Russia, Chinese food market; export of goods; consumer preferences, competitiveness, promotion, brand.*

Introduction

China is the largest market for foreign suppliers of commodity products, ranking second after the United States. At the same time, it is a world leader in exporting goods to the world market. At the end of 2022, according to UNCTAD, China imported and exported goods worth $3.6 and $2.7 trln, respectively. China also ranks first in the world in food imports, with $236 bln worth of goods purchased in 2022.

Trade turnover between Russia and China is rapidly increasing and, according to experts, in 2023 it exceeded 200 bln dollars (about 240.11 bln dollars is estimated), of which 129.14 bln are Russian exports to the Chinese market[1].

In recent years, there has been a stable and sustainable growth of the PRC economy, accompanied by an increase in household incomes and followed by increased consumption of foreign food products, which are more environmentally friendly compared to local ones, as many Chinese believe. The rising standard of living in China leads to a demand surge for organic products by an average of 14.3% per year. At the same time, the development of the healthy food industry becomes a state priority, which leads to an accelerated growth in demand for certain groups of commercial products[2].

Russian agricultural producers are striving to significantly increase food supplies to the Chinese market and the share of this segment in the volume of Russian food supplies to foreign markets. Let us clarify that according to *Agroexport*, food exports from Russia for 2013-2023 increased from 16.8 to 45.0 bln dollars, that is, 2.7 times. In the last year alone, food exports from the Russian Federation grew by 8.1%, and the number of companies registered in the CIFER system of food suppliers in China reached 3.1 thousand as of September 2023. The main buyers of food products from Russia in 2022 in value terms were following countries (in descending order): China ($5.1 bln), Turkey ($5.05 bln), EU countries ($4.1 bln), Kazakhstan ($3.4 bln) and Belarus ($2.8 bln). Thus, China this present day is the largest buyer of food not only in the world, but also in the Russian segment [3].

Factors for expanding Russian food exports

An analysis of the research results of Russian and Chinese scientists showed that for progress in the development of Russian-Chinese trade in food products, there are a number of favorable conditions (factors) of both a geopolitical and political-economic nature that have developed in the long and short term. These include the following:

- complementarity of foreign trade commodity structures of the two countries;
- resilience and adaptability of the Russian agro-industrial complex;
- the strategic focus of the Russian Federation on developing the export potential of the Russian agro-industrial complex while achieving a high level of food self-sufficiency over the past ten years;
- the huge capacity of the Chinese food market;
- gradual liberalization of certain segments of the PRC food market;
- the ability to carry out settlements for foreign trade transactions in national currencies;

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[1] PRC estimates. TASS. URL: https://tass.ru/ekonomika/19713193?ysclid=luik8ef3tj721723276

[2] Hinkis , L.L. Export of canned products to China: formation of institutional conditions. Economics: yesterday, today, tomorrow. 2021. T. 11. No. 9-2. P.476.

[3] Market of agricultural opportunities. What stimulates and restrains the export of products from Russia to China. Kommersant 10.20.2023. URL: https://www.kommersant.ru/doc/6283629?ysclid=luij1kq3qp552521721

- an increase in average incomes and a growing interest of the Chinese population in healthy food, and accordingly, growing demand for environmentally "clean" and premium product types (live crab, highly processed fish products, high-quality sunflower and rapeseed oil, etc.);

- the PRC's interest in promoting the "One Belt – One Road" project and maintaining sustainable high rates of economic development due to external factors;

- strategy for the development of the "dual circulation" economy;

- risks of a decrease in Russian exports to China while simultaneously increasing demand for Russian products in this market due to tightening anti-Russian sanctions during the Russian-Ukrainian conflict;

- reorientation of trade flows from Russia to the markets of "friendly countries";

- the presence of common external threats and Russia's political trust in China [4567].

A key role in promoting Russian exports can be played by measures aimed at strengthening economic and military-political ties between the PRC and the Russian Federation, further opening the Chinese market for foreign products, as well as taking into account the specific features of Chinese consumer demand for Russian products. Thus, in September 2023, the Chinese authorities lifted restrictions on the import of pork from Russia [8](which had been discussed by trading partners for 15 years). The potential volume of this market for Russian suppliers is estimated at 200 tons per year [9]. A year earlier a promising pea market for export was opened [10]. It should be noted that the vegetable oil imported by China from Russia is considered by consumers as a premium product and used mainly for cooking, since only high-quality and expensive bottled oils are supplied to the market (as rapeseed, sunflower and soybean oil), while cheap palm oil is purchased by Chinese importers in Indonesia and Malaysia [11].

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[4] China has opened up enormous opportunities for Russian farmers. URL: https://vz.ru/economy/2023/10/17/1235267.html?ysclid=lu89os8qvl194271266

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[6] N. Kireeva, I. Kublin , O. Prushchak , Xu Ban. Russian food exports to China: growth strategies. Practical marketing No. 6 (303).2022. P.8-15; DOI: 10.24412/2071 3762 2022 6303 8 15

[7] Hinkis , L.L. Export of canned products to China: formation of institutional conditions. Economics: yesterday, today, tomorrow. 2021. T. 11. No. 9-2. pp. 476-486.

[8] Note. Until September 2023, pork supplies from Russia were prohibited due to the spread of ASF.

[9] Note. Estimates from Yakov and Partners. Source: Kommersant. Market of limited opportunities What stimulates and restrains the export of products from Russia to China. https://www.kommersant.ru/doc/6283629

[10] Note. Over the eight months of 2023, 300 thousand tons of dried peas were exported to China.

[11] China has opened up enormous opportunities for Russian farmers. China has opened up enormous opportunities for Russian farmers URL: https://vz.ru/economy/2023/10/17/1235267.html?ysclid=lu89os8qvl194271266

At the same time, there are a number of general and specific medium- and long-term factors that are holding back the intensive increase in Russian food supplies to China. These include:

- fierce competition and low prices in the food market due to the presence of a large number of domestic and foreign producers (for example, high competition for Russia in the meat market from pig farmers from Brazil, the USA, Canada and Spain);

- maintaining a large number of restrictions on the import of products from the Russian Federation (in particular, rapeseed, corn and rice - partial restrictions apply; supplies of winter wheat - a complete ban since 1997);

- the need for lengthy and procedurally complex coordination at the government level of further measures to liberalize food exports from Russia (for example, coordination of Russian pork supplies will take about two years);

- high quality, range and documentation requirements for food products entering the Chinese market;

- overestimation of GMO content standards in oil and fat products coming from Russia compared to European standards, and the need for processors to register in two control systems;

- the need to repurpose a number of industries and adapt manufactured products to the requirements and preferences of Chinese consumers;

- a high probability of copying and production of counterfeits of popular imported Russian goods by local entrepreneurs in the event of untimely registration of trademarks on them;

- duration of delivery, imperfection and high cost of logistics (additional phytosanitary control at the China′s border; the prevalence of more expensive railway transportation over cheaper sea transport; high workload and low capacity of the railway infrastructure, lack of specialized terminals in ports; etc.);

- introduction of export duties in the Russian Federation tied to the ruble exchange rate [12];

- low level of mutual investments observed over a long period of time, etc.

Russian food exports leaders

The main product groups of agricultural exports to China are: rapeseed oil (19.0%), frozen fish (15.9%), soybeans (12.4%), crustaceans (12.0%), meat and

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[12] Decree of the Government of the Russian Federation "On the rates of export customs duties on goods exported from the Russian Federation outside the customs territory of the Eurasian Economic Union, and on amendments to the rates of export customs duties on goods exported from the Russian Federation outside the customs territory of the Eurasian Economic Union» dated September 21, 2023 No. 1538. The measure is temporary (until the end of 2024), applied in order to maintain a rational balance between the export of goods and domestic consumption, as well as to protect the domestic market from unjustified price increases. http://government.ru/docs/49567/

poultry by-products (7 .6%) [13]. China is the largest buyer in Russia of such goods as poultry meat, rapeseed oil, beef, soybeans, oats, flax seeds and flaxseed oil, honey. According to *Agroexport*, among the most promising categories of commodity exports to China are four groups: fish and seafood, grain crops, meat products and vegetable oils. Necessary conditions for expanding the supply of these products, according to experts, include: improving logistics − deliveries both by sea and by rail; payments settlement with transit countries (Kazakhstan and Mongolia), development of own production potential, etc. (see Table 1).

Table 1.

Conditions for expanding Russian promising food exports to the Chinese market

	Product group	Conditions for increasing exports
1.	Fish and seafood	increased catching fish in the Far Eastern region and the Murmansk region; increasing the depth of processing fish in Russia; transition to digital permitting certificates; maintaining restrictions on the import of Japanese fish products
2.	Rapeseed oil	increasing rapeseed production in the Siberian Federal District; inclusion of rapeseed in crop rotation in the Far East region
3.	Poultry meat	Chinese leadership's rejection of zero policy tolerance; restoring the rhythm of supply chains; reduction of sea transportation costs; decrease in meat supplies from the USA to the Chinese market
4.	Cereals	lifting restrictions on Russian grain imports by the Chinese side

Source: compiled by the author according to China has become the largest buyer of food from Russia. Russian newspaper. 02/09/2023. URL: https://rg.ru/2023/02/09/kitaj-stal-krupnejshim-pokupatelem-rossijskih-prodovolstvennyh-produktov.html?ysclid=lu89l1955332363425

According to many Russian and foreign experts, Russian food products are highly valued in China. According to surveys, 91% of consumers in China who bought Russian food products note their positive properties and are ready to buy in the future [14]. Some experts believe that the main factor in demand is its environmental friendliness , others believe that this is a myth, and the main motives for buying Russian goods are low price and the ability to satisfy the traditional pref-

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[13] Note. Data for 2022

[14] L.L. Hinkis. Export of canned products to China: formation of institutional conditions. Economics: yesterday, today, tomorrow. 2021. T. 11. No. 9-2. pp. 476-486. P.477.

erences of Chinese buyers [15]. Research by N. Kireeva and others has shown that Russian food products such as wheat and barley, vegetable oil and fish have strong competitive advantages in the Chinese market. The benefits of the second group, which includes flax seeds, rye, bran, molasses, millet, straw and chaff, and margarine, are slightly weaker. Some products are not highly competitive, but are quite widely represented in the structure of Chinese imports from Russia − soybeans, wheat flour, crustaceans, corn, canned vegetables. As far as export support is concerned it is interesting to investigate a group of goods that has low competitiveness and does not occupy a significant share in Russian exports − processed products, meat and dairy products, rapeseed and soybean oil, confectionery, alcoholic and non-alcoholic beverages[16]. Most often, in various information sources, confectionery products, canned vegetables, honey, milk and beer are called the most popular Russian goods on the Chinese food market.

A study of Russian food products demand conducted by experts from *Asia Pacific* [17] held among users of the largest Chinese marketplace *Taobao* (Tmall) [18] showed that five products became the most popular on this platform: chocolate candies, canned cucumbers, honey, milk powder and beer. The authors draw a disappointing conclusion that "despite some successes of individual Russian products in China, Russia is not perceived as a producer of high quality food and beverages; sales of German, English, Australian, New Zealand, Japanese and Korean goods far exceed sales of food from Russia". Experts name the following main problems of Russian exports to China:

– goods sales are mainly in the low price segment;
– lack of budgets for product promotion;
– the inability or unwillingness to develop Russian brands in China;
– insufficient interaction between enterprises and government bodies [19].

We believe that these factors certainly play a role in the promotion of Russian products, but they do not exhaust the entire list of restrictions and problems, the solution of which could expand the supply of Russian products to the Chinese market.

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[15] Danila Petrov. TOP 5 Russian food products for export to China. UL: https://vc.ru/trade/446956-top-5-rossiyskih-produktov-pitaniya-dlya-eksporta-v-kitay?ysclid=lu89e62k6d389450611

[16] N. Kireeva, I. Kublin , O. Prushchak , Xu Ban. Russian food exports to China: growth strategies. Practical marketing No. 6 (303).2022. P.13; DOI: 10.24412/2071376220226303--15

[17] Note. Asia Pacific is a company consisting of young Russian and Chinese experts, conducting analysis of the Chinese market and providing clients with full-cycle services in the field of Internet marketing in China. URL: https://as-pacific.com/

[18] Note. Taobao was one of the most popular shopping apps in 2023. Around 1.03 billion people in China were actively shopping on their mobile devices in September 2023. URL: https://translated.turbopages.org/proxy_u/en-ru.ru.41a590d0-660c13e8-1f8621d6-74722d776562/https/www.statista.com/statistics/1327377/china-taobao-monthly-active-users/

[19] Danila Petrov. TOP 5 Russian food products for export to China. URL: https://vc.ru/trade/446956-top-5-rossiyskih-produktov-pitaniya-dlya-eksporta-v-kitay?ysclid=lu89e62k6d389450611

At the same time, the *Asia Pacific* revealed the specific preferences of Chinese consumers, which determine the competitive advantages of Russian products in the local market (see Table 2).

Competitive advantages of the 5 Top Russian food products on Taobao

	Product	Competitive advantage	Sales volume in April 2022, number of orders, thousand
	Roasted candies "Krokant" (or "Purple candies" (Chinese), produced by *KDV Group*	They occupy 40% of all Russia′s confectionery products sold on the marketplace; conspicuous rustling purple-green packaging; a pleasant combination of almonds, beloved by the Chinese, and overseas chocolate glaze; the taste of Snickers; the price is at the level of Chinese brand candies (reasonable)	184
	«Vetli» cakes , «San-Bane» gingerbreads, «Akkond «waffles	Unusual banana shape (gingerbread); pleasant cheese taste (waffles "Khutorok") and the taste of creamy ice cream ("Plombirok"), crispiness, relatively low price	
	Canned cucumbers "Favorite Hippopotamus", "Uncle Vanya", "Golden Valley"	Crispiness : it often used as an ingredient in homemade hamburgers or salads; Russian goods are inferior to German brand "Kuhne "	17
	Honey	High quality, environmental friendliness, healing properties, often sold in branded packaging made in China; low purchase price; on the platform is purchased as a high-end gift product and medicine	11
	Beer "Baltika", "Stary Melnik", "Polar Bear"	Own production in China ("Baltika"); high strength, bitter taste, large bottle size	8
	Powdered milk "LyubiMo" and "Burenka", a substitute for powdered whole milk (Line LLC PKF)	Low price, unbranded (milk is prepacked in transparent packaging without emphasis on the brand)	6.5

Source: compiled by Danila Petrov. TOP 5 Russian food products for export to China. URL: https://vc.ru/trade/446956-top-5-rossiyskih-produktov-pitaniya-dlya-eksporta-v-kitay?ysclid=lu89e62k6d389450611

Our analysis of the presented *Asia Pacific* study and responses from Russian site visitors allows us to identify a number of weaknesses of the Russian products quality:

– Russian products sales on *Taobao* is insignificant;

– some knowledgeable buyers claim that the quality of Russian chocolate is low as palm oil is used in its production and it has an unpleasant taste; chocolate adapted to the taste of the Chinese is bought by them once "to try"; French, Belgian or Swiss chocolate, despite its higher cost (30-60% higher), is considered much tastier;

– The Chinese prefer New Zealand honey or locally produced honey to Russian one, but among Chinese products there are many low-quality surrogate products;

– producers of Russian milk powder have strong competitors - Australian and German suppliers;

– Chinese living in the south of the country do not have a definite opinion about the quality of Russian products and trust Western goods more, especially from Japan or the Republic of Korea;

– Those who have visited Russia have an idea about Russian alcoholic products in China; beer is really liked and rated highly;

– Russian ice cream, which was not included in the rating, is indeed in demand on the Chinese market, but the number of orders is influenced by a number of factors: its demand is determined by seasonality; a small amount of orders is explained by calculation based on sold lots (10-12 pieces), which reduces the overall sales volume; the most popular ice cream in China from Russia - *Iceberry*, is mainly sold through offline channels; sales on other large platforms such as *JD* and *Pinduoduo* are not taken into account ;

– Chinese manufacturers are constantly trying to copy popular Russian products, including ice cream, beer and candy, which reduces demand for the original product and creates a false impression among consumers about its quality.

Conclusions

In conclusion of our research, we note that the awareness of the Chinese about Russian food products presented on the local market is insufficient; most products do not go beyond the category of "exotic food" or are of lower quality than Western food, even if they are adapted to the traditional preferences of the Chinese population. The reasons for this fact should be carefully studied in relation to each specific product and taking into account the characteristics of consumer preferences in different regions of China. At the very least, it can be argued that, in general, administrative delays in documenting import permits caused by Chinese

legislation and other formalities, as well as the ability of the Chinese to quickly copy in-demand Russian goods, play a negative role in increasing exports.

In our opinion, this problem can be partly solved through large financial investments in the creation of strong Russian brands, taking into account the consumer preferences of the most mobile part of the Chinese population, youth, and active promotion of Russian exports in Chinese social networks and marketplaces. To do this, it is necessary to constantly monitor the most popular trading platforms in China. Due to the fact that in the future, tourist flows from China to Russia, as well as educational student exchanges flows, will increase, it would be advisable to develop programs for promoting Russian export products with a focus on this segment of consumers.

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区域特征对萨哈（雅库特）共和国咨询公司市场成功发展的影响
THE INFLUENCE OF REGIONAL CHARACTERISTICS ON THE SUCCESSFUL DEVELOPMENT OF THE MARKET FOR CONSULTING COMPANIES IN THE REPUBLIC OF SAKHA (YAKUTIA)

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抽象的。　本文通过对萨哈共和国企业对咨询服务的需求进行系统分析，结合区域发展政策的具体情况，从咨询活动融入商业活动的角度审视产业间互动中存在的问题，旨在解决 区域内企业增效问题。 事实证明，创建此类能够参与该地区业务稳定发展的咨询公司的必要性。 对雅库特一家咨询公司能力的 SWOT 分析可以采用系统方法来确定该地区咨询公司 "质量概况" 的必要结构要素。

关键词: 质量、咨询活动、系统方法、发展。

Abstract. The article, through a systematic analysis of the demanded consulting services by enterprises of the Republic of Sakha and identifying the specifics of regional development policy, examines the existing problems of interaction between industries from the perspective of integrating consulting activities into business activities, aimed at solving the problems of increasing the efficiency of enterprises in the region. The necessity of creating such consulting companies that would be able to participate in the stable development of business in the region is substantiated. The developed SWOT analysis of the capabilities of a consulting company in Yakutia allows for a systematic approach to identifying the necessary structural elements of the "quality profile" of a consulting company in the region under consideration.

Keywords: quality, consulting activities, systematic approach, development.

The flexibility and adaptability of organizations in today's complex and sometimes changeable conditions of the Russian market are necessary properties that make it possible to determine the direction of change not only in the field of stable retention of financial indicators in the achieved positions, but also in the field of development and improvement of enterprise processes. In such conditions, there is an increased need for the services of specialists in the field of consulting in key functional areas that help optimize activities and obtain financial benefits.

Currently, there is an increase in demand for the services of consulting companies in Russia according to the RAEX ranking over the past five years, which is primarily due to various factors: the global pandemic; sanctions; exit of foreign participants; quantitative increase and qualitative improvement of the social product and the factors of its production; the adoption of a set of measures aimed at creating an effective system of executive authorities based on the regulation of their functions in the field of economic activity [12, 14].

These factors lead to the fact that the formation of the market for consulting services is influenced by key areas of demand determined by trends in management, financial support of business, information and communication technologies and the virtual environment. As the situational analysis shows, consulting companies are actively adapting the service models and technologies of leading entities that are resistant to negative crisis influences [14].

In this case, the formation of the correct development strategy for consulting companies will help to build a direction towards improving the activities of the enterprise and realize the full potential of resources, while determining [2]:

- target segments for which development is oriented;
- methods of communication and distribution channels necessary to enter new promising markets;
- unique advantages that distinguish you from competitors;
- opportunities for innovative and investment development;
- changes in the structure and management systems.

Each consulting company has its own individual experience and development path depending on its goals, mission and vision, as well as on external and internal market factors, so, within the framework of this article, it will be noteworthy to analyze the state of the consulting services market in the Far Eastern region of Russia, namely in the Republic of Sakha (Yakutia).

SPECIFICITY OF THE REGION

The territory of the Republic of Sakha (Yakutia) is characterized by a complex structural organization and a combination of natural-climatic, territorial-sectoral, settlement and production-resource potentials. This regionalization is due to the socio-economic differentiation of the existing relatively and poorly developed areas, the characteristics of the territories inhabited by indigenous peoples, the underdevelopment and lack of road transport and other types of infrastructure [9].

In terms of population, the Republic of Sakha (Yakutia) (RS(Y)) ranks 3rd in the Far Eastern Federal District after the Primorsky Territory and the Khabarovsk Territory. The total population of Yakutia is 1,001.9 thousand people, estimated by Rosstat as of 01/01/2024, when the number of residents of the capital of the region is 361,154 people, which is according to the classification of Yu.L. Pivovarov. In terms of population, Yakutsk is a large city [9, 11].

Like any other region, Yakutia has its own specifics, due to which a local industry market is formed, these are:

1) special, extreme climatic conditions (the widespread presence of permafrost causes seasonal dependence, including an increase in production time, a reduction in service life, a significant increase in costs in capital construction, housing and communal services, limited opportunities for agricultural production);

2) low population density;

3) the most important mineral resource and mining region in Russia;

4) high natural resource potential;

5) raw material export-oriented model of the economy (the share of industrial production in the structure of the gross regional product is more than 52%, more than 80% of industrial production is accounted for by mining);

6) remoteness from the central regions, but proximity to markets in the Asia-Pacific region;

7) difficult logistics (the influence of the local climate, remoteness and, as a result, the region's underdeveloped road and transport infrastructure);

8) low competitiveness of products produced in the republic.

For Yakutia, the constant development and maintenance of its budget-forming sector of the economy, such as the extraction, production and processing of the most important types of industrial products, becomes strategically beneficial; thanks to this, several large existing export-oriented enterprises operate. Tourism and the recreation sector are also developing intensively, and small and medium-sized businesses focused on trade and services are developed.

As a result of the 2023 national rating on the state of the investment climate in the constituent entities of the Russian Federation, Yakutia entered the top 5 in the "regulatory environment" area, which indicates high investment attractiveness. Thus, the goal is to increase the growth rate of 10% per year in the non-resource sector of the Republic's economy in the following areas [8, 10]:

- IT services (increasing the share in the gross regional product by 5 times);

- processing of raw materials (diamond cutting, jewelry production, products from mammoth fauna raw materials);

- intellectual services and creative economy (cinema, design, music);

- transport (AC "Yakutia", Zhatai shipyard);

- AIC products (food industry, fertilizers, wild plants);

- tourism (Yakut transport and logistics hub, small aviation).

This direction takes development within the framework of commitment to the principles of sustainable development (UN Global Goals, principles of ESG and digitalization), saving people and increasing human capital [6]. At the same time, the vision of sustainable development of the regional socio-economic system is based on the balance of system-forming components (subsystems), which are: society, nature, economy and innovation (see Figure 1) [1, 13]. In this case, the best approach would be an ecosystem approach, where the main thing is cooperation with all stakeholders and the formation of their interests in order to identify and quickly respond to possible risks and opportunities [5].
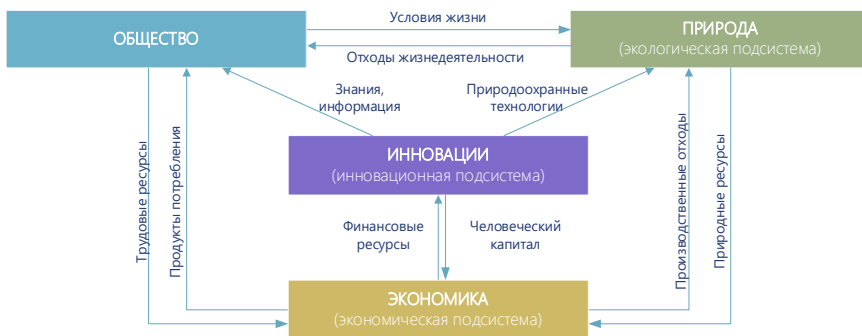
Figure 1. *Interaction of system-forming components of sustainable development of the regional socio-economic environment*

MARKET OF CONSULTING SERVICES IN YAKUTIA

Despite the extensive opportunities for the development of consulting services within the region, the analysis showed that the market in this area has its own peculiarity: in terms of the number of consulting companies in Yakutsk, the largest number are agencies providing tax and legal consulting and financial management services, and companies engaged only management consulting – only a few.

Using the example of a company providing management consulting services in a given region, it is necessary to highlight the share of the main industries that most often request services (see Figure 2) and compare with the total share of enterprises by type of industry throughout the Republic of Sakha (Yakutia) (the total number of which is about 20 thousand according to regional statistics for 2022) [15].

Соотношение основных предприятий по виду отрасли в РС(Я) — pie chart with outer and inner rings:

- Деятельность профессиональная, научная и техническая
- Сельско-лесное хозяйство
- Добывающая промышленность и связанные услуги
- Деятельность с недвижимым имуществом
- Легкая и пищевая промышленность
- Социальная инфраструктура
- Строительство
- Торговля оптовая и розничная автотранспортных средств и услуги по их ремонту
- Торговля и оптово-розничная торговля

Outer ring values: 8%, 8%, 13%, 7%, 2%, 16%, 17%, 14%, 19%, 10%, 2%, 9%, 0,03%, 10%, 6%
Inner ring values: 3%, 10%, 7%, 3%, 7%, 3%, 3%, 14%, 3%, 6%

ВНЕШНЕЕ КОЛЬЦО: СООТНОШЕНИЕ ОСНОВНЫХ ПРЕДПРИЯТИЙ ПО ВИДУ ОТРАСЛИ К ИХ ОБЩЕЙ ЧИСЛЕННОСТИ В РС(Я) НА 2022
ВНУТРЕННЕЕ КОЛЬЦО: СООТНОШЕНИЕ ПРЕДПРИЯТИЙ ПО ВИДУ ОТРАСЛИ К ИХ ОБЩЕЙ ЧИСЛЕННОСТИ ОБРАЩЕНИЙ В КОНСАЛТИНГОВУЮ КОМПАНИЮ В РС(Я) В ПЕРИОД С НОЯБРЯ 22 Г. ПО ИЮНЬ 23 Г.

Figure 2. Interaction of system-forming components of sustainable development of the regional socio-economic environment

It is worth noting the time period of the analysis of data from requests to this consulting company - November 2022 to June 2023. During this period, the main clients of the consulting company under study are small and medium-sized enterprises (SMEs), which in Yakutia remain at a stably developed level.

Also, by expanding the results of the analysis of the ratio of enterprises by type of industry to their total number of requests to a consulting company in the Republic of Sakha (Yakutia), one can see which services were most in demand (see Figure 3).

Bar chart. Период: ноябрь 22 г. по июнь 23 г.
Categories: Сельско-лесное хозяйство; Добывающая промышленность и связанные услуги; Легкая и пищевая промышленность; Строительство; Торговля оптовая и розничная; Торговля оптовая и розничная автотранспортных средств и услуги по их ремонту
Legend: Систематизация, Сопровождение, Аутсорсинг, Аудит, Обучение и форсайт, Техподдержка

Figure 3. *The most popular services of consulting companies in the Republic of Sakha (Yakutia)*

Thus, given the fact that the basis of the economy of Yakutia is the mining industry, it, for the most part, does not use the services of Yakut consulting companies. Most often, clients are enterprises from the construction sector, as well as wholesale and retail trade. A popular link within this management consulting is operational consulting, aimed at systematizing and optimizing business processes (see Figure 4).
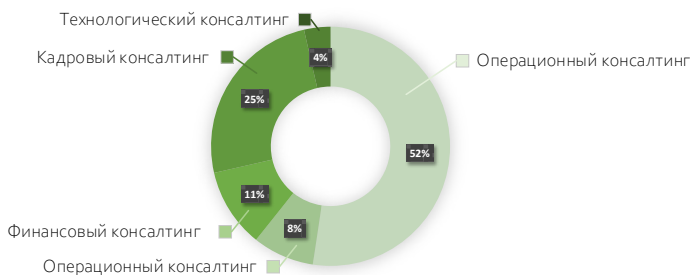
Figure 4. *Distribution by type of management consulting in the field of construction and trade.*

WAYS FOR FORMING A DEVELOPMENT STRATEGY FOR THE CONSULTING SERVICES MARKET IN YAKUTIA

So, a number of internal and external trends contribute to the development of the global and domestic market for consulting services: the development of a set of natural and social conditions, increased competition, fluctuations in inflation, changes in the pace of economic development, political instability, the rapid development of transnational corporations, the introduction of modern technologies, etc. , all this can be summarized by a number of factors [4]:

- factors of a political nature;

- factors influencing the purchasing power of consumers and consumption structure;

- normative and regulatory factors;
- factors of the scientific and technical environment;
- factors of a social and organizational nature;
- socio-psychological factors.

A study of the activities of a consulting company in Yakutsk using the method of observation, collecting information from employees and analyzing current and authoritative media sources, strategic socio-economic development programs (SED) of Yakutia and the Far East, as well as the specifics of the region, identified the main problems in the field of management , management and quality management systems at enterprises of various sizes, forms of ownership and industry [7, 8, 9]:

– insufficient level of management;
– ineffectiveness of the existing management system;
– often a formal attitude to the QMS in small and medium-sized businesses, replication according to existing templates - there is no individual QMS;
– reduction in the quality of human capital, lack of qualified workers in the Republic in the field of quality management.

Table 1 shows a SWOT analysis of development opportunities for a consulting company in Yakutia, with an emphasis on the main goals of the region's strategic development until 2032 with a target vision until 2050 [3, 7].

Table 1.

SWOT analysis of development opportunities for a consulting company in Yakutia

Strategic development of the region until 2032	SWOT analysis of development opportunities for a consulting company	
High standard of human life	Possibilities	– unique local experience that can be improved; – increase in the number of SMEs – growth of clients; – increasing the potential of the scientific, technical and innovation environment; – Yakutia is the leader of the Far East in terms of investment inflow;
Effective territory management		presence of companies - world and Russian leaders in the field of mining and processing; increased opportunities for partnerships with foreign partners and enterprises thanks to strategic and investment cooperation of the region with other regions and countries; – formation of mechanisms for involving business entities and non-profit organizations in the provision of services in the social sphere (ESG agenda, preservation of national culture);

Globally competitive core economic sectors		– increasing IT consulting and technical consulting (online consulting); – goal of strategic development: development of SMEs as a key mechanism for providing employment to the population; – going beyond the regions.
Development of a non-resource export-oriented economy	Risks	– low competition; – low motivation of stakeholders; – regulatory factors; – low solvency of the regional economic sectors; – geopolitical risks; – factors negatively affecting the socio-economic state of the country; – low financing; – wrong paths of development, stagnation or decline.
Preserving nature for future generations and the whole world Ecosystem	Strengths	– process approach; – there is regional experience in the development of local enterprises and various industries; – focus on sustainable development; – involvement in business communities; – continuous improvement; – experience of the influence of negative geopolitical and macroeconomic trends, as well as the COVID-19 pandemic; – extensive experience in systematization and optimization of SMEs; – building up mutually beneficial cooperation.
Sustainable development	Weak sides	lack of competent personnel; low mastery of technological and innovative tools in processes or work methods: the latest consulting technologies are not sufficiently introduced and formed; there are no obvious management decisions; formal, formulaic attitude towards the creation of an organization's management system; there is no understanding of the methodology for an individual approach to each specific organization; weak marketing.

The results of the SWOT analysis make it possible to form a set of quality indicators for consulting companies in Yakutia, focused on active and creative interaction with enterprises in the region (Table 2). Each of the formulated structural elements must be mandatory in the "quality profile" of a successful consulting company. The creation and implementation of all of the above elements within a consulting organization will ensure its relevance and competitiveness.

Table 2

Development of a "quality profile" for a consulting firm in Yakutia

№	Profile structural element	Demand at enterprises of Yakutia	Functional
1	Development of a QMS and preparation of documents for QMS certification	Medium-low	Construction of a quality management system that meets the requirements of ISO 9001, environmental management ISO 14001, food safety ISO 22000, supply security system ISO 28000, energy management system ISO 50001, risk management system ISO 31000. Construction of an information security management system ISO/IEC 27001, occupational safety and health management systems OHSAS 18001.
		According to the results of the report of the executive bodies of state power of the Republic of Sakha (Yakutia) for the end of 2023, there are many opportunities: the growth trend of SMEs, population growth, significant development of infrastructure and growth of socio-economic indicators, leadership in the mining industry, investment growth, development of new products, development of agricultural activities, IT potential (high rates of IT services and products), development of transport and logistics infrastructure (the "Bridge over the Lena River" project - the formation of the Northern Latitudinal Economic Belt of Russia), the growth trend of the cultural, creative, sports environment (leader of film production in Russia, international sports games Children of Asia 2024, etc.) direction towards sustainable development.	
		But in Yakutia, few SMEs strive to increase their competitiveness in the Russian and international markets by introducing a QMS, since among SMEs operating within the region the specifics of managing a company that meets the requirements of international standards are not popular, there are also often financial restrictions, small staff and equipment, sometimes the implementation of the system may be considered a formality, and it is also affected by unpredictable changes in consumer behavior. And budget-generating companies in the region do not use the services of local consulting companies to prepare for certification.	Compliance with quality standards, preparation for certification, ensuring compliance with legal requirements.
2	Development of training programs for internal use of the enterprise	High	Development of specialized training programs with quality aspects. Improving employee qualifications, training new employees, improving training and development processes with a focus on building a strong corporate culture.
		The most important strategic priority for the next decade in the Republic of Sakha (Yakutia) is the development of human capital.	

		High	Analysis and optimization of business processes, development of development strategies, implementation of innovations and improvements.
3	Improving the activities of the enterprise. (Development of an efficiency improvement program)	The development of the socio-economic component of the region, the widespread dynamics of scientific and technological progress, service and product innovations, specific conditions in the Republic of Sakha (Yakutia), and the experience of previous global crises acquired by consulting companies form the demand for the development of local companies.	
		High	Development and implementation of a quality model, preparation for participation in awards and competitions, increasing the prestige and competitiveness of the enterprise.
4	Selection of enterprises to participate in the competition for the Russian Quality Award. Creating a quality model	Participation in such events helps to attract attention to the company's brand, improve its reputation and increase trust from potential clients and partners; many companies in Yakutia participate in the annual competition from the Government of the Russian Federation in the field of quality (mostly in the field of higher education, healthcare), as well as many others companies participate in tenders, programs, open competitions (construction, trade, etc.).	
		High	Assessing the effectiveness of activities, identifying problems and vulnerabilities, recommendations for improvement and optimization ISO 10000 series standards
5	Enterprise audit	In a dynamic market and increased competition in Russia and the region, enterprise audit becomes an integral part of a successful business; companies often need an objective assessment of their activities, identifying bottlenecks and developing an improvement strategy.	
		High	Defining goals and vision, identifying and understanding the needs of stakeholders; understanding the ecosystem, one's own opportunities and threats; development of business planning programs.
6	Development of strategic development of the enterprise	The choice of a company's development vector is now ubiquitous in the region, since the modern Russian market is characterized by a high level of uncertainty, which in turn encourages the region's management personnel to develop flexible strategies for the development of organizations.	
		High	Optimizing work processes, increasing efficiency, improving management and control processes
7	Systematization of enterprise business processes	This service is in greatest demand among consulting companies in Yakutia, since it is easier for companies to understand and has less documentation.	

Conclusion

The modern Russian consulting market has integration trends, which is accompanied by the expansion of services, globalization, digitalization, focus on partnership and cooperation, and strengthening of expertise in certain industries [14]. In the conditions of the region, an important factor in its development is the focus

on specifics and strategic plans. In such conditions, enterprises in the region need the support of consulting companies that can adjust their activities to achieve the strategic goal of the SER RS(Y) by 2030: to achieve the status of a geopolitically significant leader of the Far East and the Arctic zone of the Russian Federation, a comfortable and safe republic for the full implementation of human capital unique natural potential, a "magnet of technology" for life in conditions of low temperatures and vast territories.

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北美商品分销网络
COMMODITY DISTRIBUTION NETWORKS OF NORTH AMERICA

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注解。 本文致力于研究北美分销网络、其形成以及促成其的主要先决条件。审视市场关键参与者，分析零售网络业务发展趋势，探讨数字化对网络公司运营的影响。 本文还概述了配电网络在区域经济中的作用及其对 GDP 和创造就业机会的贡献。 分析了北美不同国家的网络发展策略。 沃尔玛和塔吉特等公司已被作为案例研究。

关键词: 商品分销网络、北美、美国、跨国公司、物流市场、数字化、沃尔玛。

Annotation. *This article is devoted to the study of distribution networks in North America, their formation and the main prerequisites that contributed to it. It examines the key players in the market, analyses the trends in the development of the retail network business, and explores the impact of digitalization on the operation of network companies. The article also outlines the role of distribution networks in the regional economy, their contribution to GDP and job creation. The strategies of network development in different countries in North America have been analyzed. Companies such as Walmart and Target have been taken as case studies.*

Keywords: *Goods distribution networks, North America, USA, MNCs, logistics market, digitalization, Walmart.*

The study of distribution networks in North America is an important topic that requires attention and analysis. For any country, the logistics system is one of the fundamental components of the production infrastructure. In general, the following prerequisites for the formation of commodity distribution networks in the world can be traced: mass demand, consumer solvency and the development of international economic relations.

The latter is due to the fact that from the middle of the 19th century. The process of globalization has become active. After two world wars, countries needed to rebuild their economies and therefore create new profit-making mechanisms. Thus, the United States began to develop and integrate its TNCs, which over the course of several decades earned a huge share in the largest markets. They also contributed to the acceleration of globalization and the construction of logistics links around the world.

Also, the construction of transport corridors in North America was facilitated by the development of the coal, copper and oil industries and the development of huge gold deposits in the southern states. Thus, the development of railways, improved roads and the introduction of trucks made it possible to more efficiently transport raw materials and goods over long distances. This expansion of transportation infrastructure provided the necessary means to move goods between manufacturing plants, warehouses, distribution centers, and ultimately to consumers. (see figure 1)
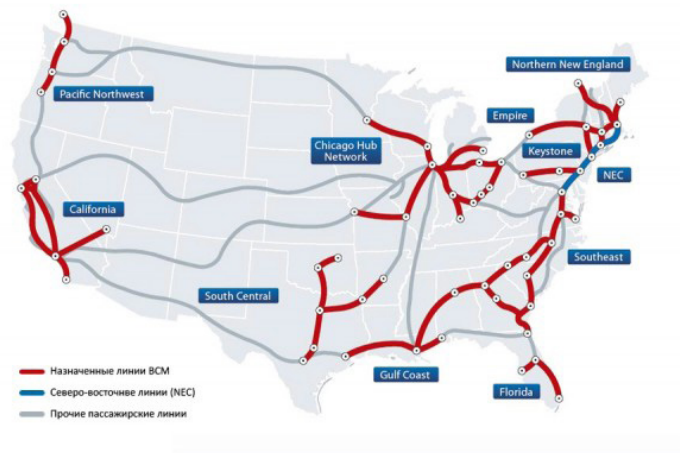
Figure 1. *US Transportation Map*

Source: https://geography-ege.ru/transport-ssha

This construction of transport lines in the USA may be due to several reasons: proximity to water (oceans, seas and bays), as well as favorable interconnection centers. Previously, in North America, transport networks were built spontaneously based on demand, in rare cases having the opportunity to be connected into a single whole, but now governments are trying to combine links for more convenient and affordable transportation of both goods and passengers, which can be seen on the map in Figure 1 Distribution networks currently represent the basis for the development of trade and, moreover, have a significant impact on the cost of the final product.

An integral part of any commodity distribution network is logistics, since transport is the link between the production of goods, their storage and subsequent sale. Very often, a product needs to travel vast distances before ending up on the shelves of supermarkets or any other stores, and logistics companies play a major role in this process.

In the field of commodity distribution networks, North America has a developed transport system, which is characterized by a high level of development of all modes of transport, including road transport, railways, air transport, maritime transport and pipeline transport.

Today, the length of the North American transport system accounts for 35% of the entire global network. It is noteworthy that each of the listed types of transportation ensures the effective delivery of goods from the manufacturer to the consumer, however, among the general list, the general operation of road and rail transport is especially highlighted. Pipeline transport, as well as inland waterway and coastal sea transport are also important.

It is important to note that the high efficiency of the North American transport system is determined not only by the developed economy and the vast territories of the United States and Canada, but also by the signing of the North American Free Trade Agreement or NAFTA in 1992, which greatly facilitates the movement of goods from one part of the continent to another, and also allows you to optimize the transportation process due to the huge variety of companies specializing in organizing the delivery of goods and its subsequent escort to their destination.

In the world of outsourcing logistics business, including the United States, there are two main categories of specialized companies: the first has its own vehicles, handling equipment and warehouse facilities (asset-based), and the second is intermediaries (nonasset-based). For example, C.H. Minneapolis-based Robinson arranges transportation for its clients through approximately 30,000 carriers. Caterpillar Logistics, in turn, coordinates cargo transportation for its parent company Caterpillar Inc. and about 50 other partners.

Road transport plays a special role in North America, where almost 90% of intercity trips are made in private cars. The USA and Canada have an extensive

auto service network. In these countries there are up to 122.7 million passenger cars (mostly for personal use) and about 172.4 million trucks and buses. However, in the USA the number of trucks exceeds the number of cars, while in Canada the situation is completely opposite.

When it comes to road transportation, US and Canadian companies occupy leading positions in the world. According to a report by the auditing and consulting firm Kept, the top three trucking companies included two American Companies Old Dominion Freight Line and Knight-Swift Transportation, as well as the Canadian company TFI International. (see figure 2)

Компания	Страна	EV	Капита-лизация	Чистый долг	Выручка, LTM	EBITDA, LTM
Old Dominion Freight Line	США	37 259	37 475	(216)	6 205	2 103
TFI International	Канада	12 058	10 354	1 704	8 471	1 319
Knight-Swift Transportation	США	10 812	9 110	1 702	7 239	1 528
Werner Enterprises	США	3 374	2 876	498	3 358	580
Marten Transport	США	1 623	1 702	(79)	1 275	244
P.A.M. Transportation	США	794	634	160	949	162
Covenant Logistics	США	517	466	51	1 192	123

Figure 2. *Rating of road transportation companies*

Source: https://assets.kept.ru/upload/pdf/2023/08/ru-transport-and-logistics-kept-review-1q-2023.pdf

Railroads, especially transcontinental railroads, played a historically significant role in the region's economy, connecting the Atlantic and Pacific coasts in the second half of the 19th century. They are the main means of transporting up to 1/3 of all domestic cargo. Metal ores, timber, grain are transported along these roads from west to east, and cars and other industrial goods are transported in the opposite direction.

A prominent example of a leading railroad company in the US logistics market is Union Pacific, which provides multimodal transportation services by partnering with trucking companies such as JB. Hunt and Schielder National, which were acquired by Overnight Express.

"Transport corridors", along which the movement of railway and road transport occurs through the corresponding highways, run in the latitudinal and meridional directions. Nevertheless, latitudinal routes are primarily developed in Canada due to the peculiarities of the development of the state.

Shipping by sea from the USA has long been the main way of transporting goods around the world. This type of transportation is not only much cheaper than

transporting goods by road, but also has other advantages. The share of maritime transport in the United States reaches 85-90% in different years, which emphasizes its importance. The North Atlantic cargo transportation route between the USA and Europe is considered the largest in the world and deserves special attention.

The Ports of New York and New Jersey, including the Port of Newark-Elizabeth Marine Terminal, which are focused on Europe, are among the largest cargo facilities in the country and play a key role in the region's transportation infrastructure. This port complex on the East Coast is an important transportation hub for the region and has the same high economic importance as New York International Airports, which play an important role in long-term transportation.

The state of California boasts two of the largest ports in the Western Hemisphere - the Port of Los Angeles and the Port of Long Beach, connecting North America with the Asia-Pacific region. In addition, it is also home to one of the busiest cargo airports, serving both domestic and international traffic.

Los Angeles Airport (LAX), in combination with port facilities, handles a wide range of international cargo such as electronics, engineering and textiles. Cargo originating from this cargo hub is distributed throughout the country, including many goods from Asian partner countries such as China ($211.3 billion) and Japan ($58.5 billion).

Given the geographic characteristics of each state in North America, road transport predominates in the eastern United States, as well as water transport along the Mississippi-Ohio river system. At the same time, rail transportation has a dominant position in the central states, with some transportation also carried out in the east.

Regarding the regional characteristics of transport and logistics services in Canada, rail transportation throughout almost the entire territory is the main method of transporting goods and prevails in terms of distance and volume of transported cargo. Road transport is carried out mainly between neighboring provinces in the west and east of the country. Water transport is most commonly used in the Great Lakes and Gulf of St. Lawrence regions, with Toronto and Montreal being important logistics centers in Canada.

The North American freight and logistics market is currently valued at $1.55 trillion, growing at a CAGR of 4.05%. It is expected to reach US$1.89 trillion by 2029.

Despite increasing competition from China and India and changes in consumer behavior, the outlook for distribution networks in North America remains quite favorable.

Companies are now actively investing in the development of online trading, the creation of convenient and innovative platforms for online shopping, as well as in logistics and delivery of goods. The North American e-commerce industry grew

over 6% YoY in 2022, led by the fashion and electronics sub-segments. Largely thanks to online trading, sites are being personalized for consumers, which provides them with more accurate recommendations and offers. This is how targeted marketing works today.

In recent years, the market has been dominated not only by B2B and B2C sales. Analysts are now observing how D2C (direct to consumer) sales are rapidly gaining momentum. Companies are moving away from cooperation with intermediaries, building their own sales channels and interacting directly with consumers. This is largely due to the desire to increase control over the sales process and reduce costs. Companies also strive to maintain control over their brand and image, which can be difficult when working through intermediaries who may not always meet the company's standards and values.

Innovations in the form of digitalization and automation are also being carried out in commodity distribution networks. Technological breakthroughs have become a key driver of sustainable competitive advantage. Most retailers in the region are planning to automate their warehouses rather than expand with such expensive rent. There will also be the introduction of new technologies such as the Internet of Things and artificial intelligence.

An important link in commodity distribution networks are warehouses and distribution centers, where goods are stored, sorted and distributed to retail outlets. Warehouse space in North America continues to grow. They are distributed among industrial and trading companies, firms specializing in logistics, and operators of public refrigeration/freezing warehouses. The overall increase in space for storing goods is largely explained by the construction of new warehouses by the leading operators of all three of these groups, as well as consolidation processes in the industry. The leader in warehouse space in the group of industrial and trading companies is still " United RacellService".

U.S. oil and general cargo exports, coupled with growing demand and construction projects, are driving economic growth. Due to sanctions imposed on Russia, the US has exported a huge amount of oil to Europe over the past few years.

North American seaports are expanding maritime connectivity to overcome challenges such as global shipping congestion. This problem became especially urgent during the pandemic, when online sales doubled and all terminals were overloaded, which showed their inefficiency.

It is known that cargo transportation is one of the most highly developed and promising industries in the development of the US economy, which annually contributes from 5 to 8 percent to the GDP of the American economy. These data are a sure sign of the prospects for the development of the industry at least in the next 5 years.

Logistics in North America is at a new level of development thanks to the introduction of modern technologies, digitalization of processes and sustainable environmental initiatives. Projects aimed at creating smart warehouses, environmentally sustainable transport systems, optimizing last-mile delivery, digitalizing supply chains and developing multimodal transport systems will play a key role in improving logistics operations and increasing business efficiency.

Walmart is usually called one of the most successful commodity distribution networks. This is one of the world's leading retailers, with a powerful network of stores offering consumers a wide range of products. Walmart is a distribution network and is actively involved in the delivery and distribution of goods from manufacturers to consumers. The company has more than 10,000 stores worldwide (see Figure 1), including 4,700 in the United States and Canada, and offers a wide range of products ranging from food and clothing to appliances and home furnishings. Walmart works directly with its suppliers, building long-term relationships and ensuring availability and quality of products for its customers. The company has its own supply chains and logistics systems that allow it to effectively manage inventory and ensure delivery of goods to stores.
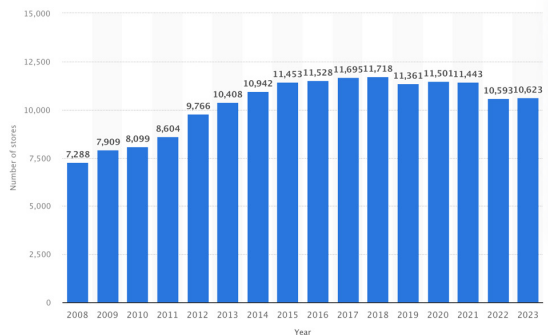
Figure 3. *Number of Walmart stores by year (2008 -2023)*

Source: https://www.statista.com/statistics/256172/total-number-of-walmart-stores-worldwide/

Unlike many other retailers that outsource the development of their IT infrastructure, Walmart runs 95% of its software in-house. This is well illustrated by the following example. Walmart uses proprietary technology to manage product delivery, giving it a competitive advantage. As a result, the company's programmers are tasked with developing information systems that support this technology. Walmart then "outsources" inventory management to its suppliers and uses Re-

tailnet's automatic replenishment system. Although Walmart calls this a "supplier partnership," it is actually a form of outsourcing.

The company uses state-of-the-art technology such as barcode scanners and inventory management systems to ensure accurate inventory counts and minimize waste.

Walmart also works with suppliers directly without using intermediaries, which allows it to control the quality and price of goods. The company has an extensive logistics network that efficiently delivers goods to stores. This allows Walmart to maintain competitive prices and offer a high level of customer service.

Walmart has a significant impact on the North American economy and, in particular, on GDP. This can be seen by analyzing Walmart's worldwide revenue chart (Figure 2). The company is one of the largest employers in the United States and Canada, providing jobs to millions of people. Its activities contribute to increasing household incomes, consumption and investment, which in turn contributes to the growth of the region's GDP.
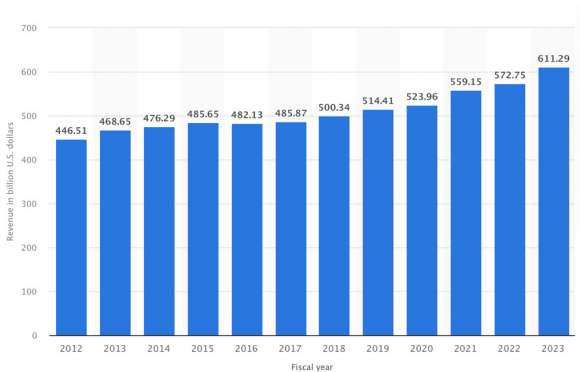
Figure 4. Walmart revenue worldwide (2012 to 2023)

Source: https://www.statista.com/statistics/555334/total-revenue-of-wal-mart-worldwide/

In addition, by offering a wide range of products at affordable prices, Walmart makes shopping easier for people, which contributes to the growth of retail sales in the region and overall economic development. Thus, it can be said that Walmart plays an important role in the North American economy and has a significant impact on the region's GDP.

In addition to Walmart, retail chains such as Target, Costco, Home Depot and others also have a significant impact on the North American economy. Studying

the activities of these chains allows us to better understand the dynamics of retail sales, consumer trends, and the impact of these companies on the local economy and the region's GDP.

Carrying out a more detailed analysis of the study of commodity distribution networks in North America makes it possible to assess their role in the regional economy, identify opportunities for improving efficiency and competitiveness, and also predict their future impact on the development of the North American economy. Distribution network analysis can be useful for understanding the current state of the market, assessing the competitive environment, identifying industry trends, identifying opportunities for business growth and development, and making informed decisions about company strategy.

Based on the analysis, several important conclusions were drawn. Firstly, the sector is at a stage of dynamic development, when competition between the main players is significantly intensifying. Secondly, there is high demand for products and services related to technological innovation and online customer service. Companies in this sector strive to innovate and offer quality products and services to consumers. Online trading is also having a significant impact on the distribution network market, requiring companies to be flexible and adapt to new technologies. Finally, it should be noted that the success of companies in this sector directly depends on their ability to adapt to changing market demands and respond to consumer wishes. Therefore, to achieve long-term success in this sector, it is necessary to actively monitor trends and constantly improve business practices. Distribution networks in North America are actively developing all parts of their activities; they are of great importance for the effective distribution of goods and services throughout the continent. North America is characterized by developed infrastructure and a strong logistics base, which contributes to the efficient operation of supply chains.

One of the key elements of supply chains in North America is transportation. The continent has an extensive network of road, rail, water and air routes, which makes it possible to quickly and reliably deliver goods to any point in the region. Ports and customs points also play an important role in facilitating cargo flows between North America and other regions of the world.

Technology also plays a key role in optimizing supply chains. Modern warehouse, transport and inventory management systems can reduce costs, improve demand forecasting and speed up delivery processes. The use of the Internet of Things, artificial intelligence (AI) and data analytics is helping companies optimize their logistics operations and improve efficiency throughout the supply chain.

Effective supply chains improve companies' competitiveness, reduce costs and improve customer service. In addition, they contribute to the economic development of the region by creating jobs, stimulating trade and improving access to goods and services for consumers.

Overall, distribution networks in North America play a key role in ensuring the efficient functioning of the region's economy and meeting the needs of consumers. Their continuous improvement and optimization are important tasks for companies seeking to remain competitive in the market.

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日本的分销网络和人工智能（AI）的使用
DISTRIBUTION NETWORKS IN JAPAN AND THE USE OF ARTIFICIAL INTELLIGENCE (AI)

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抽象的。 作者考虑了日本在持续数字化和引入生成式人工智能系统过程中的商品分销网络政策，并指出了买家和制造商、物流商和营销人员的贸易特点。

关键词: 生成式人工智能、商品分销网络、数字化、日本、NBICS、工业 4.0、ITS（智能交通系统）。

Abstract. The authors consider the policy of commodity distribution networks in Japan in the process of ongoing digitalization and the introduction of generative AI systems, and note the peculiarities of trade for buyers and manufacturers, logisticians and marketers.

Keywords: generative AI, commodity distribution networks, digitalization, Japan, NBICS, Industry 4.0., ITS (intelligent transport systems).

Japan, a country famous for its efficiency and innovation in various sectors of the economy, is a leader in the field of robotics and NBICS technologies of Industry 4.0. In recent decades, artificial intelligence (AI) technologies have become increasingly common and widely used in various fields, making the lives of producers and buyers more harmonious, aimed at serving product consensus and optimizing costs on both sides of the market counter. One such area is retail, where artificial intelligence is used to optimize processes and increase the efficiency of distribution networks. In Japan, distribution networks play a particularly important role as they are the main method of selling goods and services. The use of artificial intelligence in this industry makes it possible to automate many

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processes, increasing the speed and accuracy of decision making. In this article we will look at the features of commodity distribution networks in Japan, how AI is used in Industry 4.0 and what results of the implementation of its AI mechanisms have already occurred [1].

With changing consumer behavior, increased competition and the growth of the online community, artificial intelligence is becoming an increasingly important tool in commerce. Nowadays, businesses need to solve many problems related to marketing, including attracting customers, satisfying their needs, reducing costs and increasing profits. In these conditions, the integration of innovative technologies based on artificial intelligence into business processes becomes critical for the success and competitiveness of enterprises, allowing them to provide better service, better understand consumer preferences and predict demand. This is a key factor for maintaining and strengthening market positions in conditions of fierce competition and attracting customer loyalty.

Features of commodity distribution networks in Japan

Japan has one of the most developed and efficient commodity distribution systems in the world. It consists of several elements such as wholesalers, retailers, distributors and logistics companies. All these elements work closely together to ensure the efficient movement of goods from producer to consumer. Japan is the world's fourth largest economy,[20] accounting for about 10% of global trade, according to Bloomberg.

There are certain challenges in Japanese traditional marketing and advertising that require a deep understanding of local issues. At the moment, Japan is a little behind other countries in the field of digital marketing. However, global digitalization has led to significant growth in digital marketing in Japan. The country's online retail sector has been slow to develop due to technology aversion among older consumers. However, the COVID-19 pandemic has caused changes in consumption patterns and government policies supporting digitalization have contributed to an increase in online sales. According to the Japanese Ministry of Economy, Trade and Industry (METI)[21], e-commerce survey, the online trading market size in 2021 is 20.7 trillion yen, of which 13.3 trillion yen are goods, 4.6 trillion yen services and 2.8 trillion yen digital products such as online entertainment [2]. Another major obstacle to the growth of online shopping in Japan is the preference for cash over cashless alternatives. The government's push for digitalization in the long term is expected to lead to increased use of digital technology in the retail

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[20] Japan Loses Its Spot as World's Third-Largest Economy as It Slips Into Recession // Bloomberg URL: https://www.bloomberg.com/news/articles/2024-02-14/japan-s-economy-slips-into-recession-clouding-boj-s-policy-path (дата обращения: 25.03.2024).

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sector, as METI promotes cashless payments as part of its Cashless Vision 2018 policy plan, which calls for 40% of retail payments to go cashless by 2025. METI estimates this to reach 32.5% in 2021, with a long-term target of 80% on par with international levels.

One of the key factors for the success of promoting Japanese goods is [1;3]:

– meeting customer needs;

Many believe this is due to the deep-rooted culture of "Omotenashi", which is due to the Japanese placing great importance on hospitality and taking exceptional care of clients and guests by anticipating their needs.

– unusual approach to advertising;

Creative marketing in Japan with sometimes horrific content has already gone viral around the world. In addition, the bright and acidic billboards on the streets of Tokyo are an attraction.

– Japanese vending machines.

An interesting promotion of goods are vending machines. Suppliers load products into them, for example, eggs or bouquets of flowers, and the buyer pays and picks up the desired product.

Successful cases of artificial intelligence implementation

With the growing demand for fast delivery in e-commerce and increasing pressure on logistics infrastructure in Japan, the use of artificial intelligence and intelligent transport systems (ITS) is becoming increasingly relevant. Several companies in Japan have joined forces to develop remotely operated cargo ships with plans to launch by 2025. Mujin has created a new type of intelligent controller that uses the principle of motion planning through complex calculations and data processing. These controllers are widely used to control robots, but the manufacturing process is often unique and tailored to specific customer requirements. Mujin is a pioneer in the development of intelligent platforms for logistics processes with real supply chains, attracting highly qualified engineers from around the world to work on specific tasks [4].

In Japan, systems for automatic identification of goods are actively used, which make it possible to track their movement from the manufacturer to the store. ABEJA, a Japanese AI venture startup specializing in solutions for the retail distribution industry. The company has attracted much attention in the fields of IoT (Internet of Things), artificial intelligence and big data analytics both in Japan and abroad, making headlines late last year when it received funding from Google. The company's retail analytics service, called ABEJA Insight for Retail, uses artificial intelligence to produce data such as the number of store visitors, people passing by, age and gender estimates of people, people flow analysis and ratings of loyal customers. Using customer data, neural networks help analyze the elasticity of demand for goods for different groups of buyers, which allows supermarkets

to optimize the range of products on shelves [2;5]. This ensures customers have access to fresh and essential products in convenient locations where they won't miss out.

Another example of the use of AI is automatic warehouse management systems. These systems use cameras and sensors to locate items in the warehouse and move them to the correct location. This allows you to reduce the time spent searching and moving goods, as well as reduce the likelihood of errors when performing warehouse operations. The Kanban system is a typical production process at Toyota Motors. Attaching a tag (kanban) to parts (simple material or batch) needed for a manufacturing process, removing the kanban at the stage used for manufacturing, and returning it to the parts supplier. The parts supplier sends the next batch into the production process when it receives the kanban. It is an effective method of minimizing inventory by supplying the required parts in the required quantities and just in time for the production process. The Kanban system is a system that is implemented only after ensuring efficient and uninterrupted transportation [3;6].

One of the most famous examples of the use of AI in Japanese distribution networks is the use of robot cashiers. Some stores have already installed robots that can independently scan goods, accept payments and give change. This not only speeds up the service process, but also reduces personnel costs.

AI innovations are also impacting customer interactions. Many Japanese companies have begun using AI-enabled chatbots and voice assistants to provide customers with product information, place orders, and receive advice. This gives customers the opportunity to receive quick and accurate information about products and services, which improves the level of service and helps increase sales.

Results of using AI and commodity distribution networks

The use of AI and modern commodity distribution technologies in Japan has led to a number of positive results:

1. Improving network efficiency: Thanks to the use of AI and process automation, Japanese distribution networks have become more efficient and faster, better focused on the needs of a personal client or focus group.

2. Improving the quality of customer service: by optimizing logistics and forecasting demand, Japanese companies can better meet the needs of their customers, anticipate their taste preferences in the product range, offer substitute products that are similar to the original product lines.

3. Reducing logistics costs: the use of AI and modern technologies allows you to reduce the costs of transporting goods and storing them in warehouses, create multiplying effects in logistics "from the wheels", save on safety and benefit from the efficiency of the location of goods in warehouses and on store shelves.

4. Increasing competitiveness: thanks to the use of modern technologies, Japanese companies have become more competitive in the global market; chats and

generative AI bots have made product sales channels shorter and more controlled specifically for each focus group and region of location of the distribution network [7].

Thus, the further implementation of artificial intelligence in commodity distribution networks in Japan, general digitalization and the development of AI models will increase operational efficiency, improve the quality of service and reduce costs. Thanks to this, Japanese companies will be able to take leading positions in the world market, accelerating the growth of the Japanese economy, and raising it to its previous, 3rd place in the world GDP ranking [1;5].

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COVID-19 大流行期间美国和俄罗斯医药物流危机的后果
CONSEQUENCES OF THE CRISIS IN PHARMACEUTICAL LOGISTICS IN THE USA AND RUSSIA DURING THE COVID-19 PANDEMIC

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抽象的。　　　文章探讨了美国医药物流的特点以及该行业在2021年和2022年COVID-19大流行期间面临的问题。此外，美国医药物流市场结构出现问题的主要原因以及解决方案　这些困难凸显出来。　作者还列出了该行业因应对新挑战而获得的前景，以及未来的实施计划。　最后，本文概述了俄罗斯政府和企业所采取的药品物流趋势，并分析了这将如何影响市场形势。　研究药品生产和物流的专家以及市场参与者会对本文感兴趣。

关键词：药品物流、美国、COVID-19 大流行的后果、问题、解决方案。

Abstract. The article examines the features of US pharmaceutical logistics and the problems the industry faced during the COVID-19 pandemic in 2021 and 2022. In addition, the main reasons for the problems of the US market structure in terms of pharmaceutical logistics and a plan for solving such difficulties are highlighted. The author also lists the prospects that the industry has gained as a result of responding to emerging challenges, and plans for their implementation in the future. In conclusion, the article outlines the trends in pharmaceutical logistics that have been adopted by the Russian government and business, and analyzes how this will affect the market situation. This article will be of interest to specialists studying pharmaceutical production and logistics, as well as market participants.

Keywords: pharmaceutical logistics, USA, consequences of the COVID-19 pandemic, problems, solutions.

Introduction

The relevance of the study is determined by the fact that the COVID-19 pandemic has significantly hit virtually all sectors of the economy, and logistics,

which ensures the movement of goods from suppliers to buyers, has become a particularly problematic area. At the same time, as a result of difficulties in logistics, the functioning of even the most developed industries, one of which is pharmaceuticals, is under threat. Despite the significant increase in sales volumes in the pharmaceutical industry, the industry also suffered huge losses as a result of logistics disruptions. And since the US is one of the leading pharmaceutical manufacturers in the world, the country's industry has also faced many challenges caused by reduced transport capacity, pharmaceutical distribution, disruptions at ports and labor shortages as a result of border lockdowns.

In addition, the pandemic has caused the closure of pharmaceutical raw material manufacturing plants in China, which has impacted the production of active pharmaceutical ingredients in India. All this has hit the US healthcare system hard, which was previously considered one of the best in the world. These vulnerabilities are amplified when combined with other pharmaceutical manufacturing complexities and challenges, including a lack of data sharing and transparency in the supply chain, and technological limitations that impede rapid response and flexibility during surges or crises. All this requires finding solutions that will help optimize the industry, taking into account emerging challenges and the transformation of the modern market in the world.

Main part

The COVID-19 pandemic illustrates the vulnerability of the U.S. pharmaceutical supply chain and how much a crisis can impact its integrity. A surge in demand for life-saving drugs coupled with disruptions in global supply chains has left the United States facing shortages and distribution challenges , which had direct implications for patient care.

Unfortunately, global pandemics are not the only events that impact the pharmaceutical supply chain. In 2017, Hurricane Maria devastated the island of Puerto Rico, including many facilities producing injectable saline for the United States; supplies remained under critical pressure for several years. Even in the absence of a crisis, the U.S. pharmaceutical supply chain can be impacted by market and economic factors, such as decisions to close manufacturing facilities.

The closure of pharmaceutical raw material factories in China has impacted the production of active pharmaceutical ingredients in India. As a result, India began to run out of materials to produce essential drugs, and the country imposed a ban on drug exports during the pandemic [6]. All this has taken a significant toll on the US healthcare system, which was previously considered one of the best in the world.

Problems like these are crippling the pharmaceutical supply chain, preventing the United States from providing the health and preventative medications its people need. Moreover, these vulnerabilities are amplified when combined with other

complexities and challenges in pharmaceutical manufacturing, including lack of data sharing and transparency in the supply chain, and technological limitations that impede rapid response and flexibility during surges or crises.

Let us consider the problems from the US market structure in terms of pharmaceutical logistics in more detail.

The most significant of them are as follows:

- most of the APIs are produced not in the USA, but in India and China;

- due to the coronavirus (closure of ports and factories), delivery deadlines were not met, although previously everything worked like an hour;

- in the United States, some drugs could not reach the market for about a year.

Thus, as of March 2021, 87% of production sites producing APIs and 63% producing finished dosage forms were located abroad. China, in particular, controls the majority of fermentation-based API production and has pursued strategies such as dumping products below cost to increase its market share in China. It is also a leader in the production of APIs for low-cost generics, including antibiotics and analgesics, which also became a problem during the pandemic and the closure of major US logistics routes. In addition, it is worth emphasizing that India supplies finished dosage forms to the United States, a significant part of which uses Chinese substances in the production. During the pandemic, the US also had limited access to such drugs.

U.S. dependence on foreign pharmaceutical manufacturers has increased during COVID-19 as many U.S. manufacturing sites have closed or moved overseas.

The second logistics problem due to the coronavirus was related to the closure of ports and factories. As a result, delivery deadlines were not met, although previously everything worked like clockwork. The pandemic forced weak and small logistics companies out of the US market, which were unable to increase capital during their existence.

As a result, some drugs could not reach the market in the United States for about a year, which hit the image of corporations and public health, and also caused significant damage to the reputation of the country's government and its pharmaceutical industry.

One of the key decisions that contributed to solving the pressing issue were:

1. Preparation of a list of 84 vital drugs;

2. Launch of localized production of APIs for vital drugs;

3. By using public-private partnerships to create shared infrastructure/data networks for both government agencies and pharmaceutical supply chain participants to collectively respond to supply and demand challenges.

4. To require reporting of key information about inventory levels to the US government and consider increasing the frequency of reporting (i.e., monthly or quarterly rather than annually) of data that is currently required.

As a result, the US government has set a task to build a transparent system of traceability of the current availability of APIs for the production of vital medicines in manufacturers' warehouses.

Identification of the problem and setting of goals by the institute that solves this problem and has created a list of 84 drugs that need to be localized. They include several groups of analgesics, anesthetics, IG products of animal origin, etc.

At the same time, emphasis is placed on the localization and implementation of the full cycle of pharmaceutical products, which will avoid future difficulties with the supply of Chinese and Indian active pharmaceutical ingredients and generics in the event of such failures. Directions have also been identified for attracting pharmaceutical talent to the industry and strengthening new developments that will help ensure the country's domestic market in full.

At the same time, it is worth emphasizing that the Russian government has already implemented specific actions to eliminate difficulties in pharmaceutical logistics. For example, the Ministry of Industry and Trade developed a draft government resolution, called the "second odd one out" mechanism, according to which government purchases of certain drugs against HIV, oncology, diabetes and tuberculosis produced by foreign enterprises are limited. In essence, this is an import substitution strategy in government procurement and works by analogy with the current "third wheel" rule, according to which a foreign drug manufacturer is not allowed to bid if at least two manufacturers from the EAEU countries enter the auction. However, this concept must be adjusted taking into account the requirements of patients and assessment of the quality of domestic drugs. The lack of quality solutions can lead to a shortage of a number of drugs and deprive patients with individual intolerance of access to therapy.

By analogy with the United States, work is also underway in the Russian Federation to provide vitally needed medicines produced in Russia. For these purposes, it is necessary to observe the principle of the full cycle of drug production, starting with the active pharmaceutical substance.

Information about medicines of the full production cycle will be contained in documents, for example, in certificates of the country of origin of the form - "ST-1" or in the "Conclusion on confirmation of the production of industrial products in Russia, issued by the Ministry of Industry and Trade of Russia."

The traceability system for pharmaceutical substances will work simultaneously with the "second wheel" mechanism. The implementation of such events will help meet modern challenges in the pharmaceutical industry and accelerate the scientific and technological development of the industry. In addition, such mechanisms are one of the key ones for the implementation of the development strategy of the pharmaceutical industry of the Russian Federation for the period until 2030.

Conclusion

Overall, the COVID-19 pandemic has caused significant challenges and changes in US pharmaceutical logistics. However, it also stimulated innovation, investment in research and development, and increased awareness of the importance of efficient logistics and supply chains not only in the United States, but also in the Russian Federation.

Various market pressures and economic factors have created sustainability challenges for the U.S. pharmaceutical supply chain, increasing risks and vulnerabilities. Low margins have led to a significant volume of API production moving overseas, as well as reducing the duplication required for supply chain sustainability.

These vulnerabilities are compounded when other complexities and challenges in pharmaceutical manufacturing, including a lack of data sharing and transparency in the supply chain, have created a drug supply crisis in the US.

To ensure better preparedness and a more resilient and stable manufacturing environment in the U.S. overall, the White House issued an executive order on supply chain resilience in February 2021. As a result, the government ordered the creation of a unified traceability system in the pharmaceutical supply chain, and also instructed manufacturers to report inventory balances to begin with, increasing the frequency of reporting (i.e. monthly or quarterly rather than annually).

In the Russian Federation, a unified system for monitoring the movement of medicinal products will be fully operational in 2021, and starting in 2024, a traceability system for the production of APIs will be operational.

In order to stimulate national manufacturers of APIs and medicines, the Ministry of Industry and Trade launched the "second odd one out" process, according to which preferences in the public procurement market will be given to those market participants who have completely localized the production of medicines in Russia.

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使用 CHATGPT 起草法院判决书：人工智能能否取代俄罗斯法官的职业？
DRAFTING A COURT JUDGEMENT USING CHATGPT: CAN ARTIFICIAL INTELLIGENCE REPLACE THE PROFESSION OF A JUDGE IN RUSSIA?

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抽象的。 本文致力于探索将人工智能（AI）引入司法活动的可能性，以及利用人工智能能力变革司法程序的趋势和前景的思考。 文章正文证实了需要保护法官活动所依据的法律、原则和规则的人文本质的原因。 相关结论是根据所考虑的规定得出的。

关键词：司法制度； AI（人工智能）； 法官； 司法程序的公正性； 案件审查。

Abstract. This article is devoted to the exploring of the possibility of introducing artificial intelligence (AI) in judicial activity, as well as to the consideration of trends and prospects of transformation of judicial proceedings using the capabilities of artificial intelligence. The text of the article substantiates the reasons for the need to preserve the humanistic essence of law, principles and rules on which the activity of judges is based. The relevant conclusions are drawn on the basis of the considered provisions.

Keywords: judicial system; AI (artificial intelligence); judge; fairness of judicial process; case review.

Today, there are many professions that're subject to extinction due to the introduction of AI into the work process. AI is capable to replace workers with highly qualified competences, since routine intellectual operations of any complexity are easily algorithmized and controlled by a program capable of handling a volume of data much better than that available to humans. For example, after 2020 professions considered to obsolete are legal adviser, notary, logistician, analyst and others [4].

	LEGAL ADVISER	GOVERNMENT SERVICE OPERATOR
AFTER 2020	NOTARY	LOGISTICS EXPERT
	BANKING CLERK	DIAGNOSTICIAN
	REAL ESTATE AGENT	SYSTEM ADMINISTRATOR
	TOUR GUIDE	CONTROL ROOM OPERATOR
	ANALYST	
	JOURNALIST	NAVIGATOR
	SPORTS ANALYST	PHARMACIST
	SECRETARY/PERSONAL ASSISTANT TRANSLATOR/INTERPRETER	

Ref. 1. «White-collarjobs to become obsolete after 2020».

They are becoming obsolete since the tasks performed by specialists in these professions are completely transferred to intelligent programs, including artificial intelligence. The volume of data and its complexity is increasing, making it difficult for a person to process such a flow of information quickly and efficiently. What is AI? The definition of this concept was given in the National strategy for the development of AI for the period up to 2030, approved by the President of the Russian Federation. Thus, AI is a set of technological solutions that allows imitating human cognitive functions (including self-learning and search for solutions without a predetermined algorithm) and obtaining results comparable, at least, to the results of human intellectual activity when performing specific tasks. The set of technological solutions includes information and communication infrastructure, software (including software that uses machine learning methods), processes and services for data processing and solution search.

In February 2023, the news that a Colombian judge had used the currently gaining popularity ChatGPT to deliver a judgement sparked serious discussions on the Internet. The judge himself said that he used AI in order to speed up the procedure of making a judgement. Having analyzed the results of the queries that the AI provided, the judge included complete answers in the decision and explained that the use of AI significantly reduces the time required to draft a court decision [2]. Such news, on the one hand, allows us to understand that nowadays AI significantly facilitates and speeds up the activities of the legal community, however, on the other hand, it raises great concerns. The question arises: is AI with its rapid development able to completely replace the activity of judges?

Certainly, the possibility of using AI in judicial activity cannot be underestimated. In the Russian legislation, Presidential Decree № 490 of 10.10.2019 approved the national strategy for the development of AI in the Russian Federation [1], which shows the interest of our country in the introduction of AI in various spheres of public life. As for the legal sphere, modern technologies are indeed able to significantly simplify judicial activity. Thus, AI can process a large amount of information, search for appropriate regulations and articles of law, analyze them and even issue its own court decision, based on the processing of similar decisions. For example, in 2002 an attempt was made to predict the decisions of the US Supreme Court. The results of the experiment showed that machines coped with the task better than humans - machine intelligence was right in 75% of cases, experts - in 59.1%. Rapidly developing, AI will be able to eliminate gaps in the law by using the analogy of law, as well as to correctly interpret and apply the rules of law. That's why many countries, in whose courts AI is used as an auxiliary tool that helps to analyze documents, are now thinking about automating the entire justice process. However, only those countries whose legal system represents the Anglo-Saxon legal family, in which the institution of case law is developed, can talk about this, since the activity of AI is based precisely on the search for similar court decisions.

To answer the question of whether AI can fully replace the judge, it is necessary to analyze the main arguments that refute and support the possibility of automating the judge's work.

In support of the possibility of using AI systems as a judge, the following arguments can be highlighted:

– Firstly, the courts of the Russian Federation are currently significantly overloaded, which delays the process of hearing cases. Therefore, as mentioned earlier, the creation of an "electronic" judge would be able to solve a number of problems and provide many advantages;

– Secondly, in today's world, in the age of global civilizations, creating a neural brain capable of solving court cases would be a great advantage in the legal direction;

– Thirdly, adjudication by AI excludes the possibility of diametrically opposed decisions. In addition, AI is impartial, it cannot be bribed, influenced by unlawful methods, misled and so on;

– Fourthly, the quality of judicial acts is improved, because AI uses current court practice, the latest legal doctrines, samples of the best court decisions when making decisions and can analyse and compare more information than a human being.

The Laser-IP-GPC-2020 programme was developed in Russia to assist judges in making reasoned court decisions under the rules of the Civil Procedure Code.

It allows the judge to create the conditions of movement through the stages of enforcement and legal reasoning and reduces the deficit of judge's time. In the process of proceedings, the judge fills in the programme form and it issues a motivated court decision based on the technologies of mathematical logic. The algorithms of the programme remind the judge of the necessary sequence of actions during the case. This programme is based on laws and provisions of the theory of law enforcement, rather than on pro-enforcement practice.

In the process of considering the benefits of AI as a judge, one might assume that indeed an electronic judge is capable of replacing humans. But is this really the case? It is necessary to address the negative side of such "replacement".

–   Firstly, in December 2018, a "European Ethical Charter on the use of AI in judicial systems and the realities surrounding them" was adopted [3]. This document defines a number of principles, as a result of analyzing which, it can be understood that AI activity should be used only as a recommendation in rendering a judicial decision, but not completely create it. Thus, the Council of Europe opposes the replacement of the judge by AI. At the moment, the Russian Federation also adheres to this position, since a living judge, in the course of his activity, is based on moral principles, which are not taken into account by AI, which uses only the provisions of the law, but not the human factor. Consequently, AI is not able to take into account mitigating or aggravating circumstances.

–   Secondly, the "spirit of the law", on which the enforcement process must be based, can only be identified and understood by a highly qualified expert, but not by AI.

–   Thirdly, if there are a large number of contradictions in the applicable rules or evidence in a case, AI is currently unable to analyse them properly.

–   Fourthly, AI is currently susceptible to numerous "hacks", which is unacceptable in litigation because it violates the principle of fair trial.

1.   Summarizing the above, we can conclude that a court decision can significantly change the fate of a person, so it is impossible to make mistakes in this process. Accordingly, such decisions should be made on the basis of legal logic. Indeed, AI can facilitate the work of a judge, but not completely replace it. However, the automation of many processes of public life should not be prevented, so the most successful option at this point in time will be the symbiosis of a living judge and AI. This will speed up and simplify the work of judges, and their decisions will be more accurate. Thus, combining the capabilities of AI and the skills of a competent judge will improve the judicial system, modernize it and bring it to a new level.

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现代教育潮流背景下学生智力与人格的形成
FORMATION OF STUDENTS' INTELLIGENCE AND PERSONALITY IN THE CONTEXT OF MODERN EDUCATIONAL TRENDS

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注解。 在本文中，作者分析了国内教育发展的现代方面，并发现了其对我们社会未来积极公民的多方面发展的潜力。 学校提供的传统教育在十五年后就变得无可救药地过时了，所以我们必须能够积极主动。 对此，笔者认为，我们在教育过程中必须积极运用现代教学技术。

例如，今天许多人错误地认为远程学习的出现是为了应对与 COVID-19 大流行相关的问题。 事实上，俄罗斯在21世纪初就开始实行远程教育，当时开始为残疾儿童创建远程学习中心。

关键词：背景、人工智能、教育元宇宙、神经网络、网络、播客、学生智力发展、中心。

Annotation. In this article, the author analyzes modern aspects of the development of domestic education and finds their potential for the multifaceted development of future active citizens of our society. The traditional education provided by school becomes hopelessly outdated in fifteen years, so we must be able to be proactive. In this regard, the author believes, we must actively use modern pedagogical technologies in the educational process.

For example, many today mistakenly believe that distance learning appeared as a response to the problems associated with the COVID-19 pandemic. In fact, distance learning was practiced in Russia at the very beginning of the 21st century, when distance-learning centers for children with disabilities began to be created.

Keywords: background, artificial intelligence, metaverse for education, neural networks, networking, podcasts, development of student intelligence, hub.

Trends in education are directions in its modernization and change. Their appearance is caused by the emergence of new pedagogical conditions and active teaching methods, which are considered the basis of the educational paradigm of

our time. In addition, the increasing demands from society for a critically thinking and functionally literate individual, capable of continuously updating his knowledge, contribute to his rapid retraining and changing the area of application of his potential for a successful and productive life in a rapidly changing world. Thus, trends arise in response to existing problems in our education. At the same time, all trends can be divided into non-instrumental (technical) and social (humanitarian) trends. Before characterizing them, the author proposes to consider the leading problems of modern education.

Problems of the modern education system. The education of the future faces many challenges. Research conducted by other authors most often points to the formalization of knowledge, the lack of an individual approach, a decrease in the meaning of education and insufficient motivation of students [2].

Formalization of knowledge– this is a problem in many countries, including Russia. In this case, education does not reveal or develop the abilities of students, but only contributes to the receipt of formal documents: certificates, diplomas, certificates. Overloading of teachers also formalizes education. Lack of time reduces the desire to be creative in preparing lessons, and teachers who are under 30 years of age perceive the problem more acutely than their older colleagues. However, all this together often leads to stress and professional burnout among representatives of the older generation of teachers.

Reducing the meaning of system elements. Due to the fact that the Russian education system relies on different temporary models, some replace each other. For example, studying in high school has largely turned into preparation for the Unified State Exam instead of providing knowledge that will be useful in students' further education and career; Career guidance often fixes a path in a specific specialty, excluding the opportunity to try different directions and learn to make your professional choice independently [9].

Lack of an individual approach in education at any stage and level. Many educational organizations now design individual trajectories for students, but most implement them formally - in the form of clubs and elective courses of extracurricular (extracurricular) work. At the same time, an individual approach involves not only changing the content of the educational process, but also the pace of learning, formats, student interests, and personal characteristics. As a result, the central figure in the school remains the teacher, not the student.

Also problematic factors include the aging of the teaching corps and the need to improve the quality of training of future teachers. To reduce tensions, a law came into force in 2023 allowing final year students of teacher training colleges to officially work in kindergartens and primary schools. Previously, only students of pedagogical universities had a similar right. In one of his articles, the author analyzes this problem in detail and concludes that it is necessary to improve quickly the quality of teacher education [7].

Thus, the main trends in the development of modern education include the integration of technology, the development of online education, the true individualization of education, practical orientation, vocational training, globalization and the development of competencies of the future. Understanding these trends allows us to be prepared for the challenges of the future and provide quality education for all [8].

Today, various researchers identify 8–10 trends in the development of national education in 2024. However, in this article the author dwells in more detail only on those areas of development that contribute to the formation of intelligence and the development of the personality of students. The author considered this problem quite a long time ago, but the relevance of this issue has not decreased to this day [3].

In general, the author believes, intelligence is one of the leading personality qualities of a future specialist. Intelligence determines the general culture of a modern person, which affects the building of communications and the ability to work in a team of like-minded people [4].

So, the trends in the development of the Russian education system, which the author considers key in 2024 for the formation of students' intelligence and the comprehensive development of their personality.

Personalized learning. At the same time, the course content and learning processes must be developed for each student, taking into account his pace of learning the educational material and cognitive interests. This will increase the level of student interest and the effectiveness of education. Adaptive learning platforms and artificial intelligence-based tools will help with this. The main trend here is individualization. If society copes with it, education will respond to the needs of the modern world. However, there are several aspects to customization.

Educational program. It is clear that each program has a certain framework, since it prepares the student for a specific educational result. However, within disciplines, courses, modules can be a little wider or deeper - depending on what the student needs and what his career and personal plans are. Training formats are directly related to the individual characteristics and needs of the student. Some people learn better in game mode, others in training mode, and others in traditional mode. However, any of the formats must ensure the formation of intelligence and the development of the student's personality. An individual approach in this regard increases the effectiveness of the educational process. At the same time, it is more complex and costly than other methods and requires additional training of teachers.

Educational results. The Federal State Educational Standard for General Education always contains a minimum base that the educational program must provide. Nevertheless, the formation of a personal trajectory and intelligence also

implies obtaining personal results that are important for students. In this way, we will receive graduates, each of whom will have a unique set of competencies, knowledge, skills, and developed personal qualities (intelligence, basic national culture, Russian identity, moral values). This is exactly what will ensure graduates' success in the current unpredictable world and will allow them to enter new types of markets, industries and professions, systems and relationships.

Global and collaborative learning. The education of the future will become more interconnected, allowing students around the world to participate in joint projects and cultural exchange. In this communication, a special environment will be created in which the intelligence of students will naturally be formed. Technology will facilitate student communication and networking. By networking, the author understands expanding the network of acquaintances to solve professionally significant and personal problems with their help. Teachers and students will have to develop empathy, communication skills, creativity - these skills are far from being mastered by machines. Some students have them from birth, but even then they can be improved. Chat-bots will not be able to replace the teacher: he will also need to establish contact with different students and their parents. Since there is a trend towards multilingualism and multiculturalism, it is possible that representatives of different cultures will study in the same class. This is already happening in some schools.

By the end of the decade, there will be a growing demand for workers with higher levels of intelligence and creativity, with well-developed critical thinking, and who are not afraid to make decisions. At the same time, advanced literacy and statistical data skills will not be in high demand: the need for them will remain the same or may even decrease. It will also be necessary to develop collective competencies: difficult projects will be carried out in teams where people of different ages and with different cultural backgrounds gather. (Background is everything related to a person's life, education, connections, experience; intellectual level, cultural preparation, degree of education, life and professional experience). Accordingly, it is important here to understand each other, be able to negotiate and cooperate, but at the same time argue your position and resolve conflict situations.

Schools will collaborate more with museums, libraries, technology hubs and similar organizations. They will turn into a kind of educational hubs - platforms where innovative educational practices and approaches are integrated in the format of additional education programs. The word "hub" is an abbreviation of the English word hub, which literally means the hub of a wheel or center. It turns out that a hub is the central node of some network where different elements or information flows converge.

Pedagogy of relationships. In the learning process, it is important not only to acquire knowledge, but also to have a healthy climate that promotes the devel-

opment of relationships between participants in the educational process. In this regard, it is important to note that only a third of online school students consider this trend to be paramount: this is explained by the fact that the pedagogy of relationships in the online education environment is developing, ahead of other segments - the majority of students have no need for it yet, but they have the opportunity to independently choose mentors and adapt the curriculum to your needs and workload. That is, there is a need to organize a personally adequate educational environment based on taking into account the situational dominance of students. Experts believe that in such a paradigm the role of a mentor is especially significant, with whom the student develops trusting relationships and who helps to achieve goals. For example, in the formation of the same intelligence and other necessary personality qualities [5].

Artificial intelligence in education. Intelligent learning systems, chat-bots and virtual assistants will improve the learning process and transform the entire educational environment. Generative artificial intelligence is experiencing a real boom today. Large Russian edtech- companies are actively including it in the educational process, and experts, although they note the uneven coverage of artificial intelligence in education, predict the scaling of technology in education in the near future. Moreover, among innovators, business representatives more often hold this opinion than participants in the traditional education system. Online students are also less likely to report the importance of this trend compared to other trends. However, due to the adoption of rules for attracting artificial intelligence in educational organizations, there may be an increase in interest from students and government institutions in the future.

Therefore, despite the boom in artificial intelligence, this trend is still far from being in first place. This can be explained by the fact that artificial intelligence has not yet been built into pedagogy in the literal sense; its coverage in education remains uneven until the rules for its use in educational institutions are developed. However, with the help of artificial intelligence, other trend areas can already be implemented - interdisciplinarity, interpenetration of learning environments, and multimodal pedagogy, and the coupling of learning contexts [1].

The same can be said about podcasts - they are not yet considered as an independent pedagogical technology, but they can be a good help in the implementation of similar trends. In simple terms, a podcast is a thematic audio program that can be listened to online or downloaded for further listening. Unlike radio, which plays in real time, a podcast is a pre-recorded audio clip that is uploaded to a podcast platform. In recent years, educators have taken a closer look at podcasts as an educational tool. You can not only listen to them and learn something useful, but also create educational material using a multimodal approach. The informality of podcasts, the breadth of formats and topics - audio lectures, interviews, cases, recordings of excursions - may interest students.

Neural networks already help to learn foreign languages and correct errors in code. True, such systems are just beginning to be integrated into the daily work of teachers, and in different educational institutions the process proceeds at different speeds. A neural network is a mathematical model that works on the principles of the nervous system of living organisms. Its main purpose is to solve intellectual problems. That is, those that do not have an initially specified algorithm of actions and a predicted result. The main feature of neural networks is their ability to learn. They can learn both under human control and independently, using previously gained experience.

Metaverse for Education. Virtual worlds are a new trend not only in the field of education, but also in the industry of high-tech innovation. The trend regarding the inclusion of metaverses in education is still futuristic and we will see it develop over the next decade. Although there are no major educational projects related to metaverses on the market yet, individual corporations are already developing this area in various industries. Metaverses are virtual spaces where people interact with digital objects and each other. The difference between a metaverse, for example, and a computer game is that it is infinite, complements the real world and is open to everyone, at least in theory. Therefore, the metaverse can become an ideal resource for shaping a student's personality in a given direction.

Features of metaverses can improve educational processes. For example, design training so that the student is fully involved in the process, studies the social environment, independently selects the necessary tasks and solves them because he wants to, and not because it is necessary. In metaverses, you can create schools, colleges, universities, open branches, classes - additional or alternative to physical space. Here you can design group meetings, conduct active networking sessions, model the individual and personal development of students in the information and educational environment of the metaverse [6]

Thus, returning to the title of the article, we can conclude that the inclusion of artificial intelligence in education is one of the main trends today. Chat-bots won't replace teachers, but they can free up time for more complex tasks. Teachers will have to work more closely with digital technologies, develop empathy and communication skills. Students will need to develop critical and systems thinking. Learning will become flexible, personalized, and students will gain their knowledge through practical experience. In these conditions, the formation of real intelligence in students and the cultivation of the necessary personality qualities will become much faster and more effective.

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跨学科联系和能力在学生形成物理模型中的作用
THE ROLE OF INTERDISCIPLINARY CONNECTIONS AND COMPETENCIES IN THE FORMATION OF PHYSICAL MODELS BY STUDENTS

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注解。 文章基于自然科学学科能力形成研究的中间成果，探讨了跨学科联系的实施和过程物理模型的构建。
关键词: 跨学科联系、物理模型、能力。

Annotation. *The article talks about the implementation of interdisciplinary connections and the construction of physical models of processes based on the intermediate results of research on the formation of competencies in the study of natural science disciplines.*

Keywords: *interdisciplinary connections, physical models, competence.*

Some of the main objectives of the educational process are: the formation of a system of education and training that will fully meet the educational needs of citizens and the state, the norms of Russian and international law; creation of work motivation, active life and professional positions.

Today, in the context of the development of information technology, the definition of educational goals in the framework of training specialists capable of adapting to social and information realities plays a vital role.

The ability of graduates to master information technologies and apply them in their activities, to apply self-education skills to improve their professional level today is a "default" requirement. Another important task of the education system is to create conditions in which it is possible to carry out the learning process efficiently. Our teaching experience suggests that motivation by evaluation criteria alone is not enough to awaken students' interest in the issue of high-quality knowledge acquisition.

In general, the approach of presenting a sum of knowledge as ready-made answers that just need to be memorized, without posing problematic questions that encourage students to solve them, is not productive.

Educational standards define a competency-based approach as the basis of the learning process, which makes it possible to combine the basic training of students and issues of an applied nature into a single whole, orienting future specialists to the formation of skills that will serve as the basis for their future activities as specialists. Of course, the key role here is played by the issue of mastering professional skills at a good, high-quality level, which is impossible without mastering the disciplines of the basic cycle.

The prerequisite for carrying out research by us, the teaching staff of the Department of Physical and Technical Fundamentals of Safety of the Ural Institute of the State Fire Service of the Ministry of Emergency Situations of Russia in this matter was the presence of negative experience of students' poor mastery of the disciplines of the natural science cycle due to insufficient motivation to master knowledge, associated, first of all, with lack of understanding of the importance of this for their further education in other disciplines

The subject-based education system that has been formed in universities carries with it the lack of disunity of disciplines that form specific knowledge, skills and possessions. The use of a competency-based approach as a combination of all elements of knowledge and skills into a common ability or abilities solves the global problem of training specialists.

An important task here is to search for competencies that would integrate the main expected results of education, which could help form a quick response to changes and would facilitate adaptation to them [1].

And here we have to take into account many related tasks, starting with keeping each student in balance between his own and social needs, simultaneously pursuing the task of socializing each individual in the learning process, and ending with the same formation of motivation for creation, a meaningful and high-quality work process.

Competence is a synthetic concept that presupposes the possibility of using acquired knowledge in specific, diverse situations of professional activity, while presuming the result obtained. Competence is also understood as a skill to carry out activities based on knowledge and skills in accordance with specified requirements [2]. One should take into account the huge number of possible situations in professional activity, their diversity, as well as the obvious complexity of integrating each individual subject knowledge and skills.

The process of meaningful integration of competencies is determined by the creation of connections between areas of knowledge, and in our case, between specific disciplines of study, the creation of an integral structure that unites all components into a single one. This includes combining different areas of knowledge to create a holistic description of processes, balancing the importance of each individual discipline in comparison with others, and changing the existing traditional monodisciplinary education system.

Integration is possible in two options: monodisciplinary and multidisciplinary. Integration in one subject involves the teacher using knowledge gained from studying other disciplines to effectively master new material. Multidisciplinary integration is the integrated use of different areas of knowledge to reveal the essence of the issue under consideration. The result of this can be either the emergence of a cycle of classes in which material from several disciplines is used, or the emergence of new disciplines and courses.

Due to the strengthening of structural and logical connections between disciplines, contradictions that arise in the subject education system can be resolved along the way. Strengthening interdisciplinary connections also leads to improving the quality of professional training, which directly affects the formation of the professionalism of future specialists. It is this component that ultimately serves as a measure of the student's professional competence upon completion of his training. Integration processes that accompany any activity against the backdrop of the development of informatization of society lead to changes in the requirements for specialists: they must have the skill of comprehensively using the knowledge acquired during training.

Our study confirms the feasibility of using multidisciplinary integration, since this teaching principle, like any other, can be used in relation to each of the teaching disciplines. This also helps to create conditions for joint activities of students and teachers within the framework of scientific work [3].

The conditions that help form the educational process on a multidisciplinary basis, when each previous discipline is used as a basis for presenting the material of the subsequent discipline, imply the integration of the conceptual apparatus of all areas of science to realize the unity of approach in the description of all phenomena. The foundation for this in the pedagogical process is a clearly structured system of competencies, which determines the qualities necessary for the development of future specialists.

Speaking about competencies, it should be noted that competence is both a list of knowledge, skills and abilities that will be necessary for the implementation of an individual's activities in the work and social sphere, as well as the already formed qualities of the student, as well as his, albeit small, but already accomplished work experience in this field. Competence in education is determined by a set of related concepts in relation to objects of objective reality and the corresponding necessary productive actions. The interconnectedness of competencies in education is determined by the provisions of educational standards,

The use of competence as an integral requirement for training students, the connection between the skills acquired in the learning process and their intended use determine the success of the entire educational process as a whole. In our study, we examined the development of competence when considering all disciplines as a whole, taking into account interdisciplinary connections and their impact on the effectiveness of mastering the concepts and methods being studied, which are reflected in further professional activities.

In particular, the discipline "Physics" is a basic discipline and the acquired knowledge and skills in the form of formed competencies will further serve as the basis for the study of subsequent disciplines. In our study, based on the curriculum for the specialty 20.05.01 "Fire Safety", the training of students in the level of knowledge of general physics is considered, which implies the integration of physical knowledge and skills as the basis for understanding the processes occurring in all technical systems. This is important not only from the point of view of understanding the processes occurring in modern technical systems used in professional activities, but also as a fundamental basis for the study and analysis of such systems, and the formation of an engineering approach as a whole.

Physical models of processes and systems, the ability to build them is the result of training in physics, and from this point of view the following stages can be distinguished: initial (initial data) - absorption of material for further modeling; subsequent (selection of methods) – data analysis, selection of applicable laws and data processing methods; final (model formation) – solving particular problems and constructing a general algorithm for describing the modeling object. In relation to all problems in general, this implies solving applied problems systematically. In general, the construction of physical models can be considered as a way of developing in students the ability to construct simple models in the course of mastering subsequent disciplines and qualitatively analyze the results. The teacher, in the process of using an interdisciplinary approach, pursues the goal of expanding the known boundary of knowledge to the boundary of new knowledge [4].

The qualitative organization of the learning process for mastering the methods of constructing physical models should be structured as follows:

1. when building a model, you need to learn the generalization technique: verbal formulation of the problem – formalization of the problem – construction of a

generalized model – application of specific laws and rules – solution of the problem – calculation of the errors of the result – analytical conclusion;

2. during the presentation of theoretical material in the classroom, the concepts of a physical model and methods for constructing a physical model are defined, defining in each section of the discipline a set of objects and phenomena in the form of a model describing this subject area;

3. in the course of solving problems, students are offered tasks from a specific section for which didactic units are defined, the general direction of solving problems is determined, after which students independently solve the problems; when solving complex problems, the general solution algorithm is first analyzed;

4. a summary is made at the end of the classes, where the degree of development of students' knowledge and skills is assessed in terms of their ability to analyze, generalize and summarize the construction of the model.

Thus, when developing competencies, it is necessary to pursue not only the assimilation of the amount of knowledge, but also the qualitative integral component of a systematic approach to the analysis of phenomena and processes as a whole [5]. The first stage of longitudinal research confirms the need to formulate requirements for future graduates using this approach.

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医学教育中导师对医生专业发展的影响
THE INFLUENCE OF MENTORING ON THE PROFESSIONAL DEVELOPMENT OF A DOCTOR IN MEDICAL EDUCATION

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抽象的。 本文介绍了使用指导的经验。 选择导师辅导模式作为提高"全科医学"专业实习生专业能力的方式，以"全科医学实践"培养方向为导向。 注意到需要为导师创造威望地位。
关键词：导师、导师角色、导师、经典导师模式、实习生。
Abstract. *The article presents the experience of using mentoring. The a- mentor mentoring model was chosen as a way to improve the professional competencies of intern students in the specialty "General Medicine" in the direction of training "General Medical Practice" . The need to create a prestige status for a mentor is noted.*
Keywords: *mentor, role of mentoring, mentor, classical mentoring model, interns.*

The understanding of mentoring as a process of directed assistance, support and accompaniment in the formation, choice of life path, development and self-improvement of a person through interaction with an older, experienced, wise person with unique knowledge (mentor) is almost universal and inherent in most world cultures. Over the past 40 years, mentoring has been widely implemented in specially designed and organized projects and programs within educational, professional and social contexts [1; 2–5; 6; 7].

Foreign studies have revealed that employees who have mentors gain significant benefits, including in terms of career growth, job satisfaction, etc. [8-10]. Having a mentor facilitates the process of social adaptation [11]. In addition, those who have been in the role of a student are more likely to then become mentors themselves, that is, they "pay in advance" for their knowledge and experience [12, 13].

It is known that the ultimate goal of mentoring is the fullest possible disclosure of the mentee's personal potential, which is necessary for successful personal and professional self-realization through the creation in a medical institution of conditions for the formation of an effective system support, self-determination and professional guidance of medical workers [14].

Mentoring is the prerogative of the most trained employees who have significant work experience, have high professional and moral qualities, show ability for educational work and enjoy authority in the team. The selection of a mentor is carried out by the head of a structural unit together with the administration of the institute and depends on a number of factors, such as the needs of the mentee, his initial training, professional knowledge, skills, and work experience [15].

The mentoring period, the duration of which depends on the degree of professional training of the mentee, is established by order of the director at the request of the head of the scientific department. A prerequisite for assigning a mentor to a young specialist is their mutual consent, as well as the possibility of creating the necessary conditions for collaboration between the mentor and the mentee. In the mentoring process, the personality of the mentor plays a huge role, because not every employee (even a professional in his field) can become a mentor. A mentor must have a number of characteristics, such as the desire and ability to share his knowledge, responsibility, responsiveness, dedication, a sense of tact, and self-organization [16].

Mentoring is a process that develops and motivates not only beginning employees of the institute, but also the mentors themselves.

Mentoring is used in the training/development of different categories of employees (including future employees of the institute) and for various purposes: with high school students - for career guidance purposes, with student interns - to deepen professional education and prepare for possible future professional specialization, with new employees - for the purpose adaptation, accelerated mastery of norms and requirements, entry into a full-fledged working mode, with established professionalism [15] .

Mentoring work is considered an important element in the organization of educational activities of a medical university. At the same time, it has its own characteristics, determined by the profile of education in the chosen profession, mastering a wide range of medical and natural science disciplines. The problem of

instilling universal spiritual and national values in medical students remains extremely relevant for a medical university, since these qualities are the main source of development of the future doctor's personality. Therefore, to increase the effectiveness of this type of activity, it is necessary to improve methods of working with students, using modern technologies of education and training [17, 18, 19].

The activities of specialist mentors are an effective form that promotes the personal and professional development of senior students in accordance with their chosen specialization. The main goal of this work is to assist future young doctors in their professional development, acquiring knowledge and skills to successfully perform their job duties. The mentor should help the student immerse himself in the profession in accordance with the chosen specialization, in the formation of personal and professional competencies, and reveal personal potential [14] .

The activities of specialist mentors allow them to solve several problems simultaneously, the main of which is to provide high motivation for independent cognitive activity, acquire strength and depth of professional knowledge, develop communication skills, which helps to establish emotional contacts within the team, develop team spirit, mutual respect and freedom of expression. Thus, mentors contribute to the development of moral qualities in medical school students, which acquire special importance in the formation of a doctor's personality.

Purpose of the study. To identify the conditions for increasing the effectiveness of mentoring at the Department of Pediatrics and Neonatology among 7th year intern students of the specialty "General Medicine" in the direction of training "general medical practice (GP)" .

Materials and methods

of the specialty "General Medicine" in the direction of training "General Medical Practice" was assessed .

At the workplace, a young specialist faces a number of difficulties that are both personal and social in nature. The development of mentoring is one of the options for making the transition from a traditional learning model to a person-oriented one, to create the necessary conditions for the development and manifestation of personal functions and a person's ability for self-development. A person-centered learning model, implemented in the form of mentoring, presupposes the presence of motivation to improve one's professional activities.

Of the various models for organizing mentoring, we chose mentoring . The purpose of the " mentoring " model: training, adaptation, monitoring the current work result, improving communications. Mentoring combines and accumulates the properties of coaching (partnership relationships, self-learning, active listening, asking questions) to teaching activities. The mentor first explains the theory, then demonstrates the technique, then the student completes the task and receives feedback.

Mentoring allows you not only to learn from the experience of an older and experienced colleague, but also to take an active part in the learning process; using this learning model, it was possible to cover a certain topic as widely as possible and transfer the experience and approaches of the mentor. Medicine is a practice, it doesn't matter how much you know if you don't know anything. Using this model, a mentor can approach training from different angles, i.e. there should be a theory from the mentor himself, a link to additional literature, examples from his own practice, questions to the student and listening to his opinion [1; 2–5; 6; 7].

Professional employees of the clinic have been appointed as mentors at the department: deputy. chapters _ in medical work, heads of cardio-rheumatology, pulmonology, allergy departments, with teaching abilities, communication skills, friendly, able to empathize.

Results and its discussion

The mentors were distributed as follows: one mentor took part in training 6-7 intern students.

The mentor formulated the learning goal and always received feedback from the trainers. Using the mentoring training model, the mentor, in accordance with his specialization, following the teaching technique, explained the tasks to the trainee, having previously distributed it into steps, and then asked questions to make sure that the intern student had learned the information. The mentor's contribution to the formation of the professionalism of interns of the 2nd year of study was that the mentor showed how to perform this or that study and examination, commenting along the way on what step he was performing. At the end of the training, the mentor asked if everything was clear. The student performed the task himself; the mentor could ask the intern student to do this or that step again, anew, if the quality of the work performed was not satisfactory. At the end of each section of the practical part of the mentoring model, the mentor gave feedback to the intern student and assessed the skills acquired.

The classic mentoring model included classic rounds with a mentor at the "bedside", when the student could see certain methods and methods of examination and questioning that are not described in the literature, and then use them himself.

When the mentor transferred his knowledge with an emphasis on practical activities, the skill or information was better absorbed, since the student began to independently perform the skill and develop thinking in non-standard situations. The student could ask the mentor what he did wrong and how to do it better. Mentoring as an undeniable factor in the formation of a young specialist largely determines the quality of his training and gives the right direction to the professional development of the future doctor.

Conclusion.

1. Mentoring is one of the promising practices for the professional development of doctors, since medicine requires the doctor to have practical

experience and high skill, ensuring the safety of the patient in the process of medical practice. Healthcare in general is in need of massive and rapid training of qualified personnel.

2. The most promising models of mentoring in medicine are mentoring and the traditional model of classical mentoring.

3. The effectiveness of mentoring depends primarily on the personality of the mentor and his professional experience, as well as on the availability of methodologically justified legal and organizational documents, theoretically supported by psychological and pedagogical research.

4. It is necessary to create prestige for the status of a mentor and attract experienced doctors who want to pass on their knowledge.

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作为语言文化代码的谈判过程
NEGOTIATION PROCESS AS A LINGUOCULTURAL CODE

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抽象的。 文章揭示了谈判过程作为语言文化代码的表征。 谈判取决于谈判双方的文化、经济和社会环境、传统和生活方式、目标和利益，参加者应予以考虑。 谈判语言文化规则意味着以下模式：谈判环境、谈判参与者、谈判各方的目的和动机、谈判的主题和过程、谈判的方法和结果。 所有这些元素都由不同的词汇单元和结构来表达，通常在研究和新闻中具有客观和主观的评价。
关键词：语言文化密码、谈判过程、中俄谈判策略。

Abstract. The article reveals the representation of the negotiation process as a linguocultural code. Negotiations are dependent on cultural, economic and social environment, traditions and ways of life, goals and interests of negotiating sides which should be taken into consideration by the participants. Negotiation linguocultural code implies the following model comprising as the main elements: the environment of negotiations, its participants, the aims and motives of the negotiating parties, the subject and process of negotiations, methods and its results. All those elements are verbalized by different lexical units and structures often having objective and subjective evaluation in research and press.

Keywords: linguocultural code, negotiation process, Chinese and Russian negotiation strategies.

The concept of code is variable. Generally it may be represented as a system of conventional signals transmitting information. Linguocultural code is simultaneously related to the culture and the language. In the context of culture and language, some scientists consider code as a matter being analogous to the notion of a "sign system" [1]. N.B. Mechkovskaya defines a code as a language or its variant, which is used by participants of a given communicative act [16]. V.A. Maslova

adds that the significance of a sign is determined by a code and by an interpreter who decodes this information [15, p. 21]. The code also may be defined as a set of units and rules that allow creating and interpreting texts. From this point of view, generating the text is considered as coding, understanding the text with the help of a code is specified as its decoding.

Culture is also represented as a set of codes that determines the mechanisms of human behavior. According to Yu. Lotman, cultural codes are systems of images codified in the given culture [14]. R. Barth interpreted them in a slightly different way: he nominates associative fields as codes, which impose an idea of a specific structure. Codes, to his mind, prove to be specific types of what has already been seen, read, done, and we may come across a large number of these cultural codes: scientific code; rhetorical code; chronological code; socio-historical code; action code etc. [2, p. 455 – 457].

The established code creates reality through the prism of some figurative theme. The role of a figurative code can be performed by any sensory perceived area of reality [20, p. 15]: landscape, celestial bodies, natural phenomena, plants and animals, artifacts (household utensils, tools, implements, housing, clothing, etc.) and also by what actually happens to these things. The semantics and pragmatics of such a code is an ensemble of conventionally adopted images, and its syntactic structure can be expressed in the form of a frame - a joint scheme according to which individual images are combined into a holistic picture.

Cultural codes accumulate and transmit stable systems of values and behavior. U. Eco considers these systems ideologies in a semiological sense [7, p. 76], which, when conventionalized, constitute the core of the human personality in each member of society. Cultural code is a means of programming or socially codifying the human behavior. Each ethnic culture presupposes a certain set of rules determining behavior and almost all the life [18, p. 32].

Linguocultural codes closely interact with cultural codes. Cultural codes are verbalized and transformed into linguocultural codes that function in speech communication. The linguocultural codes are the verbal embodiment of cultural codes. For example, you can lower your head as a sign of repentance, but it is possible for the same purpose to say: "Sorry, I'm very sorry," i.e. the nonverbal signal of social symbolism is replaced by its verbal equivalent.

Any bearer of linguistic culture ontogenetically assimilates cultural codes along with their native language. As V.M. Savitsky notes, the linguocultural code is a modeling system, a regulatory system and a speech-generating system, because it contains a structural analogy (model) of any area of existence, contributing to its comprehension, influencing people's behavior and verbalized by its speakers' own categories [19, p. 59].

We see the linguocultural code as a way of interpreting a system of symbols united by a community (social, age, professional, thematic), having a single fig-

urative basis, performing a sign function and assigned to linguistic designators united in a lexical-semantic field.

Let's turn to negotiations and consider it through the prism of a linguocultural code. Negotiations fundamentally involves the communication between the parties, in order to bring near different positions. According to R. Fisher and W. Ury, the negotiations is a mutual communication, created in order to reach an agreement between the people which have common and different interests, the negotiations being used to adjust the differences [10, p.15]. Basing on the statements on a linguocultural code of the state audit by V.V. Pestova [18, p. 56-57], we may define negotiations as a linguoculural code oriented to the needs of people in information, experience and interaction, power and cooperation. Negotiations comprises the element of conflict and mediation, or bargaining, where partners with different needs and viewpoints try to reach agreement on matters of mutual interest.

In accordance with this view, the linguocultural code "Negotiation process" will consist of linguistic units associated with the environment of negotiations, its participants, the goals and motives of the negotiation process, the subject and process of negotiations, methods (strategies and tactics) and its results.

The model of the linguocultural code "the negotiation process" is represented in Picture.
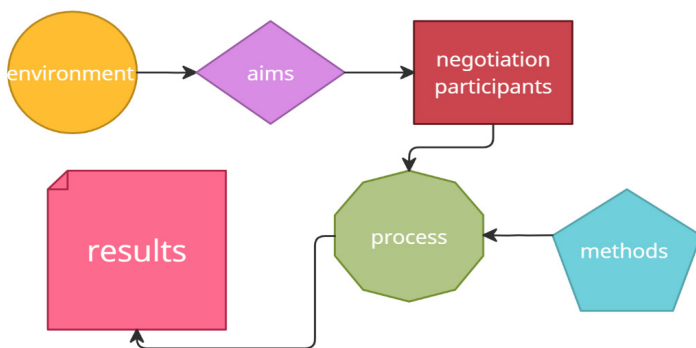
Picture. *Linguocultural code "the negotiation process"*

In English, negotiations can be named through such nominations as *negotiations, meeting, contact, arrangement, bargaining, debate, dialogue, discussion, management, settlement, transaction, wheeling and dealing.*

In order to sit down at the negotiating table you always need a context (environment). This could be either a question about the supply of any equipment, or

the solution to a global issue or the resolution of a situation in the world that has affected most countries (or all countries). Based on the context, goals that need to be achieved during the negotiations are identified, and then, based on the goals, all participants in the negotiations are identified and invited to their country or to the neutral territory.

During the negotiation process itself (or before the start of the negotiations), methods, ways, strategies and tactics of negotiations are determined, by which one can achieve the put forward goals. The result of the meeting is achieved due to the strategies and tactics worked out in advance.

More specifically, the direct participants in the negotiations can be generally referred to as *participants, negotiators, entities, sides or parties*.

Direct participants include:

 countries: Russia, China, America, Mongolia, Russia's Far East, UK, France, Germany, Hong Kong,

- country leaders: Emanuel Macron, Elisabeth II, Frank-Walter Steinmeier, Vladimir Putin, Vladimir Zelensky, Xi Jinping, Cai Ing-wen, Naruhito.

- representatives of ministries and diplomats: Jimmy Carter, Deng Xiaoping.

- political and religious parties: Communist Party of China, Indian People's Party, Democratic Party, Republican Party, United Russia, LDPR.

- political and public organizations: the UNO, WHO, FIFA, WTO, NATO, SCO, CBSS, CIS, CSCE, EU, CE, ACEAH.

- companies: Gazprom, CNPC, Apple, Microsoft, Google.

- businessmen: businessmen, tycoons, investment bankers, property developers, tech entrepreneurs, foreign businessman, local businessman, enterprising businessman, businessperson, man of affairs, entrepreneur, business man, business, employer, man of business.

Indirect negotiators are those parties who stand to gain or lose in the course of the negotiations. They are often referred to as *third parties, affected parties, stakeholders, interest groups*.

Intermediaries can play a dual role becoming both direct and indirect participants in negotiations. These include roles such as *mediators, lawyers, journalists, respected people* etc.

The process of negotiations acquires the stadium character and is evaluated in terms of the pre-negotiation, negotiation, and post-negotiation stages. These three stages are influenced by different factors such as culture, strategy, background, and atmosphere. For instance Chinese negotiation behavior and tactics may be explained from the perspectives of the political and economic conditions, Confucianism, and Chinese stratagems [11, p. 308].

The process of negotiations in research and media is often compared to trade and bargaining.

«Diplomacy is accomplished by negotiation, or **bargaining**. Usually, each group in a negotiation will ask for more than they **expect to get**. They then **compromise**, or **give up** some of **what they want**, in order **to come to an agreement**» [13].

Negotiations is never simple because it may involve a lot of parties.

«The WTO negotiations on agriculture subsidy, BREXIT negotiations between Britain and EU and RECP trade negotiations among ASEAN plus six countries etc. are some examples of complex international negotiations» [21].

If we take into consideration the process of negotiations and strategies used by a Chinese party, it should be admitted that, on the one hand, respect for hierarchical relationships, preservation of face and group harmony [21], relying on personal relations, respect and hospitality when the Chinese tend to avoid saying " no", use euphemisms to spare listeners' feelings; tell others what is believed they want to hear [17, p. 143] – all of these are inherent features of Chinese strategy. On the other hand, a ping-pong-model of negotiations [11, p. 306] is practiced in China, i.e. the negotiation process is bouncing back and forth, so that to reach the result of outwitting the opponents by subtly manipulating them in order to put them at the maximum disadvantage. Besides, the Chinese side always gives priority to procedure and protocol. Thus, negotiation relationships in China are always double-face [9, p. 321]: they are formal at formal occasions and at informal meetings everyone needs to open up oneself, by showing true feelings and thus building up trust.

Russian style of negotiations have much in common to the Chinese style, as the Russians also tend to value personal relationships to the sides, but they are more open and sincere, empathic and at the same time more direct (at the beginning even hard), tend to be oriented to the prolonging process itself but being more straightforward using facts, statistics and try to achieve results mutually profitable within the context of situation.

Negotiations is recognized as secret affairs where results are being discussed and gained over the closed doors. «Most of the negotiations are done **behind the scenes** and not in the boardrooms as shown on TV. When both sides reach some understanding, they convey an official ceremony, or a press conference and announce their achievements» [12].

The negotiation process is often estimated quite emotionally. The next example demonstrates the imaginative and connotative simile comparing participants to sharks, which sniff out the weak points of the sides.

«When you're desperate for a deal to go ahead, never ever let the other party even get a hint that you're desperate. **They will sniff it like a shark sniffs blood**, in particular, if the other party is experienced» [4].

The neologism structured as a blend of the words "friends" and "enemies" = frenemies used in the context of Sino-Russian negotiations characterizes friendship without confidence and trust.

«Best **frenemies**» [4].

The results of the negotiations are described through the following lexical items: *deal, contract, agreement, alliance, treaty.*

The pricing of the new **gas deal** will be similar to that of Power of Siberia, the source said, adding that both were "fairly satisfied" with that arrangement [6].

«Yet even thousands of bilateral **deals** would still fall short of a multilateral **agreement**» [10, p. 7].

Negotiations is quintessentially a linguistic act. It involves use of the language to cajole, persuade, threaten, induce, drive, blackmail, intimidate, and flatter. «These are the familiar weapons employed at the bargaining table and in everyday life», - states D.V.J. Bell, in the book «The Discourse of Negotiation: Studies of Language in the Workplace» [3, p. 50].

To the mind of D.V.J. Bell, negotiation's outcomes are also of a linguistic nature as the object of the negotiations is almost always to arrive at a written agreement of terms and conditions [3, p. 50]. The results of the negotiations are not always approved by all the parties, so they are appreciated through the vocabulary included into the field of emotive modality

«The champions of ignorance of good negotiating techniques are the British Brexit negotiators and President Trump. Hence, the **disastrous results** both are achieving» [22].

«Chinese negotiators often seem **obsessed** with minutiae of price» [5, p. 93].

Thus, to conclude, the linguocultural code is an important component of understanding the negotiation process, without which successful negotiations can't be carried out. It can be represented as a process between direct, indirect participants and third parties in negotiations, who negotiate in a certain socio-cultural and communicative situation, having their own motives and goals, using their own methods and strategies to achieve results. The negotiations between the leaders of the countries or their representatives, business sides take place mainly in an atmosphere of secrecy, therefore, their results can be learnt from memoranda and statements of the leaders of the countries, analytical reviews or news in the media. The linguocultural code of negotiations thus acquires a subjective-objective character, as negotiations may be highlighted directly by immediate participants or involved representatives or through judgements of half or non-knowledgeable interpreters of the events. Obviously, it is impossible to say exactly in which way the negotiations will take place, because every country, every person, each problem and interests involved within are completely different in each case. There are always the same general rules for everyone, regardless of nation, age and culture but it's necessary for negotiators to have basic respect for the opponents and understand the peculiarities of their state system, values, way of life and preferred negotiation strategies.

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学前教育师范学院学生的价值取向
VALUE ORIENTATIONS OF STUDENTS OF THE PEDAGOGICAL COLLEGE OF PRESCHOOL EDUCATION

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抽象的。 文章对某师范学院学生价值取向的研究结果表明，他们更多地表达了善良、普世、安全、传统和自我超越的价值观。 同时，这些价值观的指标适中，并不能表明这些价值观对于这一类青年来说很重要。 独立这样的价值观对于实习教师的人格来说，无论是在价值准则层面还是在活动动机层面都不重要。 获得的结果确定了对大学生价值动机领域有针对性的影响的必要性。 为此，建议在教育过程中纳入阅读和讨论先例文学文本的技术，这些文本传达了我们文化的最重要的意义和价值观。
关键词：价值观、动机、师范学院学生、文化适应、个性。

Abstract. The results of a study of the value orientations of students at a pedagogical college presented in the article indicate a greater expression of their values of kindness, universalism, security, traditions, and self-transcendence. At the same time, the indicators of these values are moderate and cannot indicate that the values are important for this category of youth. Such a value as independence is not important for the personality of student teachers either at the level of value guidelines or at the level of motives for activity. The results obtained determine the need for a targeted impact on the value-motivational sphere of college students. For this purpose, it is recommended to include in the educational process technologies for reading and discussing precedent literary texts that convey the most significant meanings and values basic to our culture.

Keywords: values, motives, students of a pedagogical college, enculturation, personality.

Introduction

The high sociocultural significance of pedagogical activity for society determines close attention to the quality of professional training of teaching staff, including preschool teachers. In this regard, in the educational system of any level, the final results, in addition to knowledge, abilities and skills, should contain attitudes and values that are traditional for Russian culture and contribute to the harmonious development of the student's personality. However, values and attitudes cannot be conveyed in the form of theoretical material; they are transmitted from person to person in conditions of subject-subject interaction.

The value-motivational component of a teacher's personality serves as the basis for the formation of professional culture and determines the humanistic orientation in becoming a professional. The effectiveness of a teacher, due to the high degree of his educational influence on the child's personality, directly depends on his system of value orientations. The trajectory and dynamics of professional development are derived from the type and level of personal motivation.

Studenthood is a period when professional self-determination and mastering a profession are tasks of psychosocial development. In this regard, it seems necessary to study and analyze the values, both the declared ideals and those that determine and motivate the behavior of students at a pedagogical college of preschool education, as well as identifying the possibilities of the educational process of the educational institution for their development.

The activities of a preschool teacher require greater emotional inclusion, creative involvement, and interactivity than the activities of school teachers; therefore, along with the development of professional competencies, the training of a preschool teacher should include the motivational and value development of the personality of the future teacher.

I.V. Dubrovina points out that "when preparing a specialist of any profile, priorities must be determined in the following sequence: first - a decent, cultured person, then a competent person, then a competitive person" [Dubrovina, 2018, p. 10]. She highlights such an important psychological trait for any person, and especially for a teacher, as "intelligence, which is based on a humanistic worldview, a responsible attitude towards the world and people, the concepts of honor, conscience, human dignity, attachment to one's culture, one's people.", to their homeland" [ibid., p. 11].

At the heart of human life are values that determine the coordinate system in such areas as spiritual, intellectual, and social. V.P. Zinchenko points out that the education system should make a significant contribution to the search for their specific forms and relationships, ways to achieve them [Zinchenko, 2003, p. 23].

Working in a kindergarten requires the teacher to have great love for children, high empathy towards them, for which an internal altruistic motive is responsible, associated with a person's urge to help others, based on the values of kindness.

The cognitive motive as a basic one is determined by a sense of responsibility for the safety and harmonious development of the preschooler's personality and encourages the teacher to constantly improve the level of his professional competence. The motive of creative self-realization allows the specialist to remain a lively, enthusiastic, harmonious person, interaction with which will contribute to the development of the students' personality.

Purpose, research methods

Based on the understanding of the importance of the motivational and value orientation of an individual for the professional development of a future teacher, in order to identify the value orientations of students at a pedagogical college, a study was conducted with 25 girls (average age 20.5 years). The value questionnaire of S. Schwartz was used, which allows us to define values as abstract ideals towards which a person is oriented and values that act as motives for action (Fig. 1,2).

Research results
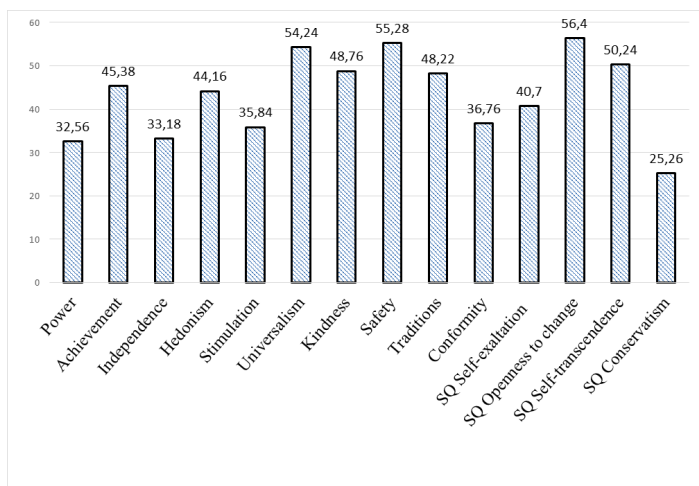
Figure 1. Indicators of value orientations obtained using the method of S. Schwartz (%)

Indicators from 21 to 40% indicate that value is not important to the individual. Indicators from 41 to 60% on the scale indicate moderate expression of the value. Results in the range from 61 to 80% indicate that the value is important and strongly expressed, from 81 to 100% - the value is very important.

It was revealed that the following values were most expressed in the group of students of the pedagogical college: kindness (48.76), universalism (54.24), safety (55.28), traditions (48.22), self-transcendence (50.24). However, according to the methodology, such indicators indicate their moderate severity (see Fig. 1).

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The values of power (32.56), stimulation (deep emotions) (35.84), independence (33.18), and OR of conservatism (25.26) are at a low level. Students show no interest in gaining power and dominating others, which may indicate the stability of self-esteem and the absence of a tendency to confirm their own importance. Student teachers show emotional restraint; they have no need to stimulate their own emotions. A low level of independence may indicate a lack of personal maturity and a need for guidance and care from significant adults. The lack of expression of conservatism as an ideal guideline may be a consequence of the age characteristics of youth, criticality, rejection of values declared by adults, and the desire for independence.

High scores were noted on the "Openness to Change" scale (56.4), which indicates interest and acceptance of new things, readiness for change, which is, in principle, characteristic of adolescence.

Most of the significant declared values are internalized by the personality of the experiment participants, and are manifested in everyday activities, but to a moderate extent.

Figure 2 shows that the most pronounced motives in girls are kindness (42.66), universalism (44.04), tradition (43.7), self-transcendence (40.34) in behavior. The unity of value orientations and accepted motives for activity indicates the congruence of the individual and guarantees the psychological safety of both student teachers and their future pupils.
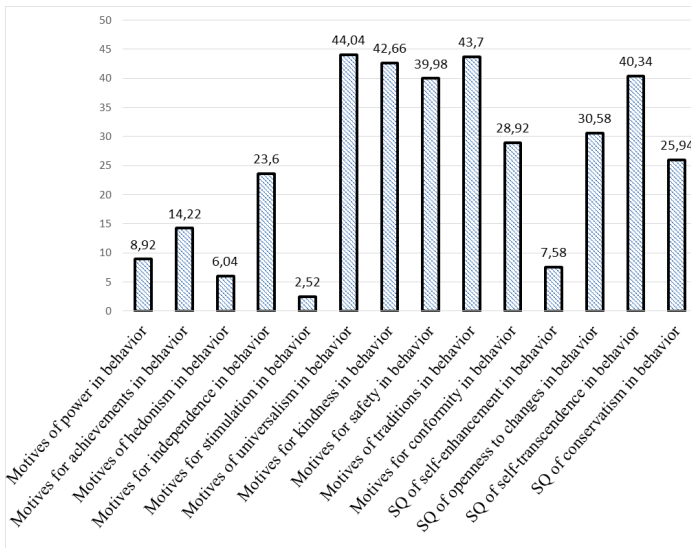

Figure 2. *Indicators of motives represented in consciousness, obtained using the method of S. Schwartz*

Discussion

The significance for students and future teachers of preschool education of the values of kindness, universalism, safety, traditions, and self-transcendence may indicate an adequate understanding of the essence of the profession and a conscious choice of educational institution, and, in turn, act as a resource for the formation of an adequate professional identity. In addition, such a hierarchy of values provides the necessary conditions for quality learning and maintaining interest in learning activities. However, these values are moderately expressed among students, which can lead to their devaluation as a result of certain life circumstances.

A low level of the value "independence" requires the organization of targeted influence in order to increase its significance both as a value guide and as a motive that determines the activities of student teachers. Independence is a necessary condition for the further professional development of a student, since teaching activities require constant self-improvement and advanced training [Vitkovskaya, 2014, p. 295, Lutoshliva, 2016, p. 189].

The development of the value-motivational sphere of the personality of students and future teachers can be productive when precedent literary texts that convey the most significant meanings and values basic to our culture are included in classes within the educational program of a pedagogical college: loyalty, friendship, sympathy, empathy, nobility, love, freedom, responsibility [Shakhova, 2017]. Works of art make it possible to convey the content of culture on an emotional level - experiences mediate the processes of enculturation. Only emotionally accepted phenomena and an active, active attitude of the individual towards them create conditions for the internalization of social values and the formation of personal meanings. The development of a program based on the principles of enculturation for the development of the value-motivational sphere of the personality of students of a pedagogical college is the goal of our further research.

Conclusions

The formation of a holistic system of personal value guidelines occurs under the influence of everyday experience in certain sociocultural conditions. According to our research, modern students choose the profession of a teacher guided by a personal orientation determined by the values of kindness, universalism, safety, traditions, and self-transcendence. However, these values are moderately expressed. Such a value as independence is not important for student teachers either at the level of value guidelines or at the level of motives for activity. The results obtained determine the need for a targeted impact on the value-motivational sphere of college students. For this purpose, it is recommended to include in the educational process technologies for reading and discussing precedent literary texts that convey the most significant meanings and values basic to our culture.

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十九世纪下半叶的华人移民: 幻想、失望、希望
CHINESE EMIGRATION IN THE SECOND HALF OF THE 19TH CENTURY: ILLUSIONS, DISAPPOINTMENTS, HOPES

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抽象的。 本文考察了 19 世纪下半叶中国人大规模移民国外的过程，找出其原因、方向和后果。 特别关注美国华人移民的状况、他们的适应情况以及与当地居民的关系。 作者得出的结论是，到二十世纪初。 在美国、拉美、东南亚等一些国家，已经形成了稳定的华侨华人社会群体。 他们在与中国保持着多种联系的同时，为当地经济和文化做出了重大贡献。
关键词：中国； 清政府； 移民； 拉美； 东南亚、美国； 唐人街； 秘密社团。

Abstract. *The article examines the processes of mass emigration of Chinese to foreign countries in the second half of the 19th century, identifying its causes, directions and consequences. Particular attention is paid to the situation of Chinese immigrants in the United States, their adaptation and relations with the local population. The author comes to the conclusion that by the beginning of the twentieth century. In the United States and some countries of Latin America and Southeast Asia, stable social communities of overseas Chinese have formed. They have made significant contributions to the local economy and culture while maintaining various ties to China.*

Keywords: *China; Qing government; emigration; Latin America; Southeast Asia, USA; Chinatown; secret societies.*

In the middle of the 19th century. Chinese society was in a deep economic, political and moral crisis. The Taiping Rebellion (1851–1864) and other social unrest, accompanied by hunger strikes, and the second Opium War (1856–1860) completely devastated and bled the state. Tens of millions of Chinese have lost their homes and hope for the future.

In addition, there was an acute shortage of arable land due to population growth, which by 1850 reached 432 million people. [1].

One of the responses to the economic and demographic crisis was emigration from China in an effort to try their luck overseas. Those who made this choice were mainly from Southeast China, primarily from Guangdong Province. These were mostly impoverished peasants who saw no opportunities for successful activities in their homeland. The majority were men, many of them had recently gotten married and now dreamed of returning rich to their native villages, buying land and changing the joyless existence of their families. They pinned their hopes mainly on three regions: Southeast Asia and Indonesia, the Caribbean and northern countries of Latin America, and the West Coast of the United States.

Emigration to Southeast Asian countries was the cheapest and easiest, and many Chinese found their way into new places in rice production, fishing, and retail trade. Although the highest levels of economic life were dominated by the British, French or Dutch (depending on the country), Chinese settlers found niches to apply their entrepreneurial skills. They controlled a significant part of the business associated with tin mining, rubber plantations and inland shipping. In Indonesia, which was under Dutch rule, the Chinese were hired to collect taxes and were managers of opium monopolies controlled by the Dutch [2. P. 224-225, 259]. Most of the new settlers came from Fujian Province and the Pearl River Delta region of Canton. They settled in groups that united people from the same area and speaking the same dialect. In places where the Chinese settled, the Triads and other secret societies intensified their activities; they thrived by running rackets, controlling opium prices, and organizing prostitution. The Qing could not contain emigration, but they tried not to completely lose contact with the half a million Chinese who had settled in the region. In 1873, the Chinese government established a consulate in Singapore, and it also tried to maintain the loyalty of wealthy immigrants by giving them honorary titles in the Qing hierarchy.

Latin America also received a significant number of Chinese settlers in the second half of the 19th century. The elimination of the colonial regime and the achievement of political independence by the former Spanish colonies in the first quarter of the 19th century. accompanied by important changes, including the abolition of slavery. Some countries in the region were economically booming and needed additional labor. The advent of steamships made overseas travel accessible and relatively cheap, and many Chinese, depraved by contract agencies and advertising leaflets that promised them enormous riches, moved to Peru, Panama, Venezuela, and Cuba. They often signed employment contracts without understanding their meaning. Some were literally kidnapped by labor suppliers and held captive in Macau or Canton before being shipped to America.

In just over 30 years (1849–1871), about 80 thousand Chinese arrived in Peru, depraved by contract agencies and advertising leaflets that promised them huge incomes in a new place. But not everyone reached their destination after four months

of sailing in conditions of terrible overcrowding (according to the standards, there was a little more than 0.5 sq. m per "passenger"), heat, poor nutrition and illness. In some years, the number of deaths reached 20% [3. P. 170].

The Chinese laid railway lines and worked on cotton plantations. Working conditions were especially harsh in quarries extracting guano, the petrified droppings of seabirds that were used as fertilizer and were exported. The lack of basic protection led to infections, lung diseases and premature death. Cases of suicide were frequent. Those who tried to escape were caught and forced to work in chains. Other Chinese worked as servants and worked in cigar factories and mills.

The first batch of Chinese, consisting of 571 people, went to Cuba. arrived in 1847. They were housed in barracks where black slaves had previously lived, divided into groups of 10, and one or more lots were bought for the planters [4. P. 7]. In the 1860s. tens of thousands of Chinese were already working on sugar plantations. They entered into a contract for 8 years and after its end they had to either renew the contract or leave the island within two months. But very few left for their homeland; the number of black slaves on plantations was declining, and Cuba needed workers. Therefore, the colonial government did not strictly follow Madrid's instructions and did not seek to deport the Chinese. They were treated by their employers as slaves rather than hired workers, forced to work long hours for meager wages, and severely punished if they walked away from their jobs or argued with their employers.

In 1874, the Chinese Department for the Administration of Country Affairs (Zongli Yamen), which dealt with foreign policy issues, initiated the creation of commissions to investigate the living and working conditions of the Chinese in Peru and Cuba. They interviewed Chinese workers, accepted written complaints and came to disappointing conclusions: work on sugar plantations turned out to be too hard, corporal cruel punishment was used against the Chinese, and suicides were frequent [5. P. 112]. The activities and conclusions of the commission resulted in the conclusion in 1877 between China and Spain (Cuba remained a colony until 1898) of a special convention, which marked the beginning of the period of "free emigration" of the Chinese to Cuba [6. P. 55.].

The main impetus for Chinese immigration to the United States was the "gold rush" that began in 1848 in California. Cantonese sailors and merchants who visited the United States described the excitement that gripped Americans about the opportunity to get rich quickly. Mostly people from Guangdong and Fujian provinces went to the USA, there was also a small Hakka community [7. P. 19]. But few Chinese managed to work in profitable fields, and most, after working in mines already abandoned by their less persistent predecessors, looked for other work. With the rapid development of the West Coast, they became market guards, store owners, and laundry workers, spreading along the coast from Los Angeles to

Seattle. In 1870, almost all laundries in San Francisco were owned by the Chinese [8. P. 14]. In the 1860s. Thousands of Chinese worked on the construction of the transcontinental railroad from California to Utah, where they made up 90% of the workforce.

After the American Civil War (1861–1865), southern planters brought several thousand Chinese to Mississippi, Alabama, and Tennessee to work the fields abandoned by freed black slaves. By the end of the 1880s. the Chinese worked in shoe factories in Massachusetts, cutlery factories in Pennsylvania, and laundries in New Jersey; A significant group of wholesale merchants formed in Boston. In the cities of Mississippi, the Chinese took up the grocery trade. Chinese shops appeared in black neighborhoods where white merchants did not want to go [9. P. 69].

The process of adaptation of Chinese settlers to the United States was not easy. From the very beginning, American society showed hostility and sometimes aggression towards them. This was caused by a complex of reasons. One of them was that many Chinese contract workers did not hide the fact that they intended to work in America for several years and return home to their families. This led to the Chinese being considered "temporary residents" rather than immigrants, and treated as such. Another reason was the industriousness of the Chinese; they were envied because they could profit where others failed. On the other hand, it was a common belief among white workers that the Chinese always agreed to work for less pay than other nationalities, and thus lowered the level of wages for everyone. There was some truth in this statement; sometimes employers used the Chinese as strikebreakers. Knowing little or no English, the Chinese were often unaware of the social and economic conflicts they were embroiled in.

The Chinese, or "Mongols" as many whites called them, were also disliked or feared because of their strange customs. The Qing braids worn by many men looked ridiculous in the United States. Americans noticed a huge difference in the ratio of men and women in Chinese communities: in 1880, more than 100 thousand men lived in the western United States and only 3 thousand women [10. P. 213]. Not understanding the reasons for this disproportion, many accused the Chinese of homosexuality. The unusual sounds of tonal Chinese speech, the tendency of a significant part of the Chinese settlers to smoke opium, drink, and gamble, as well as their strange and unappetizing food, also caused irritation.

Americans were irritated by the closedness and isolation of Chinese communities (funi). Chinatowns had their own clubs, social assistance centers, they built temples, sent letters to China, sent home the bodies of deceased fellow countrymen, trying to have as little contact as possible with the authorities and the outside world [11]. Housing and sanitary conditions in the Chinatowns of San Francisco, Los Angeles, Portland, and later New York were frighteningly unusual for the local population. All this together created an opinion about the depravity, insincerity and unreliability of the Chinese.

There were also more serious accusations that had some basis and sometimes led to tragic consequences. The Chinese were considered criminal elements and a threat to public safety. Even when Chinese emigrants arrived in San Francisco, special companies associated with Chinese secret societies (tongs) united them into groups based on dialect or regional proximity and sent them to Chinatowns, promising protection and patronage. The Toons controlled the opium trade in the United States, as well as the gambling industry and prostitution, which became enormous. There was an unspoken taboo against sexual relations between Chinese men and white women; White prostitutes extremely rarely agreed to satisfy the sexual needs of the "Mongols." Then the Tuns began importing Chinese girls from poor families, whom their parents sold to work as servants. They were resold at many times the price to brothel owners. Tung-controlled communities were involved in numerous skirmishes, and even wars, between rival gangs, which created a negative reputation for the Chinese as a whole.

At times, friction and animosity erupted into outright violence, deliberately fueled by the racist rhetoric of white workers and their political masterminds. The worst examples were in California and Wyoming. In October 1871, after two police officers were killed while attempting to intervene in a clash between rival Tongs, a mob destroyed Los Angeles' Chinatown, looting stores, setting houses on fire, and beating every Chinese they encountered. Nineteen Chinese men, women and children were killed and hundreds were wounded until local authorities finally stopped the pogroms. 14 years later in Rock Springs, Wyoming, a group of 150 white coal miners, angry over Chinese refusal to strike, first beat a Chinese miner to death with shovels, then attacked Chinese migrant worker camps and set 79 buildings on fire. 28 people were killed and 15 were wounded [12. P. 31].

The Qing government reacted sluggishly to all these excesses. The Chinese authorities have always viewed their compatriots who went overseas on trade or other business (for example, to the countries of Southeast Asia) as abandoning their country, and have shown no interest in protecting their rights abroad. In 1728, Emperor Yongzheng prohibited Chinese who left the country without trade licenses from returning to their homeland [13. P. 17]. However, in 1867, Zongli Yamen officials finally became concerned about the problems of the overseas Chinese. They secured the agreement of Abraham Lincoln's former representative to the Qing Empire, Anson Birlingame, to become Chinese ambassador-at-large. The following year, Birlingame undertook numerous trips throughout the United States. Using his extraordinary oratorical skills, he convinced Americans to change their attitude towards Chinese immigrants and towards China in general [14]. Apparently, for greater persuasiveness, E. Birlingame argued that the Qing state was ripe for conversion to Christianity and very soon it would invite Western missionaries [15]. He used personal connections with the Republican administration and quite quickly achieved results: in 1868, an agreement was signed between

China and the United States, guaranteeing the observance of the rights of Chinese immigrants to the same extent as other citizens of the state enjoying the most favored nation treatment [16. P. 83]. The Chinese government also had the right to establish consulates in US port cities. This was the first equal treaty between China and a Western power since the Opium Wars. One of its consequences was a significant increase in Chinese emigration to the United States.

But reality has changed little; moreover, the pressure on the Chinese has increased. During the election campaign between Democrats and Republicans, the issue of the "yellow peril" was constantly raised and calls were made to limit Chinese immigration. In 1878, California passed a law making it a criminal offense to hire Chinese [17. P. 114]. In 1879, President Rutherford Hayes, acting in the spirit of the 1868 treaty, vetoed a bill that would have limited the number of Chinese emigrants to 15 per ship arriving from China. However, in 1880 the Qing were forced to agree to a new treaty that allowed the United States to regulate, or temporarily stop, the flow of Chinese workers.[18]

In 1882, President Chester Arthur decided not to veto a bill (the Chinese Exclusion Act) that would "suspend" immigration of Chinese skilled and unskilled workers for 10 years, require all Chinese in the United States to obtain special registration certificates, and prohibit them from accepting U.S. citizenship. The entry ban did not apply to diplomats, students, teachers and tourists [19]. This law ushered in the "era of exclusion" of Chinese from US economic and social life. As a result, the number of Chinese emigrants in the USA began to decline: if in 1880 there were 105 thousand, then in 1900 - 90 thousand [20. P. 228]. Western states have gone much further than the federal government in violating fundamental rights and individual freedom. Thus, in California in 1885, Chinese children were prohibited from attending public schools.

At the end of the 19th – beginning of the 20th century. new anti-immigrant laws were passed that affected the Chinese. The "Era of Exclusion" continued until 1943, when China's decisive role in tying up Japanese forces in the Pacific theater of operations was revealed.

As we know, it was not possible to "exclude" or oust the Chinese from American reality. By the beginning of the twentieth century. A large and stable social community had already formed, united by culture, mutual support, and having its own churches, schools, newspapers, theaters, and banks. The Chinese in the United States reconstructed the traditional way of life and did not lose touch with their homeland, sending money to support their families. On the other hand, some of the emigrants managed to overcome the boundaries of Chinatowns, get an education and achieve success in the economic and intellectual spheres. A similar situation developed in other countries that became second homes for Chinese immigrants. The descendants of the first wave of settlers and the numerous Chinese who joined

them later are now citizens of Canada, Australia, Latin America and Southeast Asia and make a significant contribution to their development, while maintaining various ties with China.

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应用文化学研究方法论
METHODOLOGY OF APPLIED CULTUROLOGICAL STUDY

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抽象的。 本文考虑了应用文化学研究的方法论。 文化学的问题领域与研究文化的其他学科之间的边界沿着文化创造活动的过程及其结果的界限。 文化学研究所描述的，从现实主体履行社会角色的动机和方式来看，可以称之为“内部的社会性”。
关键词：文化、文化现象、文化学、方法论、应用文化学研究。

Abstract. Methodology of applied culturological study is considered in the article. The boundary between the problem area of culturology and other disciplines that study culture runs along the line of delimitation the process of culture-creative activity and its results. That, which is described by culturological research, can be called "sociality from the inside", from the point of view of motives and the manner of performance of social roles by real subjects.

Keywords: *culture, cultural phenomena, culturology, methodology, applied culturological study.*

One of the reasons for the identification of culturology with art history, ethnography, sociology or cultural anthropology is the similarity of the objects and methods of particular sciences in the field of studying culture [3]. However, the study of any phenomenon, side or aspect of culture does not become culturological only because this phenomenon is given the name of "cultural".

Of course, economics, politics, ideology, art, morality, religion, everyday life, and much more are the products and the "phenomena of culture" as the way of human existence. But all these "cultural phenomena" can be the object as of philosophy, as of sociology, history, ethnography, cultural anthropology, or semiotics. To understand what differentiate culturology from any other humanitarian study, the object of which is the "phenomena of culture", we must understand the difference between human activity as the real process and its objectivized results, products, or artifacts [1].

Despite the fact that the process and the result of human cultural activities are inextricably linked with each other, any result – both material and spiritual – gains

an existence independent of the process of its creation. Due to this, the products of culture can be studied as a completely independent form of existence, which is what happens when the archaeologist studies the remains of dwellings, tools, utensils, and other material products of once-living people; ethnographer describes the world of things and ideas of now existing ethnic groups; art-critic analyzes works of art; methodologist of science – the content and the logical structure of scientific theories, etc.

However, the study of any single product of culture or human activity does not express the specificity of culturological approach, being its prerequisite yet. Analyzing the materials collected in other sciences, culturology seeks to understand what kind of people had created certain things, works of art, or linguistic texts; what knowledge, skills, views these people had possessed; what meaning they had put into their work; what objectives they had been striving for; how they had been perceiving themselves and the world around them, etc.

What is the specific object of culturological studies goes beyond finished, "dead" forms of human activity, and vice versa: there and then, where and when the object of the study is just products, results, conditions, means, relationships, and any other factors, autonomous in relation to the real process of subject′s activity, the need for the culturological analysis does not occur.

Thus, the boundary between the problem area of culturology and other disciplines that study culture runs along the line of delimitation the process of culture-creative activity and its results. This means that culturologists study:

– Not the content and functions of this or that social role: scholar, teacher, politician or farmer, but the process of execution of this role by quite specific individuals in a particular society;

– Not the structure and functions of social institutes: state, science, art or family, but the meaning attached to these institutes by particular person or particular social group;

– Not the cultural products themselves, but the specific way of material and spiritual assimilation of the world embodied in these products by their creators.

So, analyzing the structure of a theory, a novel, a computer, a lunch menu, or features of the urban economy, we cannot say that we are analyzing the specifics of those people that have created these cultural products or to which these products were belong, since the internal form of socio-cultural activity as the interrelation of its basic elements exists only in the process of activity as such, but not in its final result.

If we want to penetrate into the specifics of those culture-creative activities that have generated cultural products, we cannot abstract from the subject of this process, because culture is just the internal form of the activity of this subject. Only such concepts as "views", "purposes", "meanings", "value orientations", "norms",

"ideals", "methods", and other of the kind could be the means of analysis of this internal form. None of these concepts can be used in analysis of the products of culture, but all of them reflect the elements of the cultural activity of the subject.

Culturologists is seeking to penetrate beyond the boundaries of objective results in the field of meaning, purpose, or principles of creation of one or another artifact, since the specificity of human existence is expressed not in the results themselves, but in the content of the main components of the actual process of creating these results, the role of which just purposes, meanings, values, and other elements of culture are playing. That, which is described by culturological research, can be called "sociality from the inside", from the point of view of motives and the manner of performance of social roles by real subjects. In the culturological analysis culture appears as a special reality that characterizes the peculiarity of existence and activity of a specific subject.

Some principles of applied culturological study could be formulated as follows:

1. In culturological study culture appears not as the world of material and spiritual products, social institutes, roles, or relations, but as a form of activity of a specific subject. The subject of culture is similar to the energy "knot" in which tied and from which feed all kinds and types of activities carried out by this subject. Each such "knot", whether individual, group or society as a whole, is tied in a different way, typical only for this subject. And it is just this way is none other than the culture of this subject.

As a real way of existence culture does not exist outside of the cultural subject. Culturologists always remember that outside of the subject there are only objectivized, dead results, which are the necessary conditions and prerequisites for the implementation of cultural and creative activity of man, but are not the alive activity as such.

2. Culturologists is interested not in the being of things and ideas, but in the being and activities of specific people in specific historical circumstances. In culturological study any products of culture are signs and symbols carrying the information about specific characteristics of existence of the specific subject of culture, who lives here and now or had been lived then and there. Any result of human activity becomes an object of culturological analysis only to the extent that it allows to identify, to detect, to demonstrate the distinctive features of the culture, the product of which it is.

3. Culturological analysis is always differential.

The term "culture" is introduced along with the concept "society" specially to reflect the distinctive features of the activity through which various subjects become acquainted with the surrounding world and pursue their own development. So, it is important for culturologists to understand the peculiarities of existence of individuals,

social groups or communities; to identify, to interpret, and to explain, what distinguishes people as subjects of culture-creative activities from each other [2].

4. Exploring the uniqueness of each culture, culturologists bases on the principle of unity of culture, considers it as the interconnection of all components: world views, purposes, meanings, values, norms, ideals, means, methods, etc.

A practical application of the principle of unity of the culture means that:

• Elucidation of the unique features of a particular culture should not turn into their simple enumeration devoid of understanding as the relationships as the meanings of these features in this particular culture as a whole;

• Each product of culture speaks to us in the language of their culture, but in order to understand the meaning of the message, we need to know the language in which it is fixed;

• Without knowledge of a particular culture as a whole, it is impossible to understand the meanings of particular results and products of this culture;

• The originality of the culture in all its specific features could be identified in any product of human activity only when culture is understood in its unity.

5. Culturological study does not substitute itself for other sciences, and deals only with the specificity of existence and activities of different subjects of culture, manifested in the features of social institutes and cultural products. In the process of archaeological research, ethnographic expeditions, historical, linguistic, semiotic, sociological, and many other studies of the artifacts and the real life of different subjects of culture empirical data about the various features and events of culture are collected. The functional significance of these data in the structure of culturological cognition is that they create an empirical basis for further theoretical research of culture.

Finally, it must be remembered that the same material and spiritual products carry different socio-cultural content.

For example, a computer can be considered:

1) As a product of material production, satisfying human need for rapid processing, storage and transmission of information;

2) As a product of material culture, which embodies the features of the worldview, goals, meanings, value orientations of its creators;

3) As a condition and means of forming the subjects of a new generation of culture;

4) As an element of the material culture of subjects who have the necessary skills and abilities to use this tool in the process of mastering new areas of reality.

Russian classical literature can be considered:

1) As an ideal product of spiritual production, fixed on material carriers;

2) As an ideal product of the artistic activity of individual writers, which embodies the peculiarities of their culture;

3) As a condition and means of forming new subjects of culture;

4) As an element of the spiritual culture of individual subjects who have turned the process of reading, studying, understanding, comprehending works included in Russian classical literature into a source of their own sense-making, inspiration and aesthetic enjoyment.

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新地缘政治挑战背景下中俄在北极的国家利益
THE NATIONAL INTERESTS OF CHINA AND RUSSIA IN THE ARCTIC IN THE CONTEXT OF NEW GEOPOLITICAL CHALLENGES

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抽象的。 文章试图全面分析新地缘政治挑战背景下中俄在北极的国家利益。该研究涵盖了两国对该地区政策的历史演变，强调了两国在北极经济、科学和军事战略活动的关键方面。 特别关注潜在合作和竞争领域的问题，并考虑了现代国际挑战下中俄在北极地区关系发展的可能情景。 作者分析了两国深化合作和加剧竞争的条件和因素，提出了优化互动以促进北极地区可持续发展的建议。

关键词：国家利益、地缘政治挑战、北极、中国、俄罗斯、协同、竞争、经济合作、军事战略存在、可持续发展、国际法、国际组织。

Abstract. *The article attempts to comprehensively analyze the national interests of China and Russia in the Arctic in the context of new geopolitical challenges. The study covers the historical evolution of both countries' approaches to the region, highlighting key aspects of their economic, scientific, and military-strategic activities in the Arctic. Special attention is paid to the problem of potential areas of cooperation and competition, and possible scenarios for the development of relations between China and Russia in the Arctic in the light of modern international challenges are considered. The authors analyzed the conditions and factors contributing to both deepening cooperation and increasing competition between the two countries, offering recommendations on optimizing interaction in the interests of sustainable development of the Arctic region.*

Keywords: *national interests, geopolitical challenges, the Arctic, China, Russia, synergy, competition, economic cooperation, military-strategic presence, sustainable development, international law, international organizations.*

The relevance of the study of the national interests of China and Russia in the Arctic in the context of increasing globalization is due to a number of fundamental

factors that have a direct impact on the political, economic and environmental picture of the region.

First of all, globalization strengthens the interdependence of states, expands the geography of their interests and contributes to an increase in the number of participants seeking access to the resources and transport routes of the Arctic. This leads to increased competition and the need to develop new forms of international cooperation and regional governance.

The main purpose of the study is to analyze the national interests of China and Russia in the Arctic region in the context of new geopolitical challenges, as well as to assess the prospects for cooperation and the risks of competition between the two countries.

Throughout the history of international relations, the concept of national interests has occupied a central place in the development of foreign policy of States. National interests represent the strategic goals and priorities of a country aimed at ensuring its security, economic prosperity, territorial integrity and strengthening the international position. They are formed on the basis of an assessment of the foreign policy context, internal needs and capabilities of the state.

The Arctic is a unique region with special geopolitical, environmental and economic characteristics. Its strategic importance is enhanced by the wealth of natural resources, including oil, gas and minerals, as well as by new shipping routes that are becoming available due to global climate change. These factors make the Arctic an object of increased attention from Arctic and non-Arctic states seeking to expand their influence and provide access to regional resources and transport corridors [4].

In the modern system of international relations, the Arctic is viewed through the prism of various international doctrines and approaches, including the concepts of sovereignty, multilateral regional cooperation and sustainable development. An important role in the settlement of relations between a number of states in the Arctic is played by international organizations and forums, the most authoritative among which is the intergovernmental forum Arctic Council, created as a platform for the development of cooperation between the Arctic states, coordination of their actions in the interests of ensuring sustainable development of the region, environmental protection, preservation of culture, traditions and languages of the indigenous peoples of the North. Over the past two years, the council's activities have been effectively frozen after Western countries announced in March 2022 that they would suspend participation in any association events due to the events in Ukraine. However, as practice has shown, the Arctic Council is not viable without Russia [4].

Today, China is becoming one of the main strategic players in the Arctic. His policy in this region has undergone a significant evolution over the past decades.

Initially, having no direct access to the Arctic region and not being one of the Arctic states, China, nevertheless, showed interest in exploring and using Arctic resources and routes. But in 2018, as part of the publication of the White Paper, the People's Republic of China declared itself as a "near-Arctic" or "almost Arctic" state, one of the countries closest to the Arctic Circle on land, directly influenced by natural conditions and changes in the Arctic, which is directly related to China's interests as The minimum is in the field of environmental and food security, and therefore economic security. Which was formulated into one of the main strategic directions of its development, called the Polar Silk Road. This initiative is part of a broader "One Belt, One Road" strategy aimed at strengthening China's trade ties and influence on a global scale through the creation of infrastructure and transport networks [2].

China's economic interest in the Arctic is driven by several key factors. First, it is access to new energy resources, including oil and natural gas, which is extremely important for the fast-growing Chinese economy. Secondly, the melting of the Arctic ice opens up prospects for using the Northern Sea Route as a shorter and more economically profitable transport corridor between Europe and Asia. It can also play an important role in the development of the northern regions of China [2].

From a strategic point of view, an active presence in the Arctic allows China to strengthen its international position and influence, as well as provides additional opportunities for scientific research and military presence in a key strategic region.

China is actively investing in various projects in the Arctic, including the development of hydrocarbon and mineral resources, the construction of infrastructure and scientific research. So, over the past 10 years, the DPRK has spent more than 90 billion US dollars on investment projects beyond the Arctic Circle. Chinese companies, often cooperating with local partners, are involved in the exploitation of Arctic resources, especially in Russia and other Arctic countries [2].

One of the most ambitious projects is the development of the Northern Sea Route. China sees it as a strategically important route that can significantly reduce the time and cost of shipping goods between Asia and Europe. In addition, China is active in the field of Arctic research, financing scientific expeditions and creating research stations to study the climate, marine ecosystem and other important aspects of the region [2].

In general, China's national interests in the Arctic reflect its desire to expand global influence, ensure economic growth and consolidate its position in the region. This leads to increased cooperation with the Arctic states, but also raises questions about potential strategic challenges and environmental security. It is noteworthy that analysts from The Globe and Mail expressed concern about China's desire to strengthen its military potential in the Arctic, which could lead to

superiority over Canada. China has already developed the technology to deploy underwater listening devices to detect potentially hostile submarines, while Canada does not have such capabilities. Special attention was paid to the incident with the Chinese balloon, which illegally entered the airspace of Canada and the United States in February 2023. Despite the fact that the balloon was shot down by a fighter, its detection did not occur in time using the Northern Warning System, which raised questions from the national security departments of both countries [2].

The Arctic traditionally occupies a special place in Russian history and economy. The development of the Northern Sea Route, starting from the era of Peter the Great, was aimed at strengthening trade relations and expanding the territory. In modern Russia, the Arctic is recognized as a priority area of strategic development, which is reflected in a number of key documents, including the strategy for the development of the Arctic zone of the Russian Federation [1].

We have already emphasized that the Arctic region is rich in natural resources, including oil, natural gas and minerals, which makes it key to ensuring Russia's energy security. The development of these resources contributes to sustainable economic growth and helps Russia strengthen its position in the global energy market. The Northern Sea Route plays an important role in this context, providing a more economical and shorter route for transporting Russian energy resources to world markets.

Russia's military-strategic presence in the Arctic is multifaceted and aimed at protecting its national interests in the region. This includes strengthening borders, developing infrastructure and increasing the combat readiness of the armed forces. Russia is actively modernizing its Arctic military bases, developing an icebreaking fleet, and strengthening air defense and radar control systems in the Arctic. Such attention to the military component is primarily due to the need to protect economic interests, but also to shifts in world politics [6].

In general, Russia's national interests in the Arctic reflect the country's desire to assert its status as a great power with significant resources and influence in this strategically important region for several centuries. Despite the economic and geopolitical turbulence in the world, Russia is actively developing the Arctic [1].

The idea of cooperation between Russia and China in the Arctic is not new, but it has never been properly implemented. Today, such cooperation can bring mutual benefits in several key areas, primarily in the energy sector, as Russia has huge oil and gas reserves in the Arctic, while China is experiencing growing demand for energy resources. In addition, logistical cooperation, especially within the framework of the Northern Sea Route project, can significantly reduce the time and cost of shipping goods between Asia and Europe. Scientific research in the field of climate research, Arctic ecology and sustainable development also provides an extensive platform for cooperation [5].

In parallel with the potential for cooperation, the Arctic is becoming a "battle-ground" between foreign countries. And the Arctic cooperation zones can become a "stumbling block" at any moment, especially if we take into account China's growing ambitions in the region and the strategic interests of the two states.

The international situation has a significant impact on the dynamics of relations between China and Russia in the Arctic. The confrontation with the West has so far stimulated closer cooperation between the two countries, but global changes in politics and the economy may make adjustments to their interaction.

Analyzing the relations between China and Russia in this region, we can assume that their development scenarios can range from deepening strategic partnership to increasing competition and even direct disagreements. Both external factors and internal political and economic processes in each country will play an important role in determining future interaction. In general, the dynamics of relations between China and Russia in the Arctic will depend on many factors, including global political and economic ones, as well as on the ability of both countries to find common interests and overcome potential differences [3].

Undoubtedly, today, being a Eurasian state, Russia has a natural superiority in the Arctic, in the context of new geopolitical challenges, the study of the national interests of China and Russia in the Arctic can be viewed through a number of key aspects:

1. Relations between China and Russia in the Arctic are characterized by both the potential for synergy in areas such as energy, transport and scientific research, as well as elements of competition, especially in the context of access to resources, logistics and strategic influence not only in this region.

2. The international agenda plays an important role in shaping the dynamics of relations between the two countries in the Arctic, stimulating cooperation in the face of external pressure, but also creating prerequisites for competition.

3. The problems of environmental safety and sustainable development represent both challenges and opportunities for cooperation between China and Russia.

Projects and scenarios to expand cooperation and reduce the level of competition between Russia and China in the Arctic should focus primarily on improving the environmental situation in the Arctic, active participation in the work of the Arctic Council and other international organizations, which will contribute to the creation of a more stable and predictable regional order.

In conclusion, we can state that further research on the national interests of China and Russia in the Arctic in the context of new geopolitical challenges should contribute to a deeper understanding of the complex dynamics of relations between states in order to strengthen peaceful and productive cooperation, since they have a significant impact on sustainable development and security in the region.

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用银鲫指标评价西北高加索地区部分草原河流的生态状况
ASSESSMENT OF THE ECOLOGICAL STATE OF SOME STEPPE RIVERS OF THE NORTHWESTERN CAUCASUS BY THE INDICATORS OF THE *CARASSIUS GIBELIO* BLOCH

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抽象的。 对来自西高加索西北部两条草原河流——波努拉河和基尔皮利河的银鲫的形态和形态生理参数进行了比较。 作为形态特征，考虑了鱼类波动不对称性的指标 – 胸鳍和腹鳍中的鳍条数量以及侧线中被孔刺穿的鳞片数量。 FAMP指标（每个性状的不对称表现频率）分析表明，波努拉河的生态状况很严重，而基尔皮利河的状况偏离标准的程度较小。 FAMI指标（个体不对称表现频率）分析表明，2017年至2020年期间，基尔皮利河的生态状况有所改善，而2018年至2019年期间，波努拉河的生态状况仍然困难。 还考虑了银鲫鱼的形态生理特征——心脏、肝脏、肾脏和性腺的指标。 波努拉河种群中银鲫的心脏、肾脏和肝脏指数明显较大。 男性性腺指数相当高； 两条河的鱼没有什么不同。 基尔皮利河的雌性鲫鱼的卵巢指数明显较高，这表明波努拉河的雌性鲫鱼在夏季还没有准备好再次繁殖。

关键词：银鲫鱼，波动不对称性，器官指数，草原河流。

Abstract. *A comparison was made of the morphological and morpho-physiological parameters of silver crucian carp from two steppe rivers of the northwestern Ciscaucasia - Ponura and Kirpili. As morphological characteristics, indicators of fluctuating asymmetry of fish were considered - the number of rays in the pectoral and ventral fins and the number of scales pierced by holes in the lateral line. Analysis of the FAMP indicator (frequency of asymmetric manifestation per trait) indicates that the ecological state of the Ponura River is critical, while the state of the Kirpili River deviates from the norm to a lesser extent. Analysis of the FAMI indicator (frequency of asymmetric manifestation per individual) shows that the ecological state of the Kirpili River improves during the period from 2017 to 2020, while the ecological state of the Ponura River remains difficult throughout 2018-2019. The morphophysiological characteristics of silver crucian carp are also considered - indices of the heart, liver, kidneys, and gonads. The sizes of the heart, kidney and liver indices of silver crucian carp are significantly larger in the*

population from the Ponura River. Gonad indices in males are quite high; they do not differ in fish from both rivers. Female crucian carp from the Kirpili River have a significantly higher ovarian index, which indicates that female crucian carp from the Ponura River are not ready to reproduce again in the summer season.

Keywords: silver crucian carp, fluctuating asymmetry, organ index, steppe river.

Introduction

One of the morphological characteristics that assess the state of ecosystems is the stability of the development of organisms, characterized by the level of fluctuating asymmetry of bilateral morphological characteristics of living organisms. Developmental stability is the ability of an organism, under specific environmental conditions, to form a phenotype that does not carry ontogenetic disorders [Zakharov, 1987].

Under optimal environmental conditions, the body responds to external and internal influences through a complex physiological system of homeostatic mechanisms, primarily humoral. When conditions change in the direction of their deterioration, these mechanisms can be damaged, as a result of which the normal development of the body is disrupted. Such disturbances are clearly identified when assessing the stability of development of individuals based on the value of the fluctuating asymmetry index [Streltsov, Zakharov, 2003].

Material and methods

We chose the silver crucian carp Carassius gibelio (Bloch, 1782) as the object of study. Identification of fish was carried out according to [Emtyl, Ivanenko, 2002]. The collection of material was carried out in the summer season in two steppe rivers - Ponura and Kirpili. Float rods were used to catch fish. Silver crucian carp is a background species in steppe reservoirs, because it is undemanding to the amount of oxygen in water.

The Kirpili River is a steppe river in the Krasnodar Territory, originating 7–8 km northwest of the village of Ladoga and flowing towards the Sea of Azov. The Kirpili River flows through a densely populated part of the steppe zone of the Krasnodar Territory, its length is 202 km. The catch was made 5–7 km from the city of Timashevsk, in the summer of 2021. The banks are flat, steep in places, densely overgrown with reeds. Aquatic plants include duckweed, hornwort and pondweed. The collection of material was carried out from the right bank. At this point, 88 individuals were caught for research, of which 52 were females and 36 were males.

The Ponura River is a steppe river; it originates 4 km southwest of the village of Dinskaya, flows through several villages and flows into the Ponursky estuary. The length of the river is 97 km. The catch was carried out 7-10 km from the vil-

lage of Starovelichkovskaya, in the summer of 2022. The banks are flat, in places high, densely covered with grass. The water contains pondweed, hornwort, and duckweed. At this point, 54 individuals were caught for research, of which 32 were females and 22 were males.

According to A. A. Zorina [2012], normal variability includes three main components: variability in the asymmetry of characteristics of an individual, variability when comparing individuals of the same population, and variability in interpopulation asymmetry. In this work, we examined all 3 components: we took into account the variability of each individual individual, individuals of different ages within one population, and also compared individuals from two populations from steppe rivers.

The distribution of bilateral characteristics of individuals was taken into account for such characters as the number of rays in the pectoral fins, the number of rays in the ventral fins, and the number of scales in the lateral line. To analyze the obtained data, we used indicators of fluctuating asymmetry: frequency of asymmetric manifestation per trait (FAMP) and frequency of asymmetric manifestation per individual (FAMI). FAMP characterizes the ratio of the number of characteristics of an individual with registered asymmetry to the number of studied characteristics. FAMI characterizes the ratio of the number of individuals with a registered asymmetrical trait to the number of individuals in the sample. A point assessment of deviations in fish development from a stable (conditionally normal) state was carried out using a previously developed scale with additions for the southern regions, where the number of points ranges from 1 (the best ecological state of the reservoir) to 5 (the critical ecological state of the reservoir) [Methodological recommendations..., 2003; Khoroshenkov, 2013]. We also assessed the morpho-physiological state of some internal organs of fish - the heart, kidneys, liver, intestines and gonads (separately for males and females). After weighing these organs, their indices were calculated in ppm (for the heart, kidneys, liver, gonads) and as a percentage (for the intestines) [Schwartz, 1958].

Results and discussion

For environmental assessment of water quality in rivers, we used the FAMI indicator. This indicator, as well as an assessment of the state of the river, are shown in Table 1.

Table 1

Frequency of asymmetric manifestation on the trait of silver crucian carp and the ecological state of two steppe rivers of the northwestern Ciscaucasia

Frequency of asymmetric manifestation per trait				Point	Ecological state of the river
Generally	Number of rays in pectoral fins	Number of rays in ventral fins	Number of scales in the lateral line		
Ponura River					
0,54±0,03	0,49	0,62	0,51	5A	The river condition is critical
Kirpili River					
0,42±0,01	0,43	0,27	0,57	4	The condition of the river is significantly deviated from the norm

Comparison of FAMP from two rivers showed the presence of significant differences (t = 3.79 with t_{st} = 2.61 for P = 0.01). In silver crucian carp from the Ponura River, the frequency of asymmetry is higher by a trait than in fish from the Kirpili River. In general, the ecological state of the Ponura River is assessed as more severe than the state of the Kirpili River.

Comparison of the distribution of asymmetry frequencies for individual characteristics using the Pearson test showed similarity in this characteristic of fish from both steppe rivers (χ^2 = 0.10). Of the characteristics taken into account, the most variable is the number of rays in the ventral fins; its contribution to the overall variability varies among crucian carp from different rivers. Other characters—the number of rays in the pectoral fins and the number of scales in the lateral line—are more stable.

We took into account the trait frequency of asymmetry per individual separately for fish of different ages. The results are shown in Table 2.

Table 2

Frequency of asymmetric manifestation per individual of silver crucian carp from two steppe rivers of the northwestern Ciscaucasia

Frequency of asymmetric manifestation per individual					Score (by year)
Generally	2+	3+	4+	5+	
Ponura River					
0,54±0,03	-	-	0,53±0,03	0,57±0,07	5 / 5
Kirpili River					
0,37±0,04	0,27±0,07	0,36±0,03	0,40±0,03	0,43±0,02	1 / 3 / 4 / 4
Note "-" - fish of this age were not caught					

Osteological characters, which are used to analyze the level of fluctuating asymmetry, are formed at the larval stage of development of silver crucian carp. In this regard, it is possible to assess the dynamics of the ecological state of rivers over a number of years. In the Ponura River, crucian carp were caught in 2022; accordingly, the development of larvae and the formation of deviations from stable development in crucian carp aged 4+ occurred in 2019, and in fish aged 5+ – in 2018. Judging by the data, the Ponura River in both years of the study characterized by consistently low water quality and difficult environmental conditions.

Crucians from the Kirpili River were caught in 2021, which means their larval development occurred in 2017 – 2020. Judging by the data obtained, the ecological state of the Kirpili River changed over the studied period of time - from significant deviations from the norm in 2017 and 2018. to a conditionally normal state in 2020. We explain this by the fact that economic activity in the Kirpili River basin has been decreasing in volume in recent years, accordingly the hydrological regime is improving, and eutrophication is decreasing.

The method of morpho-physiological indicators has long established itself as a fairly reliable way to assess organismal adaptations to the environmental conditions of a particular river. The indices of the main internal organs of silver crucian carp are shown in Figures 1 and 2.

Figure 1. *Morpho-physiological indices of the internal organs of silver crucian carp from two steppe rivers in the northwestern Ciscaucasia*

Data on the more severe ecological state of the Ponura River compared to the Kirpili River, obtained from the analysis of the fluctuating asymmetry of silver crucian carp, are confirmed by data on the indices of the internal organs of these same fish. The indices of all studied organs of fish from the Ponura River are sig-

nificantly higher than the indices of fish from the Kirpili River (for the heart index t = 7.00, for the liver index t = 18.47, for the kidney index t = 14.47 with t_{st} = 2.61 for P = 0.01).

The relative sizes of the heart of vertebrates are usually associated with their motor activity. However, fish are characterized by high interpopulation variability of this index [Dobrinskaya, 1964]. Various toxins accumulate in the liver, so increased relative sizes of the liver characterize an increase in metabolic rate. An increase in the kidney index also occurs in vertebrates under conditions of intensified metabolism [Shvarts, Smirnov, Dobrinsky, 1968].
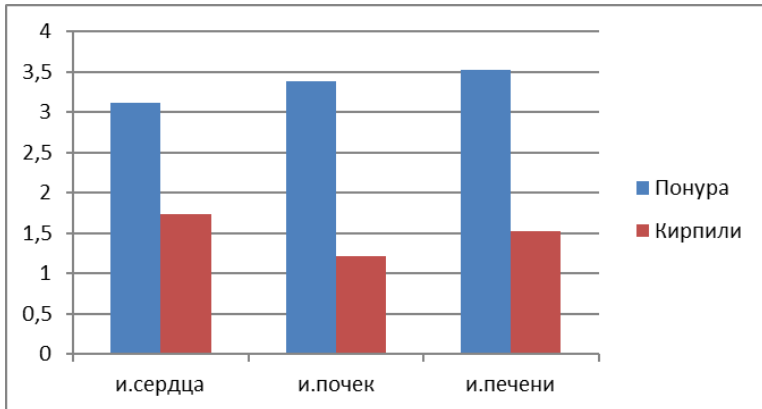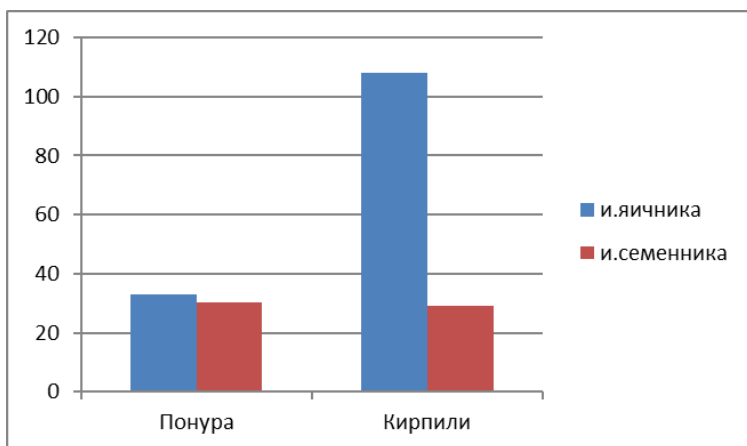

Figure 2. *Morpho-physiological indices of the gonads of silver crucian carp from two steppe rivers in the northwestern Ciscaucasia*

The relative sizes of the testes of male goldfish living in the two rivers do not differ significantly (t = 0.39 at tst = 2.75 for P = 0.01). The relative sizes of the ovaries of females are significantly larger in individuals from the Kirpili River (t = 18.26 at tst = 2.70 for P = 0.01). In the climatic conditions of the steppe zone of the northwestern Ciscaucasia, silver crucian carp can reproduce up to three times per season, but in the Ponura River the females are not ready to reproduce again.

Conclusion

A study of the morphometric and morpho-physiological parameters of silver crucian carp from the steppe rivers of the North-Western Ciscaucasia showed that the water quality of the Ponura River is greatly deviated from the optimal one, the condition of the river remains consistently critical in 2018-2019. The condition of the Kirpili River is gradually improving from poor in 2017–2018, to average in 2019 and conditionally normal in 2020.

The indices of the heart, kidneys and liver of silver crucian carp are significantly higher in fish from the Ponura River, which also indicates suboptimal living conditions for fish in this river. The gonad indices of male crucian carp at the beginning of summer do not differ in rivers, and the gonad index of female crucian carp is significantly higher in fish from the Kirpili River; females from the Ponura River have a lower ovarian index, which does not give them the opportunity to reproduce again this season.

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炎症生物标志物水平在儿童社区获得性肺炎严重程度发展中的意义
THE SIGNIFICANCE OF THE LEVEL OF INFLAMMATORY BIOMARKERS IN THE DEVELOPMENT OF SEVERITY IN COMMUNITY-ACQUIRED PNEUMONIA IN CHILDREN

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概括。 目的：对社区获得性肺炎严重程度发展中的炎症生物标志物进行比较分析

材料和方法。 在一项前瞻性队列研究中，在 110 名 5 至 14 岁儿童的监督下，其中 90 名患有社区获得性肺炎的儿童和 20 名对照组的儿童在卡拉干达儿童医院呼吸科接受治疗， 其中女孩占 43.64%（95% CI 31.51% – 56 ，33%），男孩占 57.27%（95% CI 34.91% – 59.88%）。 肺炎诊断依据儿童肺炎诊断和治疗标准 ICD –10（国际疾病统计分类第十次修订版）进行验证。 一般临床检查是根据哈萨克斯坦共和国批准的患有这种病理学的儿童的检查方案进行的，其中包括：细菌学调查方法、肿瘤坏死因子α（TNF-α）和白细胞介素的研究 通过酶联免疫分析测定血清中的 6 （IL-6）。

使用非参数曼–惠特尼 U 检验对获得的数量性状标记物浓度差异结果进行统计处理

结论。 我们的研究结果表明，随着肺炎严重程度的增加，患者血清中促炎细胞因子和降钙素原的滴度增加。 研究结果显示，在细菌性和病毒性肺炎患者中，促炎细胞因子（TNF-α、IL-6）可以作为预测肺炎严重程度的预测因子。

关键词：社区获得性肺炎、儿童、IL-6、TNF-α。

Summary. Objective: conduct a comparative analysis of inflammatory biomarkers in the development of severity in community-acquired pneumonia

Materials and methods. In a prospective cohort study under the supervision of 110 children at the age of 5 to 14 years, of them 90 children with community-acquired pneumonia and 20 children from the control group, undergoing treatment in the respiratory department of Children's Hospital of Karaganda, in which 43.64% were girls (95% CI 31.51% - 56 , 33%) and boys 57.27% (95% CI 34.91% - 59.88%). The diagnosis of pneumonia was verified on the basis of standards ICD -10 (10th revision of the International Statistical Classification of Diseases) for diagnosis and treatment of pneumonia in children . General clinical examination was carried out in accordance with the protocols of examination of children with this pathology approved in the Republic of Kazakhstan, with the inclusion of: a bacteriological method of investigation, studies of of tumor necrosis factor alpha (TNF-α) and interleukin 6 (IL-6) in serum by enzyme immunoassay. Statistical processing of the obtained results of the difference in quantitative traits marker concentrations was carried out using a nonparametric Mann–Whitney's U test

Conclusion. The results of our study indicate that as the severity of pneumonia increases, the titers of pro-inflammatory cytokines and procalcitonin in the blood serum of patients increase. The results of the study in patients with bacterial and viral pneumonia, proinflammatory cytokines (TNF-α, IL-6) can be used as predictors to predict the severity of pneumonia.

Keywords: Community-acquired pneumonia, children, IL-6, TNF-α.

Community-acquired pneumonia in children is one of the most relevant infectious diseases, due to the high prevalence among the children's population [1]. In recent years, significantly increasing the number of patients with severe and complicated course of community-acquired pneumonia [2]. Community-acquired pneumonia is accompanied by a systemic response of the organism of inflammation in the lung tissue. In recent years, much attention is given to study biological biomarkers of infection, but in these studies analyze data trends cytokine profile reflected pneumonia insufficient depending on the form and severity of the disease . In this regard, the study of the possibility of using the quantitative determination of complex biomarkers of inflammation, such as proinflammatory cytokines and procalcitonin (PCT), is of great practical importance for the assessment of prognosis of community-acquired pneumonia in children.

The main focus in the assessment of pneumonia is a complex approach assessment of the severity of the patient's condition for the prediction of the disease, especially in the early stages of its development. At the present stage, many authors have studied procalcitonin as one of the markers for the differential diagnosis of

bacterial and viral infection [3] . At the same time, the information available in the scientific literature characterizing the role of inflammatory markers in community-acquired pneumonia can not be considered exhaustive. The patterns of the distribution of markers of inflammation of the activity of the inflammatory process are not sufficiently defined depending on the degree of severity, course and outcome of community-acquired pneumonia in children. There is practically no comparative analysis of the diagnostic significance of TNF-α and IL-6 in children with community-acquired pneumonia.

Objective: conduct a comparative analysis of inflammatory biomarkers in the development of severity in community-acquired pneumonia

Materials and methods. In a prospective cohort study, under the supervision of 110 children, 90 children with community-acquired pneumonia at the age of 5 to 14 years, undergoing treatment in the respiratory department of Children's Hospital of Karaganda, in which 43.64% were girls (95% CI 31.51% - 56 , 33%) and boys 47.27% (95% CI 34.91% - 59.88%). The control group consisted of 20 healthy children .Patients and healthy children were included in the study on the basis of informed consent. T he criteria for inclusion in the group of subjects were: children from 5-14 years with verified diagnosis of community-acquired pneumonia, the voluntary participation of parents of children with registration of informed consent, to eliminate the risk of harm, damage (physical, psychological, social and economic).

Exclusion criteria were: failure of parents of children participating in the study, previously held antimicrobial therapy, the presence of comorbidity: another chronic inflammatory disease, congenital heart disease, active tuberculosis, the presence of cancer, neurological and endocrine diseases.

Verification of the diagnosis of pneumonia was carried out based on standards of diagnosis and treatment of pneumonia in children (ICD 10, J15.8).

Depending on the severity of the 90 patients were divided into three groups (I,II,III). In each group of 30 children with community-acquired pneumonia. The control group consisted of 20 healthy children .

On admission to hospital in patients determined the content of pro-inflammatory cytokines (IL-6, TNF-α) in serum.

Interleukin 6 (IL-6) was determined by ELISA using reagents for immunoassay for determining the concentration of IL-6 in serum (Interleukin-6 - ELISA BEST) (0-250 pg / ml). Tumor necrosis factor (TNF-α) was determined by IFA using a kit of reagents for immunoenzyme determination of the concentration of tumor necrosis factor alpha in serum (TNF-alpha ELISA- BEST) (0-300 pg / ml).

Statistical processing of the obtained results of the difference in quantitative traits marker concentrations was carried out using a nonparametric Mann–Whitney's U test.

Results.

When carrying out a bacteriological examination, it was revealed that most often in children was sown *Streptococcus pneumoniae* , *Haemophilus influenza* and *Staphylococcus aureus.* (figure 1)
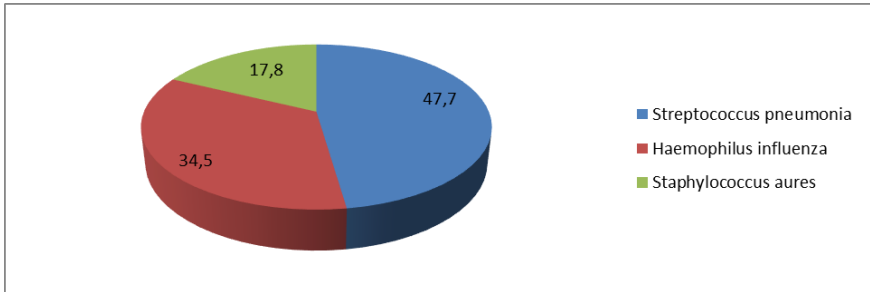

Figure 3. Results of bacteriological study in children with community-acquired pneumonia

Analysis of quantitative evaluation results of characteristics of proinflammatory cytokines (TNF-α, IL - 6) and procalcitonin are presented in tables 1,2,3 .

The analysis of the obtained data of one of the main cytokines IL - 6 showed quite significant differences in its content in the blood serum, depending on the severity of community-acquired pneumonia in children. (table 1)

Table 1

Content of IL-6 in serum depending on the severity of community-acquired pneumonia in children (pg/ml)

Severity of pneumonia	Control group (n=20) Me (Q25;Q75)	I (n=30) Me (Q25;Q75)	p-level	II (n=30) Me (Q25;Q75)	p-level	III (n=30) Me (Q25;Q75)	p-level
community-acquired pneumonia	0,17 (0,11; 0,81)	1,80 (1,38; 2,36)	P $_{C-I}$ <0,05*	2,37 (3,95; 3,22)	P $_{C-II}$<0,05* P^{C-II}<0,05* p^{I-II}<0,05*	6,16 (5,14; 6,90)	p <0,05* p^{C-III}<0,05* p^{I-III}<0,05* p^{II-III}<0,05*

Significant differences were obtained when the level of IL-6 was compared in the groups of sick children, and in particular, depending on the severity of the groups in the I and III severity of community-acquired pneumonia (p<0,05). At the same time, a significant level of significance of differences was obtained when comparing the data of the II and III groups of children's observation (p<0,05).

Content of TNF-α in serum depending on the severity of community-acquired pneumonia in children (pg / ml)

Severity of pneu-monia	Control group (n=20) Me (Q25;Q75)	I (n=30) Me (Q25;Q75)	p-level	II (n=30) Me (Q25;Q75)	p-level	III (n=30) Me (Q25;Q75)	p-level
commu-nity-acquired pneumo-nia	0,97 (0,40; 1,25)	1,23 (0,52; 1,82)	P >0,05 C-I	1,44 (2,20; 1,69)	P <0,05* p C-I<0,05* I-II	5,43 (3,69; 6,62)	P <0,05* p C-III< 0,05* p I-III <0,05* II-III

The analysis of serum TNF-α values in children with community-acquired pneumonia (table 2) showed the presence of significant differences when comparing children in groups, depending on the severity of community-acquired pneumonia in children. Thus, TNF-α in children of the 1st group was 1.23 pg / ml, and in the third group this index was 4.5 and higher at 5.43 pg / ml with the children in the control group 0.97 (p <0, 05). The values obtained in children of 1,2 and 3 groups of children with community-acquired pneumonia had significant differences, depending on the severity of the course of community-acquired pneumonia.

The analysis of the X-ray study data showed the predominance of the segmental variant of prevalence in children with unilateral lesion (71.5 + 5.21). Quite often, the examined children with community-acquired pneumonia had a focal variant of recording the pathological focus, it was most often found in the middle and lower parts of the right lung. (figure 2)
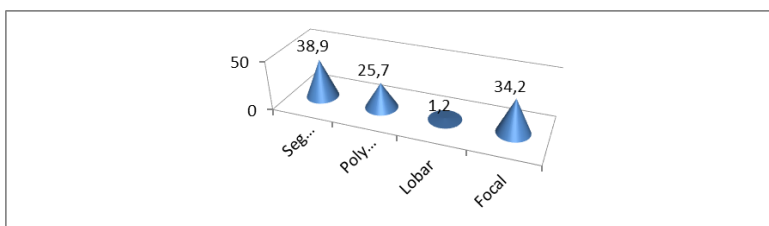

Figure 2. Data from an X-ray examination of children with community-acquired pneumonia

Discussion.

Literary data on the level of proinflammatory cytokines and procalcitonin in children with community-acquired pneumonia are rare, one study shows the use of biomarkers of inflammation in differentiating between acute pneumonia and

bronchitis in children [4,5,6]. In most studies, each marker is studied separately, there is practically no data on the complex of markers that determine several components of the inflammatory response, and in particular the IL-6; TNF-a [7,8,9]. The results of our studies show that a high level of IL-6 and TNFα in blood serum was observed in children with a severe degree of the disease, which can be a predictor of disease severity.

Comparative analysis of our study suggest that as the severity of pneumonia increases, the titres of proinflammatory cytokines in the blood serum of patients increase. The results of the study in patients with community-acquired pneumonia, proinflammatory cytokines (TNF-α, IL-6) can be used as predictors for the diagnosis of the severity of community-acquired pneumonia in children. The data of the complex study of markers of inflammation (TNF-α, IL-6), depending on the severity of community-acquired pneumonia in children, certainly determines the possibility of their use in diagnosis.

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COVID-19血液病患者肺部形态学变化特征
FEATURES OF MORPHOLOGICAL CHANGES OF LUNGS IN COVID -19 PATIENTS WITH BLOOD DISEASES

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注解。 肿瘤血液疾病对 COVID-19 的病程影响最大。 肺是 COVID-19 中主要受影响的器官，其中会出现各种形式的病变，导致肺和支气管出现不同的形态，以及血液系统疾病患者的预后。

研究目的。 探讨死于COVID-19的血液系统疾病患者肺部形态学变化特征。

方法和材料。 采用苏木精-伊红染色，对22例血液系统疾病患者的肺组织标本进行形态学分析，免疫组化标记物：CD4、CD8、CD20、CD34、IV型胶原。 所获得的结果采用描述性方法，无需进行统计处理。

结果。 对 22 例死于 COVID-19 的血液学特征患者的致命结果（13 名男性和 9 名女性）进行了分析。 平均年龄为63岁。 在选定的患者中，描述并考虑了以下血液系统疾病：骨髓增生异常综合征、慢性淋巴细胞白血病、急性髓性白血病、淋巴瘤、多发性骨髓瘤。

形态学图像的特征是，骨髓增生异常患者的肺组织以肺泡破坏的形式受损，浸润中缺乏中性粒细胞和巨噬细胞。慢性淋巴细胞白血病患者则缺乏透明膜。 肺部足菌肿被记录为免疫缺陷的结果。 分化 4 和 20 的克隆未记录在炎症浸润（CD4−；CD20−）中。 在死后诊断为淋巴瘤的研究组中注意到微循环床血管中的

血栓形成。 据报道，在多发性骨髓瘤和急性髓性白血病发作中，由于病毒变态而出现多核肺泡细胞。 未经治疗的患者外周血中存在原始细胞。 在所有考虑的病例的免疫反应中都发现了普遍性，表现为消失（CD4- 阴性表达）和分化克隆 8 和 34 阳性表达（CD8+；CD34+）。 多发性骨髓瘤的个体特征以 CD20+ 表达的形式确定。 该研究揭示了 IV 型胶原蛋白的损失，Picro-Mallory 和 Van Gieson 的阴性组织化学反应证明了这一点。

结论。 血液学特征患者中 COVID-19 的肺损伤反映了肺组织呼吸部门和气力屏障血管损伤的细微差别。 这引发了对这种传染性病理学形态表现的进一步研究。

关键词：COVID-19、血液疾病、肺部呼吸部分。

Annotation. *Oncohematological diseases most greatly affect the course of COVID-19. The lung is the main affected organ in COVID-19 in which various forms of lesion develop, causing a different morphological picture in the lungs and bronchi, as well as the prognosis in patients with hematological diseases.*

The research aim. *To find out the features of morphological changes in the lungs of patients with the blood system diseases who died from COVID-19.*

Methods and materials. *Morphological analysis of histological preparations of lung tissue was applied on 22 patients with the blood system diseases using hematoxylin-eosin staining, immunohistochemical markers: CD4, CD8, CD20, CD34, type IV collagen. The descriptive method of the obtained results without statistical processing was applied.*

Results. *22 cases of fatal outcomes of hematological profile patients who died from COVID-19 (13 men and 9 women), were analyzed. The average age was 63 years old. Among the selected patients, the following diseases of the blood system are described and considered: myelodysplastic syndrome, chronic lymphocytic leukemia, acute myeloid leukemia, lymphomas, multiple myeloma.*

The morphological picture was characterized by damage of the lung tissue in the form of destruction of the alveoli and the absence of neutrophils and macrophages in the infiltrate among the patients with myelodysplasia., The absence of hyaline membranes in chronic lymphocytic leukemia. Mycetomas in the lungs were recorded as the result of immunodeficiency. Clones of differentiation 4 and 20 were not registered in the inflammatory infiltrate (CD4-; CD20-). Thrombosis in the vessels of the microcirculatory bed was noted in the study group with a postmortem diagnosis of lymphoma. In multiple myelomas and in the onset of acute myeloid leukemia, multinucleated alveolocytes have been reported due to viral metamorphosis. The presence of blasts in the peripheral blood of untreated patients. Universality in the form of disappearance (negative expression to CD4-) and positive expression to differentiation clones at 8 and 34 (CD8+; CD34+) was found in the immune response of all the considered cases. An individual feature was determined in multiple myeloma in the form of CD20+ expression. The study

revealed the loss of type IV collagen, as evidenced by the negative histochemical reaction of Picro-Mallory and Van Gieson.

Conclusion. *Lung damage in COVID-19 among the hematological profile patients reflects nuances in damage to the respiratory department of lung tissue and vessels of the aerogematic barrier. This gives rise to further study of the morphological manifestations of this infectious pathology.*

Keywords: *COVID-19, blood diseases, respiratory part of the lungs.*

Relevance.

Oncogematological diseases, despite the variety of possibilities for targeted therapy and bone marrow transplantation, are a group at risk of complications and death. The COVID-19 pandemic significantly worsened the prognosis in patients with diseases of the blood system and especially in the presence of various co-morbid conditions, namely, in combination with chronic obstructive pulmonary disease, obesity, diabetes mellitus, arterial hypertension, coronary heart disease, chronic kidney disease, solid tumors of other localization[1,2]. It is known that the main target for SARS-CoV-2 are the lungs, and the main morphological substrate of their lesion is considered to be a rather specific diffuse alveolar injury in combination with involvement in the pathological process of the pulmonary vascular bed and the development of alveolar hemorrhagic syndrome[3].

Data on morphological variants of lung damage in COVID-19 among the hematological patients is practically not described in the studying literature, and there is also no data on the peculiarities of the formation of a local immune response.

The research aim. The aim of the research was to establish the features of morphological changes in the lungs of patients with diseases of the blood system who died from COVID-19. Using Picro-Mallory and Van Gieson histochemical stains to assess the presence or absence of type IV collagen in the tissues of the aerogematic barrier. To study the variants of T- and B-immune responses in the studied material using immunohistochemical methods.

Methods and materials.

A selective analysis of autopsy data (lung fragments) of 22 patients with diseases of the blood system (tumor and non-tumor character) who were treated at the

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infectious diseases hospital at the Regional Clinical Hospital No. 2 in Vladivostok for COVID-19 coronavirus infection in the period from 2020 to 2022 was carried out. Hematoxylin and eosin staining were used for histological examination. The chemical properties of the studied tissues were evaluated using Picro-Mallory and Van Gieson staining. The resulting sections were processed on a Linistar, Thermo FS staining machine. Immunohistochemical reactions were performed with antibodies CD4, CD8, CD20, CD34 and type IV collagen, manufactured by DAKO, Denmark, on an Autostainer Link 48 device. Microscopy was performed using Olympus CX31.

A descriptive method of the obtained results without statistical processing is used in the research, which is planned to be performed at a subsequent stage of the study.

Results.

We analyzed 22 cases of fatal outcomes of hematological profile patients who died from COVID-19. The patients were divided by gender - 13 men and 9 women, the average age of the patients was 63 years. The following diseases of the blood system were selected: myelodysplastic syndrome (MDS) with multilinear dysplasia (2 patients), chronic lymphocytic leukemia (CLL) (8 patients), acute myeloid leukemia (AML) (4 patients), acute lymphoid leukemia (ALL) (2 patients), multiple myeloma (MM) (3 patients), lymphomas (1 patient with diffuse B-large cell lymphoma (DBCCL), 2 with mantle cell lymphoma (MCL). Comorbid pathology was represented by diseases of the cardiovascular system (hypertension, hypertension), diabetes mellitus, obesity and chronic kidney disease.

The histological material of the described cases is represented by the respiratory and conduction parts of the lungs. At the same time, in bronchi of different caliber, the lesions were stereotypical and manifested by hypersecretion of bronchial epithelial cells with partial desquamation of the latter. In our observations, the walls of the terminal bronchi were accompanied by circular thickening due to both fibrosis and collagenization and expansion of the basement membrane, which was accompanied by positive expression to type IV collagen antibodies. The described changes were confirmed by the qualitative reaction of Picro-Mallory and Van Gieson. The main morphological differences were localized in the respiratory part of the lung tissue.

Thus, in the group with MDS, alternating zones of thickening of the walls of the alveoli due to collagenization of the stroma were noted, as evidenced by the positive expression of antibodies to type IV collagen, and areas with partial rupture of the interalveolar septa. Immunohistochemically, positive expression to CD34+ antibodies was recorded in the areas of thickening of the alveoli, which indicated the proliferation of fibroblasts. In the lumen of the alveoli, single desquamated alveolocytes were located among homogeneous pink masses. Along the

inner surface of the walls of the alveoli there were strips of hyaline membranes of different thickness and shape.

In the group of patients with lymphomas (DBCL and MCL), all patients were in the process of specific antitumor therapy, including the anti-CD20 monoclonal antibody Rituximab. Alternating fields of distelectases and small areas with emphysematous changes were noted in the lungs. There is thickening in the walls of the alveoli due to collagenization and fibrosis (positive expression to type IV collagen, CD34+). Hyaline membranes are marked along the walls of individual alveoli, in the form of small sections. In this observation group, we registered vessels of the aerogematic barrier with fibrin thrombi with wall decollagenization (negative expression to type IV collagen, loss of specific Picro-Mallory and Van Gieson staining). Despite rituximab therapy, the cellular composition contained an abundance of leukocytes, lymphocytes and macrophages, both in the bronchial lumen and peribronchially. The clone of differentiation of the 8th (CD8+;) prevails here, with a negative reaction with antibodies of the 4th and 20th type (CD8-; CD20-), which was regarded as an inadequate immune response in this category of patients. A similar phenomenon was reflected in the publication of Mohammed R.N. et al. and it was caused by the work of the cellular immune response with rapid depletion of T cells. According to their data, depleted infiltrated T cells cause a decrease in the number of inexhaustible CD8+ T cells in patients with severe COVID-19.

A more diverse pattern, along the course of COVID-19, was established in the group of patients with CLL. In our case, these were two patients with different stages of the disease and different statuses for specific therapy. A patient with CLL, stage «B» according to Binet, of young age (50 years old) was admitted with a newly diagnosed disease, leukocytosis of 60 G/l due to absolute lymphocytosis. At the diagnostic stage, infection with a coronavirus infection was established, CLL was not treated. Thickening of the interalveolar septa was noted in the lung tissue due to the proliferation of alveolocytes and focal sclerosis against the background of fibroblast proliferation (positive expression to type IV collagen antibodies, with positive expression to CD34+). The described changes were alternated by fields of distelectasis and emphysematous transformation of the alveoli with rupture of the walls. In the walls, the expression of antibodies to CD8+ was noted, in the absence of expression to clones of differentiation of type 4 and type 20 (CD4-; CD20-). The lumen of the alveoli is filled entirely with erythrocyte masses with clear contours of all cells of bright pink color.

The second patient is 71 years old with CLL "C" stage according to Binet, a long history of the disease (6 years), stage of relapse, the presence of concomitant chronic diseases (DM, GB, AF, COPD, obesity). At the time of infection, COVID-19 was in the process of anti–relapse therapy (a course of immunochemother-

apy in the «RCD» mode - rituximab, dexamethasone, cyclophosphamide). Destructive and necrotic processes prevailed in the lung tissue of the patient, which was accompanied by a violation of the integrity of the walls of the alveoli due to deformation and rupture against the background of thinning and necrosis. Mycelium of the fungus was registered among the necrotic masses, which was regarded as a mycetoma. The damage zones alternated with areas of thickening due to proliferating fibroblasts (CD34+) and, as a result, pulmonary fibrosis (confirmed by high-quality Picro-Mallory and Van Gieson staining). There are phenomena of reactive fibromatosis with positive expression to type IV collagen around necrotic masses. The inflammatory pool of cells presented CD8+ in friendly negative expression to CD4- and CD20-. In the alveoli, hyaline membranes were located along the inner contour of the walls. Desquamated alveolocytes and hemosiderin-loaded siderophages were located in the lumen of the alveoli among homogeneous pink masses.

In the case of multiple myeloma, these are 3 patients who received specific treatment at the initial stage, without achieving its effectiveness. All of them had concomitant diseases. Thickening of the interalveolar septa was also noted due to uneven fibrosis with positive expression to CD34+ and type IV collagen antibodies (the presence of connective tissue was confirmed by Picro-Mallory and Van Gieson reactions). Hyaline membranes were located on the inner surface of the alveoli in the form of discontinuous strips of different thicknesses. Multinucleated alveolocytes have been reported as a phenomenon of COVID-19 associated viral metamorphosis. The IHC study revealed CD20+ lymphocytes with a lack of expression to clones of type 4 and 8 (CD4-, CD8-).

Patients with acute leukemia who died from coronavirus infection were out of remission of the underlying disease and received various specific therapies. The description of the lung micropreparation is presented in a patient with the development of COVID-19 in the debut of AML, specific therapy was not prescribed. In the respiratory part of the lungs, foci of distelectases with zones of reactive fibromatosis in the walls (positive expression to type IV collagen and CD34+) prevailed. Hyaline masses were deposited on the surface of the alveoli in expanded areas of lung tissue. There are multinucleated symplasts of alveolocytes in the lumen. Expression to the CD8+ clone prevails in lymphoid tissue with a friendly negative reaction to CD4- and CD20-.

Conclusion.

During the observation, stereotypical damage to the vessels of the aerogematic barrier in the form of decollagenization with loss of expression to type IV collagen was established for all groups. It was noted that damage to the respiratory part of the lung tissue in hematological patients is characterized by destructive phenomena in the form of destruction of the walls of the alveoli, which prevailed in myelo-

dysplasia and chronic lymphocytic leukemia. These processes were accompanied by the presence of hemorrhagic exudate.

Obvious decollagenization of the walls of the vessels of the aerogematic barrier, and as a result, thrombosis, prevailed in cases with lymphomas. The formation of multinucleated alveolocytes, due to viral metamorphosis, was distinguished by observations with multiple myeloma and in the onset of acute myeloid leukemia. According to our data, the local cellular reaction in lung tissue in MDS was characterized by the absence of neutrophils and macrophages. In the inflammatory infiltrate in CLL, there was no expression for clones of differentiation of types 4 and 20. An individual feature was also determined in multiple myeloma in the form of positive expression to CD20+.

The data obtained reflect the nuances in lung damage in hematological patients with COVID-19 and require a further study.

肾癌癌周区 CD8+ T 淋巴细胞数量的定量: 与预后因素的关系
QUANTIFICATION OF THE NUMBER OF CD8+ T LYMPHOCYTES IN THE PERITUMOROUS ZONE OF KIDNEY CANCER: RELATIONSHIPS WITH PROGNOSTIC FACTORS

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抽象的。 该研究的目的是评估肾细胞癌瘤周区 CD8+ T 淋巴细胞定量计数的预后价值。 材料和方法。 回顾性分析了 74 例肾细胞癌手术治疗后并进行完整 5 年随访的患者的资料。 免疫组化染色后, 在400倍的3个代表性视野下测定癌周区CD8+T淋巴细胞的分布密度, 并与肿瘤的临床病理特征和总体5年生存率进行比较。 患者。 结果。 在疾病的 III–IV 期 (p = 0.0000001)、>7 cm 的肿瘤 (p = 0.0000001)、III–IV 级退行性变中, 观察到 CD8+ T 淋巴细胞的癌周区有高水平的浸润。 Fuhrman (p = 0 .0001), 存在转移 (p = 0.0000001)。 结论。 鉴于需要寻找新的肾癌预后标准, 我们得出结论, 瘤周区 CD8+ T 淋巴细胞的高水平浸润是一个不利的预后因素。 对肾癌瘤周区 CD8+ T 淋巴细胞浸润的评估可以作为额外的预后因素, 可以在术前水平预测疾病的进程。

关键词: 肾癌, 瘤周区, CD8+ T 淋巴细胞, 预后因素, 总生存分析。

Abstract. *The aim of the study was to assess the prognostic value of a quantitative count of CD8+ T-lymphocytes in the peritumoral zone of renal cell carcinoma. Materials and methods. The material of 74 patients after surgical treatment for renal cell carcinoma with a complete 5-year follow-up was retrospectively analyzed. After immunohistochemical staining, the distribution density of CD8+ T-lymphocytes in the peritumorous zone of carcinomas was determined in 3 representative fields of view at a magnification of x 400 and comparisons were made with the clinicopathological characteristics of tumors and the overall 5-year survival of patients. Results. A high level of infiltration of*

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the peritumorous zone of carcinomas with CD8+ T lymphocytes was observed in stages III-IV of the disease (p = 0.0000001), in tumors >7 cm (p = 0.0000001), in grades III-IV anaplasia according to Fuhrman (p = 0 .0001), in the presence of metastases (p = 0.0000001). Conclusion. In light of the need to search for new prognostic criteria for kidney cancer, we conclude that a high level of infiltration of the peritumoral zone with CD8+ T lymphocytes is an unfavorable prognostic factor. Assessment of infiltration of the peritumoral zone of kidney cancer with CD8+ T lymphocytes can serve as an additional prognostic factor that can predict the course of the disease at the preoperative level.

Keywords: *kidney cancer, peritumoral zone, CD8+ T-lymphocytes, prognosis factors, overall survival analysis.*

Cells of the inflammatory infiltrate of the peritumoral zone (PZ) of a malignant neoplasm are increasingly attracting the attention of researchers [1, 2, 3]. According to modern concepts, the inflammatory infiltrate in morphologically unchanged tissue adjacent to the tumor is involved in the process of malignancy [4], since tumor cells have the ability to spread much further than the invasive edge of the tumor. In the PZ, cancer cells are able to remodel the stroma by interacting with mast cells, macrophages, fibroblasts and lymphocytes.

The main pathway of activation of CD8+ lymphocytes in the PV is the presentation of tumor antigens by dendritic cells. This presentation occurs through the binding of the T-cell receptor (TCR) to the domains of the major histocompatibility complex (MHC-II) molecules of the dendritic cell with the formation of immunocompetent clones [5]. The path of activation of CD8+ T-lymphocytes through CD4+ T-lymphocytes is also known: it is the activated CD4+ T-helper cells PZ that stimulate the activity and migration of CD8+ T-lymphocytes by secreting effector cytokines [6]. Also, there is evidence that CD4+ and CD+ T lymphocytes of the PZ can participate in the processes of epithelial-mesenchymal transition, invasion and metastasis of carcinomas by activating matrix metalloproteinases [7, 8].

Cytotoxic CD8+ T lymphocytes are integral participants in the peri-tumor inflammatory infiltrate. At the same time, the prognostic value of counting CD8+ T lymphocytes in the PZ of carcinomas is not clear.

Danilova N.V. et al. (2021) showed that in gastric cancer, a high density of CD8+ T lymphocytes in the prostate was associated with a greater depth of invasion, a more advanced stage of the disease, the presence of tumor emboli in the vessels and a shorter overall 5-year survival [6]. For breast cancer, according to Sofopoulos M. et al. (2019) patients with high levels of peritumoral CD8+ T lymphocytes showed poor postoperative survival [9].

However, data from Hu W.H. et al. (2015) showed that in anal squamous cell carcinoma there were strong positive correlations between high levels of peritu-

moral CD8+ T lymphocytes, good tumor differentiation, early pathological stage and better prognosis [10]. Similar data were obtained for liver cancer [11]. No relationship was found between the content of peritumoral CD8+ T lymphocytes and the clinical and morphological parameters of carcinomas and the prognosis of pancreatic cancer [12].

There are some studies in the scientific literature showing that stromal intratumoral infiltration of CD8+ T lymphocytes was an unfavorable prognosis factor in renal cell carcinoma (RCC). Thus, Nakano O. et al. (2001) showed that a high number of stromal CD8+ T lymphocytes was associated with shorter postoperative survival of patients. At the same time, these authors conclude that it is not the fact of an increase in the number of CD8+ T-lymphocytes that is important, but it is also necessary to take into account the level of proliferation of immune cells; with a poor prognosis, the proliferation index of CD8+ T-lymphocytes was low [13].

Thus, studies devoted to the study of the prognostic value of a quantitative study of CD8+ T-lymphocytes in the prostate of malignant neoplasms are few. We have not found any works in the literature devoted to the study of CD8+ T-lymphocytes in the PZ of kidney cancer.

The purpose of the study was to quantitatively analyze CD8+ T lymphocytes in the PZ of kidney cancer and determine relationships with clinical and morphological prognostic factors.

Materials and methods. Surgical material from 74 patients with kidney cancer was studied. The average age of the patients was 57.05 ± 1.1 years. There were 37 (50%) men, 37 (50%) women.

The following histological types of kidney cancer were studied: clear cell – 48 (64.9%); papillary – 10 (13.5%); chromophobic – 9 (12.2%) and unclassifiable – 7 (9.4%).

When distributing patients according to the stages of the disease, 54 (70.3%) observations corresponded to clinical stages I-II, and 22 (29.7%) corresponded to stages I-IV.

The degree of anaplasia according to Fuhrman S.A. 47 (63.5%) tumors corresponded to GI-GII, and 27 (36.5%) carcinomas had grades of anaplasia GIII-GIV.

There were 15 (20.3%) carcinomas with regional and distant metastases, 59 (79.7%) were localized tumors.

The average size of the tumor node was 6.9 ± 0.2 cm.

The material was fixed in a 10% solution of neutral buffered formalin for 24 hours. Sections were immunohistochemically stained using monoclonal mouse antibodies to CD8+ (clone SP57, VENTANA, dilution 1:50) according to the protocol recommended by the manufacturer. The average number of CD8+ T-lymphocytes was counted in 3 fields of view at microscope magnification x 400 using the Image Tool computer program. 3.0.

Statistical processing of the material was carried out using the statistical package Statistica 10.0. If the obtained data were normally distributed, when testing statistical hypotheses, methods of parametric statistics (Student's t-test) were used, and if the obtained data did not meet the criteria of normal distribution (Shapiro-Wilk test W = 0.89, p <0.01), then The Kolmogorov-Smirnov test or the Mann-Whitney U test was used. Correlation relationships were determined by calculating the Pearson coefficient (r). Data were considered reliable at p < 0.05.

Research results. Correlation analysis revealed that the content of CD8+ T-lymphocytes in the prostate of kidney cancer was interrelated: with the clinical stage of the disease (r = 0.54; p = 0.0001); tumor node size (r = 0.54; p = 0.0001); the degree of anaplasia according to Fuhrman (r = 0.80; p = 0.0001) and the presence of metastases (r = 0.56; p = 0.0001).

In patients with clinical stage I-II of the disease, the average number of CD8+ T-lymphocytes in the prostate was 43.2±4.8, and in stage III-IV it increased 3.2 times to 138.5±10.7 (p = 0.0000001).

With the degree of anaplasia of carcinomas GI-GII, the content of CD8 + T-lymphocytes in the PV was 24.4±1.7, and with GIII-GIV it increased 6.6 times (160.6±9.3) (p = 0.001).

When the size of the tumor node was <7.0 cm, the number of CD8 + T-lymphocytes in the prostate was 43.6±5.2, and when the size was ≥7.0 cm, it significantly increased by 2.1 times to 111.9±9. 5 (p = 0.0000001).

In patients with localized tumors, the number of CD8 + T lymphocytes in the PZ was 53.5±4.9, and in the PZ of locally advanced carcinomas it significantly increased 3 times to 162.2±14.4 (p = 0.0000001) .

In non-transforming cancer, the number of CD8+ T-lymphocytes in the prostate was the highest (158.2±15.7), and the lowest in papillary carcinoma (19.5±2.6) (p = 0.007).

Conclusion. Thus, the results of the study showed that the content of CD8+ T lymphocytes in the PZ of kidney cancer was associated with a number of important clinical and morphological prognosis factors. The number of CD8+ T-lymphocytes in the tumor significantly increased with advanced stages of the disease, high degree of anaplasia, large size of the tumor node and in the presence of metastases. Quantitative assessment of the number of CD8+ T lymphocytes in the prostate cancer may serve as an additional prognostic factor for kidney cancer.

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癌周区高表达 CD3+ T 淋巴细胞是肾细胞癌的不利预后因素
HIGH EXPRESSION OF CD3+ T LYMPHOCYTES IN THE PERITUMOROUS ZONE AS AN UNFAVORABLE PROGNOSTIC FACTOR IN RENAL CELL CARCINOMA

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抽象的。 该工作对肾细胞癌瘤周区（PZ）中的CD3+T淋巴细胞进行了定量分析。 研究人员对 74 名肾癌患者术后材料的石蜡块进行了研究。 该研究包括 36 名（50%）男性和 37 名（50%）女性。 患者的平均年龄为56.7±1.1岁。 肿瘤 PZ 中 CD3 + T 淋巴细胞的数量在疾病 III–IV 期增加 4.5 倍（p = 0.0000001），在 III–IV 期异型性增加 6.7 倍（p = 0.001），增加 2 .3 倍（p = 0.0000001）当肿瘤淋巴结的大小超过 7 厘米时，是存在转移时（p = 0.0000001）的 2.7 倍。 在非十字型癌中，前列腺中CD3+ T淋巴细胞的数量最高（161.3±26.7），最低的是乳头状癌（85.9±31.0）（p = 0.05）。 PZ 癌中高含量的 CD3+ T 淋巴细胞与不利的病程相关，该参数可作为肾细胞癌的额外预后因素。

关键词：肾癌, 瘤周区, CD3+ T 淋巴细胞, 预后因素, 总生存分析。

Abstract. *The work carried out a quantitative analysis of CD3 + T-lymphocytes in the peritumorous zone (PZ) of renal cell carcinoma. Paraffin blocks of postoperative material from 74 patients with kidney cancer were studied. The study included 36 (50%) men and 37 (50%) women. The average age of the patients was 56.7±1.1 years. The number of CD3 + T-lymphocytes in the tumor PZ increased by 4.5 times (p = 0.0000001) at stages III–IV of the disease, by 6.7 times (p = 0.001) at stages III–IV atypia, by 2 .3 times (p = 0.0000001) when the size of the tumor node is more than 7 centimeters and 2.7 times (p = 0.0000001) in the presence of metastases. In non-crusifying cancer, the number of CD3+ T-lymphocytes in the prostate was the highest (161.3±26.7), and the lowest value was in papillary*

carcinoma (85.9±31.0) (p = 0.05). A high content of CD3+ T-lymphocytes in PZ carcinomas is associated with an unfavorable course of the disease, and this parameter can be used as an additional prognostic factor in renal cell carcinoma.

* **Keywords:** kidney cancer, peritumoral zone, CD3+ T-lymphocytes, prognosis factors, overall survival analysis.*

The study of immunohistochemical features of cells in the inflammatory infiltrate of the peritumoral zone (PZ) of malignant neoplasms has been relevant in recent decades [1,2,3,4,6].

The CD3 multiprotein complex is a surface marker of mature T lymphocytes and serves to identify lymphocytes of this type.

Studies comparing the number of CD3+ T-lymphocytes in the PZ with the clinical and morphological parameters of carcinomas in the literature are few. There are indications of an increase in the content of CD3 + T lymphocytes in the PZ compared to the tumor itself [7].

According to Helal D.S. et al. (2016) [8] there were more CD3+ T lymphocytes in the PZ of well-differentiated squamous cell carcinoma of the head and neck compared to poorly differentiated CD3+ T-lymphocytes.

Depending on the size of the tumor node Menegaz R.A. et al. (2008) [9] revealed a decrease in the number of peritumoral CD3+ T lymphocytes in tumors larger than 2 cm, compared with carcinomas whose size was less than 2 cm.

In ovarian cancer, a high number of CD3+ T lymphocytes in the prostate was associated with an unfavorable course of carcinomas. At the same time, other studies have revealed a relationship between a favorable prognosis and a high content of CD3+ T-lymphocytes in the prostate, in particular in pancreatic cancer [10] and skin melanoma [11]. However, there are studies in which the prognostic value of counting the number of CD3+ T lymphocytes in the PZ of carcinomas was not identified [12].

Keith O.I. et al. (2016) [13] revealed a relationship between the number of CD3+ T lymphocytes in the PZ and ploidy in colon cancer; in the PZ of aneuploid tumors, the number of CD3+ T lymphocytes increased significantly.

CD3+ T lymphocytes had an impact on the activity of angiogenesis in the tumor [14]. According to Kiss J. et al. (2007) [15] in skin melanoma, a positive correlation was found between the density of the microvasculature in the tumor and the number of peritumoral CD3(+) T lymphocytes. The relationship found was stronger in melanomas > 4.0 mm and in metastatic tumors. Carvalho M.I. et al. (2015) [16] established a relationship between the density of CD3+ T lymphocytes in the PV and the expression of VEGF in tumor cells.

For renal cell carcinoma according to Kowalczyk D. et al. (1997) [17] CD3 + T lymphocytes were the main population of lymphocytes and amounted to 66.9%.

Other authors provide similar data. The degree of malignancy in kidney cancer was interrelated with the distribution density of CD3+ T lymphocytes in the tumor [17]. A decrease in the number of CD3+ T lymphocytes in RCC was an unfavorable factor in the postoperative survival of patients [18]. When assessing peritumoral CD3+ T lymphocytes, it was revealed that their number was greater than in the intratumoral zone, which was an unfavorable prognosis factor for renal cell carcinoma [19].

Thus, the data from studies on the relationship between the density of distribution of CD3+ T-lymphocytes in the prostate cancer and the clinical and morphological characteristics of malignant neoplasms are scarce, and in the case of kidney cancer they are contradictory and therefore research in this direction is relevant.

The purpose of the study was to quantitatively analyze CD3+ T lymphocytes in the PZ of kidney cancer and determine relationships with clinical and morphological prognostic factors.

Materials and methods. Surgical material from 74 patients with kidney cancer was studied. The average age of the patients was 56.7 ± 1.1 years. There were 37 (50%) men, 37 (50%) women.

The following histological types of kidney cancer were studied: clear cell – 48 (64.9%); papillary – 10 (13.5%); chromophobic – 9 (12.2%) and unclassifiable – 7 (9.4%).

When distributing patients according to the stages of the disease, 54 (70.3%) observations corresponded to clinical stages I-II, and 22 (29.7%) corresponded to stages I-IV.

The degree of anaplasia according to Fuhrman S.A. 47 (63.5%) tumors corresponded to GI-GII, and 27 (36.5%) carcinomas had grades of anaplasia GIII-GIV.

There were 15 (20.3%) carcinomas with regional and distant metastases, 59 (79.7%) were localized tumors.

The average size of the tumor node was 6.9 ± 0.2 cm.

The material was fixed in a 10% solution of neutral buffered formalin for 24 hours. Sections were immunohistochemically stained using monoclonal mouse antibodies to CD8+ (clone RbCD3 (SP7), SPRING, dilution 1:40) according to the protocol recommended by the manufacturer. The average number of CD3+ T-lymphocytes was counted in 3 fields of view at microscope magnification x 400 using the Image Tool computer program. 3.0.

Statistical processing of the material was carried out using the statistical package Statistica 10.0. If the obtained data were normally distributed, when testing statistical hypotheses, methods of parametric statistics were used (Student's t-test), and if the obtained data did not meet the criteria of normal distribution (Shapiro-Wilk test W = 0.89, p <0.01), then The Kolmogorov-Smirnov test or the Mann-Whitney U test was used. Correlation relationships were determined by calculating the Pearson coefficient (r). Data were considered reliable at p < 0.05.

Research results. When analyzing correlation relationships, it was revealed that the content of CD3+ T-lymphocytes in the PZ of kidney cancer was interconnected: with the clinical stage of the disease (r = 0.65; p = 0.0001); tumor node size (r = 0.48; p = 0.0001); degree of anaplasia according to Fuhrman (r = 0.78; p = 0.0001) and the presence of metastases (r = 0.46; p = 0.0001).

In patients with clinical stage I-II of the disease, the average number of CD3+ T-lymphocytes in the prostate was 60.4±7.2, and in stage III-IV it increased 4.5 times to 274.1±19.8 (p = 0.0000001).

With the degree of anaplasia of carcinomas GI-GII, the content of CD3 + T-lymphocytes in the PZ was 40.9±2.3, and with GIII-GIV it increased 6.7 times (276.1±16.3) (p = 0.001).

When the size of the tumor node was <7.0 cm, the number of CD3 + T-lymphocytes in the prostate was 85.7±11.6, and when the size was ≥7.0 cm, it significantly increased by 2.3 times to 194.0±15. 7 (p = 0.0000001).

In patients with localized tumors, the number of CD3 + T lymphocytes in the PV was 96.5±9.2, and in the PZ of locally advanced carcinomas it significantly increased by 2.7 times to 264.8±25.2 (p = 0. 0000001).

In non-crusifying cancer, the number of CD3+ T-lymphocytes in the prostate was the highest (161.3±26.7), and the lowest in papillary carcinoma (85.9±31.0) (p = 0.05).

Conclusion. Thus, the results of the study showed that the content of CD3+ T-lymphocytes in the PZ of kidney cancer was interrelated with clinical and morphological prognostic factors. The content of CD3+ T-lymphocytes in the tumor significantly increased with advanced stages of the disease, a high degree of anaplasia, a large size of the tumor node, and in the presence of metastases. Quantitative assessment of the number of CD3+ T lymphocytes in the prostate cancer can serve as an additional factor in prognosis of the course of renal cell carcinoma.

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医疗机构竞争力分析及竞争力因素识别
ANALYSIS OF COMPETITIVENESS OF HEALTH CARE ORGANIZATION AND IDENTIFICATION OF COMPETITIVENESS FACTORS

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抽象的。 本文描述了医疗保健组织的竞争力分析和竞争力因素的识别。 上述运营和战略竞争力的因素以及提供机制都直接影响医疗机构高声誉的形成。
关键词: 医学、初级医疗和社会保健、竞争力、组织。

Abstract. The article describes the analysis of competitiveness of a healthcare organization and identification of competitiveness factors. All the above factors of operational and strategic competitiveness and mechanisms of provision directly affect the formation of a high reputation of a medical organization.

Keywords: medicine, primary medical and social care, competitiveness, organization.

The number of private commercial medical organizations has increased in the Republic of Kazakhstan over the last decade. New relationships between medical workers and patients are emerging, healthy competition between health care institutions for patients is being created, new technologies are being introduced, and the system of logistical support of medical organizations with equipment, tools and materials is being improved. The development of alternative medical institutions has led to the fact that patients have the opportunity to independently choose whether to go to a state institution or to a private clinic. The advantages of a competitive market for private medical services are based on its economic functions. The market contributes to the reduction of production costs, rational allocation of resources on the basis of the free movement of capital from less efficient segments to more efficient ones, and stimulates the introduction of new medical technologies. In the framework of the concept of the Unified National Health System for

the further development of OZ, the tasks are set to ensure the competitiveness of the market of medical services, which implies the intensification of the treatment process and resource conservation, which, in turn, are provided by the introduction of technologies for rational use of resources, marketing strategies and methods of financial management and economic analysis [1].

As it was mentioned earlier in the works of I.A. Togunov [2], maintaining a competitive environment and launching competitiveness mechanisms is very important for medical organizations in modern realities. It is obvious that competition, competitiveness assessment and evaluation criteria appear in the existence of conditions of a certain social environment that allows such relations. The conditions that form and realize the essence of competitiveness in medicine are created by a set of managerial decisions at the legislative level, in the implementation of a number of administrative and managerial measures and in the realization of economic and informational tasks. It should be taken into account that competitiveness, as one of the components of the functioning of the firm, does not reflect the effective provision of medical services. A medical organization when existing outside the competitive environment in view of its objectives can successfully perform work, have high performance indicators, but it does not possess the properties of competitiveness.

Competitiveness factors are states, properties and characteristics of an enterprise. Many studies treat the factor as the main resource of productive activities of the firm and the economy. Managers realize that to meet the needs of consumers at the same level or at a level higher than competitors is a key task. One should not overestimate the market and underestimate the competitors. It should be known that consumers are not the only object of competition of enterprises. The struggle in the market is for capital, materials, resources, the ability to use the latest technologies. Depending on how the organization responds to the competition changes the remuneration of labor, working conditions, relations between the manager and the subordinate.

In the works of O.V.Ilyushkina [3], the factors affecting the competitiveness of the enterprise are divided into external and internal factors. They usually correlate with each other. External factors include the external environment, which directly affects the vitality of the enterprise. For example, the state of the economy as a whole, the political and demographic situation, laws, the quality of labor resources, the level of health care in the country, the amount of material resources, etc. All these affect the intra-organizational system. In order to provide high quality and highly reliable health care, organizations must continuously improve. If an enterprise makes numerous mistakes, fails to implement evidence-based practices, it is pointless to spend resources - it will make it difficult to achieve its goals.

Nowadays, when healthcare has already reached a certain level, labor, raw materials, and capital are not the key indicators of enterprise success. Rather, the

indicator of competitiveness is the efficiency of activity, productivity of the enterprise under consideration. When analyzing the competitiveness of an enterprise, in addition to the industry in which firms compete, it should be emphasized by what methods they defend their position in the market. It is important to realize that competitiveness provides an opportunity to increase profits and increase efficiency, and not vice versa efficiency conditions competitiveness. But, of course, in the end, the fact that efficiency will increase, will give the opportunity to increase investment to develop the factors of competitiveness and thus it increases [4,5,6,7].

In the market of medical services, there are complex tangible factors that form business reputation and significantly influence the consumer's choice of a clinic. Business reputation consists of a combination of business elements and qualities of an enterprise. There are certain factors of competitiveness, the presence of which affect the business reputation of the enterprise. These are such factors as: availability of highly qualified specialists, competent staff, competent management, availability of new technologies (equipment) and information technologies to simplify the work of the clinic and the convenience of patients, diagnostic equipment at a high level, informative website, etc. It is important to mention that different factors may be significant in different businesses. The impact of competitiveness factors on the business reputation of an enterprise is realized through the influence on certain groups. For example, on such as: visitors of clinics, bringing their funds in the form of cash or MHI policy; health insurance companies, which carry out financing of medical institutions under MHI, VHI; on the management bodies of the industry; on employees of medical organizations (doctors, nurses, service personnel); on competitors, who claim their share of the market [4,5,6, 7].

Also an important factor affecting competitiveness is business reputation. It is the professional and social positioning of the enterprise in the market, reflecting the quality of the performance of its work and the main goal of maintaining and restoring the health of the population [8].

We know what factors of operational and strategic competitiveness and mechanisms to ensure in medical enterprises exist. These are: 1. Patient satisfaction orientation, because compliance with certain standards and processes of service to the consumer of medical service will strengthen the position in the market and ensure the fulfillment of the main goal - the restoration of the patient's health.

2. Equipping the medical organization with high-tech equipment depending on the specialization. Early purchase of equipment and training of personnel to work on this equipment will help to increase competitiveness.

3. Competent management. Clinics conduct regular training to upgrade or retrain staff. This develops managerial thinking by acquiring useful skills and knowledge.

4. Qualified staff. Creating suitable conditions to attract in-demand specialists of different profiles. One of the key factors affecting competitiveness, as many

patients visit this or that clinic for a certain specialist (by recommendations of acquaintances, reviews in social networks, etc.).

5. Introduction of automated information technologies.

6. Realization and formation of marketing strategy. Building a plan for the realization of corporate and commercial goals of the enterprise. By implementing the marketing function in the work of management such tasks as promotion of the institution in the market, sale of services and their pricing are solved.

7. Presence of social responsibility for the quality and results of provided medical services. The enterprise forms reporting on social responsibility. In case of what there are various types of control (professional medical associations, consumer protection societies, insurance medical organizations, commissions, etc.).

8. Formation of an overall strategy to improve competitiveness in the long term. Thanks to the strategic thinking of the management (improving their qualifications, training) and involvement of competent specialists in the development program, it is possible to bypass competitors in the market.

9. Open and accessible to the society a code of corporate ethics and behavior of the personnel. Corporate culture is of great importance. Its formation and change serves the effective implementation of personnel policy.

10. Improvement of the intellectual capital of the enterprise. For example, attendance of various conferences, training of specialists, development of research and development direction, conducting internship of students, careful selection of candidates for a position, etc.

11. Developing and executing a human resource strategy. Namely, retention of in-demand specialists, training and certification of personnel.

Thus, all the above-mentioned factors of operational and strategic competitiveness and mechanisms of provision directly affect the formation of a high reputation of a medical organization.

In the work of Abuzyarova M. [9], it is described that the most appropriate parameters for evaluation are the following indicators: production activity of the enterprise, labor activity of the enterprise, competitiveness of products, financial condition of the enterprise, marketing activity.

There are also opinions that competition should not be present in the field of health care, because their goal is the same - to treat the sick and maintain the health of the population. Others believe that competition, on the contrary, should be present in this sphere, as it will help to avoid receiving inefficient services, will increase efficiency, productivity and improve the health of the population [10].

Healthcare organizations compete for quality at fixed prices to identify how competition affects the variation in quality between businesses and, as a consequence, health inequalities and patient severity. The first finding is that the effect of competition on quality differences between high and low quality firms is gener-

ally ambiguous and depends on three key factors: the diminishing marginal health benefits of quality, differences in the price-cost ratio between high and low quality hospitals, and quality-dependent costs of care. On the other hand, competition is found to generally reduce health inequalities between patients with different severities, as high severity patients benefit more than low severity patients. The study assumes that quality is the same across patients. This is justified because many aspects of quality require investment in equipment (e.g., CT scan and MRI) and technology with fixed costs that benefit all patients. However, there may be some aspects of care (e.g., the time physicians spend with patients) that may vary from patient to patient, so that quality discrimination is possible [11].

Thus, it should be noted that at the theoretical level, many studies that have been cited have proposed a number of determinants that influence the competitiveness of health care organizations, their diversity. But the small amount of available empirical data indicates the need to create and test on the basis of empirical studies what are the most important factors for sustainable competitiveness of health care organizations.

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提高球磨机中水泥研磨的效率
IMPROVING THE EFFICIENCY OF CEMENT GRINDING IN A BALL MILL

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抽象的。 本文讨论了改进球磨机水泥研磨工艺的有前景的领域。 它使用新的室内设备和技术。 这些是倾斜的室间隔板和分段、能量交换衬里元件，以及组织研磨过程的方案，即封闭循环中的研磨； 离散–连续磨削方式； 厂内分类和回收。 为了解决直接在球磨机腔内组织破碎物料的分级过程的问题，在研磨设备内部开发了一种全新的设计

关键词：水泥、球磨机、倾斜室间隔板和分段、室内装置磨机、分级装置和回收。

Abstract. This article discusses promising areas for improving the cement grinding process in ball mills. Which use new in-chamber device and technologies. These are inclined inter-chamber partitions and segments, energy-exchange lining elements, as well as schemes for organizing the grinding process, namely grinding in a closed cycle; discrete-continuous grinding method; in-mill classification and recycling. To solve the problem of organizing the classification process of the crushed material directly in the cavity of the ball mill, a fundamentally new design was developed inside the mill device

Keywords: cement, ball mills, inclined inter-chamber partitions and segments, in-chamber device the mill, classifying device and recycl.

Materials subjected to fine grinding in various industries have physico-mechanical properties that differ both quantitatively and qualitatively. As well as the variety of technological conditions of production and requirements for the finished product, generates a large number of grinding units, including: ball, jet, roller, roller-pendulum, ball ring, vibrating mills, etc. [1]

Despite the development of new designs and modernization of mills, ball mills are one of the most common grinding units both in the Russian Federation and abroad [1-4]. This is especially typical for those industries where large volumes of materials need to be finely ground, and the starting material is difficult to grind and characterized by high abrasiveness [2-4].

In drum-type grinding units [2], the loading movement is carried out due to the friction of its outer layer on the working surface of the armored lining. In this case, the grinding bodies and the material of the outer layer move together with the mill body along circular trajectories to the break-off point, and then, depending on the speed of movement, either switch to free-fall trajectories or roll down the inner layers. In turn, the outer layer, due to the forces of adhesion, drives the adjacent layer located closer to the axis of rotation of the mill body. This is how the entire load is set in motion from layer to layer. A dense compact zone is formed between the actively moving outer layers, in which the loading moves weakly and the grinding process of the material practically does not occur. Such zones are commonly called "stagnant". They make up about 40-50% of the total volume of the mixture of milling balls and material [3].

This disadvantage can be partially or completely eliminated by the use of energy exchange devices inside the mill, the design of which allows to destroy stagnant zones, intensify the movement of grinding media, and improve the conditions of energy exchange between the lining, grinding media and the material [1]. The following devices and technologies are currently used to improve the grinding process in ball mills [2-4]:

-**inclined inter-chamber partitions and segments**, which have an increased transporting capacity, which leads to an increase in the speed of longitudinal movement of the material through the mill [1]. But this can lead to coarsening of the grinding product, which is unacceptable when grinding in an open cycle.

-**energy-exchange lining elements** [1] are used to destroy the sedentary core (stagnant zones), for this purpose the inner surface of the mill drum is equipped with lining elements. In the process of rotation, together with the drum, the lining elements capture the grinding bodies located in the stagnant zone, this ensures their more efficient movement from the point of view of grinding. However, energy-exchange lining elements and structures have not been widely used.

-schemes for organizing the grinding process are used such as grinding in a closed cycle, a discrete-continuous grinding method, in-mill classification and recycling [4].

To solve the problem of organizing the classification process of the crushed material directly in the cavity of the ball mill, a fundamentally new design of an in-chamber the mill device was developed [1-4], in which the classification of the material and recycling are carried out inside.

The sorting device [4] (Fig. 1) consists of a tubular screw 1, a screw surface 2, which has a winding opposite to the direction of rotation of the mill drum 3. The tubular auger is positioned coaxially to the mill drum and rigidly attached to it from the side of the inter-chamber partition 4 with the help of racks 5, and from the side of the unloading grid 6 with the help of lifts 7. Lifts 7, in addition to the fastening, perform the function of transporting milling material into the cavity of the pipe screw. There is a technological hole 8 on the side surface of the left for extracting grinding balls and material from the grinding chamber.
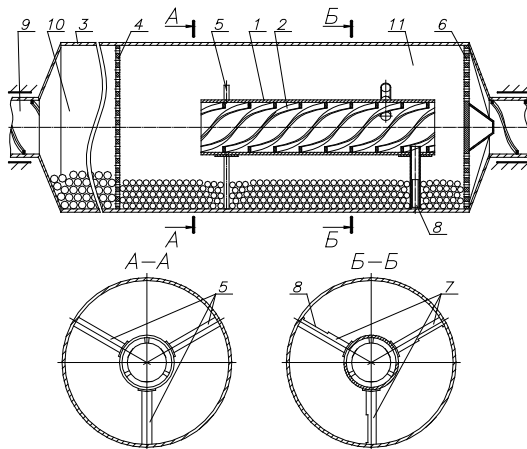

Figure 1. *Design diagram of a mill equipped with a classifying device and a recycling*

Under the action of the screw surface 2 of the funnel 1, the load is transported in the direction opposite to the direction of material movement in the mill drum and returned to the chamber 11 for repeated grinding. During the grinding of the material, aspiration air is continuously supplied to the mill at a speed of 0.4 – 0.7 m/ s, which picks up small particles of material when it is poured from the lifters into the funnel, as well as from the surface of the transported loading layer and carries them to the unloading grate. Thus, the device allows you to organize the recycling of a part of the material in the cavity of the grinding unit, accompanied by the processes of classification and withdrawal of the finished product from the grinding zone.

Thus, the device allows you to organize the recycling of a part of the material in the cavity of the grinding unit, accompanied by the processes of classification and withdrawal of the finished product from the grinding zone.

Conclusions.

1. An analysis of the state and directions of development of ball mills and grinding technology in them shows that in order to increase the efficiency of grinding in ball mills, it is necessary to use internal mills devices and technologies.

2. Currently, there are not enough effective designs of intra-mill devices to increase the efficiency of the grinding unit.

3. The design of a ball mill with the organization of a classification of the crushed material in a fine grinding chamber with recirculation and bypass flows, which allow classifying the material and removing the finished product from the grinding zone, is proposed.

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间歇式湍流混合机工作过程及强度计算研究
STUDY OF THE WORKING PROCESS AND STRENGTH CALCULATIONS OF A TURBULENT BATCH MIXER

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抽象的。 本文证实了使用湍流混合器生产砌筑砂浆的必要性，提供了工作体的强度计算，对砌筑砂浆混合组分的颗粒轨迹进行了流体动力学建模分析。
关键词：湍流混合器，螺杆工作体，强度计算，颗粒轨迹，流体动力学建模。
Abstract. The article substantiates the need to use a turbulent mixer for the production of masonry mortar, provides a strength calculation of the working body, an analysis of the hydrodynamic modeling of the trajectories of the particles of the mixed components of the masonry mortar.

Keywords: turbulent mixer, screw working body, strength calculation, particle trajectory, hydrodynamic modeling.

Masonry mortar [1, 2] is a building material used in the construction of houses, flooring, decoration of buildings and structures, filling joints, etc. The main components of this material are sand, cement and water. Their ratio can be adjusted depending on the required characteristics and properties of the final product. The quality of masonry mortars depends on certain characteristics, namely: water retention capacity, plasticity, etc. [1, 2]. Due to these properties, it does not delaminate during transportation, does not lose mobility when laid on a porous base and does not crack when stiffness increases.

It is known that in order to achieve the above properties, it is appropriate to use turbulent mixers, which allow organizing ordered circulation flows, as well as vortex flows of material above the loading level [3, 4]. A screw working body was studied (Fig. 1) [2-3], made by twisting two arc-shaped surfaces around their own axis forming blades.

The strength calculation of the mixer's working body was carried out. He showed that the maximum displacement of the blades was 0.375 mm (Fig. 1, a), in the wide part of the blades outside, and the maximum stresses are 1.1*10-8 N/m² (Fig. 1, b) in the widest parts of the screw blades inside and in the upper area of the blades attachment to the shaft. The values of maximum displacements and stresses do not exceed the strength conditions of the material.

Hydrodynamic modeling of the working process in a turbulent mixer was carried out, as a result, the trajectories of particle motion were obtained (Fig. 2) with a loading coefficient K = 1 and a rotation frequency of the working body n=300 min⁻¹ and 500 min⁻¹ in models of a turbulent mixer with a screw working body [3-4].

As a result of hydrodynamic modeling of the working process of a turbulent mixer (Fig. 2, a, b) in the SolidWorks software product, the trajectory of particle motion was obtained at a load factor of K = 1 and a rotation frequency of the working body of 300 min⁻¹ and 500 min⁻¹ in models of a turbulent mixer
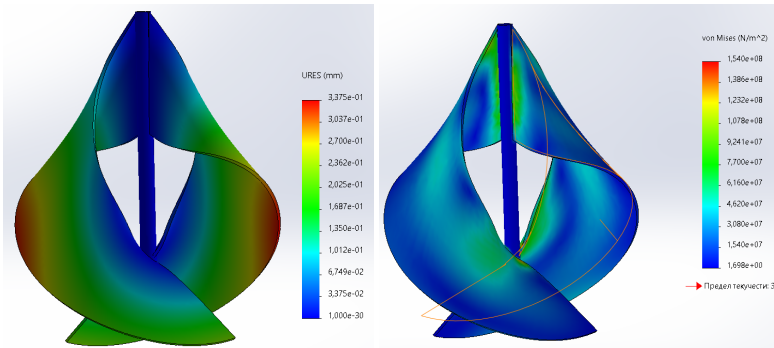

Figure 1. *The change in the maximum displacements of the blade elements (a) and the Mises stress distribution in the screw working body (b)*

At K=1 and at n=300 min⁻¹ and 500 min⁻¹, the nature of the mixture movement is of the same type. At the top, the solution flows above the end line of the working body organize the turbulent nature of the movement. Then, from top to bottom, the solution flows move along the shaft along helical trajectories with different speeds, the width of which is determined by the maximum width of the working body, below the level of point A (Fig. 1), some accumulation of solution occurs in zone B, when the particles accelerate to maximum speeds, then they move along a helical trajectory along the walls of the chamber upwards. After that, the process is repeated.
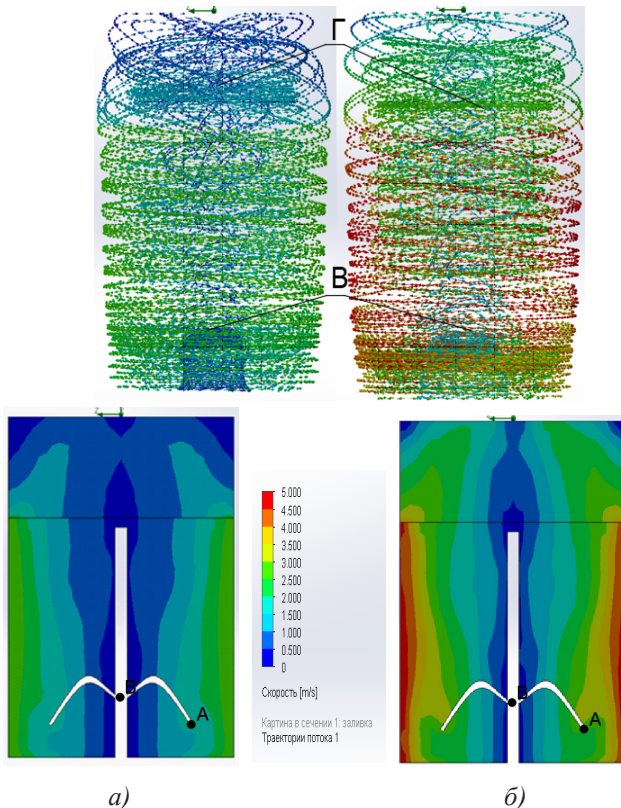
Figure 2. The trajectory of the particles and the picture of the phase portrait of velocity change in the model, when К=1: a – n=300 min⁻¹; b – n=500 min⁻¹

А) at n=300 min⁻¹, the maximum velocity of particles moving from top to bottom along the working body varies in the range of 0.5-1 m/s, the average velocity is v_sr=0.75 m/s. And the maximum velocity of the solution particles moving up the walls of the chamber varies in the range of 2.5-3 m/s, the average velocity is v_sr = 2.75 m/s.

Б) at n=500 min⁻¹, the maximum velocity of particles moving along the working body varies in the range of 0-1.5 m/s, the average velocity is v_sr=0.75 m/s. And the maximum velocity of the solution along a circular trajectory upward along the walls is 4-4.5 m/s, the average velocity is v_sr= 4.25 m/s, which is 3.5 times more than at n=300 min⁻¹.

At n=300 min⁻¹ and n=500 min⁻¹ at К=1, uneven flows are observed along the height of the chamber, for example, in the widest part of the working body there is

rarefaction and intermittency of flows, which can ensure the precipitation of large filler particles to the bottom of the chamber, where there is also a stagnant zone.

Conclusions.

1. An analysis of the equipment for mixing solutions was carried out, which showed that it is most advisable to use turbulent mixers with a vertical working body for mixing masonry mixtures.

2. The design of a two-way screw working body is proposed, made by twisting two arc-shaped surfaces forming blades, ensuring the circulation character of the material movement.

3. The strength calculation of the mixer's working body was carried out. He showed that the maximum displacement of the blades was 0.375 mm, in the wide part of the blades outside, and the maximum stresses are $1.1*10^{-8}$ N/m^2 in the widest parts of the screw blades inside and in the upper area of the blades attachment to the shaft. The values of maximum displacements and stresses do not exceed the strength conditions of the material.

4. At K=1 and at n=300 min^{-1} and 500 min the solution flows at the top organize the turbulent nature of the movement. Then, from top to bottom, the flows move along the shaft of the working body along circular trajectories downwards at different speeds, then they move along a helical trajectory along the walls of the chamber upwards. Then the process repeats. At a rotational speed of n=300 min^{-1}, the particle velocity is 3.5 times less than at n=500 min^{-1}, which indicates the expediency of its use.

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基于非线性动力学算法、分形理论和神经网络建模评估外摩擦和切削下摩擦系统的稳定性

ASSESSMENT OF STABILITY OF TRIBOSYSTEMS UNDER EXTERNAL FRICTION AND CUTTING BASED ON NONLINEAR DYNAMICS ALGORITHMS, FRACTAL THEORY AND NEURAL NETWORK MODELLING

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注解。 外摩擦和切削下摩擦系统的动力学和稳定性尚未得到充分研究。 允许估计摩擦系统稳定性的方法之一是非线性动力学、分形理论和神经网络建模方法。 在这方面,可以开发一种使用非线性动力学、分形理论和神经网络建模算法来评估摩擦过程稳定性及其控制的方法。

关键词：摩擦系统、声信号、Lyapunov 指数、分形分析、非线性动力学、稳定性评估。

Annotation. *The dynamics and stability of tribosystems under external friction and cutting is not sufficiently studied. One of the methods allowing to estimate the stability of tribosystems are approaches of nonlinear dynamics, fractal theory and neural network modelling. In this regard, it is possible to develop a methodology for assessing the stability of friction processes and its control using algorithms of nonlinear dynamics, fractal theory and neural network modelling.*

Keywords: *tribosystems, acoustic signals, Lyapunov exponent, fractal analysis, nonlinear dynamics, stability assessment.*

Description of the experimental stand at external friction

Experimental studies were carried out on a 16K20 screw-cutting lathe. A Ø45 mm bar of steel 45 with pre-cut belts with a width of 3.7 mm was used as a workpiece. As a tool a holder with a plate made of tool material VK8 was used. The scheme of the friction process is shown in Figure 1.
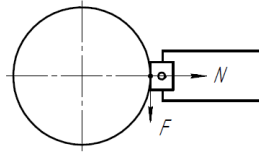
Figure 1. Model of the friction process

Research methodology

During the experiment, the tool was rubbing against the workpiece material at different modes (V-velocity of friction and so - (speed of movement of the holder with the insert relative to the workpiece) with constant recording of the vibroacoustic emission (VAE) signal in time. The data obtained from the acoustic emission sensors were processed in LabView using the DAQ Assistant component, which provides a software interface between the hardware part of the circuit and the virtual tool.

Vibroacoustic emission (VAE) signals were recorded during cutting using AP2037-100 acoustic emission sensors mounted on the cutter body in two positions (along the cutting forces P_y and P_z). An analogue-to-digital converter (ADC NI USB-4431) manufactured by *National Instruments* and a personal computer with special software - *LabView* - were used to record and process the signals.

Research results

Figures 2-7 shows the results of experimental studies at feed $s_o = 0.1$ mm/rev. Figure 2 shows the view of the VAE signal along the Y-axis.
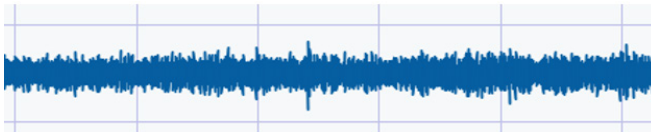

Figure 2. VAE signal along the Y-axis

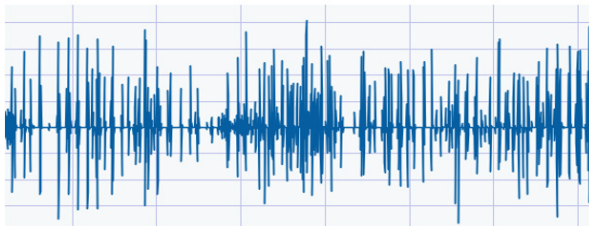Figure 3 shows a typical VAE signal along the *Z-axis*.

Figure 3. VAE signal along the Z-axis

Figures. 4 and 5 show the time phase portraits of the VAE signals.

Figure 4. *Time phase portraits of the VAE signal at friction along the Y-axis*

Figure 5. *Time phase portrait of the VAE signal at friction along the Z-axis*

Using the software developed by us, we also determined the fractal dimension of the VAE signal. The calculated data on Y and Z axis are presented in Table 1 and 2.

Table 1

Results of estimation of the fractal dimensionality of the VAE signal at friction along the Y-axis

Time, s	1	3	5
Fractal dimension D_F	4,0108	2,9260	3,1463

Table 2

Results of estimation of fractal dimensionality of the friction process along the Z-axis in time

Time, s	1	3	5
Fractal dimension D_F	0,6048	0,7465	0,8001

The analysis shows that the results of the estimation of D_F of the fractal dimension of the VAE signal, presented in Tables 1 and 2, should be considered as the evolution of the stability of the friction process in time.

Another important indicator of the state of complex thermodynamically unstable systems is the Lyapunov exponent. The values of the Lyapunov exponent along the Y and Z axis calculated using special software signal VAE are presented in Tables 3 and 4.

Results of estimation of Lyapunov index on the Y-axis

Time, s	1	3	5
Lyapunov index	0,8125	0,8751	0,8813

Results of estimation of Lyapunov index on Z-axis

Time, s	1	3	5
Lyapunov index	0,65005	0,1604	0,5244

Experimental data on fractal dimension and Lyapunov exponent in time, are presented as graphs in Figures 6-7.
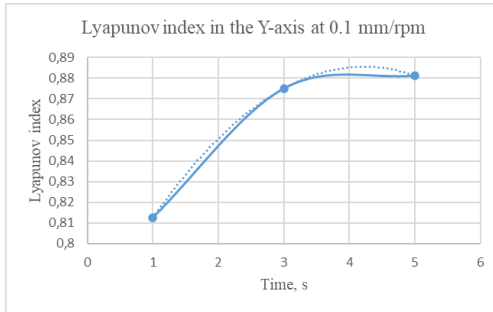

Figure 6. *Time dependence of the Lyapunov index along the Y-axis*

Figure 7 shows the time dependence D_F of the fractal dimension of the VAE signal at s_o =0.1 mm/rev along the Z-axis.
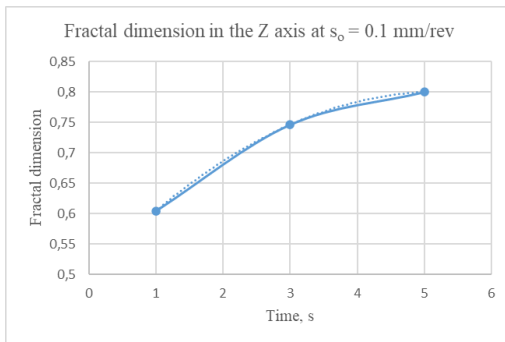

Figure 7. *Time dependence of D_F of the fractal dimension of the VAE signal at S= 0.1 mm/ about Z-axis*

The analysis of Figures 6-7 shows that the obtained time dependences are non-monotonic. In particular, there is a parabolic character of dependences D_F.

Experimental studies of the mechanism of loss of stability of the cutting process and evaluation of the role of friction and contact processes on its stability during cutting tool plunging into the workpiece were also carried out.

Figure 8 shows the dependence of the Lyapunov exponent on the time of tool plunging into the workpiece.
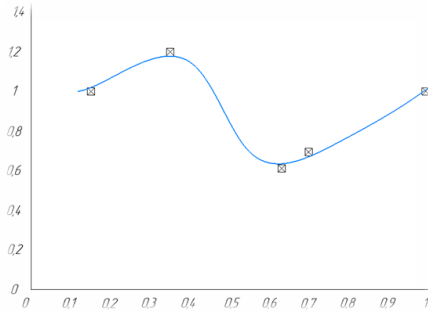

Figure 8. *Dependence of the senior Lyapunov exponent during tool plunging into the workpiece according to the analysis of VAE signals. VK8 cutter. Steel 45, V= 15 m/min, a = 0.1 mm, c = 2 mm. Free cutting.*

Figure 8 shows that the presented dependence of the Lyapunov exponent during tool plunging into the workpiece has a periodic character. The transient period (lag) of cutting forces was 0.03s, which corresponds to the lag of the system under the action of the force factor [1-3].

Figure 9 also shows the evolution of attractor dynamics during tool plunging into the workpiece, the values of fractal dimension and Lyapunov exponent when analysing the VAE signals.

Plot	1	2	3	4
Time, s	0,4	0,7	0,95	1,2
Fractal dimension	4,1227	3,927	3,5988	3,7903
Lyapunov index	-0,3778	-0,521	-0,4844	-0,2615

Figure 9. *Attractor formation during tool plunge into the workpiece. Steel 45, cutter VK8, V= 15m/min, a = 0.2 mm, c = 2 mm. Free cutting.*

Figure 9 shows the formation of the phase trajectory of oscillations of the elastic dynamic machine system (EDSS) when the tool is plunged into the workpiece. The table also shows that there is a periodic increase and decrease of the fractal dimension.

Figure 10 shows the dependence of fractal dimension and amplitude of UDSS oscillations on the cutting speed of steel 45.
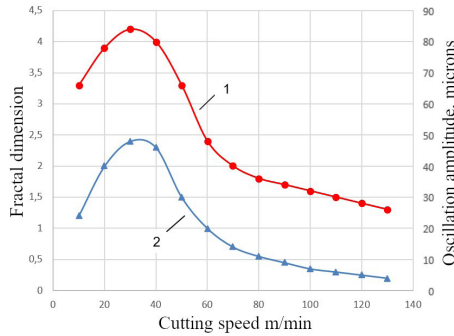

Figure 10. *Dependence of D_F of fractal dimensionality of attractors of VAE signal and amplitude of UDSS oscillations on cutting speed when machining steel 45 (a = 0.1 mm/rev). VK8 cutter: 1 - fractal dimension: 2 - amplitude of oscillations.*

It follows from Figure 10 that the fractal dependence and amplitude of the UDSS oscillations on the cutting speed are also non-monotonic. There is a cutting speed where the fractal dimension and amplitude of oscillations in the cutting system are maximum, i.e., the stability of the cutting process at this speed is minimal.

The database on friction process stability depending on machining conditions, created by us, allowed us to develop a digital twin of friction stability in order to control it on machining modes even on such modes, where cutting was not performed.

Figure 11 shows the structure of the neural network [4,5], i.e. the digital twin of the friction process stability. The input of the neural network contains the main parameters - the friction coefficient itself, as well as the parameters determining the stability of friction during cutting, and the output is the Lyapunov exponent. As mentioned above, the stability of the friction process during cutting is affected by a large number of factors. Such as: cutting speed, feed, depth of cut, cutting angle, S_k actual tensile strength, length of chip contact with the front surface of the tool, chip shrinkage, coolant, vibrations, coatings, etc., as well as the friction coefficient.
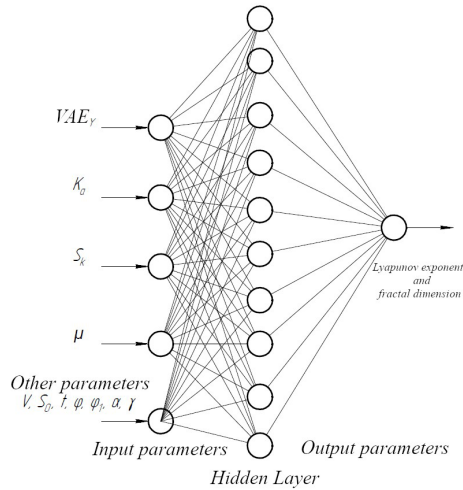
Figure 11. *Structure of the neural network for predicting the stability of the friction process during cutting.*

It is difficult to take into account all parameters, because it requires more experiments and special equipment. Therefore, we limited the number of parameters considered for its training and affecting the friction stability as input to the neural network.

The neural network was trained in *Matlab* environment. The digital stability twin was also tested using parameters different from those on which it was trained.

Figure 12 shows the dependence of the coefficient of friction during cutting, on the fractal dimensionality of the VAE signal in neural network modelling.
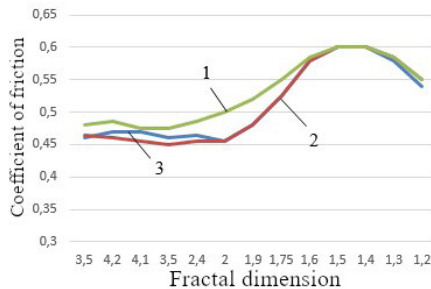

Figure 12. *Dependence of friction coefficient on fractal dimension. Steel 45. a =0,2 mm, c = 2 mm (Cutter VK8): 1 - machine learning data; 2 - neural network modelling data; 3 - experimental data.*

Figure 12 shows that the friction coefficient depending on the fractal dimension has a maximum at the value of 0.6. In other words, an increase in the friction coefficient up to 0.6 causes a sharp decrease in the stability of UDSS during cutting. The estimation error in neural network modelling was 0.4%, in machine modelling - 3.29%.

Conclusions

It is shown that the temporal stability of the tool material-steel tribosystem, depending on the friction conditions, is significantly determined by the friction parameters. During the experiment it was found out that Lyapunov index and fractal dimensionality of the friction process between the tool material VK8 and the workpiece from steel 45 grows. This indicates that the friction system periodically loses stability in time. The similar character of the tribosystem evolution is observed both at its estimation on the parameter fractal dimensionality, and on Lyapunov's index. The nature of time dependences of D_F and λ is caused by the growth of entropy (heat) in the tribosystem. A digital twin of tribosystem stability has been developed and its stability prediction by Lyapunov index and fractal dimensionality has been carried out depending on the speed of movement of the toolholder with the tool material relative to the workpiece.

Using the approaches of synergetics theory and its most important directions, such as nonlinear dynamics, fractal theory and neural network modelling, allows both to assess and control the stability of the cutting process in a wide range of machining conditions, and to predict the friction coefficient, at which the cutting process sharply loses stability.

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钢框架加固钢筋混凝土桁架支撑部分拉伸变形分析

ANALYSIS OF TENSILE DEFORMATIONS IN THE SUPPORTING PART OF A REINFORCED CONCRETE TRUSS REINFORCED WITH A STEEL FRAME

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抽象的。 本文通过数值建模和数学分析，讨论了框架加固钢筋混凝土桁架支撑部分拉伸变形的分析。

关键词：钢筋混凝土桁架受拉变形、数值建模和数字技术、钢框架、LIRA CAD 和 wxMaxima 程序。

Abstract. *The article discusses the analysis of tensile deformations in the supporting part of a reinforced concrete truss reinforced with a frame through numerical modeling and mathematical analysis.*

Keywords: *deformations in a reinforced concrete truss under tension, numerical modeling and digital technologies, steel frame, LIRA CAD and wxMaxima programs.*

The deformation behavior of a reinforced concrete truss reinforced with an external frame describes the ability of the structure to resist tensile deformation under loads. Steel reinforcement in a reinforced concrete truss helps improve its strength characteristics and prevent destruction. When deforming a reinforced concrete truss reinforced with a frame, it is important to consider the interaction between the concrete and steel and the external frame, as this affects the overall reliability and durability of the structure. The authors proposed a design and technological solution for strengthening the supporting parts of the trusses [1, 2], and the article examined the behavior of deformations depending on the factors adopted for the study. Calculations of the truss were carried out taking into account the nonlinear work of materials in the LIRA CAD program using a numerical method, and the results were processed to obtain a mathematical model of the processes occurring and its analysis using the wxMaxima program [3, 4, 5].

Digital technologies make it possible to create structural models for analyzing loads and deformations, including tension [6, 7, 8], which is presented in Figure 1.
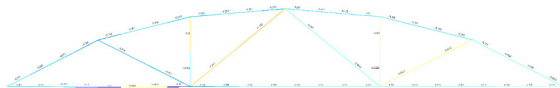

Figure 1. *Diagram of deformations along the truss and supporting parts of a reinforced concrete truss reinforced with a frame in tension*

The mathematical model obtained on the basis of the results of numerical calculations for tensile deformations along the supporting part of the truss with the frame has the following form:

$$Z(x,y) = 2.17938 - 0.28707 \cdot x - 1.26319 \cdot 10^{-4} \cdot y +$$
$$+7.91636 \cdot 10^{-6} \cdot x \cdot y + 0.00924 \cdot x^2 - 3.04087 \cdot 10^{-9} \cdot y^2.$$

The surface of the response function of a truss with a frame for tensile deformations along the supporting part is shown in Figure 2.
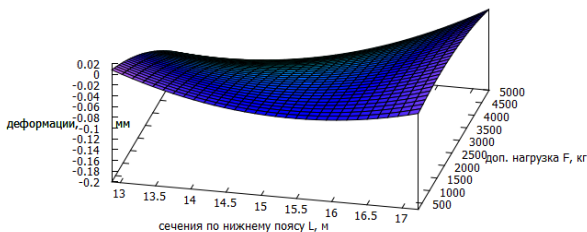
Figure 2. *Surface of the response function according to the mathematical model for tensile strains (mm), in a truss with a frame along the supporting part along the lower chord*

Analysis of the surface of the response function according to the mathematical model, along the lower chord, according to tensile deformations, of the truss with the frame allows us to state that when changing the arguments along the OX axis, the distances to the sections along the rods from 0.36 to 17.23 m, as well as along the OY axis, the additional load along nodes from 250 to 5000 kg, the values of tensile strains, that is, the response function, can change from +0.02 to –0.2 mm. In this case, the response surface is a fairly uniform convex plane, which indicates the unconditional presence of extreme values in the range of arguments under study. Further study of the behavior of the mathematical model in terms of tensile strains involves obtaining lines of equal levels along the surface of the response function, which is presented in Figure 3.
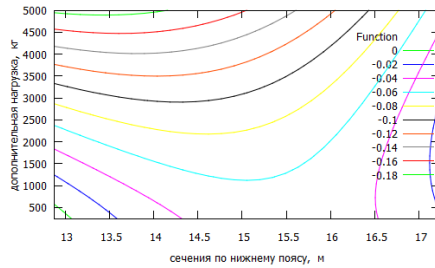
Figure 3. Lines of equal levels along the surface of a function response, according to the mathematical model for deformations sprains, in a truss with a frame, along the bottom chord

Analysis of the response function for tensile deformations, under constant load in the nodes of the truss $F_1(x, 250)$; $F_2(x, 2625)$; $F_3(x, 5000)$ resulted in the following simplified equations:

$$F_1(x, 250) = 0.00924 \cdot x^2 - 0.28509 \cdot x + 2.14761,$$
$$F_2(x, 2625) = 0.00924 \cdot x^2 - 0.26629 \cdot x + 1.82684,$$
$$F_3(x, 5000) = 0.00924 \cdot x^2 - 0.24749 \cdot x + 1.47176.$$

Analysis of equations and graphs allows us to draw the following conclusions. At the lowest loads in the truss nodes equal to $F_1(x, 250)$, it allows us to fix the extreme value of the function at a minimum equal to –0.05 mm, at a distance to the section of 15.46 m. At a section of 12.88 m, the value of tensile deformations (mm) will be equal to + 0.01 mm, and with a distance to the section equal to 17.23 m, the value of tensile strains (mm) will be equal to –0.02 mm. In turn, the function acquires a zero value at a cutting distance along the lower belt equal to 13.05 m.

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钢筋混凝土桁架支撑件受压变形分析
ANALYSIS OF DEFORMATIONS DURING COMPRESSION OF SUPPORTING PARTS OF A REINFORCED CONCRETE TRUSS

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抽象的。 本文通过数值建模和数学分析讨论了钢筋混凝土桁架支撑部分的压缩变形分析。
关键词：钢筋混凝土桁架受压变形、数值建模和数字技术、LIRA CAD 和 wxMaxima 程序。

Abstract. *The article discusses the analysis of compressive deformations in the supporting part of a reinforced concrete truss through numerical modeling and mathematical analysis.*

Keywords: *Deformations in a reinforced concrete truss under compression, numerical modeling and digital technologies, LIRA CAD and wxMaxima programs.*

When a material is compressed, deformation occurs, which is characterized by a change in its shape under the influence of external forces. For most materials, compressive deformation manifests itself as a decrease in volume and an increase in density. This process can lead to various effects, such as changes in the physical properties of the material, the occurrence of cracks and deformations, as well as loss of its strength. Understanding and controlling compressive strain through numerical modeling is important for developing materials and structures with optimal performance and durability. The causes of compression deformation can be varied and include several factors. One of the main reasons is the action of external forces, such as longitudinal forces, which can cause tension or compression of the material. In addition, internal stresses generated during welding or due to uneven heating of the material can also contribute to deformation. Natural wear and tear of the material or metal fatigue after many compression-retraction cycles

can also cause deformation. It is important to note that the rigidity of the material plays a significant role in preventing unnecessary deformation. Thus, the causes of deformation during compression can be both external - stresses, forces, and internal - fatigue of the material, uneven heating, which is why a detailed study of these processes is very relevant. The authors proposed a design and technological solution for strengthening the supporting parts of the trusses [1, 2], and the article examined the behavior of deformations depending on the factors adopted for the study. Calculations of the truss were carried out taking into account the nonlinear work of materials in the LIRA CAD program using a numerical method, and the results were processed to obtain a mathematical model of the processes occurring and its analysis using the wxMaxima program [3, 4, 5].

Digital technologies make it possible to create structural models for analyzing loads and deformations, including compression [6, 7, 8].

View of the mat model of a truss without a frame based on compression deformations in the lower chord, along the supporting part:

$$Z(x,y) = -17.73713 + 2.38538 \cdot x + 4.99979 \cdot 10^{-4} \cdot y -$$
$$-2.2438 \cdot 10^{-5} \cdot x \cdot y - 0.07937 \cdot x^2 + 7.56388 \cdot 10^{-8} \cdot y^2$$

The surface of the response function of a truss without a frame for compressive deformations along the supporting part is shown in Figure 1.

Figure 1. *Surface of the response function according to the mathematical model for compressive deformations in the truss, along the support part*

Analysis of the surface of the response function according to the mathematical model, along the lower chord, according to compression deformations, of a truss without a frame allows us to state that when changing the arguments along the OX axis, the distances to the sections along the rods from 12.88 to 17.23 m, as well as along the OY axis, the additional load along nodes from 250 to 1900 kg, the values of compression strains, that is, the response function, can change from +0.80 to –0.20 mm. In this case, the response surface is a fairly actively convex

plane, which indicates the unconditional presence of extreme values in the range of arguments under study.

Further study of the behavior of the mathematical model in terms of compressive strains involves obtaining lines of equal levels along the surface of the response function, which is presented in Figure 2.
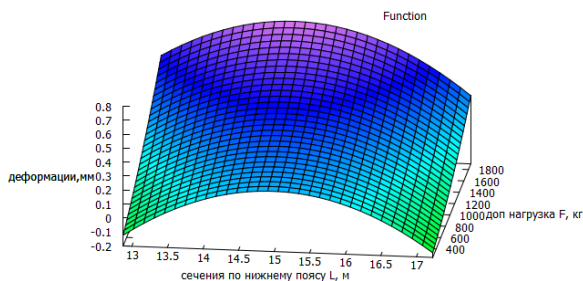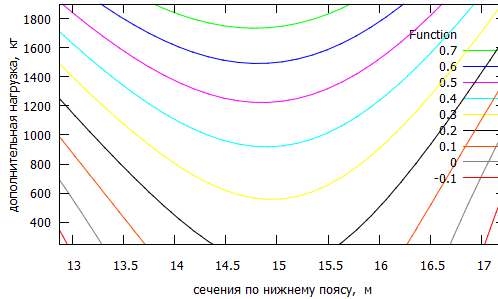

Figure 2. *Lines of equal levels along the surface of the response function, according to the mathematical model for compressive strains (mm), in the truss, along the lower chord without a frame*

Analysis of lines of equal levels according to the response function allows us to state that when changing the arguments along the OX axis, the distances to sections along the rods from 12.88 to 17.23 m, as well as along the OY axis, the additional load on the nodes from 250 to 1900 kg, the values of compression deformations, that is, the response function may change from +0.70 to -0.10 mm, according to updated data. This clearly confirmed the assumption that the response function has extreme values in the range of arguments under study.

Analysis of the response function by compression deformations, under constant load in the nodes of the truss $F_1(x, 250)$; $F_2(x, 1075)$; $F_3(x, 1900)$ allowed us to obtain the following simplified equations:

$$F_1(x, 250) = -0.07937 \cdot x^2 + 2.37977 \cdot x - 17.60741,$$
$$F_2(x, 1075) = -0.07937 \cdot x^2 + 2.36126 \cdot x - 17.11224,$$
$$F_3(x, 1900) = -0.07937 \cdot x^2 + 2.34275 \cdot x - 16.51411.$$

With the smallest loads in the truss nodes equal to $F_1(x, 250)$, it is possible to fix the extreme value of the function at a maximum equal to +0.23 mm, at a distance to the section of 15.00 m. At a section of 12.88 m, the value of compression deformations (mm) will be equal to - 0.12 mm, and with a distance to the section equal to 17.23 m, the value of compression strain (mm) will be equal to -0.17 mm. In turn, the function acquires zero values at distances along the sections, along the

lower belt, equal, in the first case, at 13.29 m, and also, in the second case, at a distance equal to 16.69 m.

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传输每个符号的小数位数时幅度相位调制信号的噪声抗扰度估计。 第 1 部分：
生成

ESTIMATION OF NOISE IMMUNITY OF AMPLITUDE-PHASE MODULATED SIGNALS WHEN TRANSMITTING A FRACTIONAL NUMBER OF BITS PER SYMBOL. PART 1. GENERATING

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抽象的。 该文章提出了评估抗噪性的方法以及使用幅度相位调制对每个符号的一小部分比特数进行信号编码的方法。 所提出的方法的优点是在实际使用中必要计算的复杂性方面简单。 所提出的方法是针对以特定传输速率传输信号的情况提出的，其精度高达每符号四分之一比特。 两篇文章介绍了该主题。 在这篇文章中，这是第一篇，基于用于最大化抗噪增益的比率，详细描述了所提出的编码器操作算法、同步信号的形成以及所实现的增益量 。 用于评估所提出的编码方法的抗噪性的方法已用于高速调制解调器的开发和现代化，其测试证实了所获得结果的可靠性。
关键词：APM、编码器、解码器、多维星座。

Abstract. The article proposes methods for evaluating noise immunity and encoding signals with amplitude-phase modulation for a fractional number of bits per symbol. The advantage of the proposed methods is simplicity in terms of the complexity of the necessary calculations in their practical use. The proposed methods are presented in relation to the case of transmitting a signal with a specific transmission rate with an accuracy of up to a quarter of a bit per symbol. The topic is covered in two articles. In this article, which is the first, on the basis of the ratios used to maximize the gain in noise immunity, the proposed algorithm for the operation of the encoder, the formation of a sync signal and the amount of gain achieved is described in detail. The method used to assess the noise immunity

of the proposed coding method was used in the development and modernization of high-speed modems, tests of which confirmed the reliability of the results obtained.
   ***Keywords:** APM, encoder, decoder, multidimensional constellation.*

Introduction
   When developing high-speed modems, the main requirements are to achieve set transmission rates close to the channel bandwidth at a given signal-to-noise ratio, taking into account restrictions on the complexity of implementation [1, 2]. For channels with additive white Gaussian noise, the probabilistic distribution of signals should be formed, if possible, with a Gaussian distribution in order to approach the channel bandwidth [3]. Despite the use of error-correcting codes, the gain from encoding is insufficient to achieve channel throughput. Since the parameters of real communication channels fluctuate over time, modems must be adaptive. Matching the data rate of the communication channel with the channel conditions is crucial to maximize throughput.
   Most modern communication systems use quadrature amplitude modulation constellations. As a rule, the assignment of code combinations to the points of the signal constellation is carried out for an integer number of bits per two-dimensional symbol [3-6].
   With a whole number of bits per symbol and acceptable modulation rate values in development, this leads to a grid of transmission rates that are multiples of the modulation rate. However, there are situations when the transmission rates obtained in this way do not meet the requirements. To increase the transmission rate, increasing the number of encoded bits per unit when using signal constellations with an integer number of bits per symbol leads to a doubling of the size of the signal constellation and a loss of noise immunity by about 3 dB. At the same time, such an increase in transmission rate may be excessive. Therefore, there is a need for a more flexible rate change, which leads to the need to develop a method for encoding the fractional value of the number of bits per symbol. In this regard, the purpose of the work is to assess the noise immunity of receiving signals with a fractional number of bits per symbol under the conditions of using the proposed easy-to-implement algorithm for encoding Amplitude-Phase Modulated (APM) signals.
   The encoding of a fractional number of bits per symbol involves assigning a block of a sequence of several two-digit symbols to certain binary code combinations. For the convenience of coding, the signal constellation is divided into rings. In a block of several two-dimensional symbols, there may be points of a signal constellation from various rings at each position. Choosing possible combinations

of alternating points of different rings in a block from a sequence of two-dimensional symbols is one of the coding tasks. The algorithm for encoding a fractional number of bits per symbol, which is part of the ITU-T Recommendations V.34 [5], V.90, etc., involves splitting the signal constellation into a large number of rings (up to 18), is quite complex and requires significant computing resources, which is a significant limiting factor when upgrading modems. A similar statement on the complexity of processing can be attributed to the method of transmission at a rate faster than Nyquist rate [6], which is not considered in this paper.

At the same time, [3] proposed a fairly simple algorithm for splitting a constellation into two rings to encode a half-integer number of bits. Based on [1], this approach is developed in [2] for the transmission of a fractional number of bits, in which it is possible to use a redundant encoding procedure, including convolutional. The simplicity of the proposed method is important when upgrading modems with limited computing resources. It allows you to largely preserve the original encoding method for an integer number of bits per symbol and, at the same time, solve the problem of obtaining the necessary transmission rates with less loss of noise immunity.

The method is illustrated by an example of the implementation of an encoding device when switching from an integer specific transmission rate to rates of 6.75 and 8.25 bits per symbol. It is proposed to combine the cycle formation necessary for coding with the formation of the external Reed–Solomon encoder cycle. The amount of gain in noise immunity is determined due to the proposed coding, which, although inferior to the method [5], makes it possible to significantly reduce the cost of computing resources.

The proposed method of encoding and evaluating noise immunity was used in the development and modernization of high-speed modems, tests of which confirmed the calculated parameters of modems according to the achieved rate and error coefficient in the presence of additive interference.

The Basic Principles of an Encoder Construction

Redundancy in the Reed–Solomon encoder is introduced into the input data stream after scrambling. Next, this stream enters the interleaver and the loop shaper. The signal generated in this way is sent to a multidimensional encoder in which the transmission cycle is divided into signal blocks. These signal blocks are subjected to relative and convolutional coding and, in combination with the information obtained in the multidimensional code, the procedure for mapping the elements of the signal block to the points of the signal constellation (the formation of points coordinates) is carried out. At the same time, the signal constellation being formed has the necessary symmetry to solve the problem of phase ambiguity by 90 degrees.

The coding task consists in dividing the selected signal constellation into "rings", selecting permitted combinations of alternating points of the "rings" and assigning certain code combinations to the points of the signal constellation.

The choice of the signal constellation shape, its division into rings, the choice of allowed combinations of alternating points of the rings at a fixed value of bits per symbol should be based on the condition of obtaining a minimum energy of the signal as a whole: $P_S = \min$.

With regard to the options considered in this paper, we will limit ourselves to considering the division of constellations into 2 (A, B) and 3 rings (A, B, C):

$$p_1 \sum_A P_k(x_k, y_k) + p_2 \sum_B P_k(x_k, y_k) + p_3 \sum_C P_k(x_k, y_k) = \min,$$

where p_1, p_2, p_3 are the appearance probabilities of constellation signal points from the rings A, B and C, respectively; $P(x_k, y_k)$ is the energy of the k-th point of the constellation with coordinates x_k, y_k.

In order to minimize the signal energy, it is necessary, with the selected placement of the required number of points in a grid of rectangular coordinates, to select the outer boundary of the constellation with the lowest power, which leads to the shape of the constellation in the form of a circle and an approximation to the Gaussian probability distribution of signals within the constellation. In optimal constellations with QAM, the symbols are located at the nodes of the hexagonal lattice, however, in practice, constellations formed at the nodes of a rectangular lattice are more often used, which lose no more than 0.6 dB in energy distance to optimal constellations [3].

The assignment of code combinations to the points of the signal constellation is performed according to the criterion of the minimum number of distorted bits in case of error in the signal point, which is equal to the minimum of the code distance between each transmitted one, and the possibility of making a mistake in neighboring points of the constellation:

$$\sum_i \sum_k d_k(U_i, Q_k) = \min, \qquad d_i(U_i, Q_k) \leq M, \qquad (1)$$

where U is the code of the transmitted point; Q is the code of the neighboring point; M is the maximum allowable code distance between neighboring points.

To find the coordinates of the signal constellation and assign the appropriate code combinations, an optimization procedure was used, with the help of which, under given constraints, the code distance between neighboring points of the constellation was minimized. An example of such an assignment of combinations with not redundant coding is the Gray code.

Denote by n the value of the integer part of the specific transmission rate of the number of bits per symbol. For the case of transferring the fourth part of a bit in the procedure of splitting a constellation into rings, two options are possible: transferring one quarter of the bits per symbol ($n + 0.25$) and three quarters of the bits per symbol ($n + 0.75$). In both cases, the formation of a signal block from a sequence of 4 2-dimensional symbols (the formation of an 8-dimensional constel-

lation) is used, and for the variant of one quarter of the bits per symbol, the length of the signal block is $4n + 1$ and three quarters of the bits per symbol, the length of the signal block is $4n + 3$.

Note that with a similar approach, and to obtain a specific transmission rate with an odd multiplicity of 0.125 bits per symbol, it will require the formation of a signal block of eight 2-dimensional symbols, etc. Accordingly, the generated length of the signal block will be $8n + j$, where j is selected to be 1, 3, 5 or 7.

Due to convolutional encoding, the number of bits sent to the mapper (point coordinate shaper) increases. However, to simplify further presentation, the number of displayed bits is given without taking into account convolutional encoding. When choosing the shape of the constellation, rounding is performed, taking into account the fact that the constellation in the form of a circle provides the lowest average power [3].

In the case of transmission of one quarter of a bit/symbol, the encoding problem is most easily solved by dividing the signal constellation into two "rings": the inner one with the number of points 2n (ring A) and the outer one with the number of points 2n–2 (ring B) surrounding the first ring, with the constellation points selected from condition (1).

When transmitting three–quarters of the bits per symbol, the signal constellation is divided into three "rings" with different numbers of points:

- the first group (ring A) consists of 2^n points corresponding to the transmission of the whole part of the bits per symbol;

– the second group (ring B) consists of 2^{n-1} points surrounding the first ring;

– the third group (ring C) includes 2^{n-2} points surrounding the second ring.

When solving the encoding problem, it is necessary to choose combinations of symbol placement of two types of rings A and B when transmitting one quarter of the bits per symbol (Table 1), and three types of rings A, B and C when transmitting three quarters of the bits per symbol at 4 possible positions in the signal block [2].

Table 1.
Rings Combinations Variants in the Signal Block (Rate is n + 0.25)

Number	Ring Combination Variant	Average power	First Bits Code
1	4A	162,75	0
2	4B	374,0	?
3	3A+B	215,5625	100
4	2A+B+A	215,5625	101
5	A+B+2A	215,5625	110
6	B+3A	215,5625	111
7	2A+2B	268,325	?
8	A+3B	321,1875	?

From the rings A and B symbols placement combinations list, preference should be given to combinations with, if possible, the least energy. A certain set of the first bits of the block is matched to the selected rings A and B symbols combinations (Table 1).

If the first bit in the signal block is equal to 1, then depending on the values of the second and third bits, three two-dimensional symbols from the number A and one from the ring B are formed (in different sequences). The number before the ring name means the number of symbols in the signal block from this ring. When calculating the average power in the rings, it is assumed that the points of the signal constellation are located within a rectangular grid with odd coordinates ± 1, $\pm 3, \pm 5, \ldots, \pm (2m - 1)$. In this case, the appearance probability of two-dimensional symbols from the A ring will be 7/8, and from the B ring – 1/8.

Note that with a uniform selection of symbols, the probability of signals from rings A and B is 0.8 and 0.2, respectively. In other words, the probability distribution of the appearance of various points in the signal constellation according to the proposed procedure is formed unevenly with a decrease in the probability of the appearance of signals with an increase in their energy. The calculation using (1) shows that the gain from the proposed choice of points of the signal constellation is about 0.34 dB.

In the second case (at a rate of n + 0.75), there are 81 possible combinations of symbols. The types of combinations of ring symbols in the signal block, the corresponding number of permutation variables and the average signal strength of a certain combination for a constellation of points with odd coordinates and the case of transmission of 6.75 bits per symbol are given in [2].

From the list of combinations of symbol placement, the rings are suspended when transmitting three-quarters of the bits per symbol, and preference should also be given to combinations with, if possible, the least energy. It is proposed to use combinations of symbols of rings 4A, 3A+B, 3A+C, 2A+2B, 2A+B+C, A+3B, A+2B+C, and combinations of symbols of rings 2A+2C are prohibited.

It can be shown that when using the block formation procedure proposed below, symbols from ring A occur in the signal combinations used with probability 5/8, symbols from ring B–9/32, symbols from ring C–3/32 (with uniform distribution, symbols from ring A occur with probability 4/7, from ring B–2/7, from the ring C–1/7). Just as at a rate of 8.25 bits per symbol, the probability distribution of the appearance of various points in the signal constellation changes – with increasing energy of the signals, the probability of their appearance decreases.
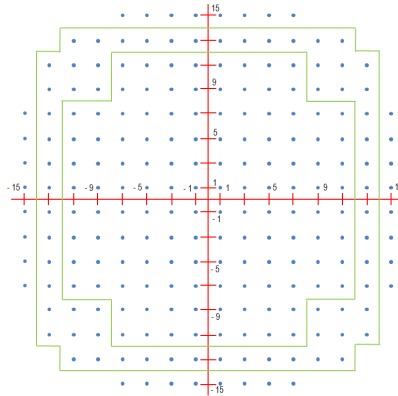
Figure 1. *Signal constellation for 6,75 bits per symbol*

As is known, the optimal uneven distribution of signal probabilities (Gaussian) in a channel with additive white noise gives a maximum gain in noise immunity of 1.33 dB compared with an equiprobable distribution in a two-dimensional constellation, for an eight-dimensional constellation the maximum gain is 0.73 dB [3]. The amount of gain due to the proposed splitting of the signal constellation into three rings is about 0.28 dB (0.34 dB into 2 rings), which corresponds to about half of the potential gain with the optimal procedure for generating a multidimensional signal.

The signal constellation formed according to the above method, for the 6.75 bit per symbol variant, taking into account the doubling of the size of the signal constellation when using a convolutional encoder, is shown in Figure 1. This signal constellation is formed of 224 points, and the inner ring A includes 128 points, ring B – 64 points, ring C – 32 points. Similarly, for the 8.25 bit per symbol variant, the constellation contains 640 points, of which 512 points are in the inner ring A and 128 points – in the outer ring B. Broken lines separate the inner and outer rings.

Signal Block Formation and Signals Mapping

The bits of the sync signal and the service channel are inserted into the information sequence at the beginning of each cycle. In a multidimensional encoder, the resulting sequence is divided into signal blocks, depending on the specific transmission rate, either $4n + 1$ or $4n + 3$ bits each. The distribution of blocks with a length of $4n + 1$ bits when transmitting one quarter of the bits per symbol is based on the values of the first three bits in the block. If the first bit is zero, then 4 symbols from the A ring are transmitted. Otherwise, taking into account the values of the second and third bits of the block, one of the 4 possible combinations of ring symbols is transmitted: 3A+B, 2A+B+A, A+B+2A and B+3A.

The distribution of blocks of $4n + 3$ bits into bits forming 4 consecutive symbols is proposed to be carried out in two stages: first, it is divided into sub-blocks, and then the latter are divided into symbols.

Let's consider the procedure of splitting into sub-blocks. First, the value of the first bit of the block is determined. If this bit is zero, then the next $4n + 2$ bits of the block are divided into two sub-blocks of $2n + 1$ bits each. If the first bit of the block is 1, then with the second bit of the block equal to zero, the next $4n + 1$ bits are divided into the first sub-block of $2n + 1$ bits and the second sub-block of $2n$ bits. If the first two beta blocks are equal to 1, then the next $4n + 1$ bits are divided into the first sub-block of $2n$ bits and the second sub-block of $2n + 1$ bits.

Then the procedure for splitting the sub-blocks is carried out. If in a sub-block of $2n + 1$ bits the first bit is zero, then the remaining $2n$ bits of the sub-block are divided into two symbols of the ring A, n bits each. If in a sub-block of $2n + 1$ bits the first bit is 1, then with the second bit of the sub-block which is equal to zero, the remaining $2n - 1$ bits of the sub-block are divided into symbols from ring A (n bits) and ring B ($n - 1$ bits). If in a sub-block of $2n + 1$ bits, the first and second bits of the sub-block are equal to 1, then the remaining $2n - 1$ bits of the sub-block are divided into symbols from the B ring and the A ring.

If in a sub-block of $2n$ bits the first and second bits are zero, then the remaining $2n - 2$ bits of the sub-block are divided into symbols from the A ring and the C ring ($n - 2$ bits). If in a sub-block of $2n$ bits the first bit is 0, then with the second bit of the sub-block, equal to 1, the remaining $2n - 2$ bits are divided into symbols from ring C and ring A. If in a sub-block of $2n$ bits the first bit is 1, then with the second bit of the sub-block equal to 0, the remaining $2n - 2$ bits are divided into two symbols from the ring B. If in a sub-block of $2n$ bits the first two bits are equal to 1, then at the third bit of the sub-block equal to 0, the remaining $2n - 3$ bits are divided into symbols from ring B and ring C. If in a sub-block of $2n$ bits the first three bits are equal to 1, then the remaining $2n - 3$ bits are divided into symbols from ring C and the ring B.

Based on the distribution of the signal blocks, an appropriate control signal is formed, which, together with the bits at the output of the convolutional encoder, is used to form the coordinates of the points of the signal constellation (rings A, B and C).

The Cyclic Sync Signal Structure Selection

To carry out decoding, it is necessary to mark the boundaries of the signal blocks at the transmission, which is convenient to combine with the multidimensional sync signal of the Reed – Solomon encoder cycle. Below is an example of the formation of a sync signal for transmitting three quarters of a bit per symbol, the formation of a sync signal when transmitting one quarter of a bit per symbol is performed similarly.

In order to increase the noise immunity of cycle boundary recognition, it is desirable to form a sync signal with the highest power, for example, from two two-dimensional symbols of ring B (a combination of two symbols of ring C is prohibited). Then, in accordance with the above procedure, the first 4 bits of the sync signal should be 1110. The next 3 bits of the code combination corresponding to the symbols of the sync signal are selected, for example, 010. To set the coordinates of a two-dimensional symbol, three more bits are needed, the absolute values of which do not matter, since their values for the two input bits are calculated in the relativity encoder and the convolutional encoder. Changing the values of these three bits leads to the rotation of a two-dimensional point. Since the information about the sync signal is embedded in the amplitude of the ring B signals, which is encoded by three bits 010, two free bits are released in the code combinations at the input of the convolutional encoder of each of the two two-dimensional symbols of the sync signal, which can be used to increase the signal transmission rate of the service channel. In this case, the sync group at the input of the convolutional encoder can be represented as 1110 010xx 010xx, where the symbol 'x' indicates additional bits of the service channel.

Conclusions

In this paper, we propose a method for encoding APM signals when transmitting a fractional number of bits per symbol, which is quite simple and does not require significant computing power of the modem. Examples of two considered constellations with a fractional number of bits per symbol are given and the resulting gain in noise immunity is determined in comparison with the transmission of an integer number of bits per symbol, taking into account the unequal distribution of signal points in the constellation. In addition, a method for generating a cyclic sync signal is proposed, which, along with indicating the boundaries of the signal blocks, indicates the boundaries of the cycles of the external Reed – Solomon encoder.

The proposed methods of encoding and generation of a sync signal can be used in the construction of high-speed modems, and especially their modernization in order to increase the transmission rate with limited computing resources.

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传输每个符号的小数位数时幅度相位调制信号的噪声抗扰度估计。 第 2 部分.
解码
ESTIMATION OF NOISE IMMUNITY OF AMPLITUDE-PHASE MODULATED SIGNALS WHEN TRANSMITTING A FRACTIONAL NUMBER OF BITS PER SYMBOL. PART 2. DECODING

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抽象的。 本文提出了评估抗噪性以及使用幅度相位调制对每个符号的小数位进行信号编码/解码的方法。 所提出的方法的优点是在实际使用中必要计算的复杂性方面简单。 所提出的方法是针对需要以高达每个符号四分之一比特的精度生成特定信号传输速率的值的情况提出的。 两篇文章介绍了该主题。 本文是第二篇文章，介绍了用于评估抗噪性的计算比率、解码器操作算法以及使用该方法实现的能量增益值。 用于评估所提出的编码/解码算法的抗噪性的方法被用于高速调制解调器的开发和现代化，其测试证实了所获得结果的可靠性。

关键词：APM、编码器、解码器、多维星座。

Abstract. The article proposes methods for evaluating noise immunity and encoding/decoding signals with amplitude-phase modulation for a fractional number of bits per symbol. The advantage of the proposed methods is simplicity in terms of the complexity of the necessary calculations in their practical use. The proposed methods are presented in relation to the case when it is necessary to generate the value of the specific rate of signal transmission with an accuracy of up to a quarter of a bit per symbol. The topic is covered in two articles. This article, which is the second, presents the calculated ratios used to assess noise immunity, the decoder operation algorithm and the values of the energy gain achieved using this method. The method used to assess the noise immunity of the proposed encoding/decoding algorithms was used in the development and

modernization of high-speed modems, tests of which confirmed the reliability of the results obtained.

Keywords: APM, encoder, decoder, multidimensional constellation.

Introduction

When developing high-speed modems, the main requirement is often the maximum approximation of the transmission rate to the bandwidth of the channel at a given signal-to-noise ratio, taking into account restrictions on the complexity of the implementation. To achieve this goal, when implementing optimal signal processing algorithms using simple methods, the first part of the work [1] considers the proposed algorithm for encoding and generating signals with amplitude-phase modulation with a fractional number of bits per symbol [2, 3]. In modems, signals with quadrature amplitude modulation are widely used, in which code combinations are assigned to the points of the signal constellation for an integer number of bits per two-dimensional symbol [4…8]. With a whole number of bits per symbol, the modem's transmission rate grid turns out to be a multiple of the modulation rate, which may not meet the development requirements. In addition, a similar situation may arise when upgrading modems, when the task is to increase the transmission rate quite definitely. If it is necessary to increase the transmission rate and use signal constellations with an integer number of bits per symbol, an increase in the number of encoded bits per unit leads to a doubling of the size of the signal constellation and a loss of noise immunity by about 3 dB. Therefore, there is a need for a more flexible rate change, which leads to the need to develop a method for encoding the fractional value of the number of bits per symbol. This makes it possible to achieve a smaller increase in the size of the signal constellation while reducing noise immunity losses. Depending on the type of communication channel, the quality of modem operation can be determined by a whole set of interfering factors, which include additive Gaussian white noise (AGWN), phase noise and distortion of the nonlinearity of equipment elements, pulse and harmonic interference, etc. It should be emphasized that in any case, regardless of the type of communication channel, when evaluating the operation of the modem, the AGWN noise immunity analysis is primarily used.

In this regard, the purpose of the work is to assess the noise immunity of receiving signals with a fractional number of bits per symbol, and to consider the proposed easy-to-implement algorithm for decoding the corresponding Amplitude-Phase Modulated (APM) signals.

When encoding with a fractional number of bits pet symbol, a block of bits from a sequence of several two-dimensional symbols is assigned to certain binary

code combinations. When encoding, the signal constellation is divided into rings. In a block of several two-dimensional symbols, there may be points of a signal constellation from different rings (A, B and C) at each position. The peculiarity of the fractional bit per symbol encoding algorithm proposed in [1…3] is the simplicity and the need for less computing resources compared to methods that allow obtaining a fractional number of bits per symbol in ITU-T Recommendations V.34 [6], V.90, etc. and by the method of transmitting signals faster than Nyquist rate [7].

The simplicity of the method proposed in [1…3] is important when upgrading modems with limited computing resources. It allows you to largely preserve the original encoding method for an integer number of bits per symbol and, at the same time, solve the problem of obtaining the necessary transmission speeds with less loss of noise immunity.

Estimation of Noise Immunity

In [1], the method is illustrated by an example of encoding implementation at specific rates of 6.75 and 8.25 bits per symbol. Table 1 below shows the types of combinations of ring symbols in the signal block at a specific rate of 6.75 bits/symbol, their number and the average signal power of each constellation combination.

The combinations with the lowest energy are selected from the list of combinations of the placement of the symbols of the rings A, B and C. In the proposed version, combinations of ring symbols are used 4A, 3A+B, 3A+C, 2A+2B, 2A+B+C, A+3B, A+2B+C.

Table 1.
Rings Combinations Variants in the Signal Block, Rate is 6.75

Number	Ring Combination Variant	Variants quantity	Average power
1	4A	1	42
2	4B	1	102
3	4C	1	126
4	3A+B	4	57
5	2A+2B	6	72
6	A+3B	4	87
7	3A+C	4	63
8	2A+2C	6	84
9	A+3C	4	105
10	3B+C	4	108
11	2B+2C	6	114
12	B+3C	4	120

13	2A+B+C	12	78
14	A+2B+C	12	93
15	A+B+2C	12	99

In [1], the algorithm of operation of the corresponding encoder is given and it is proposed to combine the formation of the cycle with the formation of the cycle of the external Reed–Solomon encoder. It should be noted here that for the convenience of decoding, it is useful to ensure an integer multiplicity of the cycle length and the length of the signal block due to the rational choice of parameters of the Reed-Solomon encoder and the field of service symbols. The gain in noise immunity is determined by the power difference of the constellations [1], which, although inferior to the method [6], makes it possible to significantly reduce computational costs.

To estimate the probability of a bit error in the channel with AGWN for selected constellations containing M signal points, it is possible to use the calculation formula for QAM constellations, taking into account the correction factor $Y = P_{orig}/P_M$, taking into account the change in signal power in the proposed encoding method. In the correction factor, similarly to [7] P_{orig} is the average power of the symbols of the original constellation, on the basis of which the used one is formed, P_M is the average power of the symbols of the constellation used, taking into account the unequal probability distribution of signals in it and the transition from a square (cross form) constellation to a rounded one. For constellations with QAM, the bit error estimate [8] for even values of $k = \log_2 M$:

$$P_B \approx \frac{2(1 - L^{-1})}{\log_2 L} Q\left(\sqrt{\left(\frac{3\log_2 L}{L^2 - 1}\right)\frac{2E_b}{N_0}} \right) \tag{1}$$

and for an arbitrary value k ≥ 1, the formula of the upper bound of the error coefficient is used [8]:

$$P_B \leq \left(1 - \left(1 - 2Q\left(\sqrt{\left(\frac{3k}{M - 1}\right)\frac{E_b}{N_0}}\right)\right)^2\right)/k. \tag{2}$$

In these expressions, $L = \sqrt{M}$, $h^2 = E_b/N_0$ is the ratio of the bit energy to the spectral density of the interference, where $Q(x)$ is the Gaussian error integral:

$$Q(x) = \frac{1}{\sqrt{2\pi}} \int_x^\infty e^{-u^2/2} du.$$

When using formulas (1) and (2) for the studied constellations, the value of the signal-to-noise ratio Yh^2

is used instead of h^2. Note that in the constellations under consideration, the minimum Euclidean distance between the signal points in the original and used constellations is the same.

Figure 1 shows the calculated dependences of the probability of a P_b bit error on the signal-to-noise ratio. For a constellation with a specific rate of 6.75 bits per symbol (112 points), the constellation with 128-QAM (at $Y = 1.128$) was used as the source, and the curves were constructed based on expression (2). For a constellation with a specific rate of 8.25 bits per symbol (320 points), the constellation with 256-QAM (at $Y = 0.903$), and the formula (1) was used to calculate the error coefficient.

Since the alternative to using specific rate of 8.25 bits per symbol is an integer rate of 9 bits per symbol, for this case, Figure 1 also shows the corresponding noise immunity criterion calculated by formula (2). From Figure 1 it can be seen that if an error is likely $1 \cdot 10^{-8}$ gain in noise immunity for a specific rate of 6.75 bits per symbol by compared with the integer specific rate of 7 bits per symbol (the initial constellation) is about 0.9 dB, for the rate of 8.25 – about 2.1 dB compared with the integer specific rate of 9 bits per symbol.

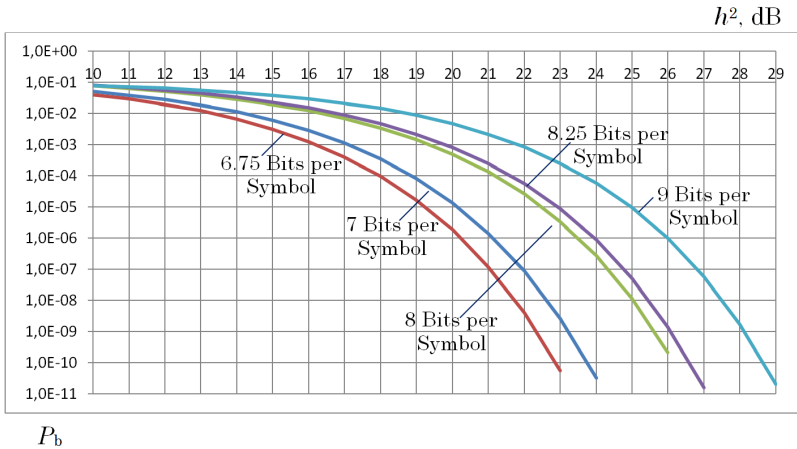**Figure 1.** *Dependencies of the Bit Error Probability P_b on the Signal-to-Noise Ratio*

It should also be noted that due to the transition from integer specific rates to fractional ones (from 7.0 to 6.75 bits per symbol and from 9.0 to 8.25 bits per symbol), the average power, peak power and peak factor of the signal (the ratio of peak signal power to average) decrease. The corresponding calculated data are shown in Table 2.

It should be noted that, as a rule, the value of the peak power of the equipment is fixed. Then the transition from an equally probable to an unequal distribution of signal points in the constellation, along with a decrease in the average signal power, leads to a corresponding shift of the operating point down in the powerful output amplifier of the equipment, which reduces the level of non-linearity interference and power consumption. This circumstance is important when using modems in channels where it is necessary to take into account the influence of distortion of the nonlinearity of active elements. Thus, the use of constellations with a fractional number of bits per symbol increases the information and energy efficiency of the equipment.

Table 2.

Changing the parameters of constellations when switching to fractional values of bits per symbol

Canstellation/ Parameters	128-QAM Cross form	112-QAM Equiprobable distribution	112-QAM Unequal probable distribution	512-QAM Cross form	320-QAM Equiprobable distribution	320-QAM Unequal probable distribution
Specific Rate	7,0	6,75	6,75	9,0	8,25	8,25
Average Power	82	71,143	66,75	330	205,0	189,156
Peak power	170	130	130	754	410	410
Peak factor	2,073	1,827	1,948	2,285	1,996	2,1675

Decoding Procedure

After synchronizing by symbols and finding the boundaries of the Reed-Solomon code cycles, as a result of which the boundaries of the fours of two-dimensional symbols are determined, the de-coding procedure of the signal blocks is performed. It consists in defining:

– the beginning of the cycle mark, which also makes it possible to mark the beginning of each signal block included in the cycle,
– the belonging of signal points to rings A, B or C (according to the coordinates of the signal points) to determine the combinations of the initial bits of the block and sub-blocks dividing the block of 4n + 3 (or 4n + 1) bits into 4 two-dimensional symbols, and create appropriate control sig-nals for selecting a section of the decoding table,
– the bits combinations corresponding to the coordinates of the signal points on the transmit-ting side, taking into account the control signals defining the section of the decoding table.

The sequence of bits obtained taking into account the decoding table is sent to the input of the deinterleaver, from the output of which the already converted sequence is sent to the Reed-Solomon decoder.

Further discussion is conducted in relation to decoding at a specific rate of 6.75 bits per sym-bol. Decoding at a rate of 8.25 bits per symbol is performed similarly.

The definition of the initial bits of blocks and sub-blocks is based on the analysis of the types of rings in two pairs of two-dimensional symbols that make up the block. First, for each pair of symbols, the initial bits of this pair and the number of bits that these symbols represent are deter-mined. Then, according to the types of symbol pairs (a pair of 2n + 1 bits or 2n bits) in the block, a decision is made on the initial combinations of bits of the 4-symbol signal block. After performing all these actions, a (4n+3)-bit block is formed from combinations of bits correspond-ing to the coor-dinates of the signal points and the prefix bits of the block and sub-blocks, which is sent further for subsequent processing.

The proposed method for assessing noise immunity and encoding was used in the develop-ment of an adaptive modem with specific rates from 2.0 to 8.25 bits per symbol, tests of which con-firmed the reliability of the results obtained.

Conclusions

In this paper, we propose a method for evaluating the noise immunity of signals and decoding APM signals when transmitting a fractional number of bits per symbol, which are quite simple and do not require significant modem computing resources. Using the examples of the considered con-stellations with a fractional number of bits per symbol, the resulting gain in noise immunity is deter-mined compared to the transmission of an integer number of bits per symbol.

To provide a simple way to identify the boundaries of signal blocks at the receiver side based on the receiving of the cyclic sync signal, which simultaneously indicates the boundaries of the Reed–Solomon code cycles, method for the formation of a cyclic sync signal with high noise im-munity is proposed.

The proposed methods for assessing noise immunity and encoding/decoding can be used in the construction of high-speed modems, and especially their modernization in order to increase the transmission speed with limited computing re-sources.

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罗文粉在生姜饼生产中的用途
THE USE OF ROWAN POWDER IN THE PRODUCTION OF RAW GINGERBREAD

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抽象的。 姜饼 – 俄罗斯国家面粉糖果产品，具有明显的甜味、香料的气味、柔软的稠度，是高热量产品，不提供成分平衡，符合营养学的科学原理和要求[1]，它们含有较多的碳水化合物，而蛋白质、维生素、矿物质、膳食纤维不足。 储存姜饼时，会观察到两种类型的缺陷——产品的快速停滞和微生物腐败的可能性。变质，尤其是生姜饼的变质，是由于淀粉回生过程导致水分损失造成的[2]。 姜饼中的微生物腐败过程是可能的，因为它们与中间湿度为 13-16% 的产品有关。 在这方面，人们感兴趣的是在姜饼的生产中使用复合食品添加剂——含有对健康有益的维生素和矿物质的水果或浆果粉，以及保湿成分和防腐剂。 本工作致力于研究罗文粉对姜饼感官和理化质量指标的影响，以延长产品的货架期，提高产品的营养价值。

关键词：姜饼，营养价值，保质期，山灰粉。

Abstract. *Gingerbread – national Russian flour confectionery products, with a pronounced sweet taste, the smell of spices, soft consistency, are high-calorie products that do not provide a balance of components, in accordance with scientific principles and requirements of the science of nutritionology [1], they contain an increased amount of carbohydrates, with insufficient protein, vitamins, minerals, dietary fiber. When storing gingerbread, two types of defects are observed - rapid stalling of products and the possibility of their microbiological spoilage. Staling, especially of raw gingerbread, is caused by loss of moisture as a result of the starch retrogradation process [2]. The processes of microbiological spoilage in gingerbread are possible, since they relate to products with an intermediate humidity of 13-16%. In this regard, it is of interest to use complex food additives in the production of gingerbread - fruit or berry powders containing vitamins*

and minerals useful for health, as well as moisture-retaining components and preservatives. This work is devoted to the study of the effect of rowan powder on the organoleptic and physico-chemical quality indicators of gingerbread in order to extend the shelf life and increase the nutritional value of products.

Keywords: gingerbread, nutritional value, shelf life, powder of mountain ash.

The purpose of these studies was to establish the range of possible use of mountain ash powder in the production of raw gingerbread to increase the nutritional value of products and extend their freshness.

This goal was achieved by solving the following tasks:

- justification for choosing rowan ash powder as an enriching functional additive, moisture-retaining agent and preservative;

- study of the influence of rowan powder on the quality of products during storage;

- development of recommendations for rational dosage (range) of powder use in the production of raw gingerbread to increase the nutritional value and slow down the process of staling of products;

- confirmation of an increase in the nutritional value of raw gingerbread when using berry powder from mountain ash.

Raw gingerbreads were chosen for research, as they are the most popular among gingerbread products. In accordance with GOST 15810-2014 "Gingerbread products. General technical conditions", the shelf life and storage conditions for gingerbread products are established by the manufacturer in accordance with the procedure in force in the states that have adopted the standard (clause 8.3.). In Russia, the standards of a number of enterprises for raw unglazed gingerbreads set a shelf life of no more than 20 days at a temperature of $(18+5)$ C ° and a relative humidity of no more than 75%.

When assessing the quality and shelf life of confectionery products with intermediate humidity - from 13 to 35% (for raw gingerbreads, the mass fraction of moisture is set from 11 to 16%, GOST 15810-2014) with water activity from 0.6 to 0.9, (raw gingerbreads fall into this range) [3], one of the main indicators of spoilage is their staleness. In addition, products may be susceptible to microbiological deterioration [4, 5].

It is believed that the staling of gingerbread is due to loss of moisture during storage. In dough pieces, starch grains swell and partially gelatinize with the absorption of moisture. When storing gingerbread products, the opposite process is observed. The moisture released in this case is no longer bound and is quickly lost. Thus, to extend the freshness of gingerbread, it is necessary to bind moisture [2].

To extend the shelf life of gingerbread, various techniques are used, including glazing, sealed packaging, replacing part of the wheat flour with rye flour, and part

of the sugar with invert syrup and honey. Dietary fiber in a dosage of 2-4% of the total amount of raw materials binds water, increases the shelf life of gingerbread and improves the consistency of the dough and the texture of the finished product [6] as a result of sorption and desorption of moisture [7]. Products with high humidity are more susceptible to microbiological spoilage [8].

The processes of microbiological spoilage can be slowed down with the help of preservatives. For flour confectionery products, the use of sorbic acid and its salts (potassium sorbate) is permitted [9]. These preservatives are effective in neutral confectionery products susceptible to microbiological spoilage by molds and yeasts

Common rowan (lat.Sórbus aucupária) is a widespread fruit tree in Russia, noticeable for its bright fruits that remain on the branches until late autumn. As a medicinal raw material, rowan fruits are used as multivitamin funds and carotene-containing raw materials. Rowan fruits are rich vitamin C (up to 160 mg%) and carotene (up to 56 mg%). The fruits contain sugar (up to 5%), apple, lemon, wine and succinic acid(2.5%),tanning(0.5%) and pectin(0.5%)substances, sorbitol and sorbose, amino acids, essential oils ,salt potassium, calcium, magnesium, sodium, ascorbic acid(up to 200 mg%),flavonoids, bitter substances, sorbic acid[10].

The fruits are harvested ripe in August - October until frosts, dry in dryers at 60-80 °C or in well-ventilated areas, spreading a thin layer on fabric or paper [11]. Freeze-drying of fruits is also used, which allows preserving all the beneficial properties of the native product. The dried fruits are ground into powder, which is a functional additive in food production.

The dietary fiber included in the composition of rowan powder allows it to be considered as a moisture-retaining additive that can reduce water activity, increase the amount of bound water, which slows down the process of product staling, microbiological spoilage and leads to an increase in the shelf life of products. The presence of primary and secondary hydroxyl (cellulose, hemicellulose), phenolic (lignin), and carboxyl (hemicellulose, pectin substances) groups determines intermolecular interaction (hydrogen bonds), the ability to sorb water and other polar molecules [12]. The presence of sorbic acid in rowan powder suggests its preservative effect against molds and yeasts.

The objects of the study for compliance with the requirements of regulatory documentation were: premium wheat flour (GOST 26574-2017); white sugar (GOST 12576 – 2014); sunflower oil (GOST 1129 – 2013); mountain ash powder (TU 10.29.25-1086-37676459-2024 "Sublimated fruits and berries. Technical conditions"); taste, smell, structure, color, broken appearance of finished products (GOST 15810-2014) organoleptically (GOST 5897-90), mass fraction of dry substances in raw materials and products - by drying at a temperature of 130 °C, in an oven for 40 minutes (GOST 5900-2014); alkalinity - according to GOST 5898-87,

density according to GOST 15810-2014. The nutritional and energy value of the products was determined by calculation.

Rowanberry powder was a finely divided product of dark orange-red color with a pleasant berry smell, with a slightly bitter taste, without any foreign flavors. The dry matter content (DS) of the powder is 95%.

The recipe for raw gingerbread [13], given in Table 1, was chosen as the base one.

Table 1.
Unified recipe for raw gingerbread

Name of raw materials	Dry matter content,%	Consumption of raw materials, kg per 1 ton of finished products	
		actually	in NE
Premium wheat flour	85.50	566.61	484.46
Premium wheat flour (for dusting)	85.50	44.20	37.79
White sugar	99.85	351.30	350.77
Ammonium carbonate salt	-	6.63	-
Vegetable oil	100.00	14.17	14.17
Vanilla essence	-	2.26	-
Total	-	985.17	887.18
Exit	86.50	1000.00	865.00

The technological process for the production of raw gingerbread in accordance with the basic recipe consisted [14] of the following stages: preparation of raw materials for production, preparation of sugar syrup, preparation of dough, molding, baking in a baking chamber at a temperature of 180-200 ºC for 20 minutes, cooling and storage

The production of gingerbread with the addition of rowan powder was carried out in a similar way; the powder was added along with flour at the stage of kneading the dough. Baked products were stored at room temperature. Product quality indicators were determined 24 hours after baking. The influence of different dosages of rowan powder on the quality of products was determined. The proportion of powder varied from 5% to 15% by weight of flour in the recipe at SV, with a variation step of 5%. For long-term storage, gingerbread cookies were packed in foil paper. The quality indicators of gingerbread cookies were assessed after 30 days of storage.

The organoleptic characteristics of raw gingerbread samples were determined 24 hours after preparation. All products had a brightly sweet taste and aroma, with a soft structure that did not crumble when broken, the color of the crumb was uniform throughout the entire volume of the products, the surface was dry without

large cracks, and the shape was regular. The sample with the addition of 15% rowan powder to the flour mass at SV had a bright, original taste and berry aroma, and a pleasant yellow crumb color.

Physico-chemical parameters of gingerbread are given in table. 2

Table 2
Physico-chemical indicators of gingerbread

Indicator name	Indicator value			
	Basic recipe		Recipe with the addition of 15% rowan powder to the flour mass at SV	
	in 24 hours (control sample)	in 30 days	in 24 hours (control sample)	in 30 days
Moisture content, %	86.7 +0.1	84.8	86.5	85.8
Density, g/cm3	0.64 +0.1	0.73	0.71	0.74
Alkalinity, deg.	1.6 + 0.1	1.7	1.3	1.2

The following results were obtained as a result of the conducted research: in gingerbread cookies with the addition of rowan powder in an amount of 15% by weight of flour, the moisture content after 30 days decreased compared to the control sample (86.5-85.8, moisture loss is 0.8%), however, the decrease in this indicator is significantly slower than in the sample prepared according to the basic recipe (86.7-84.8, moisture loss is 2.2%). The density indicator behaves similarly, it increases after 30 days in all samples, but in the sample with the addition of powder, this indicator increases significantly slower than in the sample prepared according to the basic recipe. The alkalinity of the products remains practically at the same level, while it can be noted that this indicator in the sample with the addition of powder is initially slightly lower than in the sample prepared

In general, we can conclude that adding rowan powder to the recipe of raw gingerbread leads to a slowdown in the staling of products, which is due to the high moisture-holding capacity of its components - cellulose, hemicellulose, pectin substances, etc. A 15% addition of rowan powder does not lead to a noticeable deterioration in product quality.

Based on the research carried out, a range of use of rowan powder in the recipe for raw gingerbread was recommended (10-15% by weight of flour on dry soil), which allows to slow down the staling of products during storage.

The nutritional value of raw gingerbread is given in table. 3.4.

Table 3.
Nutritional value of raw gingerbread

Samples	Nutritional value (per 100g)			Dietary fiber, g	Energy value, kcal
	Proteins, g	Fats, g	Carbohy-drates, g		
Gingerbread cookies made according to a basic recipe	7.1	2.3	81.2	2.3	373.5
Gingerbread with the addition of 15% rowan powder to the flour mass at SV	6.2	2.2	74.9	3.7	345.4

Table 4.
Content of minerals and vitamins in raw gingerbread

Samples	Minerals (macro- and microelements), mg						Vitamins					
	Na	K	Ca	Mg	P	Fe	A, µg	B1, mg	B2, mg	PP, mg	D, µg	β-carotene, mcg
Gingerbread cookies made according to a basic recipe	273.3	81.8	15.5	10.7	57.3	0.92	0	0.11	0.03	1.98	0	0
Gingerbread with the addition of 15% rowan powder to the flour mass at SV	272.9	142	26.7	119	51.7	1.44	510	0.11	0.03	1.83	0	3.4

Thanks to the use of mountain ash powder, the developed products have increased nutritional value. The content of dietary fiber in raw gingerbread with rowan powder at a dosage of 15% compared to the control increases by 1.6 times, respectively, vitamin A - by 510 times, magnesium - by 11 times. In terms of beta-carotene content, the products exceeded the control by 3.4 times.

Based on the results obtained, a recipe for gingerbread was developed using rowan ash powder, which has increased nutritional value and delayed staling during storage.

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沃洛格达州湿地野生食用菌的结果
FRUITING OF WILD EDIBLE MUSHROOMS IN THE WETLANDS OF THE VOLOGDA OBLAST

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抽象的。 建立了沼泽泥炭土上野生食用菌优势种的物种组成，揭示了研究区森林主要蘑菇类型的平均长期产量。
关键词：野生蘑菇种类组成、食用菌、产量。

Abstract. The species composition of the dominant species of wild edible mushrooms on swampy peat soils has been established, and the average long-term yield in the main mushroom types of forests in the studied region has been revealed.

Keywords: species composition of wild mushrooms, edible mushrooms, yield.

In forest biogeocenoses, fungi are the most important heterotrophic link, carrying out part of the biological cycle of substances, which is associated with the processes of mineralization and humification. Wild mushrooms determine the metabolism of terrestrial plants by supplying them with mineral nutrients and water. Possessing a highly developed enzymatic apparatus, they take part in the destruction of dead organic matter. The species composition, abundance, fruiting and

trophic structure of fungi visually reflect a number of features of forest communities, in particular, edaphic and hydrothermal environmental conditions, the direction and speed of material and energy processes occurring in them. Wild edible mushrooms are valuable food products, and also play the role of intermediaries in the soil nutrition of woody plants, being mycorrhiza-formers. Therefore, the study of fruiting of wild edible mushrooms on peat soils is relevant.

The Vologda region is one of the important mushroom-bearing regions of Russia, distinguished by the diversity of growing species of wild edible mushrooms. Data on the species composition and fruiting of agaricoid basidiomycetes in the Vologda region are fragmentary. On the territory of the Russian North National Park, 404 species of agaricoid basidymycetes have been identified [1], of which 50 species are officially permitted for harvesting and processing [2]. At the same time, the population collects no more than 20-30 species.

The most common species of fungi that have stable fruiting on peat soils in forest ecosystems of the Vologda region are the following: numerous species of the genus Russula (Russula decolorans, Russula rosea, Russula emetica, Russula alutacea), boletus boletus (Leccinum holopus (Rostk.) Watling), yellow-brown moss (Suillus variegatus (Sw.) Kuntze), travelers, goats, smoothies, and common smores, which were the object of the study. However, some aspects of the formation of the species composition and productivity of fungal communities in the region have not been sufficiently studied.

Peat (Marsh) soils, the formation of which is associated with conditions of constant and excessive moisture, are widespread within the Vologda region, occupying in general about 10% of its area [3]. In comparison with neighboring regions (Arkhangelsk region, Republic of Karelia), excessively moist soils in the region are characterized by high forest cover. The forested area accounts for 61%, with a predominance of pine (41%) and spruce (40%) plantings with a variety of their species and age composition. Deciduous forests are dominated by birch trees [4].

The purpose of the work is to study the characteristics of fruiting of wild edible mushrooms in wetlands in the Vologda region.

The study of fruiting was based on an analysis of field studies conducted in the administrative districts of the southern taiga subzone of the Vologda region from 2005 to 2022 [5]. Research methods were based on a combination of stationary and route accounting methods. The species composition and yield of wild mushrooms were determined using generally accepted methods [6,7,8]. The objects of the study were stationary trial plots with annual censuses, and temporary trial plots, where census plots measuring 50x50 m were laid out in such a way as to ensure the necessary reliability of the experiments. For statistical processing of the obtained data, the STATISTICA 6.0 program was used.

The unique soil and climatic conditions on peat soils determine the insignificant yield and species composition of edible mushrooms in the wetlands of the Vologda region. The main contribution to the mass fruiting of mushrooms on peat soils within each forest type is made by dominant species. Almost every year, the main dominant species of edible wild mushrooms in forest phytocenoses on the wetlands of the Vologda region are the following species: russula, goat mushrooms, moss mushrooms and travelers (Table 1). All of the listed types of fungi are mycorrhiza-formers. Pine, spruce and birch forest types are represented by IV – V quality classes.

Table 1.

Fruiting of wild mushrooms on peat wetlands in the Vologda region (2005-2022)

Forest type	Quality class	Age of planting лет	Species composition of mushrooms	Crop yield, kg/ha
Sphagnum pine forest	V	50 - 120	Mossiness mushrooms, birch boletes, putniks, russula.	23,5±1,9
Shrub-sphagnum pine forest	V	60 - 120	Bovines mushrooms, mossiness mushrooms, russula, boletus mushrooms.	18,9±1,8
Sedge-sphagnum pine forest	V	60 - 120	Bovines mushrooms, putniks, russula, lactarius trivialis, birch boletes.	25,7±2,5
Swamp-grass spruce forest	V	50 - 120	Woolly milkcaps, butter mushrooms, mossiness mushrooms, bovines mushrooms, lactarius trivialis, putniks, russula, birch boletes, aspen mushrooms, putniks, honey fungus.	31,8±2,8
Swamp-forb spruce forest	V	50 - 120	Woolly milkcaps, butter mushrooms, mossiness mushrooms, bovines mushrooms, smoothies, putniks, russula, birch boletes, aspen boletuses, putniks.	40,5±3,7
Long-mossy birch forest	IV	10 - 30	Birch boletes, russula, morels, putniks.	16,7±1,5

In the pine group of forest types, the species composition is represented by 4-5 species of mushrooms. Productivity reaches 25.7±2.5 kg/ha (sedge-sphagnum pine forest). In the spruce group of forest types, the species composition of fungi increases to 11 species (swamp-grass spruce forest). However, the highest yield was found in the marsh-forb spruce forest (40.5±3.7 kg/ha). The lowest species composition and yield were observed in the long-moss birch forest (16.7±1.5 kg/ha).

Thus, we can draw conclusions:

1. The greatest species diversity of wild edible mushrooms is represented in spruce forest types. The dominant species are represented by woolly lactarius, butter mushrooms, mossiness mushrooms, bovines mushrooms, lactarius trivialis, putniks, russula, birch boletes, aspen mushrooms, putniks and honey fungus.

2. The highest average long-term yield of fungal fruiting bodies was found in the marsh-forb spruce forest (40.5±3.7 kg/ha), and the lowest in the long-moss birch forest (16.7±1.5 kg/ha).

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