



SCIENTIFIC RESEARCH OF THE SCO COUNTRIES: SYNERGY AND INTEGRATION

上合组织国家的科学研究：协同和一体化

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

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Foreword

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

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

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

Fan Fukuan,

Chairman of the organizing committee of the conference

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

Full Professor, Doctor of Economic Sciences

前言

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

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

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

范福宽，

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

业务流程软件市场
BUSINESS PROCESS SOFTWARE MARKET

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摘要本文将讨论在企业中实现业务流程自动化的重要性，在办公室工作和生产的各个阶段普遍实施软件的需求，还将回顾西方各行各业，不同目的的当前软件市场。市场，独联体市场尤其是哈萨克斯坦。

关键字：业务流程，自动化，建模，组织结构，信息技术。进度，技术进步，生产，软件，效率，管理，改进。

Abstract *This article will discuss the importance of automating business processes in enterprises, the need to implement software at various stages of office work and production in general, and will also review the current software market for various industries and for different purposes, consumers of the Western market, the CIS market and Kazakhstan in particular.*

Keywords: *business process, automation, modeling, organizational structure, information technology. progress, technological progress, production, software, efficiency, management, improvement.*

Progress. Progress is present in everything, in life, in the economy, in business, in technology. Today, owning a lot of information and keeping up with progress means being at the helm. The same thing in business, to increase efficiency it is necessary to regularly monitor the trends of the information technology market and, as far as possible, apply them in your company.

More than two centuries ago, at the dawn of the growth of industrial production, the Scottish economist and philosopher Adam Smith proposed breaking the entire production cycle into simple basic steps that can be performed by one person, which will increase production capacity and minimize costs. Currently, these simple actions are business processes and are an integral aspect in every industry, without which it is impossible to imagine modern production. [one].

Today, during the period of widespread computerization and automation, the theory of the aforementioned Adam Smith has undergone significant changes. So, M. Hammer and J. Champi in “Reengineering Corporation. The manifesto of the

revolution in business ”for the first time touches upon the topic of radical improvement of business processes by introducing new tools, including using computer technology. [2]

The idea of a methodology and automation of business processes is being introduced not only in the Western market, but also in the post-Soviet market, there are authors who believe that modern business processes cannot exist without a clear organizational structure, methodology and automation. So, Yu.F. Telnov and I.G. Fedorov in “Enterprise Engineering and Business Process Management. Methodology and Technology ”also considers methods and means of engineering and business process management based on the implementation of information technology. [3]

V. Repin in the book “Business Processes. Modeling, implementation, management ”gives a number of examples based on personal experience in Russian companies, which clearly traces the relationship between a successful business model and automated business processes. In addition to acquiring software, the business owner and company management need to streamline the internal organizational structure, develop a step-by-step plan for the introduction of an automated system at one stage or another, and also inform the entire team about upcoming changes. [4]

Having passed the first and important stage of modeling and software selection, the team of key employees of the company starts implementing the selected product. And at this stage, you need to know about all the systems that meet exactly the requirements that the company needs at the moment. V.V. Baronov in his work “Automation of enterprise management” analyzes the issues of creating automation systems for enterprise management, considers the main approaches to planning and managing enterprise automation processes, and also gives a brief overview of the management systems present on the Russian market, comparing it with the Western one. [5]

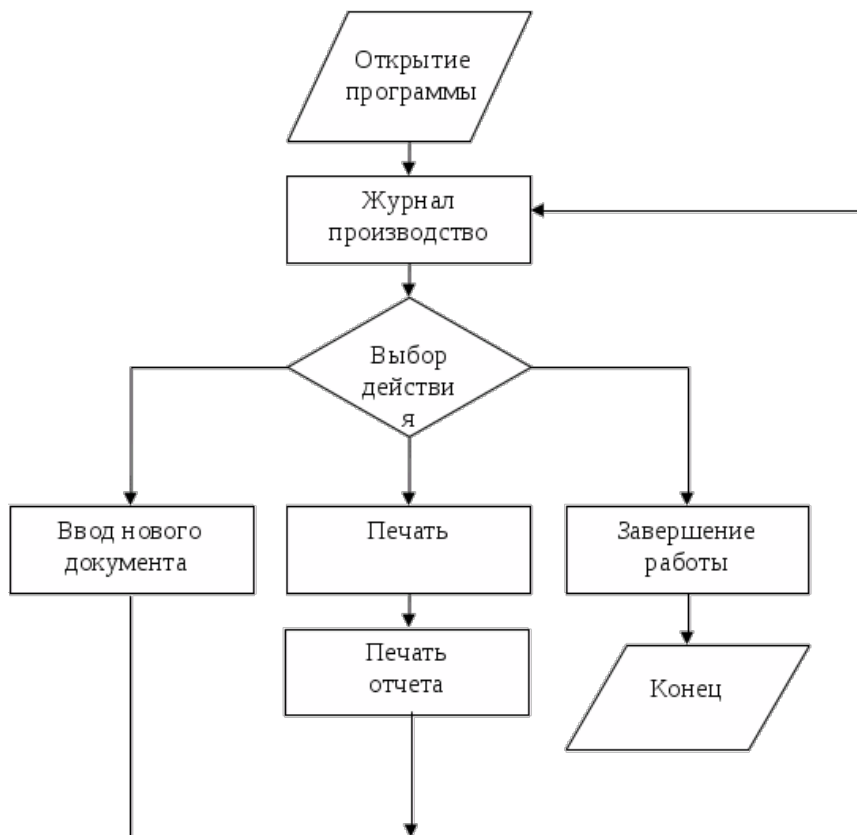
As the development of information technology, the globalization of the Internet, the demand for accelerated processing and data exchange increases. The scope of information technology is very wide and covers almost all business sectors, as it allows to provide simple functions in the company in the form of official correspondence before system analysis and decision support tasks. As a rule, such programs are necessary for large companies, financial institutions, banks, etc. So, at the very beginning, the automation of business processes began with the introduction of email. Often, well-known resources were used to exchange data, but if it was a question of additional functions and additional data protection, they already resorted to information managers such as Microsoft Outlook. Microsoft Outlook is a fairly effective program for working with both the client base and with employees within the company, the program provides a full range of functions that can be

controlled remotely, it is enough to have a connection to the Internet or the local network of the company. Perhaps the user-friendly interface and intuitive use of the program made it so popular. In addition to storing and exchanging data, any developing company, including a bank, needed tools to simplify certain business processes. Therefore, at different time periods and in different companies, individual programs appeared that were developed for a particular company and for a specific business process. [6]

So, Microsoft Outlook is being replaced by the Russian Bitrix 24 and 1C - quite popular programs both in the CIS and abroad. These programs contain the most popular functions, such as workflow at the input and output, while storing the entire client base and quickly processing information, providing ready-made solutions and reports. For example, the 1C program is a universal program for conducting accounting and tax accounting, it allows you to keep a full account and receive ready-made regulated reports for submission to state bodies or tax committees. Also, it provides universality to the approach to solving accounting problems, write primary documents, prepare a quarterly report, calculate wages, etc. Moreover, the program is not limited only to the accounting or economic division of the enterprise, but can also cover and process information from other divisions of the company. The program can be used both by large companies and individual entrepreneurs with tax benefits, since the legislative base is regularly updated by the developer. [7,8]

Among the programs for paperwork and document management, Bitrix24 system, a worthy competitor to Microsoft Outlook, deserved special attention. The main distinguishing feature of this application is the great similarity with the social networks familiar to us, in which data about the company, the client base of the company, employee data, etc. can be stored and processed. In addition, the program can fully organize teamwork, set and control tasks, organize working hours, make appointments. According to the developer himself, the Bitrix 24 system helps the business to work. The system is designed in such a way that its use is as simple as possible, and the content and functions are most suitable for use in any industry. In addition, system developers are constantly in search of new solutions for existing functions in the system. So, there are additional applications that can work on the basis of the Bitrix 24 system, which will not only systematize the storage and processing of data, but also automate the calculations of the accounting or financial department. [9]

Below is a brief block diagram of the operation of any software designed to simplify any business process.



Today, there are hardly any companies that do not have experience in implementing and using information technologies and software. This is especially true for management companies and companies in the financial sector. Of course, organizations of this kind have a staff of competent employees who develop individual information systems. Often, second-tier banks have their own automated banking information systems that have been developed or changed for a particular focus of a bank. For example, banks with foreign participation use a shareholder system adapted to the local market with a controlling stake. It is not difficult for employees to use such a system, since programs designed to simplify and speed up business processes have a simple algorithm of actions. However, often, such systems cover only part of the business processes. Otherwise, 1C Enterprise, Bitrix 24, Microsoft Outlook, or their little-known counterparts are used. [ten]

In the Kazakhstani market, products and developments of Western or Russian specialists prevail. So, in large companies they use products of Russian developers adapted to local specifics - BISquit automated banking information system, Bitrix 24 system, and, of course, 1C Enterprise. Western programs are also gaining popularity among Kazakhstani owners and company executives - Oracle and SAP are among the first Western applications that Kazakhstani companies use. However, in fairness, it should be noted that recently the growth of local IT companies has been increasing, which provide quality products that take into account all the requirements of the local market and legislation. The list of such programs is long, since the demand for such services is growing every day. Such an increase in consumer interest is due to the fact that business owners, even in the small and medium-sized business sector, are reporting that simplifying a sufficiently voluminous business process is much more profitable and will cost the company less than the likely losses that the company will suffer with a long production cycle and having the cost of maintaining additional units of staff. [11]

However, with all the variety of information systems, software and applications, it is also worth mentioning that any introduction of a new tool into existing business processes begins with modeling a new business process or its radical change. Modeling business processes by company managers allows you to analyze in detail the current state of the organization structure of the company, identify weaknesses that need to be improved, and take the right approach to solve possible problems, as well as increase the speed of processing actions at each stage of production, improve interaction with customers and within the company. Since, no matter how innovative the software was, a person is engaged in its implementation and further management. And, the leading link in the chain of business processes, on the interest and competence of which depends on 80% of a successful upgrade of the company structure and business processes in particular. [12]

Of course, at present, the topic of modeling and automation of business processes is very relevant. The modern owner or leader of the company must understand that his business is competitive and meets all the requirements of the consumer, it is necessary to invest in information technology and choose for your company the software that will meet most of the requirements of the company. For this, it will be necessary to carry out rather costly procedures to identify weaknesses in the production cycle, to simulate a future platform for introducing a new tool in the form of software or updating an existing one. Replacing existing software is also a necessary measure to improve the quality of the organizational structure of any company, due to the fact that the information technology market every day offers new functions and opportunities to improve the performance of any system. Despite the high cost of the whole process, the result of the work done will be the company's high competitiveness in the market, and, as a result, increased profitability.

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在组织中选择有效的员工薪酬体系的方法
**APPROACHES TO CHOOSING AN EFFECTIVE SYSTEM OF
STAFF REMUNERATION IN THE ORGANIZATION**

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注解。 本文讨论了选择有效的员工薪酬体系的主要方法。 标明了工资与组织经济成果的关系。 介绍了外国和俄罗斯确定有效工资制度的经验。

关键词： 薪资制度，员工激励，劳动生产率，人员物质激励，无形人员激励，组织偿付能力。

Annotation. *The article discusses the main approaches to choosing an effective staff remuneration system. The relationship of wages and economic results of the organization is indicated. The foreign and Russian experience of determining effective wage systems is presented.*

Keywords: *salary system, staff motivation, labor productivity, material incentives for personnel, intangible personnel incentives, solvency of the organization.*

One cannot argue with the fact that the primary financial and economic tasks of each organization are, of course, closely interconnected with its direct activities. Stable positive results of the organization's leadership depend, including on the diligent work of its subordinates. For good performance, staff should be aware of what employees are working for, and, most importantly, what they will receive for their direct work. Therefore, the management is interested in describing the relationship of the organization of remuneration of its staff and the final successful results of the company, because to achieve the best results, each employee individually.

The motivation, both tangible and intangible, of subordinates should be realized only when the organization is reliable and stable, when it receives the profit it needs, is solvent [1]. This requires a harmony of staff and leadership interests. If the organization constantly makes a profit, has a high profitability of production,

is able to pay its employees a decent salary and thereby ensure a decent standard of living, then all these factors themselves are considered significant enough to speak about the high efficiency of not only the motivation itself, but also the performance of all employees and the organization as a whole. The results of the work of subordinates are strongly influenced by such factors as: leadership style and a clear understanding of the purpose of the work [2].

An indisputable fact is that the introduction and cultivation of constant self-improvement of the staff, the feeling of dissatisfaction with the achievements and the desire for new achievements, since there are always “not yet conquered peaks” - the most important component necessary to achieve the goals of the organization [3].

The leadership of any organization may be wrong. It so happens that mistakes are made, consisting in the lack of interaction with their subordinates. Often, the organization's bosses unilaterally review staff pay systems, and employees, in turn, are aware of this only upon receipt of a salary.

Hence the result - the frustration of subordinates. Often the consequence of such management actions is the dismissal of the employee from his post. It should be assumed that this is not an indicator of the competent leadership of the organization, it is necessary to more openly accept changes related to staff remuneration. The management should take into account the constant development of the market, the characteristics of the organization's sphere of activity, current trends in the remuneration system of various categories of personnel working in this organization for their successful development and improve the financial and economic situation as a whole [4].

To achieve the goals set for any organization, the enterprise management should at any time use a simple, understandable and transparent system of motivation for subordinates. The resulting system should be justified and understandable to staff. It is important that the employee understands these parameters as fair. It often happens that management wants to take into account more indicators - the employee will doubt that they will not understand these complex and confusing formulas, assuming that they want to deceive him.

Today, most workers are not satisfied with the distribution of their income, lack of connection with the results of work, confusion in the ratio of salaries of specialists of different divisions, a big difference in the salaries of homogeneous specialists at enterprises of one region, etc. This is indicated by statistics, open polls of respondents about the degree of satisfaction with wages, as well as its relations with the final results of the company's activities on the websites of the All-Russian Center for the Study of Public Opinion [5], the Federal State Service State Statistics [6], journal of human resource management [7], a variety of questioning, questioning, interviews available on the Internet and so on. This shows the urgent serious problems in the system of labor motivation.

Among the problems of determining the approach to choosing an effective staff remuneration system in an organization, the following are distinguished: a drop in the level of staff satisfaction with working conditions; decrease in motivation for activity among employees; instability of teams; staff turnover; loss of funds by the company associated with the training of constantly changing specialists; loss of customers and others. As a result of these factors, the basic financial and economic indicators of the organization are reduced, such as: revenue, profit, profitability, etc. In connection with the growing number of problems the organization has in such situations, it is necessary to understand what is happening and solve a number of data contradictions with the staff of the organization.

Since the staff of any organization is its core, on which a large number of performance indicators and the effectiveness of the organization depend, the management needs to timely and correctly assess the atmosphere in the team, observe whether everything suits the workers, listen to the wishes and requirements, take into account current trends on labor market, meet the demands of the world market (crisis situations, unstable growth and fall of foreign currency, the fall of the ruble).

In many countries of Western Europe and in the USA, considerable attention is paid to approaches to choosing an effective system of staff remuneration in the organization. The methodology and experience are applied without problems in Russia. The traditional incentive scheme fades into the background. The creators of modern wage systems, taking into account many methods, state the following:

- the tariff and salary system is outdated and has not been true for a long time;
- the focus of the incentive system should be consistent with the tactics and strategies of managing the company, its units and personnel;
- incentive payments should be closely linked to individual and collective employee outcomes;
- income growth relative to labor productivity growth must be regulated in accordance with the planning tasks of the company;
- incentive system should be understood by employees [8].

The tasks set can be solved with the help of flexible non-tariff wage systems. The advantage of such systems is that they can be transformed taking into account the necessary requirements of the planning tasks of the company, as well as on the basis of the labor market conditions in the region, the nature, goals and objectives of the company, personnel management policy, etc.

In recent years, such material incentive programs have transformed into complex systems that take into account many factors. Russian analysts are convinced that with the introduction of flexible systems in the organization's personnel policy, profitability rises by 5–50%, and the incomes of subordinates increase by 3–30% [9].

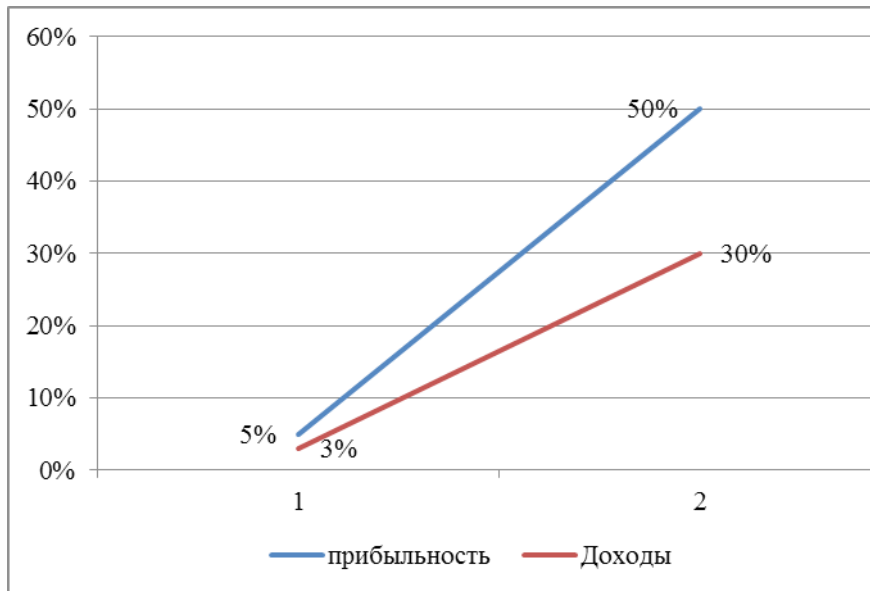


Figure 1 - Growth in the implementation of flexible systems of material incentives, %

Motivating factors are diverse for any given organization. The success of the personnel policy depends on an individual approach to the team as a whole and to each of its subordinates individually. Serious types of intangible motivation include:

1. attracting the organization of workers' funds at a high percentage;
2. incentives in the form of letters, letters, awards and thanks;
3. leisure activities (rewarding with tourist trips, trips to holiday homes, etc.);
4. paid days off, additional days to leave, valuable gifts.

For successful and effective stimulation, it is necessary to constantly monitor the team, because each organization has its own characteristics and psychological climate, its own organizational structure, people of a certain age, contingent, mentality work. All this has a significant impact on the formation of personnel policies. It follows that the observation and knowledge of the leadership needs and personal qualities of employees is one of the important prerequisites for the effective operation of any company.

To analyze the relationship between pay and economic results, organizations can directly help reports on the financial performance of the company. Often, in an organization where employees are not satisfied with the system of remuneration

for their work, there are certain problems with the final results of the company. In general, employees are not satisfied with the size of the wages received, namely, the lack of their attachment to the actual results of the organization.

An example of firms with such problems can be travel companies that have been on the market not so long ago.

In this case, conflicts may arise on the basis of staff remuneration, up to the dismissal of employees. In this situation, this organization will be forced to incur losses in connection with the selection and training of new employees. The deterioration in the financial performance of the organization can be observed in the reports of the company, where, most likely, sales of vouchers will decrease, profitability will fall, the capital of the organization will decrease, etc. This is due to the fact that managers are not interested in improving the quality of customer service of the company, increasing sales of permits, increasing the assets of the company, increasing profitability, increasing the customer base, etc.

After the transformation of the wage system, the establishment of friendly relations in the organization's team, one should expect an increase in the financial and economic indicators of the company's performance, including a decrease in staff turnover in the company, an increase in production and a decrease in labor intensity, an increase in the quality of customer service, an increase in labor productivity and an increase in throughput "Welcome."

Thus, a competent policy in the field of remuneration allows to increase its productivity, and, therefore, to increase the efficiency of the staff remuneration system in the organization.

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EAEU国家中的移民流动: 现代阶段的特征
**MIGRATION FLOWS IN THE EAEU COUNTRIES: FEATURES OF
THE MODERN STAGE**

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抽象。在全球化,一体化,国际化,跨国化,合作的背景下,资源的劳动力迁移过程明显加剧,这与以往一样,在选择其劳动国别的过程中继续主要关注经济因素。如果移民实现了在国外寻找工作的目标,则捐助国和接受国都将从二十一世纪参加适当形式的国际经济关系中受益。在这种情况下,欧亚经济联盟是一个例外,因为各国从内部移民过程中获得的利益的数量和质量明显不平衡。这个问题可以而且应该通过不仅进行内部的国家经济改革,而且通过深化联盟内部的对话来解决。

关键字。人力,劳务移民,欧亚经济联盟

Abstract. *In the context of globalization, integration, internationalization, transnationalization, cooperation, there is an obvious intensification of the processes of labor migration of resources, which, choosing the country of application of their labor, as before, continue to focus primarily on economic factors. If migrants achieve their goal of finding work abroad, significant benefits from participating in the appropriate form of international economic relations in the XXI century are received by both donor countries and recipients. The Eurasian Economic Union is in this case a certain exception, since there is a clear imbalance in the volume and quality of benefits acquired by countries from internal migration processes. This problem can and should be resolved by conducting not only internal national economic reforms, but also by deepening the dialogue within the Union.*

Keywords. *Manpower, labor migration, Eurasian Economic Union*

According to the evolution of the development of international economic relations (MER), labor migration is one of the first forms that appeared on the world market along with trade in finished goods and such types of services as transport,

banking and exchange¹. If we consider migration as a whole, then the moment of its origin should be postponed even to an earlier period of the IV - VII centuries, when the process of the Great Migration of Peoples begins to unfold.

Over the past centuries, there has been an obvious qualitative and quantitative transformation of both the labor resources themselves and their trade. The corresponding changes, albeit not systematically, however, have been comprehensively and sufficiently thoroughly studied in the works of such foreign authors as: E. G. Ravenstein, S. Stoffer, K. Zipf, E.S. Lee, W.A. Lewis, J. Fey and G. Ranis, V. Zelinsky, M. Todoro and J.R. Harris, O. Stark, D.S. Massey, M. Piore, I. Wallerstein and others [9, 10, 11, 12, 13, 14, 15]. Among the Russian researchers on labor migration issues are: O.S. Chudinovskikh, V.A. Tishkova, M.N. Rudenko, A.V. Dmitrieva, E.B. Yakovlev and others [3,7].

Analytical material on the development of the corresponding MER form is also very widely presented on the websites of international economic organizations: the United Nations (UN), the International Organization for Migration (IOM), the International Labor Organization (ILO), the Office of the High Commissioner for Refugees (UNHCR), Organization for Economic Co-operation and Development (OECD), etc.

In particular, according to statistics, it is known that initially the key donor countries of the labor force were mainly developing countries, and the main flow was low-skilled labor force, which left the borders of their country in search of work. Later, the types of labor migrants expanded significantly. These began to include professionals and contract workers (along with illegal immigrants, refugees and migrants) [1], and the register of active donor countries increased due to developed countries.

To date, experts are practically unanimous in the view that modern migration flows are characterized by the following main features.

Firstly, albeit at an insignificant pace, but still there is an upward trend in the growth of migrants to the world population (Table 1, Table 2).

Table 1
The dynamics of the number of migrants in the world

Year	The number of migrants, million people	Migrants to the global population, %
1970	84,5	2,3
1980	102,0	2,3
1990	153,0	2,9
2000	173,6	2,8
2010	220,8	3,2
2019	271,6	3,5

Note: compiled by the authors based on a synthesis of sources [IOM 2020 Report [Electronic Resource]. – Access: https://publications.iom.int/system/files/pdf/wmr_2020.pdf (appeal date(2.04.2020)]

¹Even though, initially, as you know, the exchange of labor resources in its purest form related to the trade in goods (slaves).

Secondly, in the overall picture of the growth of the flow of migrants in the world, the growth of flows of directly migrant workers² is also clearly traced, which is facilitated, inter alia, by the processes:

- globalization and integration, simplifying the procedure for individuals to cross national borders;
- internationalization and transnationalization of production and capital, which, breaking the reproduction chain between countries, pull the labor resources of home countries beyond national borders, contributing to their integration with domestic capital;
- cooperation, in the framework of which the labor resources of different countries are most often combined at the production sites of those macroeconomic entities that are engaged not so much in technology and detail, as in subject specialization.

Table 2
Dynamics of the number of migrant inflows by country (thousand people)

p l a c e	2005		2010		2013		2017	
	country	qty	country	qty	country	qty	country	qty
1	USA	2000,0	USA	2000,0	USA	2000,0	Germany	1400,0
2	Spain	682,7	Germany	683,5	Germany	1100,0	USA	1100,0
3	Germany	573,3	Australia	574,1	Australia	757,0	United Kingdom	520,0
4	Australia	451,0	Canada	503,8	Canada	540,3	Japan	475,0
5	Canada	414,0	United Kingdom	459,0	United Kingdom	406,0	Turkey	466,3

Note: compiled by the authors based on a synthesis of sources [IOM 2020 Report [Electronic resource]. – Access: https://publications.iom.int/system/files/pdf/wmr_2020.pdf (appeal date (30.03.2020)]

Thirdly, despite the growth of non-economic causes of labor migration, its main message remains the differences in wage levels in different countries of the world. At the same time, not only the availability of a job in the country where he can really earn more, but the holding of relatively liberal legislation in the issue of paying benefits and ensuring social guarantees is becoming the optimism for a modern labor migrant.

²The latest available data show that in 2017 there were approximately 164 million people in the world of migrant workers, which is about 2/3 of the total number of migrants (258 million people) in the world at the end of the corresponding year. Compared with the global number of international migrants of working age — people of 15 years and older (234 million) are considered — the migrant labor force occupies 70%.

Fourth, the largest share of modern labor migrants falls on the male population of the planet. In particular, it is known that since 2013 an increase in the proportion of men among labor migrants has been observed. In 2017, the number of male labor migrants (96 million people - 58%) exceeded the number of female labor migrants (68 million people - 42%).

Fifth, of all the possible directions of movement of labor migrants, the most intense flows are between developing (donor country) and developed countries (recipient country) with an obvious increase in contacts within developed countries themselves (Table 3). In particular, according to the results of 2017, it was revealed that at present:

- about 68% of labor migrants (111 million people) live in high-income countries, their share is 18.5% of the total working population of the corresponding countries of the world;
- in middle-income countries - 29% or 47 million labor migrants, which is 1.4 - 2.2% of the working population of the respective countries;
- in low-income countries - 3.4% or 5.6 million labor migrants, which is 1.9% of the total labor force of the respective countries.

Table 3
*Dynamics of the number of migrant workers entering
(first five countries of the world), thousand people*

p l a c e	2000		2005		2010		2017	
	Country	Qty	Country	Qty	Country	Qty	Country	Qty
1	USA	106,6	USA	114,0	Italy	134,2	Canada	80,9
2	Canada	58,1	United Kingdom	90,2	United Kingdom	107,0	USA	64,8
3	Japan	17,5	Canada	61,6	Spain	89,8	Germany	61,7
4	Germany	9,3	Italy	53,9	Canada	76,5	Australia	58,1
5	Netherlands	6,8	Australia	41,2	Russia	70,4	Japan	53,1

Note: compiled by the authors based on a synthesis of sources [IOM Official Statistical Portal [Electronic Resource]. – Access: https://migrationdataportal.org/data?i=inflow_work&t=2015 (appeal date (4.04.2020))]

Sixth, against the backdrop of the obvious expansion of the benefits of recipient countries: increased competitiveness at all levels of economic analysis, through increased use of the price factor; growth in production followed by an increase in gross domestic and national products (GDP, GNP); savings in government spending (on education, training, the implementation of social programs, etc.), there is also an increase in the positive consequences of labor migration for donor countries: a theoretical possibility of reducing unemployment; increased

qualifications of emigrants; increase in national currency reserves; growth of living standards of the population, etc.

As for the Eurasian Economic Union (EAEU) and migration flows in it, we believe that the following should be attributed to the main distinguishing features of the development of the corresponding form of MER.

First, as well as throughout the world, there is a clear upward trend in the growth of the flow of labor migrants to all countries of the Union (Table 4). The absolute leader in the number of entrants (within the Union) is Russia. The same country ranks 1st in the total volume of labor immigrants. In the first half of 2019 alone, about 50 thousand labor migrants from the PRC, almost 11 thousand from Germany, a little more than 10 thousand from Turkey and others arrived on its territory. At the same time, only 20,862 people arrived in the Republic of Belarus for the whole of 2019. The lowest number of labor immigrants by the end of 2019 is in Armenia and, possibly, Kyrgyzstan (statistics for the last country are missing).

Secondly, an analysis of the directions of movement of labor migrants within the EAEU countries demonstrates the exclusion from the global picture of migration: the largest share of those who move in comes from no less, and vice versa, from more competitive countries of the Union. The point is that in addition to the fact that Russia is a leading recipient country of labor resources of the EAEU countries, it is also the main donor country within the association. Moreover, the Russian Federation itself most of all enters really from a country with more serious economic problems - from Kyrgyzstan. For this country, Russia is the main center of attraction for its workforce. It accounts for 81% of all labor migrants from the Republic of Kyrgyzstan, while Kazakhstan - 16%, countries of the European Union (EU) - 6%, Asia - 3%, North America - 1%.

Thirdly, there is a clear specificity by types of labor migrants. In particular, while professionals and contracted specialists with higher and secondary vocational education leave mainly from Russia, the bulk of its immigrants from the countries of the Union are people who have only secondary, specialized secondary and incomplete secondary education [8].

Fourthly, within the framework of the integration association, an attempt is being made to resolve migration issues in general, as well as labor migration, in particular, together, by developing a common policy in the relevant direction. In particular, relatively recently, the Department of Labor Migration and Social Protection was formed in the structure of the Eurasian Economic Commission, whose areas of activity are:

- labor migration and migration policy;
- social, retirement and medical care, education and professional activities of the working member states;
- other areas defined by international treaties within the Union.

Table 4
*Dynamics of the number of citizens of the EAEU member states who entered the member countries of this integration as-
sociation to carry out labor activities for 2014 - 2019*

Country of citizenship		The number of workers of member states							
		1 half of 2014/2014	1 half of 2015/2015	1 half of 2016/2016	1 half of 2017/2017	1 half of 2018/2018	1 half of 2019/2019		
Republic of Armenia (state of entry)	Belarus	-	-	15/15	16/16	24/33	31/38		
	Kazakhstan	-	-	40/41	38/40	51/55	63/61		
	Kyrgyzstan	-	-	3/3	4/2	1/5	5/7		
Republic of Belarus (state of entry)	Russia	-	-	2123/2140	2242/2357	2564/2877	3043/3289		
	Armenia	172/387	155/383	206/372	196/400	187/432	189/397		
	Kazakhstan	409/1034	249/653	169/385	153/313	196/381	229/597		
	Kyrgyzstan	23/48	23/72	27/50	28/57	29/73	49/126		
	Russia	1819/4546	762/2209	1148/2140	1222/2453	1815/4126	2550/6741		
Republic of Kazakhstan (state of entry)	Armenia	67/272**	911/2974**	1325/2297**	1843/3022**	2167/3121**	1734/2575**		
	Belarus	378/598**	257/608**	307/817**	494/1007**	588/1189**	603/1336**		
	Kyrgyzstan	307/798**	513/1138**	1108/2962**	3416/1506**	3258/5493**	2880/5808**		
	Russia	4498/8672**	6447/12529**	6376/19371**	11458/4650**	12483/24816**	14964/30158**		
Kyrgyz Republic (state of entry)	Armenia	-/2	2/-	-	-	-	-		
	Belarus	-/6	3/-	-	-	-	-		
	Kazakhstan	-/130	58/-	-	-	-	-		
Russian Federation (state of entry)	Russia	-/370	100/-	-	-	-	-		
	Armenia	96110/194684	146038/264135	112536/209887	115819/232247	115888/207945	106604/210460		
	Belarus	40379/86234	38335/86463	46617/97743	56563/124633	67773/134690	75114/63410		
	Kazakhstan	28383/58744	32508/70073	32647/71600	39615/88202	50121/111464	60246/136208		
	Kyrgyzstan	166616/371656	228291/512432	174286/361875	171835/376863	161839/351959	202220/453702		

Note: compiled by the authors based on a synthesis of sources [of the Migration Service of the Ministry of Territorial Administration and Infrastructures of the Republic of Armenia; Ministry of Internal Affairs of the Republic of Belarus; the Ministry of Education and Science of the Republic of Kazakhstan, the Ministry of Health and Social Development of the Republic of Kazakhstan and the Ministry of Internal Affairs of the Republic of Kazakhstan; ** Ministry of Internal Affairs of the Republic of Kazakhstan; State Migration Service under the Government of the Kyrgyz Republic (there is no information after the entry of the Kyrgyz Republic into the Union); Ministry of the Interior of the Russian Federation]

In addition to this, as in any other country in the world, each EAEU member state carries out active independent work on labor migration issues. In Russia, the Federal Migration Service is responsible for their implementation; in Belarus - the Department of Citizenship and Migration of the Ministry of Internal Affairs of the Republic of Belarus; in Kazakhstan - the Ministry of National Economy of the Republic of Kazakhstan and the Department of Social, Migration Policy and Development of Government Agencies; in Kyrgyzstan - the State Migration Service under the Government of the Kyrgyz Republic; in Armenia - the State Migration Service.

We believe that the need to “strengthen” the national structures of supranational is caused, first of all, by the absolute imbalance in the consequences of labor migration for the member countries of the Union.

Thus, comparing the dynamics and modern general characteristics of the development of labor migration in the world and in the EAEU, we can draw the following conclusion.

At present, the EAEU, as an integration association, cannot pretend to be a leader either in the form of cooperation achieved or in the results obtained (production, financial, scientific and technical, etc.). However, based on the fact that after the collapse of the Union of Soviet Socialist Republics (USSR), attempts to revive active cooperation within the region do not stop: the formation of the Commonwealth of Independent States (CIS), the Union State of Russia and Belarus (USRB), the Customs Union, it is possible that some there is still a sense of regional integration, especially since scientists have been writing about the specific place and role of EurAsia as a whole with the Russian Center for a very long time [6].

It is important to understand at what expense the country's reserves can give impetus to further progressive development by moving towards it together, and what role labor migrants can play in this.

Currently, there is no equality among the participants in the corresponding structure in the levels and rates of economic development, the role of the absolute leader is assigned to the Russian Federation [4], and therefore, all free factors of production, including labor, will seek it. And, if no steps are taken, Russia will soon "drown" in the flows of low-skilled labor from the countries of the Union, and those, in turn, will face a complete lack of supply on the labor market. Highly skilled personnel also actively emigrate from the respective countries, not only within the Union, but also outside it, although, ideally, they should contribute to the search, creation, and increase of the comparative and competitive advantages of their states.

Based on the fact that the main goal of any integration is not to build up at the expense of other advantages of the leading country, but to develop all the partici-

pants [2], we believe that migration processes should be approached not as an inevitable consequence of some imbalance in the level of development of countries, but how to a possible source of this development.

It's not enough to just have to state that minds are flowing out of countries, because they have nowhere to find a job. It is necessary to try to stop this flow and, moreover, to attract highly sought-after highly qualified personnel to itself through, for example, active development of cooperation processes and participation in transnationalization (pushing the existing regional business beyond national borders) [5], try to revise the adopted social policy towards development guarantees. Naturally, the state should play the main role in carrying out these reforms.

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形成商业教育预算体系
**FORMATION OF A BUDGETING SYSTEM IN BUSINESS
EDUCATION**

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抽象。 本文专门讨论商业教育中预算体系形成的细节和问题。 本文讨论了商业教育预算法规的发展, 预算本身的格式以及产生财务成果的程序, 并在此基础上确定了计划开发者和教师的激励系统。

关键词: 预算, 预算, 财务结果, 费用分配, 商业教育, 预算对象, 动机。

Abstract. *The article is devoted to the specifics and problems of the formation of a budgeting system in business education. The article discusses the development of budgeting regulations for business education, the formats of the budgets themselves, as well as the procedure for generating a financial result and, on its basis, determining a system of motivation for program developers and teachers.*

Keywords: *budgeting, budget, financial result, distribution of expenses, business education, objects of budgeting, motivation.*

Budgeting is the process of formation, approval, execution, as well as control and analysis of budget execution. The importance and significance of this process for any organization is difficult to overestimate. However, the formation of the budgeting system itself is associated with overcoming many difficulties, both organizational and psychological, as well as taking into account the specifics of the activity (industry, managerial, organizational, motivational, etc.) of a particular organization. The field of business education is no exception. When forming a budgeting system in this area, it is necessary to take into account:

1. Organizational issues of the formation of budgeting regulations for business education, the formats of the budgets themselves. Who is responsible for this process at a university or business school?

2. The procedure for the formation of the financial result and on its basis the formation of a motivation system;

Organizational issues of the formation of budgeting regulations for business education, the formats of the budgets themselves.

The budgeting system includes two main elements: the budget process and the budget model. The budget process is people and procedures (organizational structure, functions, processes). It answers the question: who will do it and how? The budget model is objects, formulas and a calculation algorithm. It answers the question: how to count?

Practice shows that in an educational organization (university, business school), program managers of additional education are responsible for the formation and execution of budgets, and the financial service is responsible for the development of planning regulations and technical support of the budgeting system. However, financiers see the budget as an assessment of the financial results of planned activities in a certain period in the future, and the main tasks in budgeting are the coordination of business education participants regarding their functionality, target results and a list of resources. Thus, the budget in business education is a tool to achieve strategic goals through ongoing activities. Figure 1 shows two approaches to the budgeting process: ideal and undesirable schemes.

The procedure for the formation of a financial result and, on its basis, the formation of a motivation system

One of the most problematic and painful in the organization of business education is the question of the distribution of costs and profits between the university or business school and the unit that implements continuing education programs. The general scheme and the procedure for the formation of the financial result in business education are presented in table 1. Each element in this scheme has its own characteristics and problems of formation, both accounting and managerial in nature. Let us analyze the main ones.

- Pricing models and income distribution scheme depending on the role in business education projects;
- Teacher pay system and the development of simulating teaching staff allowances;
- Coverage of overhead costs and distribution of financial results.

The difference in *pricing models* is based on the role that a university or business school plays in implementing business education programs. An educational organization in modern conditions is a kind of marketplace and here the following roles may arise in the creation and sales of continuing education programs:

- “Owner”: Own programs and sales through the own channels of the university and business school;
- “Partner”: Own programs and sales through partners' channels;
- “Agent”: Affiliate programs and sales through its own channels of the university and business school;

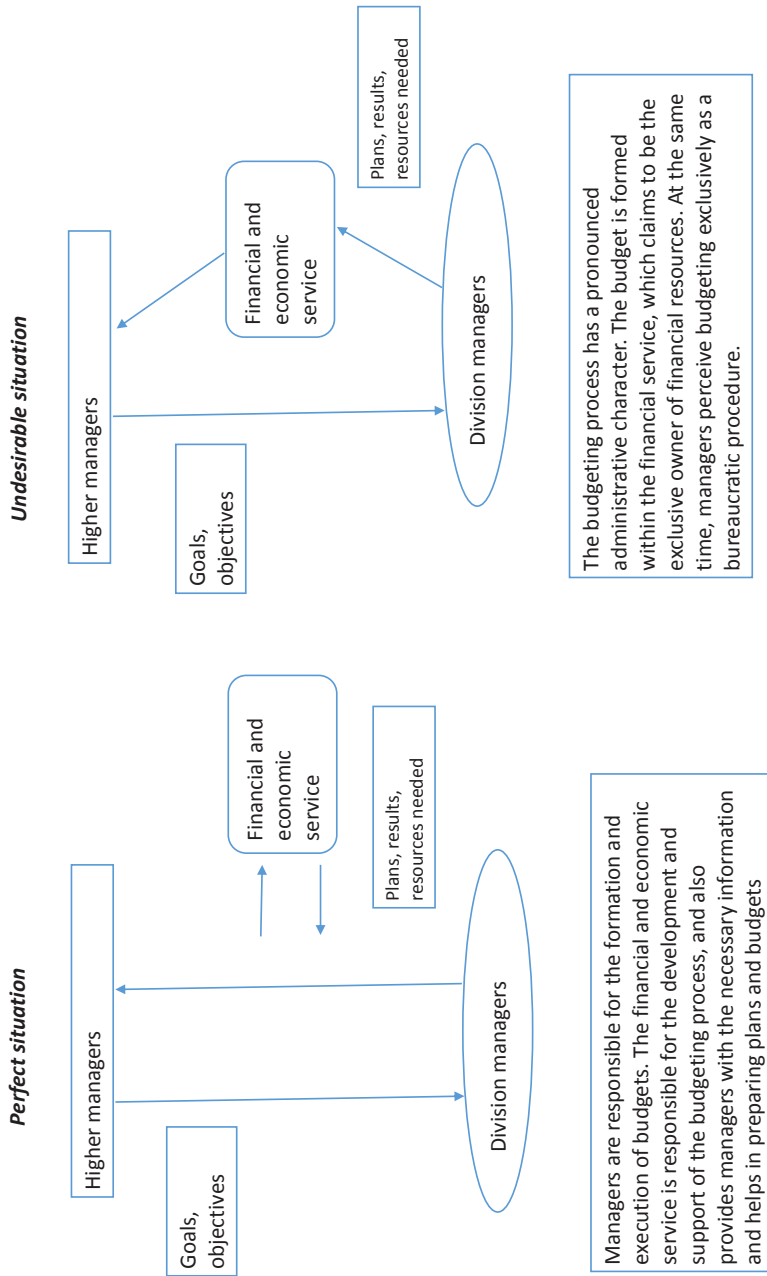


Fig. 1. The interaction of managers in budgeting.

• “Intermediary”: Programs and sales of partners, but are implemented with the assistance of the university team or at the university site.

Based on an analysis of the practice of Russian business schools, the most common income distribution schemes depending on the role in business education projects are the schemes shown in Figure 2. Of course, the percentage ratios are different in different universities, which is associated with the university’s brand (the more significant the brand, the more a higher percentage of income distribution falls on the university), the fame of the author of the program, the qualifications and image of the teaching staff, and other factors.

Revenue		
The main costs (per division/ direction)	Direct costs (for the APE product)	<i>Costs (per 1 listener)</i> 1.Handout, access codes to the virtual classroom, etc. 2. Agent for the product (regional agents, “bring a friend”, etc.) 3. Cost of sales
		<i>Costs (per group)</i> 1. Teacher payroll fund 2. Auditoriums 3. Image events (opening/closing groups)
	<i>Indirect costs (per division/direction)</i> 1.Payroll fund for administrative and managerial staff division/ direction (methodologists, administrators, program managers (program development and management) 2. Jobs of administrative and managerial staff division/direction 3. Marketing and advertising 4. The cost of promotion division/direction 5. Costs of sales 6. Training, continuing education of teachers 7. Affiliate per division/direction 8. Accreditation of programs 9. Work with graduates	
	<i>The financial result of a division/direction</i>	
<i>Overhead costs (APE division and university)</i>		Administrative expenses
		Selling expenses
<i>The financial result of the organization’s business education</i>		

Fig. 1. The general scheme and procedure for the formation of financial results in business education (additional professional education (APE))

№	University role	University income	University income for administration	Teachers/Partners Income
1	OWNER	20%	30%	50%
2	PARTNER	20%	20%	60%(of which 20% to partners for promotion)
3	AGENT	20%	20%	60%(of which 20% to partners for programs)
4	INTERMEDIARY	20%	10%	70%

Fig. 2 Revenue distribution schemes depending on the role in business education projects

The teacher payment system and the development of simulating teaching allowances are one of the fundamental factors in the financial viability of business education programs. Low rates will scare away qualified and vibrant teachers, and inflated ones will lead the program at a loss. Based on the experience of leading business schools and university departments involved in the implementation of business education programs, the main factors that shape the teacher's rate in business education are:

- Teacher rating in a professional environment;
- Feedback from students on teachers;
- Teaching experience at a business school or university;
 - less than 2 years
 - From 2 to 5 years
 - From 5 to 10 years
 - Over 10 years
- Academic degree, academic title:
 - Candidate or Doctor of Science
 - Associate or Full Professor
- Availability of publications for the previous 12 calendar months:
 - Articles in scientific and industry publications (Hirsch index, including the international scientometric systems SCOPUS, Web of Science);
 - Books, textbooks, monographs;
- Participation in conferences for the previous 12 calendar months on behalf of a business school, university (in external conferences) and in events organized by a business school, university;
- Use of modern educational technologies:
 - Case method, virtual class

- Work in project groups
- The use of role-playing games, computer simulations, etc.
- Creation of computer simulations and situational business games
- Teaching in English (for programs implemented in English);
- Teaching at Executive, EMBA, DBA, EDBA programs;
- Business experience in the profile of the subjects taught.

For the development of business education, motivation for the creation and implementation of new programs, it is important to *cover overhead costs and distribution of financial results*. In this aspect, there are two approaches: without a financial result at the level of the unit implementing the additional education program, and with its formation. An approach without a financial result implies that the unit that implements the program at the expense of income covers all its costs, profit is formed at the level of the university, business school as a whole. The second approach has more diverse forms, the logic of the formation of the financial result in which is shown in the figures: “Invoice and profit” (Fig. 3), “Payments and profit” (Fig. 4), “Payments, invoice and profit” (Fig. 5)

Revenue (rub.)
- Direct expenses (rub.)
= Operating profit (rub.)
- Indirect costs (rub.)
= Profit (before overhead) (rub.)
- Overhead (30% ... of direct costs)
= Profit
Return on sales (%) (before invoices)
Return on sales (%) (after invoices)

Fig. 3. Overhead and profit

Revenue (rub.)
- Payments to a university, business school (20% ... 50%)
- Direct costs (rub.)
= Operating profit (rub.)
- Indirect costs (rub.)
Profit (before overhead) (rub.)

Fig. 4. Payments and profits

Revenue (rub.)
- University payments (20% ... 50%)
- Direct costs (rub.)
= Operating profit (rub.)
- Indirect costs (rub.)
= Profit (before expenses) (rub.)
- Overhead (30% ... of direct costs)
= Profit
Return on sales (%) (before invoices)
Return on sales (%) (after invoices)

Fig. 5. Payments, invoices and profits

The option "Overheads and profits" provide coverage for overhead costs, including management, only in the case of profit. Units implementing vocational education programs need to ensure the profitability required by the university or business school. But they fully cover their costs.

The option "Payments and profits" to the greatest extent ensures the interests of universities or business schools, since payments to the upper level are taken from departments in the first place to cover the costs and expenses of the departments themselves. In this option, units implementing vocational education programs are not liable for fulfilling profitability targets.

The option "Payments, invoices and profits" seems to be the most balanced from the point of view of the distribution of the financial burden of ensuring both the costs of maintaining a university or business school, and the unit itself implementing professional education programs. Since this load is distributed throughout the process of generating a financial result.

Thus, the formation of a budgeting system in business education is not only the definition of regulations and budget forms, their preparation and monitoring of budget performance, but to a greater extent the tool to achieve strategic goals through current activities.

冠状病毒对中国经济的影响

THE IMPACT OF CORONAVIRUS ON THE ECONOMY OF CHINA

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抽象。就2019年的经济发展水平而言,中华人民共和国是仅次于美国的第二个国家。中国经济是世界空间的驱动力,如果出现不可预见的情况,例如先前流行病的蔓延,未知的冠状病毒,那么其后果不仅对中国本身,而且对整个世界都具有重大意义。

关键词: 冠状病毒流行病金融市场外汇市场GDP。

Abstract. *The People's Republic of China is the second country after the United States of America in terms of economic development level for 2019. The Chinese economy is a driver in world space and if an unforeseen situation arises, such as the spread of an epidemic of a previously unknown coronavirus, then the consequences can be significant not only for China itself but also for the whole world.*

Keywords: *coronavirus, epidemic, financial market, foreign exchange market, GDP.*

Modern China is one of the countries with the most developed and dynamically developing economies. The reform policy and the desire for openness have led the country to significant achievements in various sectors of the state. Over the past decades, the country's leadership has focused on economic growth, while ignoring the social interests of society, which in turn has led to an increase in social differentiation, a lag in the sphere of public services from the leading countries. Also, the most important negative consequence of the rapid industrialization of China can be called significant environmental pollution, and as a result, an increase in mortality.

The fast-growing economy of China went through the global financial crisis of 2008-2009 with a slowdown, but without a deep drop in macroeconomic indicators, returning to the pre-crisis GDP growth rate already in 2010. Nevertheless,

the average annual economic growth rate decreased from 10.8% in 2000–2007 to 7.9% in 2008–2018, which affected the dynamics of the global economy in the post-crisis years (Table 1).

Recently, it is believed that East Asia has become the center of economic growth in the world system, with the largest state being China. The Chinese economy occupies a leading position among developing countries, as well as among developed ones. The average GDP growth rate in China is 9.8%, which indicates a dynamic development.

Table 1.

The main macroeconomic indicators of China, 2009–2019¹.

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Real GDP,% of prev. year	9,2	10,6	9,5	7,9	7,8	7,3	6,9	6,7	6,9	6,6	6
GDP nom., trillion USA dollars	5,1	6,1	7,5	8,6	9,6	10,5	11,2	11,2	12	13,5	14,2
PPP per capita GDP, thousands USA dollars	8,6	9,4	10,3	11	11,9	12,7	13,5	14,3	15,2	16,1	7,7
Accumulation rate,% of GDP	46,3	47,9	48	47,2	47,3	46,8	44,7	44,1	44,4	44,2	44
Average annual inflation, %	-0,7	3,3	5,4	2,6	2,6	2,0	1,4	2,0	1,6	2,2	5,2
Import (goods and services),% increase	2,2	19,9	17,7	6,6	10,6	7,8	-0,5	4,7	7,1	8,2	6,2
Export (goods and services),% growth	-11,3	25,6	14,6	5,9	8,8	4,3	-2,2	1,1	9,3	5,5	5
Unemployment, %	4,3	4,1	4,1	4,1	4,1	4,1	4,1	4,0	3,9	4,0	3,62
Population,billion people	1,33	1,34	1,35	1,35	1,36	1,37	1,37	1,38	1,39	1,4	1,4
Government debt,% of GDP	34,3	33,7	33,6	34,3	37	39,9	41,1	44,2	47	50,1	50,5

The most important tools for implementing the strategy of economic development and ensuring stable economic growth are:

- agrarian reform, providing agriculture with additional opportunities for the production of its products and their further sale;
- stimulation of small and medium-sized businesses, primarily operating in the field of trade and services;

¹Based on information from the Bulletins on world economic trends [Electronic resource] access: <https://ac.gov.ru/files/publication/a/20890.pdf> and information on the statistical portal [Electronic resource] access: <https://take-profit.org/statistics/countries/china/>

- attraction of foreign capital and the development of export production through the creation of special export zones with advanced production infrastructure and tax benefits;
- state control in the following sectors: financial, industry, transport sector, social security system.

After the start of the reform and opening up policy, China began to comprehensively develop trade with foreign countries and established trade relations with the vast majority of countries and regions of the world².

This trend could continue in the future if it were not for the coronavirus, which appeared according to media reports, on November 17 in Hubei³ Province, and then spread to the scale of a “pandemic,” according to the World Health Organization.

The proliferation of COVID-19 in China has had a significant impact on the Chinese economy, and consequently fluctuations in the global economic space have followed. First of all, the stock exchanges of the largest Chinese cities, namely Hong Kong and Shanghai, reacted to the virus. Due to the growing panic in early 2020, a decision was made to temporarily close the stock exchanges.

The outbreak of COVID-19, caused by its rapid spread and high death toll, has already been designated by the World Health Organization (WHO) as a public health emergency of international concern (PHEIC). By February 21, 2020, an infectious disease resulted in approximately 75,000 infections and 2,000 deaths in China, and spread to more than 25 countries around the world. To curb the spread of the disease, the Chinese authorities have blocked several large cities in Hubei, including its capital Wuhan with a population of more than 11 million people. Even outside Hubei, the authorities are making great efforts to ensure that people avoid unnecessary contact with each other to reduce the likelihood of infection.

Measures taken to contain COVID-19 infection, along with panic caused by the virus, significantly weakened economic activity in the country. Some data indicated a sharp slowdown in growth in a number of sectors, such as travel, tourism, restaurant, entertainment, and even car sales. (Figure 1.2) Meanwhile, employees started coming to work from mid-February due to the protracted holidays of the Chinese New Year (CNY). The impact of COVID-19 on the manufacturing sector will gradually weaken. More importantly, authorities pledged to fulfill their unannounced growth goal for 2020, despite the disruption of COVID-19. Such a commitment implies the adoption of more measures in the future that promote economic growth.

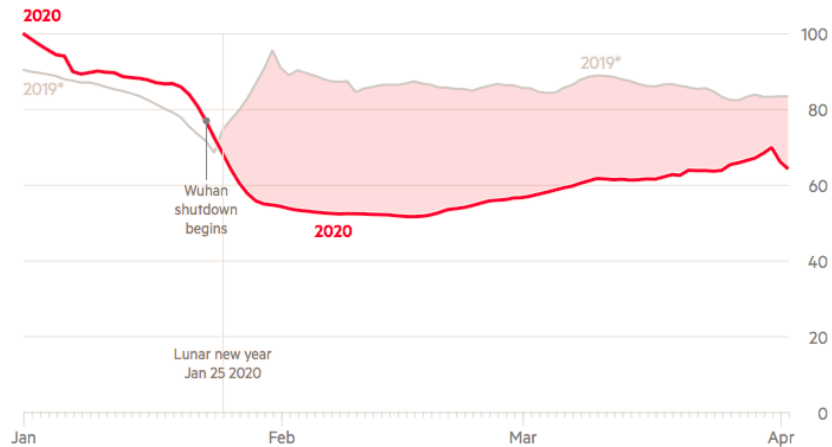
²Modern China and its role in the global economy [Electronic resource] access:<http://finuni.ru/sovremennyy-kitay-i-ego-rol-v-mirovoy-ekonomike/>

³Fitch estimates coronavirus outbreak impact on Asian economy [Electronic resource] access:<https://www.rbc.ru/economics/28/01/2020/5e303fae9a7947cc5bfd73b7>

According to analysts at *ING*, in 2020, GDP growth may drop to 5.6%. Chinese Academy of Sciences does not rule out falling below 5%⁴.

Covid 19's impact on the Chinese economy

FT China Economic Activity Index (Jan 1 2020 = 100), last updated Apr 2



*2019 values at same number of days before/after the lunar new year

Sources: WIND; EntGroup; FT research

Sources: WIND; EntGroup; FT research

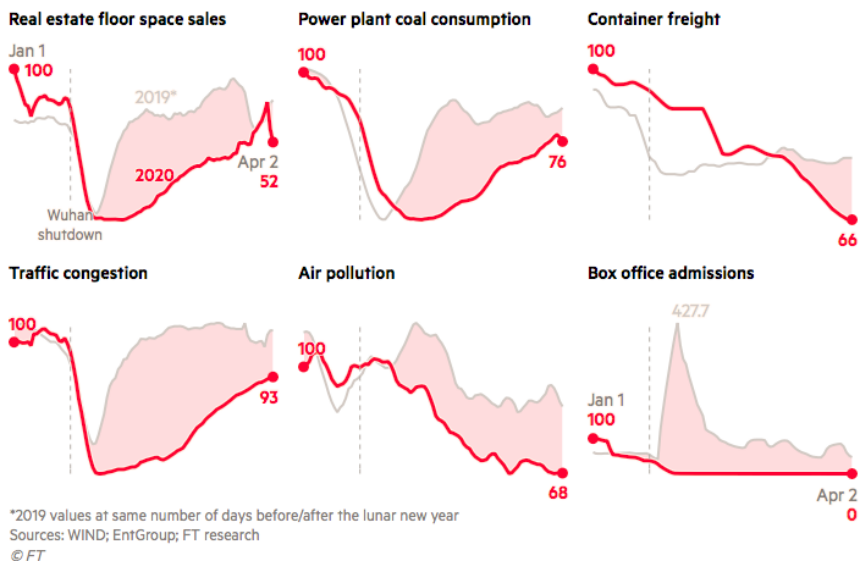
This is how the components of the index behave - real estate sales (62% of the norm), coal consumption by power plants (75% of the norm), container transportation (67% of the norm) and others

Fig 2. The effect of coronavirus on various indices of the Chinese economy

⁴V. Katasonov On the impact of the coronavirus on the economy and China-USA relations \ Strategic Culture Fund (electronic edition) [Electronic resource] access:

<https://www.fondsk.ru/news/2020/02/01/o-vlijanii-koronavirusa-na-ekonomiku-i-otnoshenija-kitaj-us-50028.html>

Subindices (Jan 1 2020 = 100)



Sources: WIND; EntGroup; FT research

The situation with the coronavirus epidemic has already significantly affected the Chinese economy, losses in the first quarter of 2020 are estimated at almost 1 trillion yuan (\$ 143.1 billion), or about 1% of the country's GDP.⁵

In the given situation, the sphere of public catering and tourism business may suffer the most. Tourism revenues in the region may fall as people reduce their travel plans in response to increased health risks. If we talk about the Asian region, the countries that have a large tourist flow, such as Thailand, Singapore and Vietnam, will suffer the most. In Thailand, for example, the share of tourist income is about 11% of GDP. Among all the tourists from Thailand and Vietnam, the fourth part is occupied by Chinese vacationers.

Naturally, the financial market instantly responds to the current situation with the coronavirus. The volatility of the stock market in the region increased, but the currency and bond markets were calm. Although exchange rates have depreciated against the US dollar, this is not surprising given the trend towards a joint movement with the renminbi.

The theory of the “black swan” is a concept developed by the famous scientist and practitioner of the stock market Nassim Taleb in the book “Fooled by

⁵Expert told how much the Chinese economy is losing due to the coronavirus [Electronic resource] access: <https://ria.ru/20200217/1564854827.html>

Chance,” which considers sudden and large-scale phenomena that can radically change the course of history. The essence of the theory is that there are completely unpredictable phenomena that, as a result, can entail unpredictable consequences.

"Black Swans" can be global or personal, positive or negative. These include wars, financial crises, unexpected death, an accidental meeting in the elevator, winning the lottery, meeting a life partner, contact with extraterrestrial civilization, etc⁶. And as we can observe in modern conditions, the emergence and spread of a completely new virus, entailing uncertainty, can be classified as “black swan”.

Under the prevailing conditions of the spread of the COVID-19 virus in China, many factories have suspended operations, Bloomberg indicates a possible second wave. European and American partners are forced to cancel orders and may delay payment due to financial instability. In China, prepared for the fact that at the end of the year, exports will fall by 10 percent⁷.

According to experts from the same agency, China is facing the first quarterly economic downturn in decades.

The consequences of the COVID-19 virus may be more significant than the outbreak of SARS in 2003. Logistic restrictions in the near future may affect product relations with foreign partners⁸. At the same time, according to February data, the PRC economy showed the worst performance over 30 years: industrial production fell by 13.5%, investment by 24.5%, and retail sales by 20%.

China – is the largest consumer of raw materials and resources, whose economic growth is reflected in many economies of the world. The reduction in output during the pandemic has a direct impact on the demand for exported resources, and naturally affects the price, which in turn leads to a reduction in foreign companies' revenues and revenues to the state budget. Consequently, the reverse situation can also have a negative effect: the suspension of supplies of components from China, as well as the fall of the Chinese stock market will undoubtedly contribute to the weakening, for example, of the USA economy, which we can already observe. According to Goldman Sachs, the USA economy is expected to decline by 5% in the second quarter.

It can be said with full confidence that even a small economic downturn in China can increase the volatility of the global oil market, which will entail a depreciation of the ruble and an increase in inflation risks.

The impact of the weakening Chinese economy on the Russian market can be seen in the rapid depreciation of the ruble over the past month. The ruble devalua-

⁶What is the Black Swan theory? [Electronic resource] access:

⁷The second wave of coronavirus hit the Chinese economy [Electronic resource] access: <https://lenta.ru/news/2020/03/27/volna/>

⁸O. Solovieva China's economy comes to life after the coronavirus [Electronic resource] access: https://yandex.ru/turbo?text=http%3A%2F%2Fwww.ng.ru%2Feconomics%2F2020-03-15%2F4_7817_china.html

tion at the maximum was 30% (the Central Bank rate as of March 20, 80.15 rubles/dollar from the level of 61.23 - January 10). In modern realities, the dynamics of the exchange rate will be determined by current oil prices.

The Russian budget is formed on the basis of the indicator of the ruble oil price of 2785 rubles from the forecast oil price of \$ 42.40 and the dollar exchange rate of 65.70 rubles/dollar. Naturally, significant deviations from the approximate indicators can have a catastrophic effect on all sectors of the Russian economy⁹.

On the basis of widespread panic, we can see the rise in gold, falling prices for oil, copper, nickel and other industrial metals. So far, these are limited movements, but they can become a trend if the Chinese authorities fail to effectively and timely cope with the situation. Or at least to clarify the situation to reduce the uncertainty factor, because the new coronavirus epidemic in China is not as frightening as the accompanying uncertainty. After all, this is not the first or last epidemic in the world.

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⁹Coronavirus as a "black swan", the world on the eve of a new global crisis [Electronic resource] access: https://ruskline.ru/news_rl/2020/03/20/koronavirus_kak_chernyi_lebed_

美国和中国在世界经济中的地位
USA AND CHINA IN THE WORLD ECONOMY

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抽象。本文讨论了美利坚合众国与中国之间的互动。国家之间外国经济互动的某些外部领域。研究的结果是确定了两国之间贸易和经济互动的趋势。

关键词：制裁，地缘政治局势，贸易，对外贸易，冠状病毒。

Abstract. *The article discusses the interaction between the United States of America and China. Certain external spheres of foreign economic interaction between countries. The result of research was the identification of trends in trade and economic interaction between the two countries.*

Keywords: *sanctions, geopolitical situation, trade, foreign trade, coronavirus.*

The current geopolitical situation cannot be called stable: local wars in the Middle East, which are driven by interested economic agents from other countries, political conflicts, popular unrest and protests, flooded the EU countries, uncontrolled migration flows, economic wars between countries through the introduction of sanctions and the embargo. Such conditions could not but affect the level of world GDP, as a result, the IMF predicted minimal growth in the global economy over the past 10 years.

The world economy in 2019 grew by only 3%, which became the minimum indicator since the global crisis of 2008-2009. All this is reflected in geopolitical tensions and the emergence of new barriers to international trade, especially because of the coronavirus. Slowdowns have been seen in advanced market economies and emerging economies. In Brazil, Mexico, Russia, and Saudi Arabia (emerging markets) and other large countries, the growth rate in 2019 was approximately 0.5% -1%, that is, significantly lower than the global average growth rate. In developed countries, the situation is different: the increase was 1.7% in 2019 (2.3% in 2018)¹.

¹Pogorletsky A. I. World economy and international economic relations: textbook for undergraduate and specialty / A. I. Pogorletsky [et al.]; edited by A. I. Pogorletsky, S. F. Sutyurin. — Moscow: Publishing House Yurayt, 2019. — 499 P.

Consider the dynamics of commodity exports of these two countries on the graph (Fig. 1, the right axis is the USA and China, the left is the world indicator), there is a stable trend of accelerated growth in China's exports, annually increasing the gap from the USA and occupying an increasing share of the world indicator.

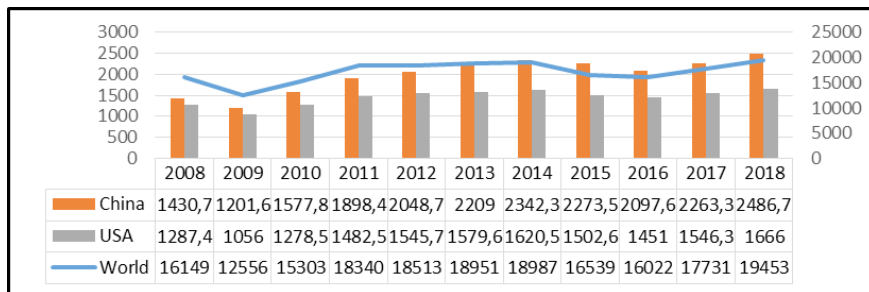


Figure 1. Volume of commodity exports of the USA and China, 2008-2018 (billion US dollars)².

As shown in the figure, exports of goods from the USA to China grew 7 times, imports from China to the USA - 5 times, and trade between the two countries - 5.3 times, from 2001-2018 it grew by 622.5 billion US dollars.

The indicators of countries' commodity imports show the opposite situation with export (Fig. 2, the right axis is the USA and China, the left is the world indicator), the USA import share is growing annually, however, between 2008 and 2018, it replaces the reduction in China.

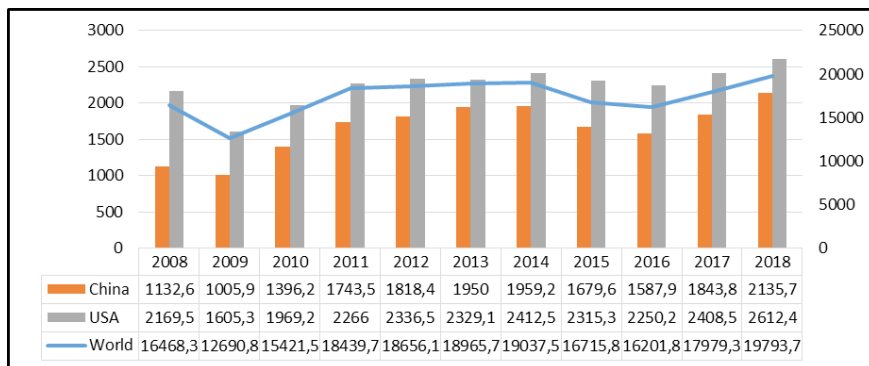


Figure 2. Volume of merchandise imports of the USA and China, 2008-2018 (billion US dollars)³.

²Compiled by the author according to UNCTAD. UNCTADstat: Merchandise: Total trade and share, annual Access: <https://unctadstat.unctad.org/wds/ReportFolders/reportFolders.aspx>.

³Compiled by the author according to UNCTAD. UNCTADstat: Merchandise: Total trade and share, annual Access: <https://unctadstat.unctad.org/wds/ReportFolders/reportFolders.aspx>.

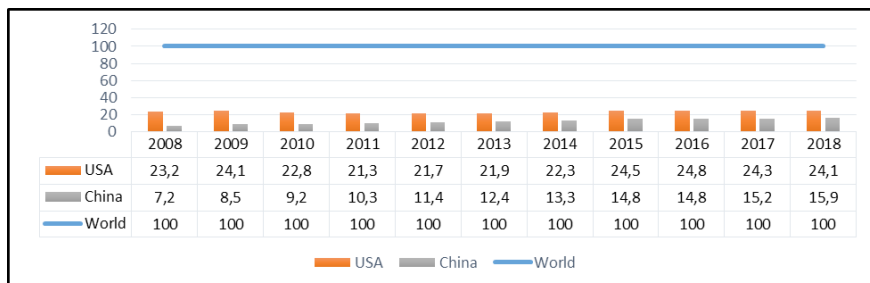


Figure 3. The share of USA GDP in the WGP(world gross product), 2008-2018 (in %)⁴

After analyzing the export and import volumes of the economies of the countries, we note that the USA GDP indicators remain significantly higher than China, occupy greater share in world terms (Fig. 3)

China entered the WTO in 2001, after which the volume of US trade with China grew from 125 billion US dollars in 2001 to more than 700 billion in 2018, being in third place after Canada and Mexico. As many economists have noted, China is the lender and holder of US Treasury bonds, being in first place in the world⁵.

China is one of the main economic partners of the United States, at the same time a serious economic competitor and a potential rival that poses a serious threat. This is explicitly stated in the US National Security Strategy, which states that “China and Russia are the main challenges for the American nation, US influence and interests, trying to undermine America’s security and well-being. The strategy calls for a revision of China’s policy over the past two decades, noting that policies aimed at building partnerships based on trust have failed.

The trade deficit, today, is one of the important aspects of US-Chinese relations. Trying to narrow the gap between savings and investment, this policy is unlikely to lead to a change in the trade balance.

Experts at the Brooklyn Institute and the American Institute of Entrepreneurship noted that total sales of US companies to China, including direct exports (228 billion US dollars) and sales of affiliated American companies in China (574 billion US dollars) amounted to 802 billion US dollars in 2019. China’s sales to the United States, including direct export (523 billion US dollars) and sales of affili-

⁴Compiled by the author according to UNCTAD. UNCTADstat: Gross domestic product: Total and per capita, current and constant (2020) prices, annual. Access: <https://unctadstat.unctad.org/wds/ReportFolders/reportFolders.aspx>

⁵Smirnov, E.N. Introduction to the course of the world economy (economic geography of foreign countries): study guide / Smirnov E.N. — Moscow: KnoRus, 2017. — 405 P. — ISBN 978-5-406-02002-9.

ated Chinese companies in the United States (45 billion US dollars) - 568 billion US dollars. Thus, 92% of Chinese exports were from direct deliveries from China to the United States, and for the United States - 71% exports accounted for sales in qi Thai through affiliated companies. Thus, the issue of trade balance takes on a new dimension⁶.

The Chinese economy has become an integral part of the global system of production chains; most of China's export products consist of overseas components first shipped to China.

Manufactured goods imported into the United States at relatively low prices are holding back inflation, reducing it by 1-1.5% per year. For an average American household, the savings are about 1,000 US dollars per year.

At the moment, the situation remains unstable, the economic relations between the United States and China as the two largest players in the world arena were mutually beneficial, and trade between the countries had unprecedented volumes. However, the United States seeks to escape from potential threats based on the dependence of the national economy on Chinese imports, which is a prerequisite for the country's active positioning in the political arena. It will not be possible to "Cut" cooperation with China, which has been growing painlessly for its own economy for 20 years, many multinational companies in America base their production capacities in China, and the commissioned ones undermine their competitiveness in the world market.

Naturally, one must understand that an economic war was inevitable, the threat of USA dependence grew gradually, and China's actions, such as industrial espionage and currency speculation, only exacerbated the situation. In such conditions, the question remains: who loses more under the conditions of limiting trade between countries, and who wins? In my opinion, USA losses will be more significant, since China is an interesting counterparty for many countries and has well-established relations, including with Russia, while the United States has a tough foreign policy, the price of which may be unreasonably high. But today, when the entire global economy is in a pandemic, namely the coronavirus, the situation has changed dramatically and now it is very difficult to predict anything.

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改革俄罗斯法律行政责任研究所
**REFORMING THE RUSSIAN LEGAL INSTITUTE OF
ADMINISTRATIVE RESPONSIBILITY**

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注解。 本文讨论了有关行政责任法律制度进一步发展的各种概念性观点。特别注意确定有关行政犯罪的立法目标。 提出了对法人实体承担行政责任的问题以及对准行政犯罪承担责任的问题的描述。

关键字: 行政责任, 行政犯罪, 准行政犯罪。

Annotation. *The article discusses various conceptual views on the further development of the legal institution of administrative responsibility. Particular attention is paid to determining the goals and objectives of the legislation on administrative offenses. The author's description of the problems of bringing to administrative responsibility of legal entities, as well as the problems of bringing to responsibility for quasi-administrative offenses is proposed.*

Keywords: *administrative responsibility, administrative offenses, quasi-administrative offenses.*

Currently, the Russian Federation is undergoing an active process of reforming the legislation on administrative offenses, various concepts of a new codified legal act are being discussed that allow building a systematic and detailed multi-purpose legal institution of administrative responsibility.

Increasingly, legal responsibility, its content, regulation and types are becoming the subject of scientific research by modern scholars, both administrators and specialists in the field of constitutional, municipal, environmental, civil, financial, budget and tax law.

There are two distinct conceptual views on the further development of the legal institute of legal liability. A number of scientists [1, 3, 6] adhere to the classical characteristics and types of responsibility, highlighting constitutional, criminal, disciplinary, civil law, material and administrative responsibility. They substantiate their position by the lack of scientific research and evidence of various material and procedural regulation of relations similar in objects and subjects, in the degree

of wrongfulness of actions (inaction), for example, in administrative and tax law or in administrative and customs law.

Other scholars [2, 4, 5] claim the emergence and development of “special”, “new” types of responsibility depending on the legal relationship, the protection of which is directed at measures of state coercion. “New” types of liability include corporate, financial, tax, business, customs, municipal, environmental, family and legal responsibility, etc. The opinion on the existence of such types of legal responsibility is based on the complete formation of individual branches of law and current legislation, for example, legal liability in financial law, as in the established branch of law, is established not only in the Code of Administrative Offenses of the Russian Federation, but also in the Tax Code of the Russian Federation, and in the Budget Code of the Russian Federation.

The above species classification in relation to administrative responsibility is based on two opposite formulas:

- “branch of law = branch type of responsibility”. For example, financial law is ensured by financial responsibility enshrined in the Budget Code of the Russian Federation, the Tax Code of the Russian Federation, the Code of Administrative Offenses of the Russian Federation, Federal Law of 10.07.2002 No. 86-ФЗ “On the Central Bank of the Russian Federation (Bank of Russia)” and other federal laws;

- “branch of law = administrative responsibility”. For example, financial law is ensured by administrative responsibility enshrined in the Code of Administrative Offenses of the Russian Federation with unified approaches to the procedure of prosecution, to determining the guilt of a legal entity, to an exhaustive list of administrative penalties, etc. Moreover, in order to avoid duplication of responsibility in the implementation of the second formula, it is required to exclude legal rules governing liability for violations in the financial sphere from the Budget Code of the Russian Federation, the Tax Code of the Russian Federation, the Federal Law “On the Central Bank of the Russian Federation (Bank of Russia)” and other federal laws.

In our opinion, the proposed formulas require a detailed study, which should begin with the definition of the goals and objectives of the legislation on administrative offenses.

Currently, such tasks are:

- protection of the individual, public morality, legal economic interests of individuals and legal entities, society and the state;
- the protection of human and civil rights and freedoms, the health of citizens, the sanitary and epidemiological well-being of the population, the environment, the established procedure for exercising state power, public order and public safety, property

from administrative offenses, as well as the prevention of administrative offenses (Article 1.2. Administrative Code).

All of the above tasks on a functional basis indicate three main purposes of administrative responsibility: to protect, guard and prevent.

To protect means to protect against encroachment, attack and other harmful actions. In this case, the legislation on administrative offenses is an integral part of the legislation on ensuring the security of the Russian Federation, and the main task of administrative responsibility is to protect, protect the identity, public morality and economic interests of individuals, society and the state from administrative offenses.

An integral part of protection is protection and warning. To protect means to take measures to prevent violations, to preserve, and in the case of administrative responsibility, to preserve human and civil rights and freedoms, the health of citizens, the sanitary and epidemiological well-being of the population, the environment, the established procedure for exercising state power, public order and public safety property.

A wide coverage of public relations arising in various spheres of the life of society and the state, the protection and protection of which is carried out using administrative and legal coercion measures, indicates the universality of the legal institution of administrative responsibility. Representing a set of legal norms that are protective and protective in nature, it is called upon to ensure effective, stable, continuous and consistent state administration. That is why, in our opinion, the complexity and systematic nature of administrative responsibility should be maintained by combining in a single codified legal act all the many disparate legal rules governing liability for violations in the field of public administration.

The proposed complexity of administrative responsibility, in contrast to the many "new" types of legal responsibility, will eliminate the existing inconsistency of legal regulation of significant social relations.

Firstly, to exclude various state approaches to proceedings on offenses in the field of public administration, the composition of the participants, the subject of proof, the application of interim measures, as well as circumstances that exclude the guilt of a person, and the procedure for appeal. Currently, proceedings on offenses provided for by the Budget Code of the Russian Federation, the Tax Code of the Russian Federation and the Code of Administrative Offenses of the Russian Federation are significantly different. For example, for violations of the legislation on taxes and fees, the statute of limitations for liability under the Code of Administrative Offenses of the Russian Federation is one year, and under the Tax Code of the Russian Federation - three years; for violation of the budget legislation of the Russian Federation, the statute of limitations for liability under the Code of Administrative Offenses of the Russian Federation is two years, and according to

the Budget Code of the Russian Federation, the deadline for applying the budgetary coercive measure is not established.

Secondly, to exclude cases of prosecution for offenses, which are currently referred to as quasi-administrative. These include violations in the field of public administration not classified by the Administrative Code of the Russian Federation as administrative.

In accordance with Part 1 of Art. 2.1. Administrative Code of the Russian Federation is recognized as an administrative offense of unlawful, guilty action (inaction) of an individual or legal entity, for which the Administrative Code of the Russian Federation or laws of the subjects of the Russian Federation on administrative offenses established administrative responsibility.

Therefore, if liability is established by other federal laws or regulatory legal acts, for example, the Federal Law “On the Central Bank of the Russian Federation (Bank of Russia)”, the Law of the Russian Federation dated December 27, 1991 No. 2124-1 “On the Mass Media”, and the Federal Law of 02.10. 2007 No. 229-ФЗ “On Enforcement Proceedings”, by the Decree of the President of the Russian Federation of February 28, 1995 No. 221 “On Measures to Streamline State Regulation of Prices (Tariffs)”, etc., such offenses do not apply to administrative offenses, despite the fact that they defend and protect the order of states management in various spheres of life.

It should also be noted that the proceedings on cases of quasi-administrative offenses are not regulated and in some cases have a conditional, approximate procedure (for example, the procedure for depriving a journalist of accreditation is established by authorities and institutions at their own discretion).

Thirdly, the comprehensive regulation of administrative responsibility in a single codified act will eliminate the parallel involvement in different types of liability for one offense. We give an example of tax law, comparing the liability under Article 15.5. Administrative Code of the Russian Federation and Article 119 of the Tax Code of the Russian Federation.

Both articles provide for liability for taxpayer failure to submit a tax return (calculation of insurance premiums) to the tax authority at the place of registration on time.

In the first case (Article 15.5. Administrative Code of the Russian Federation), the specified offense is considered administrative, and an official is brought to administrative responsibility.

In the second case (Article 119 of the Tax Code of the Russian Federation), the specified offense is considered taxable and a legal entity is brought to responsibility.

Taking into account that the guilt of a legal entity in committing a tax offense has the nature of subjective imputation, that is, it is determined depending on the

guilt of its official whose actions (inaction) determined the commission of a tax offense (part 4 of Article 110 of the Tax Code of the Russian Federation), we note the actual prosecution for one offense at the same time of two persons: an official of the organization that did not fulfill the obligation to submit a tax return, and the organization itself that could not act against the will of an official, to represent its interests.

Thus, when reforming the legislation on administrative offenses, it is proposed to create a comprehensive and systematic codified act containing all the necessary measures of administrative and legal coercion, excluding quasi-administrative and other duplicate types of liability.

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数字化策略是国家整合协会（欧盟和欧洲经济联盟）知识经济发展的一个因素
**DIGITAL STRATEGIES AS A FACTOR OF KNOWLEDGE ECONOMY
DEVELOPMENT IN INTEGRATION ASSOCIATIONS OF STATES
(EU AND EAEU)***

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抽象。 本文结合联合国（EU和EAEU）可持续发展议程，讨论了国家一体化协会（欧盟和EAEU）中形成数字“知识经济”的法律问题。 在全球，区域和国家层面，人们都认识到需要针对数字化转型的知识经济的政策和法律框架。 数字化战略以及研究和创新框架是管理科学技术发展和知识经济形成的基本法律手段之一。 在一体化联盟（欧盟和欧洲经济联盟）中，数字化战略既为创新目标也为一体化目标服务。

关键词：可持续发展，数字技术，数字战略，研究与创新，法律框架，法律文件，数字经济，信托服务，区域一体化，知识经济。

Abstract. *The article discusses the legal issues of formation of the digital "knowledge economy" in the integration associations of states (EU and EAEU) in conjunction with the UN Agenda for Sustainable Development. At the global, regional and national levels the need for a policy and legal framework for a knowledge economy focused on digital transformation is recognized. Digital strategies, along with research and innovation frameworks, are among the fundamental legal instruments governing scientific and technological development and the formation of a knowledge economy/ In the integration unions (EU and EAEU) digital strategies serve both innovative and integrative goals.*

Keywords: *sustainable development, digital technologies, digital strategies, research and innovation, legal framework, legal documents, digital economy, trust services, regional integration, knowledge economy.*

The 2030 Agenda for Sustainable Development outlined a plan to create the conditions for sustainable economic growth. Among the most important conditions is the increase in the technological potential of the economy in all countries through public and private funding of research and development; the creation of a mechanism to promote the development of technologies.

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The 2030 Agenda for Sustainable Development is being implemented in the context of the transition of modern society to the fourth technological order, the fundamental feature of which is the dominant role of knowledge and the most "knowledge-intensive" digital technologies.

Economic and social activities today use a wide range of digital technologies that can bring significant results in the field of sustainable development. These include: big data; blockchain; Internet of things; 3D printing; robotics; sensors; augmented reality; artificial intelligence and cloud computing.

At the same time, integration associations of States note the interdependence between sustainable development, digitalization and other processes taking place in the economic and social fields, including in the field of politics and law. In this regard, the need to identify the underlying nature of the changes caused by digital transformation, and not just focus on the technologies themselves, is emphasized.

Regional and national programs and strategies for digital development have been formed in integration associations of States, such as the EU and the EAEU, as well as in the member States of these associations, on the basis of which "digital spaces" are deployed along with "knowledge spaces". Digital strategies embody harmonized legal approaches to digital development, which are followed by States within the framework of integration associations.

In the European Union, the objectives of developing an economy based on knowledge, research and innovation as a competitive advantage of the EU and its member States were set in the Lisbon strategy, the Europe 2020 strategy, and the Horizon 2020 financing program for the period from 2014 to 2020. These documents provide for intensive promotion of breakthrough technologies and developments from research organizations to the market; support for the implementation of scientific ideas in innovative products and services; the use of highly promising technologies, including information and communication technologies, in order to solve social problems. Accordingly, the Horizon 2020 has allocated funding for three main purposes: "industrial leadership, advanced science and response to social challenges". Thus, the legal concept of the European Research Area (ERA) - the unified research environment of the European Union, provides for the free movement of researchers, information, scientific knowledge and technology, "open access to knowledge" in the EU; coordination of national research programs with initiatives funded and implemented at the pan-European level.

In the "Europe 2020", the socio-economic development of a unified Europe is associated with the spread of telecommunications, digital technologies in the EU member States and the formation of a digital single market of the European Union. In this regard, the Digital Agenda for Europe (DAE) program is one of the flagship projects of the Europe 2020 strategy, which includes providing access to organizations, institutions and consumers to digital goods and services, creating optimal

conditions for promoting digital networks and accelerating the development of the digital economy. The legal basis for the digital strategy of the single market is formed by legislation that supports the creation of an open and secure digital environment in the European Union. The digital agenda for Europe includes improving standards; building trust on the Internet; promoting high-speed Internet access for all categories of users; investing in research and innovation in this area; promoting digital literacy and skills; and developing artificial intelligence. In compliance with the EU legal instruments on removing barriers to digital goods and services in the single European market, Regulation no 910/2014 of the European Parliament and of the Council On electronic identification and trusted services for electronic transactions in the internal market and repealing Directive 1999/93/EC, which regulates cross-border secure electronic interaction between citizens, businesses and public authorities throughout the European Union.

In accordance with the "digital single market Strategy for Europe" and the "Horizon 2020" program, the EU is developing the "European Open Science Cloud" (EOSC) - a single European virtual environment for storing, managing, analyzing and reusing data for research, innovation and educational purposes. The concept of the European open science cloud (EOSC) was formed at the level of the European Commission as the idea of an extensive infrastructure to support and develop open science and open innovation in Europe and beyond.

As one of the stages of implementing the digital single market strategy, on 10 January 2017 the EU Commission published a Communication on Building a European Data Economy which involves the development of regulation of access to data and their transfer.

As part of the next long-term EU budget - the Multiannual Financial Framework - the Commission has proposed the Digital Europe program focused on building the strategic digital capacities of the EU and on facilitating the wide deployment of digital technologies, to be used by Europe's citizens and businesses. The program will boost investments in supercomputing, artificial intelligence, cybersecurity, advanced digital skills, and ensuring a wide use of digital technologies across the economy and society. Its goal is to improve Europe's competitiveness in the global digital economy and increase its technological autonomy. Digital Europe will complement other programs that support digital transformation, such as Horizon Europe 2021-2027. (Horizon Europe).

In the Eurasian Economic Union, the member States of the EAEU pursue a coordinated policy in the field of digital transformation of the economy of this integration Association. The use of information and communication resources and systems, primarily the integrated information system of the Union, as well as the deployment of high-tech production is carried out in order to ensure integration processes in the EAEU and strengthen the common economic space. The legal

framework is The Treaty on the EAEU, including the Protocol on information and communication technologies and information interaction within the EAEU (Annex 3 to the Treaty, which is an integral part of it). "The concept of using services and legally binding electronic documents in interstate information interaction" approved by The decision of the Council of the Eurasian economic Commission on September 18, 2014, provides for the use of trusted services within the EAEU and the formation of a so-called "cross-border space of trust". The legal structure of the trust space applies to the electronic exchange of data and *дупфд* documents between the member States of the Union, which agree on the legal, organizational and technical conditions for electronic interaction.

As already mentioned in this paper, integration associations of States have developed and adopted strategic programs - digital agendas, which provide for the transition to a digital form of interaction and the creation of digital spaces. On December 26, 2016, the decision of the Supreme Eurasian economic Council "on the formation of the digital agenda of the Eurasian Economic Union" was adopted. The digital agenda of the EAEU is implemented in the areas of economic cooperation established in the EAEU Treaty and is aimed at implementing the "Center of power" scenario outlined in the "Main directions of economic development of the EAEU" within the common economic space of the Union.

The strategic document "Main directions of implementation of the digital agenda of the EAEU until 2025" defines the principles, tasks and mechanisms of cooperation between the member States on the digital agenda and the formation of a single digital space of the Union, which integrates information resources, as well as a set of digital infrastructures, digital processes and means of digital interaction. Mechanisms for implementing projects within the framework of the digital agenda of the EAEU include the procedure for preparing, implementing and monitoring, as well as the functional structure for implementing such projects. The project is implemented if it is approved by all member States and if at least 3 member States participate in it. The priority initiatives planned within the EAEU in accordance with the digital agenda until 2025 are: 1) digital tracking of the movement of products, goods, services and digital assets; 2) digital commerce; 3) digital transport corridors; 4) digital industrial cooperation; 5) data turnover agreement and a number of others.

In accordance with the Main directions of implementation of the digital agenda of the EAEU until 2025, as well as the Main directions of industrial cooperation within the EAEU, the project "Eurasian network of industrial cooperation, sub-contracting and technology transfer" has been launched, which involves all the member States of the EAEU.

Programs and projects of the digital agenda of the EAEU are implemented in the context of improving the law of the Union, in connection with the trends of

global digital transformation, as well as the harmonization of the legislation of the member States and the construction of comparable legal regulation in this area. For example, the development of a universal legal structure of the cross-border trust space provided for by the Treaty on the EAEU is underway.

At the same time, the EAEU member States independently develop, form and implement national measures for the development of the digital agenda based on the national interests of each of the member States, their level of economic development, as well as technological features and the state of the digital infrastructure. The obligations assumed by the EAEU member States on the basis of international agreements concluded by them with third countries that are not members of the Union are also taken into account.

Regional digital strategies, along with research and innovation frameworks, are among the fundamental legal documents regulating scientific and technological development and the formation of the knowledge economy. In integration associations of States, such as the EU and the EAEU, digital strategies serve to achieve both innovation and integration goals within the framework of a coherent policy that member States ensure in accordance with the law of the Union.

培训未来教师从事经济活动的数字教育环境
**DIGITAL EDUCATIONAL ENVIRONMENT IN TRAINING FUTURE
TEACHERS FOR ECONOMIC ACTIVITY**

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注解。 本文讨论了通过数字教育环境对现代教师进行经济活动的专业培训
的当前问题,以及数字环境的构成要素,这些要素有助于未来教师的经济活动的形
成。

关键字: 数字环境, 经济活动, 未来的教师

Annotation. *The article discusses current issues of professional training of a
modern teacher for economic activity by means of a digital educational environ-
ment, as well as the components of a digital environment that contribute to the
formation of economic activity of future teachers.*

Keywords: *digital environment, economic activity, future teachers*

In the system of professional training of future teachers at the present stage of
development of higher professional education, searches are underway for ways
to improve the quality of education. These areas are economic competence and
ICT competence of future teachers. In modern conditions of the development
of society, the paradigm of education is transforming, and interest in human life
processes is increasing, which is accompanied by changes in all areas of human
practice. Modern branches of human activity such as the digital economy and eco-
nomic informatics are emerging. Active professional activity with the use of ICT

technologies, organized in a special information environment, becomes relevant. The impact of the changes is reflected in the training of future teachers [1, p. 9].

Categories such as the digital educational environment and economic activity come to the fore.

New priorities in the development of higher education, identified in the Concept of socio-economic development of the Russian Federation, are associated primarily with the achievement of a new quality of education that meets both the needs of the labor market and international standards. Higher education has been given the task of training specialists able to implement all the areas of development of the necessary economic competence determined by the federal state educational standard, which allows it to actively participate in the search and creation of jobs and the improvement of the regional economy as a whole [2].

The priority project “Modern Digital Educational Environment in the Russian Federation”, approved by the Presidium of the Presidential Council for Strategic Development and Priority Projects (Minutes No. 9 of October 25, 2016), as well as the national Education project, translates the educational environment into digital format. “The modern world is becoming more and more digital. And this means that the education process should also be digital, consistent with the realities of the modern and future world” [2, p. 197].

The role of the university as one of the components of the modern education system is very significant in the training of future specialists. It is called upon to form a sufficient level of systemic economic knowledge, decision-making skills that make up the foundation of activities in various fields, therefore the university cannot avoid solving the issues of formation and development of a digital educational environment. Economic orientation, being one of the first tools for creating personal adaptation to socio-economic changes, serves as a way of personal development, the dissemination of economic knowledge, a means of forming human capital, therefore, as it seems to us, it should also be prepared in innovative conditions and with the use of a digital educational environment.

Preparation of graduates for professional activities in line with the innovative approach based on digital technologies and the digital educational environment, involves:

- an increase in the share of students' independent work, since this preparation is impossible without increasing the role of independent work on educational material,
- innovative support for the formation of cognitive interests of students,
- strengthening the responsibility of teachers for the development of skills of innovative activity of students,
- stimulating professional growth of students,
- education of their activity and initiative [3].

In the educational environment of a modern university, the position of the teacher is changing. Now he not only transfers knowledge, but also provides support and support for the student's educational activities, that is, performs the functions of a consultant, moderator, facilitator, tutor [4].

The analysis of the teacher's modern functions shows the originality of the teacher's modern professional activity, which means that the true meaning is realized, the purpose of the teacher's activities is to support, support the student, facilitate his studies, assist in the formation of personalized educational paths and ensure continuous long-term interaction through the digital educational environment .

Also, one of the characteristics of the educational environment of a modern university is the introduction of teaching technologies that correspond to the development of the activity of future teachers (information and communication technologies, project training, distance learning, digital, robotic, etc.) [4, 5].

The digital educational environment creates the conditions for high-quality preparation for the economic activity of future teachers. The vector of development of the educational environment. Considering the levels of the educational environment of a modern university, which can be described as a complex system of multilevel education, reflecting changes in the modern educational process in the field of higher professional education, presented at the world, federal, regional levels and the level of the higher educational institution proper [2, p. 219].

Being a multi-level, the educational environment of a modern university is multi-vector. When determining its multi-vector nature in the educational environment, four vectors are distinguished that make up the coordinates of the educational environment (regulatory, regulatory, perspective-orientating, communicative-informational, and activity-stimulating). In our opinion, these coordinates can also characterize the educational environment of a modern university.

Since the main system-forming characteristic of the pedagogical system is a function, we consider it necessary to identify the functions that are most significant, in our opinion, for the digital educational environment of a modern university. An understanding of the conditions of the system's existence will help to distinguish various structural components of the medium under consideration. The most significant functions of the digital educational environment of a modern university are:

- formative and developing (in other words, the main function is to ensure the possibility of a harmonious movement of the student's personality, creating optimal conditions for its development and self-realization);
- regulatory and documentary, as a condition for the functioning of the digital environment and the allocation of the contingent of recipients of educational content;

- the structural function of the digital environment, which corresponds to the structure of the educational environment of a modern pedagogical university as a whole and consists of clusters (resource, which includes the regulatory framework governing the activities of the university), material and technical base (educational facilities and equipment, human resources (university administration, teachers and employees of the university), information and methodological fund (developments used in the educational process); service cluster, includes methods, technologies and tools training needed by students during training in high school; Procedure cluster includes various areas of student activity).

Summing up, we note that the digital educational environment that provides innovative preparation for the economic activity of future teachers is:

- modern, as it has a number of characteristics that are characteristic of the modern level of development of education (competency-based approach, openness, changing the teacher's position, introduction of information technology, digitalization of educational content, formation of economic competence, etc.);

- multi-level, as this is a digital environment at the global, federal, regional levels and at the university level;

- multi-vector, as it has four interconnected vectors: regulatory and regulatory, perspective-orientating, communicative-informational and activity-stimulating;

- multifunctional, since in the presence of certain conditions it performs various functions, the main of which are formative and developing, but taking into account the innovative approach and the use of digital resources.

The positions indicated by us in this article are the beginning of a long-term study aimed at the implementation of the national Education project, and we will continue research in terms of filling the digital educational environment with components and functions ensuring the effectiveness of training future teachers, including in terms of the formation of economic activity.

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苏联儿童的日常劳动和休闲活动是预防反社会行为的一个因素（根据20世纪60年代“老师的报纸”和“父母的学龄儿童”杂志的资料）

EVERYDAY LABOR AND LEISURE ACTIVITIES OF SOVIET CHILDREN AS A FACTOR IN THE PREVENTION OF ANTISOCIAL BEHAVIOR (BASED ON MATERIALS OF "TEACHER'S NEWSPAPER" AND "PARENTING SCHOOLCHILDREN" MAGAZINE IN THE 60S OF THE XX CENTURY)

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抽象。 根据对《教师报》和《父母学童》杂志的分析，本文重新建构了20世纪60年代苏联学童的工作经验。 儿童的日常劳动活动与文化和休闲活动相结合，被认为是预防未成年人反社会行为的一个因素。

关键词：反社会行为，学校的“赫鲁晓夫改革”，儿童劳动活动的内容，小学生劳动活动的结果，小学生劳动活动的例子，童工的风险，小学生对劳动成功的奖励，文化 儿童的休闲活动，价值观。

Abstract. *In the text, based on an analysis of the materials of "Teacher's Newspaper" and the journal "Parenting Schoolchildren", the work experience of Soviet schoolchildren in the 60s of the XX century was reconstructed. The daily labor activity of children in combination with cultural and leisure activities is presented as a factor in the prevention of antisocial behavior of minors.*

Keywords: *antisocial behavior, "Khrushchev's reform" of the school, the content of the children's labor activity, the results of the schoolchildren's labor activity, the examples of schoolchildren's labor activity, the risks of child labor, the schoolchildren's rewards for labor successes, cultural and leisure activities of children, values.*

According to the terminological juvenological dictionary, *asocial behavior* - is "a kind of deviant (deviant) behavior that is harmful to society. Unlike antisocial behavior (theft, hooliganism, etc.), *antisocial behavior* is not directed against existing social relations. Asocial behavior includes a wide range of behavioral acts - from social infantility in the behavior of children, adolescents and youth, to mentally insane states, i.e. all cases when young people are not able to understand the social meaning of their actions [10].

In order to prevent asocial behavior, large-scale foreign studies of the problems of the involvement of children and adolescents in criminal subcultures are carried out [9]. As a result of generalized scientific searches, a risk group was determined - "adolescence is the most dangerous age in terms of the risk of involvement", or rather, children under 14 years of age [9, p. 20]; the types of criminal teenage subcultures are highlighted; the reasons pushing them to criminal activity are studied; it was found that "adolescents involved in the activity of criminal subcultures demonstrate a four-fold excess of indicators of violence and delinquent behavior compared to those not included regardless of the country" [9, p. 27].

Historical analytical and statistical surveys of domestic scientists show (V.N. Kudryavtsev, 1999), (A.I. Dolgova, 1981, 2001) that juvenile delinquency in certain periods of our country either decreased, stabilized, or grew. *It is important for us to study the positive historical and pedagogical experience of social institutions that organized and controlled the socialization of children and adolescents.* We find such experience in socio-pedagogical practice of the early 60s of the last century.

After the end of World War II, economic devastation and poverty led to an increase in crime. "Crowds of street children reappeared in the country - children who lost their parents during the war, were forced to "undertake" thefts and robberies in order to get a piece of bread" [2]. In the study of legal psychologist E.V. Vasque noted that serious crimes were committed by minors, since the "Allure of Crime", against the background of adaptation to death as such, which the children observed during the long years of the Great Patriotic War, psychologically facilitated the formation of a stable motivation for them to commit serious crimes, especially under the guidance of adults" [2].

Under the influence of a timely large-scale program of government measures, by the beginning of the 1960s there was a decrease not only in juvenile delinquency, but also in general crime [2], and child homelessness was completely eliminated.

In recent years, many works have been devoted to the study of various pedagogical and psychological aspects of asocial behavior of minors and its prevention, such as candidate dissertations of E.K. Zvyagina (2006), T.V. Beloshapki (20010), E.M. Popova (20011), O.A. Oferkina (2013), M.M. Shatalova (2014), I.S. Sokolova (2015), doctoral dissertations of A.A. Kochina (20007), F.K. Zinnurova (2011), Z.K. Davletbaeva (2019) and others, in some of them the study of domestic experience is considered as one of the research tasks [7].

The question of the role of labor in the development of man is traditionally one of the most important in pedagogy. Problems of mastering labor skills by a child, building respect for the results of labor, comprehending the meaning of labor formed the basis for the scientific searches of the classics of pedagogy: D. Dewey, G. Kershensteiner, Ya. Korchak, D. Locke, AS Makarenko, T. Mor, I.G. Pestalozzi, V.A. Sukhomlinsky, K.D. Ushinsky et al.

Our task is to study the daily work of children in the 60s of the XX century, presented in the pedagogical periodical of that time ("Teacher's Newspaper" and the journal "Parenting Schoolchildren").

A review of scientific sources shows that the work of Soviet schoolchildren in the 60s of the XX century, presented in the central pedagogical periodicals, has not yet become the subject of a separate scientific study. We hope that this study will help to partially fill this gap.

Before analyzing the Teacher's Newspaper and Parenting Schoolchildren materials themselves about the working days of schoolchildren in the 60s of the XX century, we turn to the most important substantive background of the question. By the end of the 50s of the XX century, the Supreme Soviet of the USSR adopted the law **"On Strengthening the Connection of Schools with Life and on the Further Development of the Public Education System in the USSR"** (24.12. 1958). It was this law that launched the Khrushchev reform of the school, which lasted until the mid 60s of XX century. One of the reform issues was the preparation of technically competent personnel for industry and agriculture, as the *country was recovering from the dire consequences of the Great Patriotic War and was heading for the further development of the economy*.

The 60s of the XX century - is the period when it was precisely the schoolchildren's labor activity that became the most important issue of Soviet pedagogy, which is why the topic of schoolchildren's labor was one of the central issues in pedagogical periodicals.

Reflecting the *content of the labor of urban schoolchildren*, publications drew attention to: the development by children of the elementary labor skills of the working professions in which the USSR felt the need; enthusiastic classes in circles and sections in which children could develop their technical, artistic, sports abilities; at the same time, labor activity in circles and studios was considered not only as a premise for entering the profession, but to a greater extent as the basis for the personal development of the child.

Typical notes in 1960 in the "Teacher's Newspaper" informed that, for example, Nizhny Tagil, younger schoolchildren study locksmithing, and ninth-graders go to a factory in a turning workshop to practice; in Omsk, school №88 has its own factory with mechanical, locksmith and sewing workshops, in which the school "working class" masters important labor skills, and there are also rationalizers and even inventors among the children. In the premises where the children worked, slogans hung: "Our thoughts, talents, deeds - for the motherland !"; "The country of socialism needs no lazy kids!" (N.K. Krupskaya) et.al. Note that after school lessons, city children rushed to the workshops of various plants and factories, workshops to get primary labor professional skills of those types of activities that the country needed. Nevertheless, this activity was organized by the school and there was no choice of production base for children.

The content of the labor of rural schoolchildren was presented in the periodical through the personnel requests of collective farms and state farms — the development by schoolchildren of the basics of the labor of modern machine operators, vegetable growers, etc. In the 60s of the XX century, almost all rural residents had a private household, livestock, and poultry. After school, the life of rural schoolchildren was associated with daily hard work in the family, but the "Teacher's Newspaper" did not cover this topic. Almost every issue of the newspaper published notes about the work of rural children in student production teams. Basically, the children were engaged in familiar work: they cultivated and then harvested corn, apples, potatoes, grapes, tomatoes, and sugar beets. In the summer labor and recreation camps, they mastered crop production, rabbit farming, poultry farming, beekeeping, etc.

The newspaper also described almost funny situations. The chairman of the "Red Don" collective farm (1967) came to the summer tourist camp "Rocket" with a request. He asked the kids to prepare nettles for feeding chickens. The pioneers liked that he turned to them personally, without intermediaries. They picked up nettles, no less than six tons. Probably, without a true conviction of the importance of their work and genuine enthusiasm, it would hardly have been possible for the pioneers to work so bravely.

There were publications about special labor practices, for example, in the village of Alyger of the Irkutsk Oblast, senior students taught the theory of hunting for a month and a half, and then went to the taiga to hunt. Young people made a commitment to kill 75 squirrels during practice. The natural perception of such a task was associated with the traditions of the indigenous peoples of the territory of the Irkutsk Oblast.

The results of the work of schoolchildren

Firstly, these are real products created with childish hands, as well as: 1) self-esteem from the value and importance of their work for their children's team and for the country; 2) a change in the social role of "difficult adolescents", who have shown themselves to be the best in work among peers and adults; 3) acquired experience of social activity in labor, etc.

Quite often, the experience of applying the pedagogy of A.S. Makarenko to include "difficult" adolescents in the working life of a peer collective was described. Orenburgers (1966), for example, talked about the "Cosmonaut Camp", which was attended by ten children, previously sent to an educational colony. For forty days in the life of the camp, a real metamorphosis occurred with them. They worked well there, went in for sports, participated in amateur performances, and most importantly, behaved exemplarily.

The experience of using A.S. Makarenko's pedagogy in organizing "street squads" has been described more than once, which, competing, landscaped their streets, helped lonely old people, brought newspapers and magazines to the field camp, played, staged sports, held street festivals, weekly shows puppet shows,

etc. Based on socially useful labor operations, children acquired the elementary experience of social creativity. The organizers of the children's lives were sure that once awakened activity would later affect everything that a person would do.

The risks of child labor

In connection with the race for performance indicators, certain risks of child labor arose: isolated cases were described when individual high-school mechanics chemically treated flax and used it with herbicides (1968).

Awards for exemplary work

For their work, children in the 60s of the XX century received gifts, certificates, prizes, travel to the capital of the USSR - Moscow, along the Black Sea coast, the opportunity to present their achievements at the Exhibition of Economic Achievements of the USSR. It should be noted that in the 60s the country praised the labor exploits of adults and children. An optimistic, life-affirming musical and literary background praised a working man. The pedagogical periodicals, together with musical art and fiction, instilled in children socialist values, one of which is the value of a working man whose hands "create all the wealth in the world."

Leisure activities of children, its types

In addition to studying and working, Soviet schoolchildren had the opportunity in the second half to attend a variety of classes for free: in amateur art groups, school theaters; at the stations of young technicians and naturalists; in literary circles in which hand-written children's almanacs were issued; in scientific societies of schoolchildren; in local history circles; in children's libraries, clubs; in school circles of automation, telemechanics, radio, photo, film enthusiasts; in military-technical circles; holidays and trips organized by the school; in art studios, choreographic studios, music studios, in various sports sections at the Pioneer Houses and the Culture Houses, at the Housing Office (housing and maintenance offices), etc. [4], [5].

Leisure activities and "difficult" teenagers

Within the framework of the article, it is difficult to reveal the whole variety of children's circle and leisure activities. It is obvious that teachers carried out a well-thought-out state program for the upbringing and organization of children's leisure, but a feature of that time was ***the work with children of enthusiasts, activist parents, and the general public***. In unsuccessful territories where there was an alarming situation in the behavior of adolescents, groups of different ages were organized, parent raids were conducted, interest groups worked, home-based clubs, children's clubs, sports sections, etc. - all of them were led by adult enthusiasts. The pedagogical slogan was the idea of "uniting all the forces of society to educate and control the behavior of children."

Here is one of the fairly typical stories of the "organizer of extracurricular and extramural activities of secondary school №11 of Zelenodolsk, Tatar ASSR." *The children had nothing to do in the evening, they gathered in the basements, played cards, it got to the point that the fifth graders fled home. "They were gone for five days, the group was found on the Sverdlovsk-Moscow train. "Boring at*

home," they answered all the questions. Adults came to the conclusion - to organize groups of different ages at the place of residence. The children's leisure became more diverse: hockey rinks appeared, collective trips to cinema, theaters became more frequent; in the porches of the hoists appeared combat leaflets of detachments. A raid brigade has been set up to check homework and to help those who needed it."(89) *"The following is curious. The guys selected the commanders by secret ballot. And for the most part, "difficult" teenagers turned out to be in charge, many of whom did not trust public work at school "*[8, p. 88-90].

Conclusions

1. The 60s of the twentieth century in the USSR are recognized by specialists as an effective period for the prevention of asocial behavior of minors. State programs for the prevention of the asocial behavior of minors, the activities of the bodies of the Ministry of Internal Affairs of the USSR, the combined efforts of the school, family and the public helped to reduce the crime rate of minors by the early 1960s, and homelessness was completely eliminated.

2. It was during this historical period that the activities of Soviet citizens were largely subordinated to the idea of collectivism, unity, equality and fraternity, pride in their country which were firmly entrenched in the minds of people. Pioneer and Komsomol organizations relayed the values of collectivism and patriotism into children's groups.

3. The 60s of the XX century - is the period when "it was the labor activity of schoolchildren that turned out to be the "mainstream" of Soviet pedagogy" [1]. The content of the labor of rural and urban schoolchildren was presented periodically through staffing requests for collective farms, state farms, and industrial enterprises — the development by schoolchildren of the basics of labor of modern workers, machine operators, vegetable growers, etc. During the summer holidays in the pioneer and labor and leisure camps, self-service work naturally entered the children's lifestyle. The results of children's labor practices were really created products, as well as personal changes and acquired experience of social activity; adjustment of the social roles of "difficult" adolescents and the formation of new values for them (specialists working in the field of penitentiary pedagogy argue that the peculiarity of most juvenile convicts is that they are "not accustomed to analyze and evaluate their actions, their feelings and judgments" [6, p. 48] - and how is this possible if the child has not clarified for himself the values as standards in the choice of behavior?).

4. As a reward for work, children of the 60s of the XX century received gifts, letters, prizes, improved school meals, and travel rewards were organized.

5. "Workers of communist labor", heroes of socialist labor, parents, older comrades, teachers, and children themselves demonstrated examples of labor activity. In pedagogical periodicals and educational practice, the value of voluntary socially useful work of children was promoted.

6. The work of schoolchildren in the 60s of the XX century was focused on safety standards, which at the end of the XX century were revised by the International Labor Organization (beekeeping, work with chemicals for processing agricultural plants, use of firearms for hunting, etc.).

7. Filling the daily life of children with hard work, cultural and leisure activities in various free circles, research activities in technical circles, young people's stations, local history clubs, etc., in aggregate, has become a powerful factor in the prevention of antisocial behavior of children and adolescents.

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罗马勇士的神圣治疗者

DIVINE HEALERS OF THE ROMAN WARRIORS

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注解。 该报告致力于在主宰时代罗马帝国军队的健康万神殿。 根据对来自人口统计学来源的信息的分析, 本文确定了一个罗马, 希腊和色雷斯人的神灵圈子, 他们被罗马勇士们称呼, 希望能够康复, 或者感谢他们在战斗中受伤和受伤后所取得的令人满意的结果 为罗马和皇帝的荣耀。

关键字: 卫生, 原理, 原则, 罗马军队, 阿波罗, 阿斯克勒比乌斯, Hygia, Telesphor, Heracles Salutifer, 礼炮, 若虫。

Annotation. *The report is dedicated to the healthy pantheon of the Roman imperial army in the era of the principate. Based on the analysis of information from epigraphic sources, the article identifies a circle of Roman, Greek and Thracian deities, who were addressed by Roman warriors with the hope of recovery or who thanked them for a happy outcome after wounds and injuries received in the battles for the glory of Rome and the emperors.*

Keywords: *health cults, principate, Roman army, Apollo, Asclepius, Hygia, Telesphor, Heracles Salutifer, Salute, nymphs.*

The head of the pantheon of gods in the ancient world was revered Apollo. Apollo, like Hercules, was not perceived by the Romans as a purely Greek deity and was revered throughout the Empire as the eldest god of the Roman pantheon. But as a healthy deity, he was revered precisely in the Hellenic versions with his companions: the healing god Asclepius, the goddess of a healthy lifestyle, Hygia (in the Roman version, Hygiea - this is our hygiene) and the young recovery demon Telesfor. This can be especially vividly demonstrated on the materials of the Balkan provinces.

In the Balkan provinces, in popularity among the military, he can perhaps only be compared with the gods of the Capitoline triad, especially when paired with

his sister Diana. The cult of Apollo is one of the oldest. It was brought to Hellas, apparently, from Asia Minor in Mycenaean time (II millennium BC). Numerous epithets of God testify to the deep antiquity of the cult of Apollo and its totemic origin: Likeysky (wolf), Smintey (mouse). Dolphinus, etc. In Hellas, Apollo was one of the most important gods of the Olympic religion. He was considered the son of Zeus and the goddess Leto, the twin brother of Artemis and had many functions. First of all, he was the supreme patron who eliminated evil: he guarded people, their herds, crops from wolves, rodents, diseases, patronized travelers and sailors. The main center of the cult was Delphi, where the famous sanctuary of Apollo with the Delphic oracle was located. In this regard, Apollo also had the functions of a diviner-diviner. In Delphi, games were held every four years in honor of Apollo (Delia), here were also the treasures of many Greek and even some Roman cities.

The Romans borrowed the cult of Apollo from the Greek population of Qom. The name of Apollo is already mentioned in the Sibylline books. Its most ancient temple in Rome dates back to the V century BC. In Hellenistic times, Apollo was included among the twelve most important gods of the Roman pantheon. The cult acquired special significance during the time of Augustus, who considered it his patron and built its origin to it. Under Augustus, the cults of Apollo and Diana received equal rights with the gods of the Capitoline triad, and centuries-old games were held in honor of them. In 31 BC e. in Rome, near the Palatine Palace of Augustus, the Temple of Apollo was built, which during the Empire was one of the richest. After the death of Augustus, Apollo and Diana lost the importance of capitol deities, but continued to play a significant role in the Roman religion precisely connected together. The soldiers of the Roman army, both in the West and in the East, revered Apollo exclusively as a deity of healing.

The cult was especially popular with the military, stationed in the Balkans in the habitat of the Thracian tribes, in the provinces of Lower Moesia and Thrace.

So, Apollo appears in three guises - the patron saint of emperors, the warrior deity and the healer together with other healthy celestials.

The cult of the healing deity Asclepius is one of the oldest Hellenic cults. The Greeks considered Asclepius the son of Apollo. The main centers of worship were in Triikka (Thessaly), Epidaurus and Pergamum. In the classical era, Asclepius was revered in conjunction with Hygyia, the goddess of health and his daughter, as well as the young recovery demon Telesfor.

In Rome, the cult of Asclepius penetrates into the III century BC. However, we do not have enough information about the wide popularity of the cult in Italy.

In the imperial era, Asclepius was most popular in the East, where he was revered even as the keeper of the imperial house of the Severus.

In the I-III centuries. the cult of Asclepius was most widespread in all the Bal-

kan provinces. Asclepius was revered together with his companions, as well as the Hero-Horseman, Apollon, Artemis (in Latin inscriptions - with Diana), nymphs.

Monuments relating to Asclepius and his companions represent a rather varied picture. Among them are dedications to Asclepius, Hygien and Telesphorus, Asclepius and Hygyea on the reliefs of the Hero Horseman, Sylvanas, including on the reliefs of Asclepius, Hygiene and Telesphor, Sylvanas with the epithets of Asclepius on the reliefs of the Hero Horseman, Sylvanas, and forest nymphs reliefs of the Horseman Hero, Sylvanas and Diana.

The Greek inscriptions contain dedications to Asclepius, Asclepius and Hygyeus, Artemis, Asclepius and Artemis, Aphrodite, Asclepius and Aphrodite, nymphs. The reliefs depict Asclepius, Hygyea, Telesphor, the Horseman Hero. In Latin - Sylvanas and Diana, Diana, Sylvanas and nymphs. In this case, the relief images are identical in both types of inscriptions.

The close ties between Asclepius, Artemis and the Horseman are typical of the Thracian religion: relief images of the Horseman with the attributes of Asclepius, Artemis riding a doe with the attributes of the Horseman, and inscriptions with joint dedications to these gods are known.

The Latin inscriptions from the sanctuaries of Asclepius in the territory of Lower Moesia were put up either with Roman or Romanized names or (and this is a large part) by Thracian warriors. They contain dedications to Sylvanas and Diana. Considering that the relief images that accompanied these dedications are identical to the reliefs with Greek inscriptions containing the dedications to Asclepius with his companions and Artemis, it can be assumed that the first (Latin) are romanized versions of the traditional Thracian votive monuments, which are reliefs from the Thracian sanctuaries, followed by Greek inscriptions. The name of Artemis is found only in Greek inscriptions, the name of Diana - only in Latin. The situation is more complicated with Sylvanas, which is also mentioned only in Latin inscriptions. Perhaps the name Sylvanas replaces the name Asclepius? After all, in the Thracian sanctuaries we do not meet initiations of Asclepius in the Latin language. However, outside the shrines there were such inscriptions, and all of them were placed by the military or veterans. This is the dedication of the veteran of the III Gali Legion, the centurion of the Frumentarians of V of Macedonia, as well as the centurion of the XI Clavdiv Rubirius from the sanctuary of Diana and Apollo at Montana.

But back to the dedications to Sylvanas from the sanctuary in Chapter Panega. In one of them, Sylvan has the epithet "Saltecaputenus", which is either tracing paper or a translation of Asclepius's frequently occurring epithet "Σαλτεκαπουτενυσ" - "treating in a forest area". To this it should be added that Sylvan in the II-III centuries among the populace of Italy and the western provinces of the empire was revered and as a deity, healer, healer. At the same time, as mentioned above, Asclepius did not play a big role in the Roman religion in the western Empire. Apparently,

therefore, the Thracian warriors who erected monuments in the Thracian sanctuaries used the name *Silvana* as the Latin equivalent of the names *Asclepius*, and the term *Silvestri*, which meant forest spirits, was used as the equivalent to the nymphs.

The same picture appears before us and in the health of votive monuments in the western provinces of the Roman Empire.



Fig. 1. Tombstone with the image of Asclepius, Hygieus and Telesphor.

As you can see, the above sources fully confirm the conclusions made above that the western part of the Roman Empire did not have, in contrast to the eastern, specialized healing cults. Those few inscriptions dedicated to Asclepius, Chigia, and Telesforus are either placed in Dacia, which was a border between the west and east of the province, or immigrants from the eastern provinces in the western part of the Empire and Praetorians in Rome, who, from the time of Tiberius, were recruited from the eastern, primarily Balkan provinces.

In the West and in Italy, the functions of the healing gods were performed by a wide variety of deities.

One of these deities was Hercules, the veneration of which is a very complex picture.

Hercules is perceived by Roman warriors only in a romanized version under the name of the god Hercules. And if in Greece there were two cults of Hercules - as a god and as a hero, then for the Romans Hercules is only a god.

In our opinion, the cult of Hercules even in the Balkan provinces was revered by soldiers in a purely Roman version and penetrated the pantheon of the army through Rome.

Hercules is one of the most popular heroes of the ancient world. The cult of Hercules was prevalent in many places in Greece and beyond. In honor of him, games (heraclea) were held in Sikion, Thebes, on the islands of Kos and Mendoza. Hercules was revered both as a god and as a hero, having two temples in the cities: Heracles of Olympia and Hero. Researchers believe that the cult of Hercules included elements of the Phoenician cult of Melkart, Egyptian beliefs and the solar deities of the East. In Greece, Hercules personified physical strength. He is the patron saint of athletes, a hero with a lion heart, an invincible warrior who leads troops on courageous campaigns and achieves victory. In peacetime, he performs feats for people, protecting them from all evil.

The cult of Hercules penetrates into Rome from the Greek colonies of southern Italy and already by the 4th century BC gains national significance. Here he was revered as an invincible warrior along with Mars and Victoria. He also had supreme supervision over the baths and healing springs and was revered as a healthy deity, was the patron of circus and gladiator performances, the head of games in honor of Venus Genetrix and Victoria Caesaris, as well as the protector of muses.

In the era of the Hercules Empire, the patron saint of victories and triumph, the son of Jupiter. He becomes a symbol of imperial power. It was especially popular during the reign of the Antonin dynasty, whose emperors (Adrian and Commodus) were portrayed in the image of Hercules. At the end of the III century co-ruler of Diocletian Maximian officially held the title of Heraclius.

In the initiations of warriors, Hercules is invariably present along with the elder gods.

In the western provinces of Rome, Hercules was widely popular precisely as a healing deity. This is evidenced by the healthy inscriptions addressed to him.

Mars, as you know, was originally an agricultural, and later the main tribal deity of the Sabines, a neighboring Italian tribe of the Italians. The territory of the Sabines was hostile to the Romans, so Mars was for them the personification of dangerous territories that did not belong to them. He was worshiped, he was asked for protection by warriors and merchants who went outside of Rome. After the conquest of the Sabines, Mars was included in the Roman pantheon as the main deity of the war and its personification.

In the imperial era, there were cults of Mars Victor, Mars Pater, Mars Pater Ulter (Avenger). All these cults were of a military nature, were mandatory for Roman citizens, had separate holidays, which were celebrated in all parts of the Empire.

Strange, but even more often, Mars in the monuments of warriors is not found as a warrior god, but as a healthy deity.

Sylvan was very popular in the army.

Sylvanas was originally the god of forests and generally wildlife, the patron saint of shepherds. He was also revered by warriors. Apparently, this was due to his authority over the forests, where troops often had to act.

In the era of the Empire, when the gods included in the official state pantheon were increasingly losing their popularity among the working poor and slaves, Sylvan became widespread among the civilian population. Thanks to his connection with forests and groves that in ancient times separated one tribe from another, the estate from neighboring plots, he became the god of borders, a boundary, good neighborly relations, the keeper of the inviolability of possession.

He was portrayed in the clothes of a farmer with tools and a dog. Like Hercules, he turned into a deity thanks to his labors for the benefit of people, and also because he helped those who led an honest life. Sylvanas did not have an official cult, but slaves, letters, plebeians organized collegiums for his admirers, built shrines for him at their own expense, and chose his priests. Gifts were brought to him in gratitude for the prophetic dream, healing, liberation from slavery or danger.

In the II-III centuries among the masses of Italy and the western provinces of the Empire, Sylvanas was revered as a healer deity, a healer.

Often it is with Sylvanas that, as sources show, veneration of nymphs.

In the minds of the ancient nymphs personified various natural forces that produced the richness and diversity of flora and fauna. Most often, they acted as satellite gods of Demeter, Hermes, Apollo, Pan, Zeus and Hera. The veneration of certain nymphs by soldiers was apparently associated with the nature of the area in which certain parts of the garrison served.

The nymphs are also facing healthy inscriptions.

Fortune is the goddess of fate; a number of inscriptions as a healthy deity are also dedicated to her.

There are inscriptions in which Fortune is combined with other deities.

One of them was sent to several healthy gods - Apollo, Asclepius, Salute and Fortune - on behalf of Mark Rubirius Zosim, doctor of the IV cohort. The inscription was found in the vicinity of Orenburg and is clearly of a healthy character.

Thus, Fortune in the votive monuments of warriors appears in three guises: a military deity, the patroness of emperors as part of groups of gods and good luck and health in an independent version.

Also in the pantheon of healthy gods, Salute and the goddess of victory Victoria are necessarily present.

Even Nemesis, the goddess of retribution, appears in the monuments of soldiers as a healthy deity in dedication for the health of the emperor, dating from the beginning of the II century, erected by the beneficiary consular Cesidius Amand in honor of the Retribution of Augustus (Nemesis Augusti) I of the Italian Legion.

The Good Goddess (Bona Dea) is an ancient Roman deity of harvest and wild fruits. Later, she becomes a deity of success and a happy outcome, the patron of a family whose well-being depended on the harvest. Subsequently, Bona Dea - the personification of good luck and a happy outcome in general, also helps the soldiers as a healing deity in partnership with Diana and Sylvanus.

The cult of geniuses is one of the oldest Roman family cults. Each family member had his own "genius", which was considered an expression of the strength of a given person, his energy, abilities and at the same time his guardian. The genius of the father of the family was revered by all household and was called Genius familias, or Genius domus. With the development of public life, there appear public geniuses who patronize communities, towns, cities, the entire state and individual state institutions, military geniuses, the genius of the entire Roman people, whose statue was installed at the forum, the geniuses of the provinces and, finally, in the imperial era - the geniuses of emperors, which, since the emperors were officially called the fathers of the fatherland, were revered by all citizens of the Roman Empire. Geniuses were revered in various combinations: with the patron gods of the Fatherland and the emperors, warrior deities, as well as in groups of healthy deities.

Thus, the care of the life and health of warriors was a divine affair and the inheritance of the Gods.

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罗马战士的训练和教育

TRAINING AND EDUCATION OF ROMAN WARRIORS

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注解。 该报告致力于在公理时代对罗马帝国军队的年轻士兵进行教育和培养。 这篇文章基于对叙事历史资料 (Flavius Vegetius Renat) 的分析, 强调了年轻军团的独立和集体准备最重要的方面, 以完成一项艰巨而又光荣的使命-在永恒的荣耀中保护他们的祖国 市(罗马) 和神圣的皇帝。

关键字: 罗马新兵, 原理, 罗马军队, 退伍军人, 罗马军团, 训练罗马士兵。

Annotation. *The report is dedicated to the education and upbringing of young soldiers of the Roman imperial army in the era of the principate. The article, based on the analysis of information from narrative historical sources (Flavius Vegetius Renat), highlights the most important aspects of both independent and collective preparation of young legionaries for a difficult but honorable mission - to protect their Fatherland in the glory of the Eternal City (Roma) and divine emperors.*

Keywords: *Roman recruits, principate, Roman army, legionnaires, Roman legions, training of Roman soldiers.*

Unfortunately, the only summary of the training of soldiers in the Roman army was and remains the "Summary of Military Affairs" Publius Vegetius Renata.

Vegetius considers two types of training. Individual and group. The first is necessary to gain an advantage in individual battles with the enemy, the second helps to win victories in the military unit.

Vegetius notes that physical education and outdoor games are a centuries-old tradition of young Quirits. In public schools according to Greek traditions, students are taught the basics of gymnastics, jumping, fisticuffs, swimming, horseback and chariot riding and other Olympic sports. Already as part of the legion, such classes are carried out with full clothing in military marching or combat equipment, and sometimes also with double luggage. Only when the spirit and body of the young

legionnaire is sufficiently hardened by the tests described above can he begin individual lessons in mastering personal defensive and offensive weapons, devoting all his free time to group exercises.

Traditionally, all Roman male citizens between the ages of 17 and 46 were military-liable. Most soldiers were recruited into legions between the ages of 17 and 23. The main age for joining the army was 20 years old, but there are cases when troops entered the age of 13-14 or 30 years.

Speaking of their origin, the majority of legionnaires called rural settlements or large cities. In fact, only a few of them came from cities. Most cities were shopping centers of the agricultural district and had attached rural territories.

Soldiers from rural areas were preferred because of their stamina, and also because they were not spoiled by the entertainment of city life. Ideal for a legionnaire was considered a growth of six Roman feet (177 cm). The soldiers, whose height was not lower than 172 cm, were selected for the first cohort.

The legionnaire recruit was supposed to be a Roman citizen, but civil wars and aggressive policies led to the legions being dispersed throughout the empire, which in turn forced commanders to recruit local recruits. Therefore, only by training soldiers can the lion's share of the successes of the Roman army be explained.

The main goal of the training is to give the Roman soldier superiority over the barbarian during the battle. The Legionnaire must, above all, surpass his probable adversary with physical strength; it's easy to understand that sports are highlighted here. But you also need to temper character.

Moreover, the teachings were related to discipline, and it was so important that it was deified and erected altars in the camps. Discipline was not reduced to blind obedience to orders - such behavior was more likely a consequence. In fact, in the word "disciplina" we find the root disc-o, -ere; and this verb means "learn." In other words, it is necessary to master the military craft, to "learn" it in all its subtleties. Fulfilling an order, even if it seems pointless, showing respect for elders - all this is part of professional requirements, this is taught in the same way as owning weapons or building a defensive rampart. A warrior who knows what he should do - since he repeated it a thousand times in the exercises - is completely confident in himself and his commanders.

The word "training" means a variety of activities. They can be grouped into two main categories: some were performed individually, others not. The goal in the first case was to provide the Roman soldier superiority over the barbarian, even in a personal duel and even being unarmed. Pure physical training should be distinguished from military training. Warriors start with gymnastics. As in all armies of the world, they march in "sports uniform" or in their equipment, and sometimes with extra load. They must also run and jump, and when circumstances allow (that is, except for desert areas!), They are engaged in swimming.

Recruits underwent drill training on the parade ground, training to walk a leg. Then they were taken out onto the road, urgently pushing, drove them until they walked 20 Roman miles (about 30 km) in 5 hours.

March and combat training were only the first part of the preparation of the recruits of the legion. Further, the recruits went through a rigorous training program, which included running, jumping and horseback riding. There are references to a certain norm in which the legionnaire had to jump on his horse with a second rider and, upon arrival at the place, jump off it, and the unit was required to immediately build into a battle formation. Most likely, such exercises are necessary for ambushes and the rapid movement of groups of troops at a certain point. Also - if there was a pond nearby - they taught swimming.

Having tempered his body, the soldier switches to more focused, more military activities - training in gun ownership. Roman training was based on the same methods that the gladiators used. A heavy pole was set up on the parade ground, approximately equal to the weight of the man. The recruits trained to attack the pole with a heavy wooden sword and used a willow shield to defend it, which was heavier so that it was about twice as heavy as a standard shield (scutum). This was standard practice, all training weapons were heavier than real samples more than 2 times. During training, the legionnaires were constantly reminded that it was necessary to do more stabbing punches and less chopping ones, since a chopping blow is easier to parry. The point is that the construction of the republican (gastati, principes, triarii) and imperial (legion Maria) legions was too dense for a chopping strike. Yes, and weapons (gladius) did not suggest chopping as the main blow (blade length 50 cm).

The legionnaire sought to enter into close contact with the enemy. Then the long spears of the Greek armies and the long swords of the barbarians lost their advantages. When the battle is in cramped conditions it is much more convenient to deliver short stabbing blows from behind the shield.

A soldier is trained to throw darts and stones, shoot arrows from a bow, and also evade their hit. A warrior, as we see, must be able to wield a sling and use a bow. This part of the training is common to military barracks and gladiator schools. Also, special attention was paid to throwing various spears: darts, gast, pilums, heavy long pilums. By the way, throwing a heavy pilum became popular after the legion began to encounter the Greek phalanx and other heavy infantry. Pilums upset the battle order. Heavy pilum had an elongated tip, pierced the shield and wounded the enemy. In principle, for training, soldiers received special weapons, for example, riders had a special helmet. Horse riding is also the last important element of this individual training. It covers not only ordinary horsemen, but also, above all, commanders. Those who did not succeed in achieving the desired results during training, were put on a tough barley diet (by the way, it seems not in

vain: the protein in barley is 12 grams per 100 grams) and they "drove" even more until they showed an excellent result in the ranks during the review senior officers who could watch from the rostrum for ongoing training.

Well, in the end, after lengthy training, the legionnaires finally got real weapons, how light they seemed after a more familiar training. Having received weapons, they again began to "train with the pillar," and when the legion entered the battle, the weapons that the team hated in training, brought death to the enemies of Rome.

As soon as the soldier developed some physical strength and was trained in mastery of the sword and spear, he could move on to the third stage of military training. Now it was a question of providing the Romans with an advantage in battle as part of organized units, in other words, soldiers are moving to collective activities. First of all, they have to carry out community service by virtue of the principle that moving stones helps strengthen the body. Sometimes soldiers build terraces, dig ditches, or erect monuments designed to demonstrate favor with the emperor.

Some of these tasks had a very successful economic application, because it was necessary to draw roads, draw borders between tribes and carry out land surveying and cadastre. Such diverse measures were determined mainly by military expediency, because they were carried out with the aim of facilitating the movement of troops and the supervision of a potential enemy.

The main purpose of training in practice is to train soldiers to act as part of organized units. Everyone needs to know their place in battle, where, when, and how they should move without harm to the unity of their centuries. Officers conduct training simulations of the battle - infantry against infantry or against cavalry. The fleet, in which from time to time the ships are pulled together to prepare for the battle of squadrons, does not avoid this fate.

Given the importance attached to this activity, one cannot leave it to the discretion of everyone. Commanders had to regularly check the level of training of troops. Every morning they conduct an inspection: each centurion is responsible for its unit; the stands should monitor the two cohorts, and the legate - the legion; their movement leads to a series of reports. In addition, special checks have been attested. Sometimes the commander himself goes around the garrisons of a certain area. Under Adrian, for example, Arrian sailed along the shores of the Black Sea. He, of course, checked the condition of the camps, the availability of provisions and lists of personnel. But he did not forget about the training of troops. The training ground was entrusted to the care of a superior called campidoctor and his subordinate doctor cohortis. Root doc - clearly shows that this person was educated and studied his science; it is a trained specialist who must pass on his knowledge to others. His position allows him to have an assistant (optio campi) who is able to

replace him. Two other activities also require the involvement of special specialists. Fencing serves as a field for applying the talents *armatura* or *doctor armorum* - and here, too, the title *doctor* is not devoid of its main meaning.

The existence of a kind of "teacher for teachers" confirms that this art must be specially studied. Likewise, cavalry maneuvers required the availability of specially trained *Voltige* trainers, called the *exercitator* and *magister campi*. A whole hierarchical chain of specialists was, therefore, called to lead and monitor the proper conduct of training.

Such commanders in the army were only responsible for training on the parade ground (*campus*). But some of these classes were held in other places. "Martial arts teachers," says Vegetius, "demand that infantry trainings be held regularly, that they be conducted indoors in rainy and snowy weather, and on the training ground the rest of the time."

With the expansion of Roman conquests and the inclusion of young people living farther from the Eternal City, it was necessary to find new solutions and organize classes either in the hometowns of soldiers or at camps. In the era of the Early Empire, different places were chosen depending on the tasks that needed to be addressed. Firstly, it goes without saying that some exercises were carried out simply on the ground, for example, drill training.

Secondly, warriors also used structures built for other purposes, for example, amphitheaters. Archaeologists have repeatedly noted the presence of arenas near camps; they explained this practice (and rightly so) by the soldiers' addiction to cruel spectacles. But we must take into account the role of another factor. Indeed, the training of soldiers in many respects was similar to the gladiatorial, and practical fencing in good weather could well take place in those places where at other times *retarians* and *myrmillons* fought and died. However, special constructions were erected for military training, which once again shows how much importance the Romans attached to it. So, *basilica for training* (*basilica eexercitatoriae*) is known. As you know, the *basilica*, or "royal portico" consists of a vast hall, covered with a roof; her plan is very simple and is a rectangle with one door, divided into three parts by two colonnades and sometimes having an *apse* at one end (a semicircular ledge). The Romans used such structures to protect them from rain or the sun. Several training *basilicas* were localized in Britain: in *Inchutillah* - a camp of the Flavian era, in *Netherbee* (222 AD) and in *Lanchester* (from the time of Gordian III); another is mentioned in *Dacia*, in *Turda* (*Potaissa*); and also refers to the reign of Gordian III.

It seems that some of them were built inside the camp, others outside it, but there is no complete certainty. Thus, an inscription from Britain of the era of Gordian III was discovered "east of the fortifications of Lanchester", but the stone may have been moved. Historians considered, and, of course, justifiably, that they were

halls for practicing with weapons, in other words, for fencing practice. They also served as horse riding arenas, at least some of them, since the inscription from Netherby mentioned above indicates *baselica* (sic!) *Equestris exercitatoria*.

One of the motivating factors that shaped the will of the Roman soldiers to win during hard training and wars was group identification. What really made the legionnaire fight effectively was his sense of belonging to his own century, and especially to his "*contubernium*". This identification with the unit and loyalty to their comrades in the service was crucial in the battle. First of all, the legionnaire fought for his comrades, his centurion and legion, then for booty and glory, and, finally, for the emperors and Rome who were far away. The tight ties between the eight soldiers from the "*contubernium*" were all the more tight because they had to live together in the same hut or in the same tent during the military campaign. Another factor of rapprochement was a common meal.

In the Roman army there were neither common meals for all soldiers, nor common canteens located on the camp. During the military campaigns, there was no organization of large food supplies. It was assumed that the Roman soldiers themselves would cook their own food and pay for food using deductions from salaries. Century legionnaires fought effectively because they knew each other well and were friends. Centuria was not so large a division that they felt faceless and alienated. Moreover, the legionnaires experienced a sense of pride, identifying themselves with their centurion. Tied by the bonds of partnership, they tried to protect their friends from death in battle, covering them and fighting for them. The terms "*manipularis*" or "*commandipularis*" (soldiers of the same *manipula*) expressed the willingness of the centuries and individual legionnaires to rely on each other to win and stay alive in battle. The most expressive term often found in graffiti inscriptions was the term "*frater*" (brother). Different surnames of those who died at such monuments indicate that they were not real brothers, but this term expressively and simply denoted the fundamental connection between comrades. If the legion can be described as a society, then the "*contubernium*" was a family of legionnaires. The soldiers preferred to die with their comrades than to surrender to the grace of the enemy. In wartime, the sense of brotherhood intensified, and soldiers supported other units as well as their closest comrades.

The military oath - "*sacramentum*" - was pronounced by all Roman soldiers. This oath had religious significance and connected the soldier with the emperor and the state. It was repeated every year on the day of the New Year holiday. Vegetius presents a Christian version of this oath dating back to the 4th century AD "They swore by God, Christ, and the Holy Spirit, as well as the Majesty of the Emperor, who, after God, was to be the most beloved and revered by all people ... These soldiers swore that they would relentlessly carry out all the orders of the emperor, would never desert and would not refuse to die for the Roman state".

Before the introduction of the established official oath in 216 BC Legionnaires had to pronounce two voluntary vows. The first oath was an obligation to obey the consul. In the second oath, the Manipul soldiers promised each other not to leave their comrades in a difficult position in order to save their lives and never leave their place in the ranks during the battle, except in cases when it is necessary to regain arms, attack the enemy or save a comrade.

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COVID-19–奥林匹克历史上的助推器
COVID-19 – REBOOST IN THE OLYMPIC HISTORY

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抽象。奥运会历史上第一次没有组织者,赞助商,运动员,运动会主办国政府都没有做好准备的情况。据估计,冠状病毒流行所造成的经济损失达数万亿美元,这种损害已影响到包括体育产业在内的所有领域。推迟的奥运会表明,尽管存在许多反危机情况,但国际奥委会还没有做好应对这种挑战的准备。在本文中,作者试图分析体育领域最大型活动的组织者目前面临的经济风险,并评估是否取消奥运会是将损害最小化的唯一可能方法。

关键字: 国际奥委会, 2020年东京奥运会, COVID-19, 奥运会。

Abstract. *For the first time in the history of the Olympic Games there was a situation for which neither the organizers, nor the sponsors, nor the athletes, nor the government of the host country of the Games were ready. The economic damage from the coronavirus epidemic has already been estimated at trillions of dollars, this damage has affected absolutely all areas, including the sports industry. The postponed Olympics showed that, despite the existence of numerous anti-crisis scenarios, the International Olympic Committee was not ready for such challenge. In this article, the authors tried to analyze the prevailing economic risks for the organizers of the most large-scale event in the sports field, as well as to assess whether the abolition of the Games was the only possible way to minimize damage.*

Keywords: *IOC, Tokyo-2020, COVID-19, Olympic Games.*

December 2019 - echoes of the spread of pneumonia of unknown origin from the Hubei province of central China came. From this moment, first in China, and then around the world began a serious struggle for survival. The disease spreading from the Middle Kingdom was called a new type of coronavirus (COVID-2019).

A serious crisis began to prevail in more and more spheres of public life. Many global production centers were forced to suspend their activities, oil quotes reacted negatively to the spread of the new virus, and the international tourism industry incurs huge losses. Various entertainment, cultural and other mass events are regularly canceled. Coronavirus hit the sports industry. At the moment, the loss of the sports business is not so critical, but since a large number of countries have not yet overcome the peak of the spread of the disease, it becomes obvious that the losses of big sports will be more than significant.

Before the Olympic Games in Tokyo, a little more than six months remained - the six most difficult and stressful months for both the host country and the participating athletes. The decision of the International Olympic Committee (IOC) to postpone the 2020 Olympic Games in Tokyo in 2021 can be called a necessary and inevitable measure. To postpone the Olympic Games is an extremely difficult task. Games can not be compared with other major international competitions. Whatever dates are chosen, the transfer will entail many problems: material, technical, security and others.

The postponement of the start date of the Tokyo Olympics led to a complete halt to the Olympic production line. The IOC's dramatic decision to postpone the Olympic and Paralympic Games will definitely become historic. The international sports calendar will need to be adapted for more than 30 Olympic sports. The coronavirus pandemic will complicate preparations for the next Summer Olympic Games in Paris in 2024. This is due to the fact that the classical Olympic four-year cycle will be reduced to three years. The prospect of the emergence of financial problems among potential sponsors of the Olympic movement is not ruled out.

How did Japan prepare for the Olympics?

The 2020 Olympic Games are not a debut for Japan. The country already had experience in hosting the Games: the 1964 Summer Olympics in Tokyo, the 1972 Winter Olympics in Sapporo, and the 1998 Winter Olympics in Nagano. Moreover, the country also had a negative Olympic experience. In 1940, the Tokyo Games had to be canceled due to the events of World War II. 40 years later, in 1980, Japan boycotted the Olympic Games in Moscow. In 2013, Tokyo was chosen as the host city of the Games in 2020, and after another 40 years, the country has another chance to declare itself as a great sports power.

However, again, difficulties, and much in common between the “disappeared” Games of 1940 and the “postponed” 2020. Both then and now, Japan hoped that the Olympic Games would stimulate the national tourism industry. Both times, the host country wanted to use the Games to demonstrate successful disaster recovery to the world: then, after the Kanto earthquake in 1923, and now after the Tohoku earthquake in 2011 and the Fukushima nuclear disaster.

The games of the second quarter of the twentieth century and the first quarter of the twenty-first were organized to strengthen the international position of Japan.

So, the preparation of the capital for the Games took place according to the plan. The construction of the Tokyo Olympic Stadium, where the opening and closing ceremonies of the Games were to take place, as well as the matches of the football tournament, was completed in November 2019. More than 40 sports facilities, including stadiums, cycle tracks and pools, were built, updated or reconstructed in advance. A system for preventing transport collapse has been developed. The schedule was adjusted and the transfer of competitions in some disciplines outside of Tokyo was organized due to weather conditions. The IOC has sold more than three million Olympic tickets.

Anti-crisis planning relied on preparedness to deal with natural disasters such as earthquakes, tsunamis and typhoons. These natural disasters remained one of the main threats to the successful holding of the Olympic and Paralympic Games. While preparedness to confront a pandemic was considered largely remote or not addressed at all. On the part of Japan, it seemed confident, decisive and well prepared for the adoption of the Games. However, from the beginning of 2020, doctors and scientists began to think about the onset of another danger, whose name is COVID-2019.

Viruses as an Olympic threat

Previously, the Olympic Games were canceled only during the years of major wars or because of political conflicts. Viruses or epidemics have never entailed the cancellation or postponement of the Games.

The new COVID-2019 virus is poorly understood. Specialists who began research on this type of viral disease in December 2019 were given little time to determine how to resist the virus or manage to develop a protective vaccine. Every day the area of its distribution in the world increased. The situation was complicated by a long incubation period, reaching 14 days.

In the history of the Olympic movement, there have already been cases of tension in the process of preparing for the Games in connection with the epidemic. When making decisions regarding the safe conduct of competitions, the speed and method of spreading viruses, as well as their danger to humans, were always taken into account.

For example, when the Zika virus spread in Olympic Brazil in 2016, and the number of infected reached one and a half million people, virologists reported that the virus was not a cause for panic¹. In anticipation of the Olympic Games in Rio de Janeiro, more than 200 scientists and doctors put their signature under

¹Schmidt-Kanazit Yo. Virologist: Zika virus - no reason to panic. // URL: <https://p.dw.com/p/11x2D> (Reference date: 05.04.2020)

an open appeal to the leadership of the World Health Organization, containing a recommendation to postpone or cancel the Summer Olympic Games. It is worth noting that then under the letter there were practically no signatures of European scientists. The appeal was compiled by a narrowly qualified group of scientists, many of whom worked in the field of sports management. A serious scientific base in a letter to WHO was not contained.

Another important distinguishing feature is the period of passage of the peak of the spread of the virus in the country or in the world and the period remaining before the start of the competition. Firstly, Zika virus was localized only in Latin America, and secondly, six months before the start of the Games in Brazil, there was already a decline in the number of infections. It was also positive that the Olympic Games took off during the Brazilian winter, at a time when there were very few mosquitoes, the main carriers of the virus.

In order to make the right decision to host the Games, the World Health Organization and the European Center for Disease Prevention and Control (ECDC) conducted a risk assessment. None of the institutions came to the conclusion that the Olympic Games in Rio de Janeiro should be canceled or rescheduled. According to research, 80% of people infected with Zika virus do not experience symptoms of the disease, that is, they do not even know that they were carriers of the virus. Those with a fever nevertheless started, as a rule, easily endured it and recovered after a week. The danger was only for pregnant women.

As a result, the Zika virus epidemic, which was much discussed in the media, slightly reduced the tourist flow to the Olympic Games. Most people who refrained from traveling to Brazil in the summer of 2016 were more concerned about the security situation. In Rio de Janeiro, strikes often took place, uncontrolled crime was observed².

At the Olympic Games in a confined space - in stadiums or in the Olympic village, at the same time there are about 15 thousand people. When the Games in Brazil ended, according to official figures, there was no infection of the athletes and members of the delegations with Zika virus. However, quite a lot of people became infected with various types of infectious respiratory diseases. Consequently, even without the Zika virus epidemic, other diseases transmitted by airborne droplets played their role.

Consequences of the transfer of the Olympic Games - who will suffer and how?

The Japanese side expected to spend \$ 6.6 billion on the Games, but in the process of preparing the event, this figure almost doubled. The loss figure, which was determined a week after the decision to postpone the Olympic Games, was almost

²Mem. Inst. Oswaldo Cruz vol.111 no.6. Rio de Janeiro. 2016. [online]. // URL: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0074-02762016000600414 (Reference date: 05.04.2020)

equal to the initially declared amount of organization expenses and amounted to about \$ 6 billion. Most of this amount (\$ 4.5 billion) is the profit lost from sponsorship and advertising contracts³. Nevertheless, the transfer of the Olympic Games should be justified, since the current epidemiological situation did not allow a different scenario. Let's consider in more detail.

In mid-March, Canada, Australia and the Olympic committees of other countries began to receive reports of a boycott of the Olympic Games in the event of a pandemic. Even before the announcement of the postponement of the start of the Games, many analytical agencies tried to figure out what would be more beneficial for Japan in this situation: cancellation or postponement.

According to Professor Katsuhiro Miyamoto, an expert in sports economics from Kansai University, the economic damage from postponing the Olympic Games for a year will be about 640.8 billion yen, and the cancellation of the games will cost 4.5 trillion yen⁴. Economic damage is the sum of the new costs incurred in postponing or canceling the tournament and those funds that will not be received as the expected economic effect of the event. Miyamoto noted that if the Games were postponed for a year, this would require additional costs of 22.5 billion yen for the maintenance of sports facilities and the Olympic Village. An additional 390 billion yen will be required by additional companies to support their activities throughout the year. The post-Olympic economic effect as a result of the delay will be 218 billion yen.

Another problem is the presence of economic damage associated with the need for longer security at the facilities where the Games will be held. Also, financial losses entail the fact that such significant objects as the Tokyo Big Sight Exhibition Center (which is the business center for the press and the broadcasting of the Olympic Games) have already been booked during the Games. In the Olympic year, part of the center was booked from May to September. The other seven events were to take place at Makuhari Messe in Chiba Prefecture. The room has been reserved for almost six months, starting on April 21. Now it became necessary to cancel or reschedule the activities that were planned for 2021, and to pay the contract forfeit⁵. Nippon Budokan, the martial arts arena in downtown Tokyo, which was supposed to host the Olympic judo and karate tournament, has not yet been fully booked for 2021, only the summer months are scheduled, which again will result in losses.

³In Japan, calculated the financial loss from the transfer of the Olympics // IA Red Spring. // URL: <https://rossaprimavera.ru/news/a909686c> (Reference date: 03.04.2020)

⁴Preliminary calculations of Kansai University. 東京オリンピック / 「1年延期」で経済損失約6408億円 (関西大学試算) // URL: <https://www.ryutsuu.biz/strategy/m032342.html> (Reference date: 05.04.2020)

⁵Olympics postponed... 五輪延期なら…会場「1年先まで予約いっぱい」確保大変 // URL: <https://www.asahi.com/articles/ASN3J62GFN3JUTIL020.html> (Reference date: 05.04.2020)

Another seriously affected area is broadcasting. According to sports observer Kiyoko Taniguchi, NBC (USA) television company paid IOC \$ 4.38 billion for rights to games until 2020⁶. NBC broadcasts the Olympic Games since 1988 and annually invests heavily in maintaining cooperation with the IOC. The transfer of Games disrupts the work of many parts of NBC, there is a decrease in advertising revenue, and the promotion of Peacock, a new streaming network service, is becoming more complicated⁷. Additional problems arise due to the fact that the Winter Olympics in Beijing in 2022, if everything is according to plan, will be held six months after the Games in Tokyo, and the classical training is designed for one and a half to two years. On the plus side, NBC is insured in case the Olympics are interrupted or canceled. The question remains only whether the transfer of the Games is included in the coverage area.

Many international sports federations in financial matters are highly dependent on their share of revenues from the Olympic Games. Traditionally, the IOC does not publish official information on how the revenues from the Olympic Games will be distributed, but according to independent estimates, 28 summer sports federations should have received approximately \$ 590 million after the Tokyo Games⁸. 15 out of 28 federations are heavily dependent on IOC revenue. The least dependent are FIFA and rugby. In 15 federations, the share of revenues from the IOC ranges from 35% to 96%. For this reason, some of these federations are in a situation that threatens their continued prosperity: hockey, gymnastics, triathlon, weightlifting, boxing, sailing, shooting, archery, taekwondo, rowing, golf, fencing, wrestling, canoeing and modern pentathlon.

At least half of the 28 federations can use the reserves held in Swiss accounts in the event of a hopeless financial situation. These reserves can help federations survive the crisis, even if the IOC does not make advance payments, and only pays out at the end of 2021.

However, some federations, such as weightlifting, have been living off these reserves for several years now, since they cannot cover their expenses. The situation seems most dramatic in canoeing and modern pentathlon. These are two federations with more than 90% dependence on the IOC. Shooting and fencing federations also do not have significant marketing revenues, but they have the best “insurance” among all federations represented by Russian billionaires Vladimir Lisin and Alisher Usmanov, respectively.

⁶Brasor P. Who suffers the most from the postponement of the 2020 Tokyo Olympics? // URL: <https://www.japantimes.co.jp/news/2020/04/04/national/politics-diplomacy/2020-tokyo-olympics-postponement/#.Xoopu9MzY6h> (Reference date: 05.04.2020)

⁷Pallotta F. What postponing the Summer Olympics means for NBC // URL: <https://edition.cnn.com/2020/03/24/media/olympics-nbc-coronavirus/index.html> (Reference date: 05.04.2020)

⁸Weinreich J. How federations share the revenues from the Olympic Games // URL: https://playthegame.org/news/news-articles/2020/0644_how-federations-share-the-revenues-from-the-olympic-games/ (Reference date: 05.04.2020)

Insurance - will it help out this time?

Perhaps for the first time in the history of the Olympic movement, the world has faced the problem of a global epidemic as a new challenge for all spheres of life. International insurance companies, as a rule, include unforeseen events in the “standard” risk package, ranging from wars to natural disasters. However, the threat of the spread of viral infection was not provided for by most contracts.

Analysts estimated the insurance cost of the Games at \$ 2 billion, including broadcasting rights and sponsorship, and another \$ 600 million must be allocated to cover everything related to the reception of guests⁹. According to a review of information previously provided by insurance companies, payments will be significantly less, since the affected sectors will still be able to earn money at the Olympic Games when they finally take place. According to industry sources, insurance losses will be mostly incurred by Lloyd's of London, a commercial insurance market with dozens of specialized insurers.¹⁰. However, some experts note that it is impossible to predict for sure what period the Games will be postponed, and as a result, the losses of the sponsoring companies may remain uncovered.

Obviously, in connection with the transfer of the Games, local organizers and sponsors, as well as hotel and travel providers, will be able to receive some of the compensation from insurers, however, the process of recovering losses will be long and complicated.

Summary

NBC and IOC are insured, therefore, if the Olympic Games are canceled, they will not lose all invested funds. Nevertheless, for NBC, turning a blind eye to advertising revenue, a complete cancellation of the Games would be more financially beneficial than a transfer. When NBC had rights to the 1980 Olympic Games in Moscow and the event was decided to be boycotted by the American side, the insurance service covered 90% of economic losses. Delaying is even more difficult because the entire international sports calendar of 2020-2021. have to redraw.

The cancellation of the Games would have affected the governing body of the entire Olympic movement - the IOC. Firstly, due to the fact that 80% of his income comes from the sale of broadcasting rights, and secondly, due to the need to make payments to international sports federations. Almost all federations rely

⁹Sieg L., Kaneko K. Money, money, money: what's at stake if Olympics fall victim to coronavirus. // URL: <https://www.reuters.com/article/us-olympics-2020-cancellation-economy-fa/money-money-money-whats-at-stake-if-olympics-fall-victim-to-coronavirus-idUSKBN20Q0MD> (Reference date: 06.04.2020)

¹⁰Carolyn C., Noor Zainab H. Olympics delay, not cancellation, provides reprieve for insurers // URL: <https://www.reuters.com/article/health-coronavirus-olympics-insurance/olympics-delay-not-cancellation-provides-reprieve-for-insurers-idUSL8N2BH255> (Reference date: 06.04.2020)

on the money of the IOC to finance their activities. Based on the foregoing, we can conclude that the transfer of the Games was the only possible option. In any case, by the option that would not seriously contradict the historically established Olympic principles.

Of course, there are no guarantees that the 2020 Olympic Games will start in the summer of 2021. Before the Games, it is necessary to have time to hold many qualifying tournaments in all corners of the world - national championships, continental championships, as well as the stages of the World Cups and Grand Prix. If you rely on the latest news, it will be rather difficult to do this systematically, because in many countries the peak of the epidemic is not even on the horizon. Unfortunately, at the moment, the lack of clear professionally developed mechanisms for transferring or canceling the Games does not play into the hands of the Olympic Committee. There is no adequate reserve fund in the Olympic budget to compensate for emergency expenses of this magnitude. The time has come for the active actions of insurance companies. Payout processes are likely to be delayed. The question is how to proceed further to all organizations involved in this situation during the Olympic crisis.

Nevertheless, the launch of the Olympic Games in Tokyo in the summer of 2021 is an opportunity for the whole world to celebrate recovery and to thank all those involved in the fight against the COVID-19 pandemic with a bright tournament.

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国际合作背景下的欧亚经济联盟多层次管理
**MULTILEVEL MANAGEMENT IN THE EURASIAN ECONOMIC
UNION IN THE CONTEXT OF INTERNATIONAL COOPERATION**

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注解。 欧亚经济联盟的国际合作不仅是与伙伴国家建立自由贸易区，而且是大欧亚伙伴关系的项目。 在国家，州际和国家级的多层次治理，使您可以更好地理解 and 认识欧亚地区国际合作提供的机会。 该工作的目的是研究EAEU中多级管理机制的运行。 结果表明，建立的多级管理机制不仅可以解决当今联盟发展的任务，而且可以用于解决更宏大的项目。

关键字。 多层次管理，国际合作，一体化，EAEU，自由贸易区，伙伴国，大欧亚伙伴关系。

Annotation. *The international cooperation of the Eurasian Economic Union is not only the formation of free trade zones with partner countries, but also the project of the Greater Eurasian Partnership. Multilevel governance at the supranational, interstate and national level, allows you to better understand and realize the opportunities that international cooperation in the Eurasian region provides. The aim of the work is to study the operation of the multilevel management mechanism in the EAEU. It is shown that the created mechanism of multi-level management not only solves the tasks of the Union's development today, but can also be used to solve more ambitious projects.*

Keywords. *Multilevel management, international cooperation, integration, the EAEU, free trade zone, partner states, the Big Eurasian Partnership.*

The Eurasian Economic Union (EAEU) was formed as a supranational association. At the same time, it is based on the principle of respect for state sovereignty. Moreover, Eurasian integration is characterized by the process of strengthening the national sovereignty of member states. This is facilitated by such principles of building an association as observing voluntariness, mutual respect for spiritual values and cultural identities that are part of an alliance of states, and treating

a partner as an equal. All states have equal rights in supranational decisions [1. p.6]. Moreover, the sphere where this principle is used is limited. In other words, states are very attentive to such issues. In theoretical terms, an explanation of this phenomenon can be based on the concept of E. Morawczyk about liberal intergovernmental approach [2].

The central role in the EAEU is played by member states. Such areas as the development of foreign and security policies remain with the nation states. As a matter of fact, the scope of this activity within the EAEU is minimal. The EAEU is a purely economic structure.

On the other hand, Eurasian integration is at the so-called “holding-together / coming-together” integration stage. The name is associated both with states and with the region of integration. Associations created by states that belonged in the past to a common state, and other regional organizations, use the terms “holding-together” and “coming-together” regionalism. [3] The most obvious example of retaining regionalism is the post-Soviet space. After the collapse of the Soviet Union, its parts - the former Soviet republics created the Commonwealth of Independent States. Similar processes took place in Africa and the Caribbean, where former colonies of European states unite. In this regard, it should be noted that in some cases they are created by countries that are socially and economically closely related to each other. In this case, regionalism can develop on the basis of informal regionalization, - in other regions of the country they prefer limited mutual relations. [3].

A major role in this case is played by the general infrastructure: railways and cross-border highways, oil and gas pipelines, etc. Infrastructure management requires an interstate level. This level is carried out by the Eurasian Intergovernmental Council. The association was created on the basis of an understanding of the long-term political and economic goals of member countries to combine efforts to implement the modernization of economies and create opportunities for entering the world market.

The main body is the Supreme Eurasian Economic Council (SEEC), consisting of the heads of member states. The Council decides on the main directions and prospects for the development of Eurasian integration. The heads of the EAEU Member States, based on their political positions, determine the Union's activities at the international level. SEEC also makes decisions on granting the status of a candidate state for joining the Union, makes decisions on negotiations with third countries, concluding international treaties, terminating / suspending treaties or withdrawing from them. Thus, the fundamental principles of interaction with partner countries and international associations on the world stage are determined.

The bodies supranational in the EAEU are also the Eurasian Economic Commission (EEC) and the EAEU Court.

The EAEU Court is a permanent judicial body of the union. It monitors compliance with the EAEU Treaty and other international treaties of the Union with third countries.

EEC EAEU is a supranational body [4]. But Member States are delegating powers to the Commission in well-defined areas. Thus, the EEC represents the interests of each member state and has coordinated authority to carry out specific tasks. This, in particular, is the sphere of international cooperation. More precisely, the preparation of documents for the development of international cooperation. The main document formats are memoranda of understanding, a memorandum of cooperation, observer status in the EAEU, an agreement on a free trade area [5].

The EAEU, in various specified formats, cooperates with Vietnam, Iran, India, Singapore, Moldova, Chile, Thailand, Cuba, Cambodia and other countries. As well as associations of the EAEU - ASEAN, EAEU - MERCOSUR, EAEU - SCO in trans-regional and inter-regional formats.

The indicated activity is carried out on the basis of the Agreement “On International Treaties of the Eurasian Economic Union with Third States, International Organizations or International Integration Associations” adopted in 2018. This is the main document regulating this sphere of legal relations in the EAEU. Then, SEEC approved the Main directions of the EAEU international activities for 2019. The document was evaluated by experts and the scientific community as showing the Union’s readiness for open interaction and mutually beneficial cooperation in all areas, despite the current difficult international relations.

In early November 2019, the Agreement on the Free Trade Zone of Serbia with the EAEU member states was signed. The document was signed by the prime ministers of the countries of the Eurasian Union, the chairman of the board of the Eurasian Economic Commission Tigran Sargsyan and the head of the Government of Serbia Anna Brnabich. It is interesting that by this time Russia, Belarus and Kazakhstan already had such agreements with Serbia.

The agreement solved a number of technical tasks, such as harmonization of tariff and other terms of trade for all EAEU countries, opening access to new markets, resolving emerging disputes, expanding trade and economic cooperation between the EAEU and Serbia. It is obvious that the Agreement will provide significant economic benefits for the EAEU and Serbia both in the short term, as it is based on savings in customs payments for export-import, and in the medium term in connection with the realization of export opportunities while expanding the free trade regime for a wider range of products.

For our topic, it is important that at first the negotiations and the signing of agreements were in a bilateral format, and then Serbia within the framework of the EAEU. In addition, the Agreement was signed at the interstate level, at the EEC EAEU level.

To achieve a high level of integration in the EAEU, the Transport Union and the Energy Union are being created. By 2025, a single financial market and a common energy market (gas, oil, oil products and electricity), a single digital space will be created [6]. The Consortium of the Eurasian Technological Platform - “Outer Space and Geographic Information Technologies of the EAEU” already exists, there is a draft interstate program “The Integrated System of EAEU Member States” for the production and provision of space and geoinformation services based on national sources of remote sensing Earth [7].

At the plenary meeting of the St. Petersburg International Economic Forum (SPIEF) -2016, Russian President Vladimir Putin proposed creating a large Eurasian partnership with the participation of China, India, Pakistan, Iran, the CIS countries and other countries [8]. In fact, this is a look at the possible development of Eurasian civilization. It is commensurate with the views of President Xi Jinping and his initiatives.

Within this broad framework, concrete steps are being taken, for example, direct interaction between the EAEU and the Silk Road Economic Belt (SREB) in the issue of pairing two initiatives. On the part of the EAEU, they are regulated by the decree of the EEEU “On the interaction of the member states of the Eurasian Economic Union on issues of pairing the EAEU and the SREB.

In accordance with the decree, the governments of the member states together with the EEC with regard to the competence of the EAEU must ensure cooperation on issues of participation in the SREB initiative, including on issues of relevant bilateral memorandums with the Chinese side, as well as negotiations on an agreement on trade and economic cooperation between the EAEU and China.

Such variability in the selection of the interaction format is beneficial to everyone. Chinese investors receive uniform rules of work throughout the Union and minimal customs control on the way of goods to Europe. The countries of Central Asia and Armenia are participating in the negotiations. Russia does not lose influence in the post-Soviet space. This is a pragmatic approach.

The EAEU is currently being considered within the framework of the concept of “pragmatic integration”. The conceptual foundations of Eurasian integration are summarized in three articles: V. Putin, “A new integration project for Eurasia - the future that is born today,” A. Lukashenko, “On the fate of our integration,” N. Nazarbayev, “Eurasian Union: from idea to history.” future ”[9]. The proposal of the Russian president included economic, political and military components. It was designated as the main foreign policy project of Russia at that time. Apparently, the goal of Eurasian integration was to form a center of power, a pole in a multipolar world.

Based on the conceptual foundations set forth in these works, based on the principle of continuity, in accordance with external conditions and political processes

within states, a draft agreement on the EAEU was prepared. The preparation of the project was based on the principle of codification, agreements developed and adopted earlier. The development of existing principles and norms, improvement of integration mechanisms in various areas of public relations, bringing them to logical perfection, the dominant contract.

The development of these views today has led to an approach, the feature of which is that integration is not seen as an end in itself, but as a way to achieve common goals: security, modernization, and cultural development. So, the goal of the Greater Eurasian Partnership (GEP) is to transform Eurasia into a zone of peace, cooperation and prosperity. Eurasian integration is a natural process. After all, there is no state in Eurasia that would not be part of any structure. Integration here is based on centuries-old historical experience and joint creative activity. "The formula proposed by the PRC leadership" of the peoples of one historical fate of mankind "confirms the idea of Eurasian integration expressed a century ago by Russian philosophers on the basis of the general historical experience of the peoples of Eurasia" [10]. But historical fate is not only and not so much the past as the future. "In regional integration, the sense of political community is not directed to the past, but exclusively to the future" [11].

Thus, the integrity created by regional integration is the integrity of a group of actors acting together in the process of globalization. Hence, the following wording is valid: "regional integration is a model of conscious and active participation of a group of countries in the stratification of the world due to globalization" [11]. However, this does not contradict the UN Sustainable Development Goals.

GEP can only be formed on the basis of flexible projects and institutions that take into account the diverse interests of participants and the purely voluntary nature of cooperation. Integration can only be multi-speed and multi-format, representing each participant the freedom to choose a package of obligations [10]. And this is possible only on the basis of a flexible system of legal norms of multilevel management. Multilevel management, allows you to choose the level at which the most productive negotiations, is an important tool of the EAEU.

To summarize some of the results. The process of Eurasian integration is developing quite effectively, especially considering the timing of the operation of this association. The main mechanisms of this process are economic and energy factors. Successfully removed barriers to the movement of goods. Logistic and transport networks are developing. Regarding the use of the principle of supranationality, it should be noted that supranational decisions are very important in the activities of the association. However, states are very cautious about delegating authority to supranational bodies. Multilevel governance plays a very important role in the development of the EAEU. We can say that multi-level management in the EAEU is balanced and operates quite effectively. The redistribution of com-

petencies and responsibilities at the intergovernmental, supranational and national state levels allows us to make decisions that positively affect the further development of integration. At the global level, the EAEU contributes to the achievement of the UN Sustainable Development Goals for 2016-2030 by participating in world development and global governance.

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学龄前儿童情绪发展的特定特征
**SPECIFIC FEATURES OF THE EMOTIONAL DEVELOPMENT
OF PRESCHOOL CHILDREN**

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注解。本文讨论了学龄前儿童情感素养的理论方面。本文介绍了有关学龄前儿童在准备上学期间的情感领域的真实情况的研究。进行了矫正和发展工作，这有助于儿童更有效地发展，以及在情感领域实现和揭示儿童的能力。对课程进行了详细分析，并得出了学龄前儿童的矫正和发展工作的结论。

关键词：情绪，学龄前，适应，纠正措施，象形图，沟通，合作。

Annotation. *This article discusses the theoretical aspects of the emotional literacy of preschool children. The paper presents a study of the real situation regarding the emotional sphere of a preschooler during preparation for school. Correctional and developmental work was carried out, which contributed to a more effective development of the child, as well as the realization and disclosure of the child's abilities in the emotional sphere. Classes are analyzed in detail and conclusions of correctional and developmental work with preschoolers are drawn.*

Keywords: *emotions, preschool age, adaptation, corrective measures, pictogram, communication, cooperation.*

In studies on child psychology of preschool age, great attention is paid to emotions, which, according to scientists and practitioners, play a decisive role in the development of personality. The child is preparing to go to school, and he needs to be able to interact with peers, respond to a specific situation. Children with different diagnoses react differently or do not react to different emotions at all. The insufficiency of the correctional-developing aspect in practice-oriented approaches in working with the emotional sphere of preschool children with normative development. Because it assumes by itself created conditions for the development of the emotional sphere of a preschooler.

We focus on the research of D. Gaulman, who argues that in society there is a decline in “emotional literacy”. As a result, emphasis on the development of intelligence should not be put at the expense of the development of such emotional skills as empathy, responsiveness, persistence, self-control and care. In this regard,

since the end of the 90s. of the last century, the problem of developing emotional intelligence (“emotional intelligence”) is widely discussed abroad [10].

Given all the features of development, we tried to understand and verify this statement. Our work is aimed at stabilization, adaptation of preschool children and their preparation for learning at school. This will help to warn and orient the child, safely go through the period of school adaptation, and most importantly, adolescence, where the greatest number of conflict situations can arise with emotional underdevelopment.

Studied the theoretical foundations of this issue and diagnostic material for the study of personality characteristics of children with normal development, allowed us to choose corrective exercises. So a very large and strong impact on the emotional background of a child is provided by relationships in the family with parents, in society and its environment. The emotional state of the child is the basic foundation in the mental life of the child as a person.

We carried out a diagnostic examination, the result of which was further developed corrective measures.

Purpose of the study:

Define the forms and means of corrective work.

We conducted a diagnostic examination at the Correction and Development Center «Leo», which provides a separate spacious room, all the necessary equipment for working with children.

We carried out the diagnosis in two stages, at the first stage there was an individual work with each ward. The methodology “Emotional identification” by E. I. Izotova, the purpose of which was to identify the features of identification of emotions with different sensations in preschool children, individual characteristics of emotional development, as well as to determine the possibilities of children in reproducing the basic emotional states and their verbalization [4].

At the second stage, group work was carried out aimed at identifying the zone of actual development. Here, most of our work was observation, conducting an oral survey aimed at identifying knowledge of various emotions and communication. Three wards with normal development took part in the study: S. (5.4); A. (5.11); B. (5.7).

During the anamnesis, it was revealed that all children live in complete families and attend a regular kindergarten, also all go to one correctional development center for several months.

For correction, we used exercises that allow us to establish communication skills, the ability to express and understand emotions, the ability to follow instructions, and reduce muscle tension.

At the second stage of the “Emotional Identification” methodology (EI Izotova), we observed and conducted an oral survey aimed at identifying knowledge of various emotions and communicating.

We used materials such as: a pictogram (a schematic depiction of emotions of various modality), photographs of faces of adults and children with different emotional expressions. The children were shown images of people's faces, the task of the children was to determine their mood and name the emotion. Children needed to identify such emotions as joy, sadness, anger, fear, surprise. First, children were offered images (photographs), which made it easy to recognize emotional states, then schematic (pictograms) images of emotional states. Children were asked to correlate a schematic depiction of emotions with a photographic one. After the children named and correlated emotions, the teacher suggested that each child depict different emotional states on his face.

We evaluated the perception of expressive signs (facial expressions), understanding of emotional content, identification of emotions, verbalization of emotions, reproduction of emotions (expressiveness and arbitrariness), updating of emotional experience and emotional representations, individual emotional characteristics.

The data obtained were entered into the protocol, where it was evaluated in points, with the help of which it will be possible to show the dynamics of the child [3].

For clarity, we will show some criteria that have been recorded in the schedule. Each ward will be considered in pre- and post-diagnosis. Evaluation by the following system:

- find out the emotional state (name) from photographs:
 - 0 - did not recognize and did not name a single emotion;
 - 1 - recognized and named 1 emotional state;
 - 2 - recognized and named 2 emotional states;
 - 3 - recognized and named 3-4 emotional states;
 - 4 - recognized and named 5 emotional states.
- a schematic (pictogram) image (complex - name emotions, easy - correlate with photo):
 - 0 - could not correlate any emotion depicted in the photograph with the diagram;
 - 1 - could correlate 1-2 emotions depicted in the photograph with the diagram;
 - 2 - could correlate 3-5 emotions depicted in the photograph with the diagram;
 - 3 - could name 1-3 emotions schematically depicted, without photos;
 - 4 - I could name 4-5 emotions schematically depicted, without photos.

Tasks of the second stage of the primary diagnosis: the second stage of our work has already been aimed at the joint activities of the group, communication, observation, identification of knowledge of various emotions. The first task is aimed at joint activities, therefore, on emotional interaction. The game is aimed at communication in a new group. Task 1. "Acquaintance" with the ball.

The next task, aimed at knowledge of various emotions, on the ability to express, on the understanding of expressed emotions. Task 2. It is aimed at recognizing the area of actual development of emotions. Detail facial expressions. To understand what emotion is shown or to learn to show, it is necessary to consider what parts of the face are involved in this. Look at the eyebrows, eyes, lips of a person (presenting a picture with emotion).

This exercise allows you to see the children's ability to show emotions and understand the emotions that they were shown. Task 3. The Mirror.

Another task is aimed at joint activities, as well as the ability to act under rhythm. Task 4. Rhythmic game-nursery rhyme, "Cat ballooning".

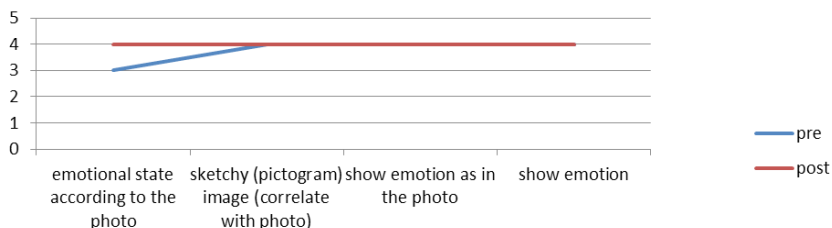
And the last diagnostic task was aimed at the ability to follow the rules, joint activities, as well as the ability to emotionally respond to various situations. Task 5. "Gawker". This exercise is aimed at both attention and the ability to listen to peers who dictate instructions.

Farewell to the ability to reflect, homework is also given, because in order to achieve the desired result faster, joint and regular work is necessary.

The tasks of the second stage of the secondary diagnosis, the post-test was carried out after 19 group lessons. Task 1. "Cube". The game is aimed at following the rules, as well as the ability to show emotions. The next task 2 was aimed at the ability to collect all the mimic details of emotions and the ability to express them. The second task, as in the pre-test, was "Mirror", where the dynamics of how children will show emotions and repeat after another will be visible. Another task was to analyze in detail each emotion and correlate the emotion with the situation in task 4. Watching the cartoon was 5 tasks aimed at determining emotions.

The last task was "The King walked through the forest", aimed at following the rules, the ability to imitate / repeat after another. At the same time, this game allows children to throw out energy, it is difficult for children to sit still for a long time. And when parting, the children were asked questions, as before.

At the post-test, preschoolers recognized all emotions and correlated with the situation, it was especially good to show "surprise", but nevertheless, not everyone managed to show such an emotion as "sadness", but this emotion is easily correlated with the situation and give examples.



Contact was easily made with the children, as we are already familiar with all the children: S. (5 years 4 months); A. (5 years 11 months); B. (5 years 7 months). The lesson was held in the evening (at 18:00), which is most favorable for work, because in the morning they can be awake, also at lunch, when the children sleep.

Children easily began to communicate with each other, S. (5.4) was the most sociable, asked questions, answered questions, regardless of whether it was true or not. A. (5.11), is the most intelligent and capable child, actively participated in answering questions, and most of them were faithful, is quiet calm, a child, but also did not mind having fun, running, jumping. V. (5.7) also answered questions well, but less productively, unlike A. (5.11).

The lesson consisted of 6 tasks, the knowledge about the emotions of the wards was clarified, tasks for following and holding instructions, as well as for communication skills, were completed.

When parting, children with normal development remembered that they showed emotions, looked at pictures with different emotions and “played with a ball and a ball”. Most liked motor tasks.

The conclusion that was made: children can relate emotion to the situation, can show the same emotion that they are presented. But they do not support eye contact, and instructions are not always followed.

Thus, we have identified several aspects that need to be included in this group. In order to not only memorize emotions, but to learn to express and understand what I don't know how to do, and for this, children need to be able to interact with each other, listen to and follow the instructions of an adult, give instructions and help another, you need to establish eye contact, etc. .d.

The results of the post-test in the group: the lesson was held in the evening, by three children with normal development: S. (5.4); A. (5.11); V. (5.7), the mood background was increased.

The first task was initially carried out independently. And always in any case, everyone shows and shows emotion in a given situation. And this time it turned out to show emotion to everyone, because pictures were presented.

They coped with the second task, but the help of a psychologist was required, because You must follow several instructions at once.

Everyone coped with the third task, a little more time was given, because before that, a task was presented with a sample of some kind, an example of a person, a picture. As it turned out, it was easier for children to say the emotion that they should show, but in order to show and know about this emotion, it was still necessary to give an orientation.

The fourth task was to consolidate the information passed, because children have already given the correct answer and result to this question, they were able to now consider each emotion and show it.

The fifth task was to watch the cartoon, as it turned out the emotions from the videos are easily perceived and understood. Each emotion was dismantled and shown.

And the last task was more aimed at raising the mood, after diligently completing the tasks. Children followed the rules and actively showed actions.

When parting, the children answered questions, all emotions were named, including children with pathology.

Conclusions:

1. orientation is being developed in preschool children, they transfer external means to internal ones and begin to understand and express emotions without external means.

2. Children show more positive emotions than negative ones in communication, they also have motivation to create a favorable atmosphere.

3. joint activity allows you to listen to each other, thanks to this, children help each other, and can regulate their emotions.

4. children show positive emotions, initiative in communication and help each other.

Thus, there is a dynamics in emotional development, the children began to recognize and correlate emotions with the situation, give examples on their own, as well as the dynamics in communication, there is more speech, there is eye contact, the priorities and rules for completing tasks are followed, and they also started to teach another, to what is good at themselves.

In preschool age, the universal form of correction is the game. Game activity can be successfully used both for correction of a child's personality and for the development of his cognitive processes, speech, communication, behavior, etc.

Therefore, all tasks are selected in a playful way, and necessarily with a change of activity, if one task was performed while sitting, didactic games or studying each emotion, then a group game is active where they can run, walk, jump.

At each lesson, each emotion was studied and examined in detail, this task allows you to visually see what emotions happen and how they manifest. This task is aimed at studying emotions, activating speech, as many children are lazy and prefer to remain silent, instead of saying everything.

Children were offered outdoor games in the form of round dances, and competitive games in the form of various relay races.

One of the main tasks was to study, consider each emotion in detail, thereby, wards, focusing on details, will be able to recognize a particular emotional state.

Also, with an increase in emotional awareness during childhood, according to K. Isard, it accelerates the development of social skills, affects the establishment of social contacts with peers and the success of educational activities [2]. Which is what all our games are aimed at, children do not just memorize certain emotions,

but acquaintance takes place through events in which they participate with their peers, so this is both communication and the development of all higher mental functions.

The results of psycho-correctional work showed that the first tasks showed problems of expression and removal of high tension during the manifestation of: sadness, fear, anger, surprise, joy. Therefore, the work was aimed at studying and correcting each emotion in a playful way.

In addition to simply studying each emotion, we developed the ability to connect the image, act and follow instructions, think logically through the game, contributed to the development of joint activities, as well as emotional interaction, etc.

Considering the dynamics of development of each child, from the initial diagnosis (pre-test), to after corrective work (post-test), it is clear how each child develops, differently despite the fact that they have a normal development path.

In conclusion, we can conclude that from birth, the child needs an emotional connection with the parents, so it is necessary to ensure it from birth. In the course of work, we observed how the child reads our emotional manifestation, and reacts in the same way. This observation showed how adult emotionality affects children and this circumstance must be taken into account for safe school adaptation.

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会员背叛的正面教训

POSITIVE LESSONS FROM AFFILIATE BETRAYAL

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注解。 拟议的材料试图强调性通奸的一些显着积极影响。 试图不以通奸为由，而是以正式自由的人为伙伴来反映通奸。

关键字：不忠，通奸，伴侣不忠，通奸的好处，通奸的心理帮助

Annotation. *The proposed material attempts to highlight some significant positive effects of sexual adultery. An attempt was made to reflect not on adultery, but on adultery in partnerships of formally free people.*

Keywords: *infidelity, adultery, partner infidelity, the benefits of adultery, psychological assistance for adultery*

The difference between marital and partner relations consists in the absence of legal liability to each other, in the absence of mutual obligations fixed by law, in the presence (or absence) of a conscious choice for a person when creating this kind of relationship. In the modern world, it is these partnerships that are developing more and more often, that is, two individuals are in relationships that are not held together by the so-called legal marriage. Sometimes such relationships are not even sealed by moral obligations to each other. Thus, both partners have the opportunity to choose to maintain just such a relationship, or are free to enter and move into other partner forms. Partnerships are maintained as long as they maintain a balance of mutual partner comfort. Such relationships are preserved by love (mutual emotional affection of partners), on the basis of interest in each other, common plans, views, values, the presence of adaptive mechanisms, when relations in a pair harmoniously change under the influence of a community of events of life together. Due to this, relationships have the ability to gradually evolve. Participants in adaptive and harmonious relationships develop as individuals, they have no tendency to degradation, because there is no reason for this.

I do not want to be booed by harsh moralists and civic activists, therefore I will not take the trouble to reflect on what is positive in adultery. I ponder over unfaithful people. Moreover, the calculations about the presence of positive experience in this homogeneous phenomenon are quite applicable to myself, I believe, to both conditions, and to marriage and partnership. It so happened that society is more tolerant of partner infidelity than of infidelity in marriage. The latter are completely unacceptable from the point of view of public (hypocritical?) Morality. Whether such a judgment affects the decrease in the total number of betrayals in the marriage from the total number of betrayals outside of it, I can not judge. But I know for sure that the presence of marriage ties will never stop anyone from infidelity if marital relations are exhausted. In this case, neither a judicial divorce, nor the division of property, nor the division of children, are able to keep a spouse who already considers herself free from marriage obligations. And on the contrary, if within the partnership relations are important and are of mutual value, and regardless of the fact that the relations are not formally fixed, each partner will think many times before creating treason. It is all the more important for partners to understand what positive experience they can draw from the situation if betrayal nevertheless has occurred and has become obvious.

It is important that partners in the perception of infidelity have significant gender differences that reduce the negotiability of partners in a crisis situation. Women most often perceive adultery as male betrayal (psychological, spiritual, physical), as something traitorous. Men consider their betrayal a minor formality, a purely physical act, not referring to the infringement of the partner's human dignity, her feelings. For men, such infidelity is just the realization of their physiological needs, an incentive to continue life, the illusion of solving an inborn problem to multiply and multiply. At the same time, men are able to perceive adultery as a real grandiose irreparable disaster, as a reason to terminate partnerships. Most women, in the case of the discovery of male adultery, are able to show rationalism and forgive the partner without destroying the relationship. It is worth mentioning that often women perceive their own betrayal as a perfectly acceptable thing. That is exactly how, for example, female (secret) revenge is carried out for male insults, real or imagined. Such a betrayal has quite tangible benefits, because it allows a woman to come to terms with reality.

If you try to comprehend the period that has come after the betrayal, it can be argued that if there is a strong emotional attachment in the partnership, the betrayal that has occurred can strengthen the relationship, provided that there is no publicity. The presence of moral torment and the desire to make amends for secret guilt can push the traitor to manifest in the partnership the best human qualities, which probably will not be underestimated. If the publicity has occurred, then this can even unite the partners after realizing the real threat of losing relations, if they are

truly mutually valuable. In the case of publicity, it is important for partners not to chop off their shoulders and be able to take a saving pause on understanding what has happened and its possible consequences. Such an analysis will add life experience, teach to appreciate the present in a relationship. In addition, such a development of events can lead partners to a conscious and balanced decision to increase their kinship, to marry. Such a marriage will undoubtedly be stronger and more stable than family unions, which are in sterile, untested relationships. Skeptics refer to the classic - the story of Anton Chekhov's "Duel".

It is important to understand that the appearance of betrayal in a stable pair necessarily has its own reasons. It is important to be aware that, like any phenomenon, adultery can have not only negative consequences. It is important to know firmly that adultery can have a positive function, since they take place in life. The negative sides of betrayal are obvious, they are destructive for the human psyche, for trust in a couple. But the positive consequences of adultery are far from always obvious and by no means to everyone. They need to be found and seen, both for men and women, in order to be able to evolve in existing relationships, in order to have hope for their preservation in a crisis situation, for a possible way out of it not with loss, but with gain in personal, spiritual growth. The crisis that arose is precisely that situation in which the soul will be "obligated to work day and night." This is a way to get a kind of immunity to difficult life situations.

From childhood, we are taught to live in myths and illusions, in the world of fairy-tale heroes from beautiful romantic stories. Not "beautiful" stories and dubious characters (for example, such as Anna Karenina, who cheated on her spouse) are rightly condemned, presented as undesirable in their consequences. We get used to living in illusions, to love illusions, to believe in illusions, and so break away from reality. We relay illusions to our partnerships, considering our hidden desires only as our personal destiny, unreasonably missing the simple idea that the partner is built in the same way and may well have the same thoughts and desires. An example of such illusions can be the story told in the cult film of Valery Todorovsky "Lover". The film with a complex semantic load, extremely deep and multifaceted, is of interest to us now only for the purpose of demonstrating only one simple thought: a prosperous man as a whole, not being faithful to his partner himself, by illusory naivety lost everything (including his own life) FROM THAT that harbored illusions regarding your partner and their relationship.

It should be understood that our illusions are our desires and at the same time our protection against painful thoughts, possible trauma, pain. We imagine what we want to believe in, and completely immersed in IT, we live in IT, not seeing THAT what happens in real life. Often, these ideas are formed in our country as a result of the rooting of our views by our partners, which in fact turn out to be fraught with false promises and statements that for us it can be both saving and

destructive. Awareness of the main character of the picture of the real state of things in his relationship with his partner cost him his life. He died first mentally, then physically. In real life, there is practically no physical mortality resulting from the realization that the relationship is not ideal, from mental suffering when experiencing betrayal. But psychologists and psychotherapists encounter quite a lot of death of a sincere, painful change in a person's personality, deformation of his morality. This is a difficult, in the sense of psychotherapeutic rehabilitation, work. Illusions (or, as Stephen Wolinsky defined them, "unrealistic expectations") protect us from pain for some time, and, in the end, still lead to mental suffering. Therefore, from psychotherapeutic considerations, it is right at any stage of rehabilitation work with partners who have survived betrayal to bring them gradually closer and closer to the real events of their life, gradually destroying their illusions. Thus, suffering and disappointment will come to their life gradually and less destructively and destructively affect them.

The partner, going on treason, either gets rid of the illusions, or confirms them. Female illusions such as "I can be needed by someone else", "he offended me, now it's my turn", "let him be hurt, just like me", "let him not think that he is the only man" and etc. Male illusions can be realized for the purpose of comparison, for the purpose of self-affirmation, raising self-esteem - "I can", "I am free", etc. The benefit of these illusions is that they tend to intensify. It's easy to live with them, but hard to part with. It's hard to understand that if a partner is cheating, then it's up to me. On the contrary, it is easy to have a mistaken understanding that it is only in it. Male infidelity, if they carry only a physical component and do not have a spiritual, psychological factor, are a confirmation of natural sexual polygamy. Female adultery reveals the problems of female need, its necessity, its uniqueness for a partner, that is, sooner or later a psychological, spiritual component is connected. Male infidelity is far from always identical with betrayal, while female infidelity is often more a betrayal, as it is inextricably linked to the degree of emotional attachment to a partner. Therefore, female betrayal of adultery is more common than male betrayal. Men rarely betray their women, in the event that there is a break in psychological and spiritual interaction in pairs. This is the positive side of male adultery - they are not finite for the relationship, it is possible to strengthen the relationship in psychological, spiritual terms.

Of course, sexual betrayal of a close, dear person is always painful, and the closer and dearer both in illusions and in reality, the more painful. In any betrayal, besides the fact that you need to see the positive aspects, as in any difficult life situation, there are three responsible, reasonable and adult decisions: change the situation, put up with the situation or close yourself from it, run away without deciding. However, this is not all, there is also a fourth choice - neurotic. That is, take offense, find the guilty and the guilty (like the main character in the film "Lover"),

shift the blame only on the partner. In this case, one does not have to wait for any evolution in relations, there is no growing up and growth in such relations, due to this they lose the property of adaptability and comfort. To be offended is like drinking poison and then waiting for someone else to die.

The positive aspects of betrayal can be seen in the fact that they give the partner the opportunity to remove his illusions and meet the reality of his life, make it possible to commit an act or look critically at himself, maybe even through recognition of his own weakness, vulnerability and loss. This is an occasion to change yourself, a situation, or both. This is the main positive moment of partner betrayal. Changing something, you will not enter into a similar relationship with this or another partner.

Our betrayal is a stampede from ourselves. Sooner or later, this flight must be realized and stopped so as not to spend life on it. Partner cheating is a way to learn how to make antibodies, to create your own protective environment. If a betrayal has occurred in your life, don't lose your temper, try to draw the right conclusions from it before you part with your partner. Gaining such an experience is almost the only way to find something real.

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教育学科个人和专业发展的心理障碍

**PSYCHOLOGICAL BARRIERS OF PERSONAL AND
PROFESSIONAL DEVELOPMENT OF EDUCATION SUBJECTS**

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抽象。在理论和实证研究中表明,边缘主义和拖延是现代个人和职业发展的障碍。边缘化和专家拖延的主要心理因素是童年时代的出现以及学校和大学对各种形式的个人(学习)无助感的教育过程的巩固。预防和纠正学习到的无助,边缘主义和拖延的重要资源是良好的教育空间。

关键词:个人和职业发展,概念,职业发展模型,适应性运作模型,心理障碍,学习无助,边缘意识,拖延,条件。

Abstract. *In a theoretical and empirical study, it is shown that marginalism and procrastination are barriers to the personal and professional development of modern man. The main psychological factor in the manifestation of marginalism and procrastination of a specialist is the emergence in childhood and the consolidation in the educational process of schools and universities of various forms of personal (learned) helplessness. An important resource for the prevention and correction of learned helplessness, marginalism and procrastination is a favorable educational space.*

Keywords: *personal and professional development, concept, model of professional development, model of adaptive functioning, psychological barriers, learned helplessness, marginal consciousness, procrastination, conditions.*

The modern era is characterized by great challenges and risks due to the scientific and technological development of society. Challenges of time require answers to a number of fundamental questions. How capable and ready for change is modern man, can he go beyond traditions, define new tasks for himself? Is he ready for transformations of himself and his consciousness? But, most importantly, what

qualities can act as motivators, catalysts for accepting challenges, and which, on the contrary, represent internal barriers that block the development potential?

The above becomes particularly acute in connection with the need to solve the problem of personal and professional development of the subjects of the educational space of a school, college, university, and the inclusive education system, which is responsible for ensuring the development, health, and effective life of students.

The answers to these questions follow from the solution of a number of inter-related theoretical, experimental and practical problems. One of the central ones is the need to study psychological barriers that impede the personal and professional development of a person, i.e. those negative phenomena that have recently become widespread.

We are talking about the marginalization of professional consciousness and self-awareness, as well as procrastination as a factor that stimulates distortions of self-determination in personal and professional development (self-determination, self-expression, self-realization) of a person.

The problem of marginalization of consciousness is studied mainly in social psychology. Currently, specialists have noted an increase in the number of studies of professional marginalism of educational subjects (students and teachers).

The relevance of the problem of the marginalization of professional consciousness is due to qualitative changes not only in the relationship between the individual and the profession, but also in the relationship of the professional with society. Reflection in the consciousness of social being means its refraction simultaneously in the individual and public psyche, influencing each other.

The mass marginalization of professional consciousness is based on the semantic inversion of the concepts of professional identity and professional marginalism [1; 5; 9, etc.].

The main sign of the marginality of individual professional consciousness is the gap between the concepts of “I can” and “I have”, and the corporate professional consciousness is the difference between the concepts of “professional” and “position”, the gap between career growth and professional development.

At the level of public consciousness, marginalization is manifested in the psychological readiness to accept a low level of professional services that do not meet social expectations. The choice between the need for personal benefit and understanding of the caused social harm occurs through its “understatement” by the subject or complete ignoring.

Earlier in psychology, the identification aspects of professional marginalism in an unstable society at the turn of the era, when it was still unclear how viable this phenomenon was, was already investigated. Now, when the concept and criteria of professionalism are being transformed, and the marginal professional conscious-

ness becomes a social norm, its study represents a new scientific direction in line with the concept of professional development of a person [7].

Our analysis of marginalism and related concepts showed that the problem of professional marginalism in this context should be studied comprehensively with the problem of procrastination, which indicates a person's tendency to constantly postpone various things for later.

The need for an in-depth study of the problem of the effect of procrastination on the process of personal and professional development of subjects of education and, first of all, on the process of personal and professional self-determination of young people consists in the fact that recently, in a rapidly developing society and lack of time, the tendency of voluntary, irrational postponement by young people of intended actions has intensified. The indicators and consequences of procrastination are stress, frustration, anxiety, caused by the unfulfillment of the goals that are vital for the person to the fullest extent desired. Decreased self-efficacy and overall satisfaction with life are, in turn, predictors of the activation of the negative social well-being of modern youth. Along with this, procrastination is a factor stimulating distortions of self-determination in the vital, personal, social and professional spheres of self-determination of a modern person.

For the first time in psychological practice, the term "procrastination" was introduced by P. Ringenbach in 1977. Further, the study of the phenomenon of procrastination was carried out by M. Aitken, J. Burka and L. Ewan, A. Ellis and V. Knaus, I. Janice, L. Mann, K. Lay, W. McCone, J. Johnson and T. Pezzel, N. Milgrem, L. Solomon and E. Robblum, P. Still and others. At the beginning of the XXI century, this problem attracted the attention of domestic researchers [2; 4; 8; 10, etc.].

Initially, the phenomenon of procrastination was considered rather narrowly. Researchers interpreted it from an ethical and philosophical point of view, most often referring to the term "laziness," that is, a mental state characterized by a lack of desire to do something if it requires volitional effort. Significantly expanding the understanding of this concept, K. Lay, describing it as a voluntary, irrational postponement of the intended actions, despite the negative consequences for humans [10]. P. Still considered the phenomenon of "procrastination" in the context of the strategy of avoiding things that cause negative emotions. The opposite point of view was held by T. Pichil, J. Ferrari, associating procrastination with a person's attempt to provoke "thrill", performing the necessary tasks in extremely short and recent terms. N. Milgram investigated types of procrastination (household, decision-making procrastination, neurotic, compulsive, academic) and together with R. Tenne subsequently combined these types into two main types: deferring assignments and deferring decision-making. Domestic researchers most often considered the phenomenon of procrastination in connection with personal

characteristics. The syndrome of “motivational insufficiency” was also considered in the context of the perceptual-semantic organization of time and the theory of perfectionism. Thus, the analysis of scientific sources showed that personality procrastination acts as an indicator of the process of personality self-determination, significantly determining the main milestones of its progress towards self-efficacy and, as a result, to life satisfaction.

Self-determination of personality is an absolutely conscious activity of a person to identify, analyze and uphold a subjective position in life situations that do not have strictly normative decisions. At the same time, self-determination of personality is not a set of local decisions, but represents a basic style way of responding to a variety of life circumstances, a kind of lifestyle. As practice shows, the main directions of the study of self-determination are: professional, personal, life, social.

Our studies of professional self-determination of a person are carried out in the framework of a systematic personality-developing approach to the study of the psychological foundations of human professional activity [7; 11].

As a result of many years of theoretical and empirical research of professional work, we formed a concept of professional development of the personality, in which two alternative models (strategies) of professional work are distinguished: a model of professional development of the personality and a model of adaptive functioning. These models differ from each other in the level of development of professional self-consciousness and integral personal characteristics (orientation, competence, flexibility), as well as the level of reflective resource, which performs a certain function with respect to resolving intrapersonal contradictions: semantic, regulatory and pathogenic levels.

Our studies proved that the model of professional development characterizes the constructive path of a person in the profession, the path of creation, building up his creative potential, while the model of adaptive functioning defines the destructive path in the profession, the path of stagnation and neurotization, marginalism and procrastination, the path of destruction, the loss of one’s creative potential and personal resources.

For many years, our attention has been drawn to the problem of ontogenesis of the personal and professional development.

Studies have shown that the main psychological factor in professional involution, marginalism and procrastination of a specialist is the emergence and consolidation of various forms of personal helplessness in childhood, especially learned helplessness.

The phenomenon of learned helplessness was first described by psychologists M. Seligman and S. Mayer in 1967. The experiments of M. Seligman laid the foundation for the theory of learned helplessness, which became a turning point

in the development of psychological science of the XX century [3; 6; 12 et.al.].

Studies allowed M. Seligman to conclude that the syndrome of learned helplessness is fully formed by the age of eight, and its essence is that a person does not believe in the effectiveness of his actions. The author notes three sources of the formation of this syndrome:

- 1) experiencing adverse (negative) events, that is, the absence in childhood of the ability to control the events of one's life;
- 2) significant limitation of autonomy (independence) in childhood, the willingness of parents to do everything for the child;
- 3) experience of observing helpless people (for example, television shows about defenseless victims).

At the same time, modern research proves that learned helplessness is formed not only in preschool, but also at a later age and even in adults. It is promoted by a high level of motivation to avoid various failures, as well as control over the action according to the type of orientation to the state.

We conducted a series of experiments on samples of teachers, university teachers, school students and students ($n = 738$) using a specially designed methodological program that includes the following methods: self-actualization test (CAT, adapted by L.L. Gozman et.al.), diagnostic technique level of emotional burn-out V.V. Boyko, STONE-P attributive style questionnaire for adolescents, Phillips anxiety level, optimistic - pessimistic explanation style questionnaire (T.O. Gordeeva, O.V. Krylova, modification of the CASQ test by M. Seligman), C. Lay scale of student procrastination C. modification Garanyan. "Report on a significant event for the week" L.M. Mitina. Author profiles, interviews, observations.

The results of empirical studies led to the following conclusions:

1. A high level of personal and professional development was revealed in a small number of people surveyed (21% of teachers and 26% of university teachers). The rest (79% and 74%, respectively) are characterized by an average and low level of personal and professional development and a model of adaptive functioning.

2. Most (68%) representatives of the model of adaptive functioning are characterized by signs of marginal professional consciousness and procrastination, largely due to the syndrome of learned helplessness formed in childhood and the role position of the victim, which is broadcast and assigned by students (intrapsychological conditions).

3. The main role in the formation of learned helplessness of children belongs to the family, the type of upbringing in it: hyper-care, hypo-care, contradictory style of upbringing.

4. Personal helplessness does not form in a child if he develops in a multisubjective "child – adult" interaction.

5. The learned helplessness is formed and fixed in the process of long-term failures during the period of school and university education, which is facilitated by the deviant forms of behavior of teachers, due to professional deformations of personality.

6. The personal helplessness of pessimistic students (37%) is manifested in isolation, anxiety, excitability, dependence on others; is a prerequisite for the emergence of addictions, psychosomatic diseases, stresses, the formation of marginal self-perception and procrastination.

7. The learned helplessness is manifested in three areas: 1) motivational, 2) cognitive, and 3) affective. In the motivational sphere, this is the inability to influence the event in any way; in the cognitive one, inability to learn ways that in similar situations can be effective; in affective, a depressed state, depression due to unfortunate consequences.

8. The most serious consequences for full mental development occur if a person's helplessness is encouraged from the outside and socially approved. Strengthening the position of "I am helpless" is formed in educational institutions, as well as at home, if the child is undergoing the wrong style of upbringing. But it is precisely in school conditions where the field of social contacts is expanding that the tendency to generalization is most pronounced according to the principle: if I am helpless in this situation, then I am helpless always and everywhere.

The above results of psychological analysis necessitate the design of such an upbringing and educational environment in which the student will gain experience of independent activity, form an active position in the search and acquisition of the meanings of his own life and profession, overcome the manifestations of learned helplessness, marginalism, procrastination. This will make it possible in the future to carry out the continuous process of personality self-designing and to move sequentially from one stage of psychological restructuring of the personality to another: self-determination, self-expression, self-realization.

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大学教育环境的安全与保障问题，作为教育关系主体充分自我实现的空间

**THE PROBLEM OF SAFETY AND SECURITY OF THE
UNIVERSITY EDUCATIONAL ENVIRONMENT
AS A SPACE FOR THE FULL SELF-REALIZATION OF SUBJECTS
OF EDUCATIONAL RELATIONS**

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注解。有必要考虑到这样一个事实，即大学拥有众多资源，其教育环境可以并且应该以一种鼓励教育关系学科的主动性的方式来组织，就好像要激发他们采取教育的态度一样。主动行动，有助于发现创造力。如果与教育环境的互动效果不佳，那么学生和教育过程中的其他参与者通常会开始遇到不确定性和压力。压力会加剧，并产生毒性作用。这个问题可以通过教育环境的组织来解决，它对大学教育过程中的参与者很友好，每个人都知道他们可以依靠必要的心理和教学支持。以下内容可以用作对大学的学生和老师友好的教育环境的要素：小组工作的选择，重点是反思和沟通能力和技能的发展，适应力，情商，创造力，各种生产形式教材（使用适当的数字技术），教育过程的可视化，创意工作室的组织，项目方法。A安全的教育环境，对教育关系的主题友好，使学生能够有效地应对压力并解决当前的生活问题。

关键词：教育环境，大学，安全，充分自我实现，教育关系学科，学生，教师。

Annotation. *It is necessary to take into account the fact that the educational environment of the university, which has many resources, can and should be organized in such a way as to encourage the initiative of the subjects of educational relations, as if to provoke them to take initiative actions, to contribute to the detection of creative tension. If the effect of interaction with the educational environ-*

ment is not productive, then often students and other participants in the educational process begin to experience uncertainty and stress. Stress can be intensified and cause toxic effects. This problem can be solved through the organization of the educational environment, friendly for participants in the educational process at the university, where everyone understands that they can count on the necessary psychological and pedagogical support. The following can be used as elements of an educational environment friendly to students and teachers of the university: options for working in small groups, focused on the development of reflective and communicative abilities and skills, resilience, emotional intelligence, creativity, various productive forms of teaching material (using adequate digital technologies), visualization of the components of the educational process, organization of creative workshops, project method. A safe educational environment, friendly to the subjects of educational relations, allows students to effectively cope with stress and solve current life problems.

Key words: *educational environment, university, security, full self-fulfillment, subjects of educational relations, students, teachers.*

In the modern Russian education system, a personality-oriented paradigm is currently becoming the most demanded, aimed at ensuring personal growth and developing the personality potential of students, as well as all subjects of educational relations, which determine the full value of self-fulfillment of students by their activity. In this context, modern Russian education at university level is developing. The priority of modern Russian universities is the search for a solution to the problem of organizing the educational process, aimed at ensuring that students get the opportunity to acquire the necessary professional knowledge, skills, develop significant general cultural and professional competencies at the modern level, gain experience in the chosen professional field, and increase their competence. The priority is given to innovative processes that determine the intensification of the development of the professional orientation of thinking, reflective and communicative abilities and skills of students, their ability to understand and interpret information of various contents [1, 3, 5, 6, 8, 10, 11, 12].

The process of personal development of a future specialist is influenced not only by the educational process, but also by the professional environment, which has been recognized as one of the leading factors in personal development. Despite this large role, many issues related to the methodology and technologies of applying different approaches remain not fully understood. Such questions include the question of the content of the educational environment of a modern university, as well as the question of managing this environment.

The phenomenon of “educational environment” has been quite actively studied and described by various researchers [1, 2, 6]. For example, G.U. Belyaev presents

the educational environment as the educational environment of a particular educational institution, created thanks to the pedagogical activity of subject teachers and administrative personnel of the institution [2].

A specially organized humanistic developmental environment is focused on considering individual characteristics, needs, opportunities, life and value orientations of all participants in educational relations. This is such a special environment where everyone can realize themselves, depending on their potentials, where the conditions allow everyone to build a strategy for self-development.

It is important to organize the educational environment of professional training of future specialists and it will become an environment filled with the personal sense of mastered professional actions, search (activity) and emotional involvement, in which the personality values are consistent with the values of the professional community [1, 3, 6].

In order for the effect of interaction with the educational environment to be more productive, its perception should be adequate, it should cause mainly positive emotions, interest, and a desire to stay for a long time in these conditions [2]. It is necessary to consider how comfortable the educational environment is and psychologically safe for the subjects of educational relations.

In order to maximize the measure of the subject's activity in the course of interaction with the educational environment, in such an environment information, objects and types of activity, people and varieties of activities with them should fall into the value-semantic field of his personality. In this case, the student becomes the real subject of the educational process and his own development, and remains the object of influence of the educational environment.

It is necessary to take into account the fact that the educational environment of the university, which has many resources, can and should be organized in such a way as to encourage the initiative of the subjects of educational relations, as if to provoke them to take initiative actions, to contribute to the detection of creative tension.

If the effect of interaction with the educational environment is not productive, then often students and other participants in the educational process begin to experience uncertainty and stress. Stress can be intensified and cause toxic effects.

Stress in the educational process is a very frequent and significant phenomenon. Currently, most of the population suffers from mental disorders caused by acute or chronic psychological stress. Sometimes, directly and sometimes indirectly, stress is one of the main causes of serious diseases, various kinds of injuries, suicides and other negative manifestations. The most common manifestations of destructive stress are anxiety, increased nervousness, increased blood pressure, anger, irritability, fatigue, depression, depression.

Currently, various stressful factors, as well as factors of an emotional aspect, affecting the development of stress in students and other participants in educational relations in the university environment are distinguished and described. Stress factors include:

- physical and hygienic conditions for the organization of the educational process;
- surrounding air temperature;
- level of illumination;
- correspondence of the schedule of the educational process to the biological rhythms of the body, the presence and duration of breaks to restore strength.

The factors of the emotional plan include:

- the level of responsibility of subjects of educational relations;
- the realism of expectations and others.

Destructive stress can have a significant effect on various body systems. There is numerous evidence of a serious influence of the psychological state of a person on the development of various heart diseases. A high level of anxiety, fear, anger, rage contribute to the development of cardiovascular diseases, coronary insufficiency, pulmonary diseases [7, 9].

Stress leads to the release of additional hormones, such as cortisol (hydrocortisone), which is a biologically active steroid-type glucocorticoid hormone that is produced by the body in stressful situations, as well as during intense physical exertion or lack of nutrition. When the level of cortisol rises in a person's blood, not only mood, but metabolism can change dramatically, changes occur at the level of the body's nominal abilities. A significant increase in cortisol levels entails a risk of developing diabetes mellitus, obesity, Cushing's syndrome and hypertension [9].

Of course, different people react differently to stress. Experts in the field of physiology and psychology of stress isolate and describe physiological and psychological reactions.

At the first stage of stress (anxiety stage), complex biochemical changes occur in the body when the body tries to restore normal functioning. During such periods, people complain of pain in the muscles and joints, fever, loss of appetite and a general feeling of fatigue.

In the second stage of stress (resistance stage), there are symptoms that indicate that physiological resistance increases to cope with ongoing stress. However, the secretion of various glands increases, and resistance to infections decreases.

In the third stage of stress (the stage of exhaustion), which becomes relevant if stress persists for too long, the symptoms of deep frustration (depersonalization, emotional devastation) arise, and the feeling of failure intensifies.

The psychological reactions to stress of subjects of educational relationships can be varied. To a large extent, they are determined by how people perceive themselves and the world around them, what their self-attitude and worldview are. People with a pessimistic look on the world and themselves experience stress more seriously and harder than optimists. People's behavior in a difficult situation also partly depends on the intensity of the stress experienced. Severe stress changes behavior and leads to apathy and immobility. A person, as it were, "winds down" his activity, ceases to be active, can procrastinate, refuse any manifestations, experiencing meaningless waste.

In this regard, the problem of ensuring the safety of the educational environment of the university as a space for the full self-realization of the subjects of educational relations is becoming increasingly relevant in modern Russian reality.

This problem can be solved through the organization of the educational environment, friendly for participants in the educational process at the university, where everyone understands that they can count on the necessary psychological and pedagogical support. The following can be used as elements of an educational environment friendly to students and teachers of the university: options for working in small groups, focused on the development of reflective and communicative abilities and skills, resilience, emotional intelligence, creativity, various productive forms of teaching material (using adequate digital technologies), visualization of the components of the educational process, organization of creative workshops, project method [4, 6, 8, 10, 11, 12].

Thus, a safe educational environment, friendly to the subjects of educational relations, allows students to effectively cope with stress and solve current life problems.

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借款人的生物社会心理特征分析
**ANALYSIS OF BIOPSYCHOSOCIAL CHARACTERISTICS OF
LOAN BORROWERS**

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注解。这项工作提供了对借贷者的生物心理社会特征进行比较分析的结果-寻求精神科帮助的人和没有寻求心理帮助的人,以及从未发放过贷款的对照组。性别和年龄构成,受访者的社会和物质状况特征,收入来源和规模,获得贷款的动机,贷款金额,亲戚对贷款的态度,收款人的影响等。比较。发现了向包括残疾人,养老金领取者和孤独者在内的精神病患者提供贷款的事实。没有资源偿还债务。债务加剧了借款人的社会心理不适,导致了心理性精神障碍的发展以及对现有内源性和器质性精神障碍的补偿。结论是根据需要提高民众的金融知识和对借款人的初步心理咨询而得出的。

关键词: 现金贷款, 借款人, 精神病, 债务, 精神病, 信用风险。

Annotation. *This work presents the results of a comparative analyze of the biopsychosocial characteristics of loan borrowers - people who seek psychiatric help and people who didn't seek it, and the control group of people who have never issued a loan. The composition by gender and age, the characteristics of the social and material situation of the respondents, sources and sizes of their incomes, motives for obtaining loans, the amount of loans, the attitude of relatives to lending, the influence of collectors, etc. were compared. The facts of providing loans to the mentally ill, including people with disabilities, pensioners, and lonely people, were found. having no resources to repay debts. Debt contributed to the socio-psychological disadaptation of borrowers, the development of psychogenic mental disorders and decompensation of existing endogenous and organic mental disorders. The conclusion is formulated on the need to increase the financial literacy of the population and preliminary psychological counseling of borrowers.*

Key words: *cash loan, borrower, psychogenic disorders, debt, mental disorders, credit risk.*

Relevance

Active lending to individuals contributes to the emergence of millions of borrowers who do not have the financial resources to repay the debt. According to the Federal State Statistics Service and the National Bureau of Credit Histories, in 2019 36.9% of Russians make payments on loans, including 59% of the working population of the country [3]. The total debt obligations of our compatriots in 2019 exceeded 55 trillion rubles, which is 7 times more than their accumulations [4]. Millions of socially unprotected low-income citizens with somatic and mental disorders unexpectedly faced the fact that they needed to pay large sums every month to pay off loans. Mental disadaptation under the influence of social frustration or socially-stressful disorders can with high probability lead not only to neurotic or psychosomatic disorders with clinically defined symptoms (anxiety, depressive, asthenic, etc. manifestations), but also to destabilization of remissions during mental pathology. [1] This new combination of stressful and psycho-traumatic factors of active lending led to the emergence of many borrowers with mental disorders that are not sufficiently developed in the specialized literature [2].

Purpose of the research

A study of the biopsychosocial characteristics of credit borrowers seeking psychiatric care.

Characteristics of the groups examined

To identify risk factors for debts and the development of mental disorders caused by lending, 3 groups of study participants were formed. The first - the main group included 104 borrowers, divided into 2 subgroups: subgroup 1A - 51 people with mental disorders that arose in a clear causal connection with loan repayment problems. Subgroup 1B includes 53 borrowers who did not file their appeal with state psychiatric institutions. The second group, the control group, included 51 respondents who did not take loans. These were employees of a psychiatric hospital and their relatives, close in socio-biological characteristics to groups of borrowers.

Research methods

The characteristics of the social and financial situation, the motives for obtaining loans, the possibility of timely repayment, the size of loans, the attitude of relatives to lending, the influence of collectors were recorded in a specially designed author survey card; the frequency of their detection in the selected groups was compared, statistical processing of the results was carried out with the determination of the reliability of their differences.

Research results

As the biological characteristics of borrowers, gender and age are considered. The survey results are as follows. The average age of patients of subgroup 1A was 37.9 ± 12.0 years, of participants of subgroup 1B - 38.3 ± 12.0 years, in group 2 - 29.1 ± 11.4 years ($p = 0.002$). The greatest number of observations in all the com-

pared groups falls on young age up to 44 years. When comparing groups by gender, it was revealed that women dominated the groups of borrowers almost twice (68.6%). Apparently, this is due to the greater responsibility of women for creating conditions for life, a greater ability to sacrifice, to care for loved ones ($p < 0.026$).

The results of a study of the social characteristics of borrowers

Professional characteristics of the studied groups: in the subgroup of borrowers 1A, the surveyed worked in the service sector and in production in low-paying positions 35.3% and 31.4%, respectively, $p < 0.001$). More than half - 58.5% of subgroup 1B borrowers worked in the healthcare sector. When studying the marital status of the studied groups, it was found that mental disorders caused by lending, most often - in 43.1% of subgroup 1A, were found in single people. Apparently, their requests for quality of life are higher, but the degree of responsibility for their expenses is lower. Least of all - in 2.0% of subgroup 1A - mental disorders developed in families without children. ($p = 0.001$). Apparently, in this case it is easier to plan your budget and less unforeseen expenses. Sources of income of the studied groups: in subgroup 1A, the number of non-working pensioners is 45.1% significantly higher than in comparison groups (3.8% in subgroup 1B; 29.4% in group 2, respectively), and the number of employees in subgroup 1A is 43, 1% of its composition - was significantly less than in the same comparison groups - 84.9% in subgroup 1B; 64.7% in group 2, respectively. The share of working and part-time pensioners, that is, respondents with higher incomes, in subgroup 1A was small - 11.8%, comparable with subgroup 1B - 11.3%; in the group of 2 working pensioners, it was 5.9%. Thus, the highest risks of mental disorders after taking loans from people with low incomes are non-working pensioners by age, disability and dependents ($p < 0.001$). This studied attribute is legally attributable to credit risk factors. This judgment is confirmed by the fact that borrowers of subgroup 1A were significantly more likely (72.5%) to have unreliable sources of income than in comparison group 1B ($p < 0.001$). This circumstance can also be attributed to risk factors for non-repayment of loans.

A survey of the studied groups by loan size revealed that in subgroup 1A the minimum loan sizes prevailed - up to 100 thousand rubles for 49% of borrowers. This indicates a modest request, a certain criticality in assessing the possibilities of repaying loans. In subgroup 1B, borrowers who did not seek psychiatric care were dominated by a loan amount of up to 500,000 rubles (45.3%). Apparently, their loan repayment opportunities were more optimistic ($p = 0.018$).

This is confirmed by the information obtained in the study of the ability to predict loan repayments. In subgroup 1A, a positive forecast for loan repayment was found in 60.8% of its composition, which is 1.5 times lower than in subgroup 1B - in 90.6% of its composition. Accordingly, the forecast of loan non-repayment - in 39.2% of borrowers of subgroup 1A was 4 times higher than in the comparison

group ($p < 0.001$). This means that the level of criticality to the possibility of loan repayment in subgroup 1A was insufficient. It can be assumed that timely advice from relatives or counselors would help to refrain this category of poor people from loans.

The borrowers who applied for psychiatric help had debts that they did not have the ability to pay off. This circumstance, apparently, was a factor in the development of their mental disorders. This assumption was investigated by comparing subgroups of borrowers 1A and 1B. A negative forecast of loan repayment in subgroup 1A was found in 39.2% of its composition, and in subgroup 1B only in 9.4% of its composition. ($p < 0.001$). This fact confirms the position that ignoring one's own negative prognosis of loan repayment is a high risk factor for the development of mental disorders among borrowers.

One of the factors of maladaptation among borrowers is the attitude to lending to their close relatives. It was revealed that relatives of borrowers of subgroup 1A in 62.7% did not approve the loan. In subgroup 1B, a negative attitude of relatives to taking a loan was found in 34% of borrowers in this subgroup ($p < 0.001$). Relatives and reproaches to borrower-borrowers were expressed by relatives in subgroup 1A - 19.6% of the composition of the subgroup, in subgroup 1B - 7.5% of its composition. Relatives were forced to provide financial assistance to 43.1% of borrowers of subgroup 1A and 18.9% of borrowers of group 1B. The difference is 2.3 times ($p < 0.001$). Borrowers of subgroup 1B were 4 times more likely to receive moral assistance than borrowers of subgroup 1A (47.2% and 11.8%, respectively). Apparently, the degree of disadaptation of borrowers of subgroup 1B was significantly less, and moral support was sufficient for them ($p < 0.001$).

A significant factor in the disadaptation of borrowers is the impact on them of collectors (moral, social, physical and material pressure). Communication between borrowers and collectors in subgroup 1A was detected 7.6 times more often (56.9%) than in subgroup borrowers 1B (7.5%). This result shows that communication with collectors is the most powerful stressful factor for loan borrowers ($p < 0.001$).

The motivation for ensuring a living wage, including the purchase of food, medicine, utility bills, in subgroup 1A was found in 23.5% of borrowers, in subgroup 1B - in 9.4% of borrowers ($p < 0.001$), which indicates an extremely low income level in subgroup 1A, and allows this to be recognized as a risk factor for exacerbation or the occurrence of mental disorders caused by debts. The motivation for helping friends and relatives is also significantly higher in subgroup 1A - 11.8% of its composition than in subgroup 1B - 1.9% of its composition, which indicates the poverty of their social environment, which not only cannot help repayment of loans, but also exacerbates the problem of repayment of loans. In the subgroup of patients 1A, 9.8% of its composition revealed a dependence

on gambling and alcohol, which forced them to take loans under the influence of attraction to gambling and psychoactive substances. This risk factor is found only in borrowers who seek psychiatric care.

A loan for the purchase of housing and improved living standards in subgroup 1B was found in 20.8% and 67.9% of borrowers, respectively. In subgroup 1A, there were no people willing to buy a house. Improving housing conditions for loans in this subgroup was also 13% less than subgroup 1B ($p < 0.001$). Obviously, the financial position of borrowers in group 1B was better. This situation is confirmed by information on the size of income: in subgroup 1A there was not a single person who could afford to buy everything that was needed (travel, car, housing). 74.5% of the members of this subgroup of funds were only enough for a minimum (food, medicine). In comparison groups, the income level was higher. Free money (for durable goods - a refrigerator, a washing machine, etc., clothes) was less among borrowers of subgroup 1A than borrowers of subgroup 1B (25.5% and 34.0%, respectively, $p = 0.011$).

The results of a study of the psychological and psychiatric characteristics of borrowers

To confirm the assumption that it was loan debts that caused the development of mental disorders for loan borrowers, a special study of their subjective opinion was conducted: borrowers of subgroup 1A, who applied for psychiatric help, were 4.8 times more likely to indicate a connection between their maladaptation and loans than borrowers of subgroup 1B. This confirms that credit debt is a significant risk factor for psychological and mental maladaptation ($p < 0.001$).

The mental state of people at the time of applying for a loan was of fundamental importance: 49.0% of borrowers of subgroup 1A issued loans having negative feelings. They were found 3.7 times more often than borrowers of subgroup 1B (13.2%). Positive experiences at the time of obtaining loans were found less often than negative ones, in subgroup 1A by 12.5 times, in subgroup 1B by 1.4 times ($p < 0.001$). But for borrowers who obtained loans in a hypomanic state, credit histories were more complex, with many loans in different banks, and had more serious consequences, including hospitalization, forensic psychiatric examination and courts. This substantiates the recommendation to consult a psychiatrist or clinical psychologist before applying for a loan.

Rank distribution of the genesis of experiences for loan borrowers: psychogenic disorders were observed among borrowers of both subgroups 1A and 1B, but they turned up 3 times more often in people who applied for psychiatric help than in the group who did not go to psychiatrists (45.1% and 15, 1% respectively). Complaints and symptoms characteristic of endogenous mental disorders were identified only in subgroup 1A (11.8%). These results confirm the position that loan debt is primarily a mental trauma, and can also actualize endogenous diseases.

Analysis of the distribution of borrowers by heading ICD 10 showed that borrowers of subgroup 1A suffered from mental disorders before taking a loan, of which 56.9% - endogenous, 25.5% - organic, 11.8% - affective disorders ($p < 0.0001$). Apparently, their exacerbation, caused by the psychogeny of debt, led to the request for psychiatric help. There were no mental disorders in the group of borrowers 1B before taking a loan. They did not arise even after obtaining a loan.

The provision of loans without taking into account the state of mental health of citizens creates risks of obtaining loans to mentally ill persons with disabilities who do not have the ability to repay them. In subgroup 1A, 21.6% of its composition had a disability due to mental illness ($p < 0.001$). There were no persons with disabilities in the group of borrowers who did not seek psychiatric help.

Discussion

The results of the study allow us to determine the biopsychosocial and psychiatric risk factors for the development of mental disorders in loan borrowers. Such factors include: low salaries or pensions, lack of family, retirement age, unfounded optimistic forecast for timely payment of a loan, ignoring realistic warnings from relatives; legal, administrative, financial and digital incompetence of borrowers; the presence of mental disorders that began before applying for a loan, the impact of collectors. Many of them are available for timely identification, which is the basis for the development of interagency recommendations for the prevention of mental disorders in borrowers.

Conclusions

1. The widespread use of consumer credit without taking into account the social, financial, and medical characteristics of borrowers threatens to create debt.
2. The impossibility of timely repayment of loans creates psycho-traumatic circumstances for borrowers that contribute to the development of psychogenic, as well as the actualization of endogenous, organic and affective mental disorders.
3. Preliminary psychological counseling of borrowers with a discussion of established factors of credit risk, socio-psychological maladaptation, development or updating of existing mental disorders is advisable.

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针刺镇痛的优化
**OPTIMIZATION OF AURICULAR ACUPUNCTURE FOR DENTAL
ANALGESIA**

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注解。这项研究致力于使用Search-02仪器评估患有各种形式龋齿的患者牙齿的耳道电镇痛效果。根据电渗度法的变化对电镇痛进行了客观评估，该指标在手术后增加了2倍和3倍。还通过三点量表对患者本人的主观感觉进行了镇痛效果评估：从无麻醉到无力和明显的麻醉。从接触开始后1、2、5分钟和手术终止后进行评估。这项研究是针对52位年龄在20-23岁之间的男性（25岁）和女性（27岁）的志愿者学生进行的。

评估了所用设备的优缺点。确定了最佳曝光时间。已经确定了其在浅表和继发龋的止痛中的最有前景的用途。

关键词：牙齿耳廓电止痛，“Search-02”器械，电渗流法动力学；麻醉治疗龋齿。

Annotation. *The study is dedicated to assessing the results of auricular electroanalgesia of the teeth of patients with various forms of caries using the Search-02 apparatus. An objective assessment of electroanalgesia was carried out on the basis of changes in electroodontometry, the indicators of which increased 2 and 3 times after the procedure. The analgesic effect was also evaluated by the subjective sensations of the patient himself within the framework of a three-point scale: from the absence of anesthesia, to a weak and pronounced one. The assessment was carried out after 1, 2, 5 minutes from the start of exposure and after the termination of the procedure. The study was conducted on 52 volunteer students male (25) and female (27) gender, aged 20-23 years.*

The advantages and disadvantages of the apparatus used are evaluated. The optimal exposure time was determined. The most promising use of it for analgesia in the treatment of superficial and secondary caries has been identified.

Keywords: *auricular electroanalgesia of teeth, apparatus "Search-02", the dynamics of electroodontometry; anesthesia in the treatment of dental caries.*

Despite technological advances in dentistry, pain remains the main problem that doctors face in everyday practice. The possibility of solving this problem through electroanalgesia is undeniable. In addition, the proposed type of analgesia avoids the injection of anesthetics, which are the cause of odontophobia and possible allergic reactions, of which there are more and more every year.

Tooth anesthesia is a recurring topic that attracts the attention of practitioners and is also quickly forgotten by them. In domestic dentistry, an apparatus for electroodontodiagnostics (ОД-1 or ОД-2), and electric anesthesia for teeth (АЭОЗ-1), which are morally and technically outdated today, were recommended for this [1, 2]. A real decrease in the pain sensitivity of teeth during electroanalgesia pushes researchers to search for new methods and devices that improve the analgesic effect and simplify the procedure.

All of the above indicates the advisability of improving methods of tooth anesthesia by optimizing electroanalgesia.

Objective: to evaluate the effectiveness of electric anesthesia for teeth with the apparatus "Poisk-02", for auricular acupuncture, in the treatment of various forms of caries.

Materials and research methods

The study was conducted on 52 volunteer students male (25 people) and female (27) gender, aged 20-23 years. For anesthesia, the apparatus of electrical stimulation of biologically active points "Poisk-02" was used. A characteristic feature of the Poisk-02 electropuncture device is its small dimensions (140x16 mm), work on 2 standard batteries, which facilitates its use by the dentist. The device "Poisk" is a generator of weak galvanic current with a microcircuit indicator Poisk-pen for acupuncture makes it possible to remove accumulated static electricity and simplify Poisk auricular points. The diameter of the conductive probe is only 1.0 mm. Supply voltage no more - 3 V. Current consumption in the storage mode: no more - 1 μ A. Mass - 70 g (Fig. 1).

When determining the acupuncture point, the device emits a sound signal, which serves as the beginning of the procedure (Fig. 2).

Before stimulation of the acupuncture point, the parameters of the electric excitability of the pulp of the teeth were measured (Fig. 3).

The obtained indicators corresponded to the research data of T. Redinova and G. Lubomirsky. [3]. After electroanalgesia, the data of electroodontodiagnostics significantly increased (Fig. 4) and served as an objective assessment of analgesia.



Fig. 1. *Appearance of the device "Poisk-02"*

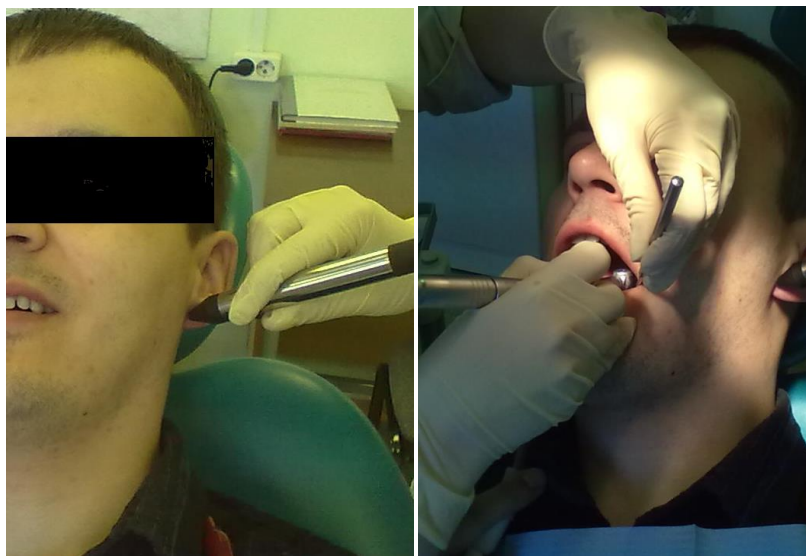


Fig. 2. *The technique of conducting auricular acupuncture with the Poisk-02 apparatus for dental treatment.*



Fig. 3. *Electroexcitation of the pulp of the tooth 2.3 prior to electrical pain relief.*

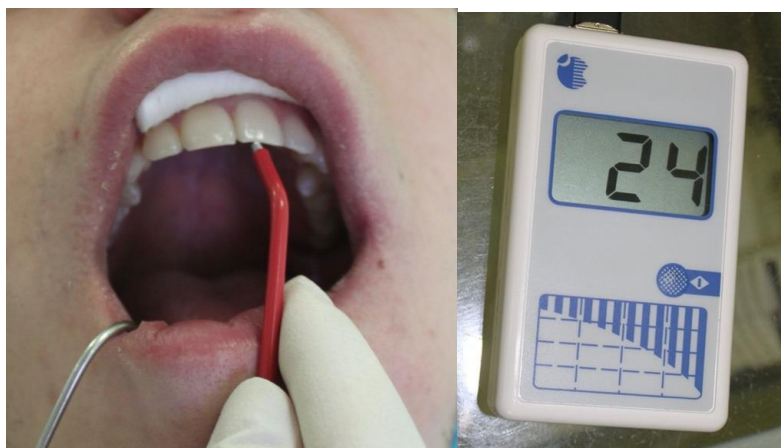


Fig. 4. *Measurement of the electroexcitability of the pulp of the tooth 2.1 after electrical anesthesia.*

The analgesic effect was also evaluated by the subjective sensations of the patient himself within the framework of a three-point scale: 1 point — the absence of an analgesic effect; 2 points - mild analgesic effect; 3 points - pronounced analgesic effect.

The assessment was carried out after 1, 2, 5 minutes from the start of exposure and after the termination of the procedure.

For quantitative indicators were calculated: arithmetic means (M) and standard error of the mean (m). The verification of the subordination of the distribution to the normal law was carried out according to the Shapiro-Wilks criterion. To compare the values of indicators in two groups, the methods of parametric and non-parametric estimation were used. Two-sample comparisons were carried out using Student's criterion. Differences were considered statistically significant at $p < 0.05$. The statistical significance of the differences when comparing two unrelated samples that do not obey the normal distribution was analyzed using the Mann-Whitney test. The significance of the before-after differences was analyzed using the Wilcoxon test (W). Statistical processing of the material was carried out using the SPSS 12.0 for Windows program.

Research results and discussion

Indices of electroexcitability of the pulp of intact teeth fit into the range: from 2 to 9 μA - in the area of incisors and canines; from 6 to 15 μA - in the area of premolars; from 8 to 18 μA - in the field of molars.

Measurement of electric excitability (EDI) of the pulp of teeth before and after auricular acupuncture was significant: in incisors and premolars, EDI increased by 2 times; in fangs and molars 3 times (Fig. 1).

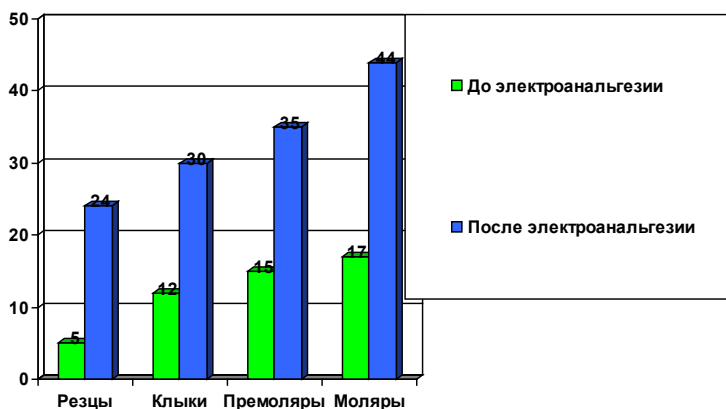


Diagram. 1. Change in the electrical excitability of the pulp of teeth before and after electroanalgesia.

Electrical stimulation led to an increase in EDI after 1 minute, but the maximum effect was manifested after 2 minutes. A further increase in electroanalgesia time is up to 5 minutes, did not lead to a significant change in the electrical excitability of the pulp of the teeth. After the termination of electrical stimulation, the

effect of analgesia was preserved, as evidenced by the achieved indicators of EDI (Table 1).

Table 1.

The dynamics of the EDI of the teeth after 1, 2, 5 minutes and after conducting auricular acupuncture with the apparatus "Poisk - 02"

EDI indicators	after 1 min.	after 2 min	P ₁	after 5 min.	After electro-analgesia	P ₂	P ₃
incisors	15,3±1,1	28,4±2,1	<0,001	29,3±2,1	28,4±2,1	>0,05	>0,05
fangs	17,2±1,3	33,1±2,2	<0,001	35,3±2,3	34,0±2,3	>0,05	>0,05
premolars	18,3±1,8	37,8±4,8	<0,001	37,9±4,9	29,1±5,1	>0,05	>0,05
molars	27,1±2,5	38,2±2,2	<0,001	36,4±2,1	32,3±2,2	>0,05	>0,05

Note: P₁ - the degree of statistical significance of differences in the studied parameters after 1 and 2 minutes of analgesia; P₂ - the degree of statistical significance of differences after 2 and 5 minutes of analgesia; P₃ - the degree of statistical significance of differences after 5 minutes and after analgesia.

Significant differences ($P < 0.05$) in the severity of auricular electroanalgesia were noted in the treatment of various forms of dental caries. So, in the treatment of superficial caries, a pronounced analgesic effect was observed in 100% of cases, which corresponded to 3.0 points. Indicators decreased with an average caries to 82% (2.5 points). In the treatment of deep caries, the analgesic effect was weak or absent (1.4 points).

Thus, the simplicity of auricular acupuncture, the small size of the apparatus, the simplification of the method for determining analgesic points are the indisputable advantages of using Poisk-2 for anesthesia in the treatment of dental caries. Analgesia occurs quickly, after a minute, reaches its maximum value in 2 minutes, is maintained for 5 minutes and persists after anesthesia.

However, a pronounced analgesic effect is observed in the treatment of only superficial and secondary caries, while cases of deep caries therapy, especially those requiring pain relief, show a lack of result.

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广义沙门氏菌病与一例临床病例的相关性。 流行病学, 诊断, 治疗的特点
**THE RELEVANCE OF GENERALIZED SALMONELLOSIS ON
AN EXAMPLE OF A CLINICAL CASE. FEATURES OF THE
EPIDEMIOLOGY, DIAGNOSTICS, THERAPY**

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抽象。沙门氏菌病-是一种由沙门氏菌属的多种血清型细菌引起的急性人畜共患感染,具有病原体的粪-口传播机制,其特征在于胃肠道主要病变,中毒和脱水综合征的发展,在发展广义形式的情况下的临床表现。沙门氏菌病存在于世界所有地区,目前是发达国家中最常见的人畜共患病之一。在任何地方,发病率都有增加的趋势,特别是对于具有集中式食品供应系统的大城市而言。这种疾病的一种特别危险的形式被普遍化,它具有并发症的高风险,有时甚至使患者死亡。由于这种形式的临床表现的多态性,实际上,医生并不总是能够正确地诊断它,这导致治疗错误和此类患者的预后恶化。

该文章描述了沙门氏菌病并发急性肾衰竭的一般形式的临床病例。研究了临床和流行病学特征,以及这种形式的诊断和治疗特征。

关键词: 沙门氏菌病, 广义形式, 急性肾衰竭, 流行病学, 诊断, 治疗。

Abstract. *Salmonellosis – is an acute zoonanthroponic infection caused by numerous serotypes of bacteria of the genus Salmonella with a fecal-oral mechanism of transmission of the pathogen, characterized by a predominant lesion of the gastrointestinal tract, the development of intoxication and dehydration syndrome, polymorphism of the clinical picture in the case of the development of generalized forms. Salmonellosis is found in all regions of the world and is currently one of the most common zoonoses in developed countries. Everywhere, the incidence tends to increase, especially for large cities with a centralized food supply system. A*

particularly dangerous form of this disease is generalized, which has a high risk of complications and sometimes death for the patient. Due to the polymorphism of the clinical picture of this form, in practice, doctors are not always able to correctly diagnose it, which leads to errors in treatment and a worsening prognosis of such patients.

The article describes a clinical case of a generalized form of salmonellosis complicated by acute renal failure. Clinical and epidemiological features were studied, as well as features in the diagnosis and treatment of this form.

Keywords: *salmonellosis, generalized form, acute renal failure, epidemiology, diagnosis, treatment.*

Introduction

Salmonellosis is one of the main food gastroenteric infections worldwide [5, 13]. According to the results of the US Centers for Disease Control and Prevention (CDC), *Salmonella* causes about 1.35 million infections, of which 1.2 million are caused by non-typhoid *Salmonella*, 26,500 hospitalizations and 420 deaths annually among the US population [12]. In the Russian Federation, unfortunately, there is no single statistical base for recording all cases of salmonellosis; only a few studies are conducted in individual regions of the country. For example, in 2015, 930 cases of salmonellosis in the Primorsky Krai were recorded (51.05 per 100 thousand), which was 2 times higher than the Russian Federation in 2015 (25.39 per 100 thousand), but lower than the 2014 level (62.51 per 100 thousand) [2].

According to the Salmonellosis Reference Center for Monitoring, in 2017, the incidence of this infection was the lowest in the last 10 years (22.02 per 100 thousand of the population). According to the I.I. Mechnikov North-West State Medical University, the Ministry of Health of Russia and the Pasteur Research Institute of Epidemiology and Microbiology in 2019 in Russia, about 50 thousand cases of people with salmonellosis were registered. Despite the tendency toward a decrease in the incidence of salmonellosis in certain regions, they occupy third place (after acute intestinal infections of viral etiology) in the structure of foci of group morbidity with fecal-oral transmission of the pathogen among the population of the Russian Federation [11]. Many measures are being taken to reduce the incidence of salmonellosis. However, this infection continues to remain relevant due to the existing risks of infection in a developing livestock and poultry complex [11]. According to WHO, the source of infection is most often animal products, such as meat, poultry, chicken eggs and dairy products [5, 13].

In the Russian Federation, *Salmonella enteritidis* is the main causative agent of salmonellosis [11]. The triad of the most common serovars also includes *S. typhimurium* and *S. infantis* [1]. In the etiological structure of *Salmonella salmonella enteritidis* group D is diagnosed in 77.6% of cases [1]. In most cases, salmonellosis occurs mainly with lesions of the gastrointestinal tract in the form

of gastrointestinal forms: gastritis, gastroenteritis, gastroenterocolitis. The most common manifestation of gastrointestinal forms of the disease is salmonella gastroenteritis - from 85-95% of all cases [1].

Immunosuppression, the presence of chronic diseases, old age are risk factors for the generalization of the infectious process [5]. The generalized form is relatively rare. Moreover, 10% of generalized forms are complicated by acute renal failure [3].

A clinically generalized form of salmonellosis can occur in two versions: typhoid-like and septicopyemic. With the typhoid-like variant, symptoms of gastroenteritis are often noted initially. When examining a patient, it is sometimes possible to note elements of a hemorrhagic rash on the skin, hepatolienal syndrome develops on day 3-5. On examination, the characteristic "typhoid" tongue is noteworthy. There is moderate arterial hypotension, relative bradycardia. The clinical picture resembles that of typhoid fever. At this stage, hospitalization of the patient is necessary, since the risk of developing complications such as toxic shock, acute cardiovascular failure, acute adrenal insufficiency and acute renal failure is high.

Another problem today is the growth of invasive "non-typhoidal" salmonellosis with the formation of secondary foci, which is noted in the countries of Central, Western and South Africa [6, 7, 8]. It is important to note that the individual serovars *Salmonella typhimurium* and *Salmonella enteritidis*, which cause the development of meningitis, arthritis with osteomyelitis, phlegmon, pneumonia, are multi-resistant to antibiotics, which is a real problem today. A study conducted in 1998-2014 showed that the role of antibiotic resistance in the development of meningitis among the population of South Africa is high [7]. The frequency of invasive forms of "non-typhoidal" salmonellosis among the pediatric population of West Africa, in particular in Mali, is also increasing. Milagritos D. Tapia et al. demonstrated that the "non-typhoidal" invasive salmonella causing the foci of infection of different localization came out on top among other microorganisms [8]. The generalized form, most often, develops with untimely hospitalization of the patient in a hospital. The most characteristic symptoms of salmonellosis include chills, fever, cramping abdominal pains, abundant loose stools of green color (like "swamp mud") and vomiting.

The procedure for laboratory diagnosis in cases of suspected acute intestinal infections (AII) in the Russian Federation is determined by the Sanitary and Epidemiological Rules 3.1.1.1117-02 "Prevention of Acute Intestinal Infections". The microbiological method (bacteriological culture) - the isolation of the pathogen (*Salmonella spp.*) From blood, urine and feces is the gold diagnostic standard [9, 10]. The use of molecular genetic research methods should not be considered as an alternative, but as a mandatory addition to the regulated diagnostic schemes AII, which allows to effectively identify a complex of pathogens. The most effective

methods for the rapid diagnosis of salmonellosis are methods aimed at detecting nucleic acids or pathogen antigens - polymerase chain reaction (PCR) with the detection of *Salmonella* spp. DNA, immunofluorescence (IFR) reaction, latex agglutination reaction (LAR), enzyme-linked immunosorbent assay (ELISA) for determination of salmonella antigens in coprofiltrate. Serological examination is indicated for negative results of bacteriological examination and is an auxiliary method.

Difficulties arise in the diagnosis of a typhoid-like variant, clinically occurring as typhoid fever, paratyphoid A and B, sepsis of various etiologies. The decisive role in the diagnosis is played by laboratory diagnostics.

Purpose of the study – research of the relevance, epidemiology, diagnosis and treatment of a generalized form of salmonellosis based on domestic and foreign literature from the eLibrary and PubMed databases. Description of the clinical case of a generalized form of salmonellosis, a typhoid-like variant complicated by acute renal failure.

Materials and methods

In this article, we report a clinical case of a 69-year-old patient with a generalized form of salmonellosis. The infectious process was characterized by an acute onset, developed rapidly and dynamically. From the epidemiological history it is known that on the eve of the patient ate home-made dried fish. The use of meat, dairy products and chicken eggs in the specified period of time denies. Chills and fever appeared 39.5 ° C. Then gastroenteritis syndrome in the form of nausea and repeated vomiting. There were pains in the umbilical region of a cramping nature, abundant watery stools of green color up to 10 times a day. The patient was taking enterosorbents and antipyretics. However, no improvement came. On the 2nd day of the disease, a team of doctors was called, an injection of Analgin with Drotaverin was made, and oral rehydration therapy (Regidron solution) was prescribed. The patient was not hospitalized. On the 3rd day, spasms of the calf muscles appeared, the frequency of diarrhea increased up to 15 times. On the 4th day, the ambulance crew was called again. A hoarse voice appeared. Blood pressure decreased to 80/40, tachycardia was noted up to 120 beats per minute. The patient was hospitalized in the intensive care unit with a preliminary diagnosis of intestinal infection of unspecified etiology (IIUE). On examination: the tongue is dry, coated with plaque, with imprints of teeth along the edges. Palpation of the abdomen: soft, painful in the umbilical region, hepatomegaly. The liver protruded 1.5 cm from the edge of the costal arch. Oligoanuria developed.

Results

The patient was prescribed a number of laboratory and instrumental studies. Bacteriological culture of blood, urine and feces - seeding of *Salmonella* enteritidis of group D. PCR of blood of feces - DNA of *Salmonella* spp.

Complete blood count: hematocrit-49%; erythrocytes- $5.37 \times 10^{12}/l$; leuko-

cytes- $9 \times 10^9/l$; stab-8%; segmented-84%; monocytes-2,9%; lymphocytes-5,1%; platelets - $155 \times 10^9/l$. Hypercreatininemia was observed (648.0 mmol/l with a norm of up to 115.0), and the urea level increased to 28.0 mmol/l with a norm of up to 8 mmol/l . The level of C-reactive protein was 223 mg/l . Laboratory data have confirmed the development of acute renal failure.

Ultrasound of the abdominal organs showed an increase and diffusely heterogeneous changes in the liver parenchyma, the presence of a cyst in the liver and an expansion of the intestinal loops.

Given the acute onset, intoxication syndrome, grade III gastroenteritis and dehydration syndrome, as well as data on the epidemiological history and seeding of *Salmonella enteritidis* group D in the blood, the patient was given a clinical diagnosis: salmonellosis, generalized form, typhoid-like variant, severe course (blood test - *Salmonella enteritidis* group D). The course of the disease was complicated by the development of acute renal failure. Etiotropic antibiotic therapy was prescribed according to the following scheme: Ciprofloxacin $400 \text{ mg} \times 2$ times a day intravenously and Ceftriaxone $2.0 \text{ g} \times 2$ times a day intravenously; pathogenetic therapy (crystalloid solutions parenterally, "Smecta" enterosorbent, enzyme therapy "Mezim-forte") and symptomatic therapy (Drotaverinum, Paracetamol).

Conclusion

Thus, patients with severe AII are subject to mandatory hospitalization. The severity of the course is determined by intoxication syndrome and dehydration syndrome.

In case of a severe course, upon admission to the hospital, antibiotic therapy should be immediately prescribed and bacteriological culture of all three media (blood, urine and feces) should be carried out so as not to miss the generalization of the infectious process.

It is important to consider that the generalized form of salmonellosis can be complicated by the development of acute renal failure, which in the absence of adequate timely therapy reduces the chances of a favorable outcome.

The basis of therapeutic measures for salmonellosis is: regimen, rehydration therapy, diet (table №4), pathogenetic therapy (enterosorbents, probiotics, prebiotics, enzymatic therapy), etiotropic therapy (antibacterial drugs, oral immunoglobulins), symptomatic therapy (antipyretic, antispasmodics). Starting drugs for the treatment of salmonellosis: nifuroxazide, trimethoprim/sulfamethoxazole, kanamycin, gentamicin, amoxicillin/clavulanate, cefexime [9, 10]. The duration of the course of therapy is 5-7 days. Reserve drugs in the treatment of severe and generalized forms: amikacin, netilmicin, cefotaxime, ceftriaxone, ceftazidime, meropenem, thienies, rifampicin, ciprofloxacin, levofloxacin. In nosocomial salmonellosis, therapy is started with reserve preparations [9, 10]. The duration of the course of therapy – 7-14 days.

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气相色谱-质谱法测定手部化脓性炎症患者的微生物标志物的经验
**EXPERIENCE IN DETERMINING MICROBIAL MARKERS BY
GAS CHROMATOGRAPHY WITH MASS SPECTROMETRY IN
PATIENTS WITH PURULENT-INFLAMMATORY DISEASES OF
THE HAND**

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抽象。 本文介绍了使用气相色谱与质量选择离子检测 (GC-MS) 作为手部化脓性炎症疾病的病因诊断方法的经验。 在所研究的患者组中, 在两个临界点收集了生物材料 (化脓性炎症和毛细血管血的重点内容)。 术前, 服用抗菌药物之前和手术治疗后的第三天。 还通过播种在固体营养培养基上, 即化脓性病灶的内容, 进行了经典的细菌学分析。 获得的结果证实了细菌菌群易位为炎症焦点的假设以及厌氧菌群在化脓性炎症疾病的发病机理中的主要作用。

关键词: 手部化脓性炎症疾病, 气相色谱质谱, 微生物组学, 细菌易位, 微生物标志物。

Abstract. *The article describes the experience of using gas chromatography with mass selective ion detection (GC-MS) as a method for etiological diagnosis in purulent-inflammatory diseases of the hand. In the studied group of patients, biological material was collected (contents of the focus of purulent inflammation and capillary blood) at 2 critical points. Intraoperatively, before taking antibacterial drugs and on the third day after surgical treatment. A classical bacteriological analysis was also carried out by means of seeding on solid nutrient media, the contents of the purulent focus. The obtained results confirmed the assumption of translocation of the bacterial flora into the focus of inflammation and the predominant role of the anaerobic flora in the pathogenesis of purulent-inflammatory diseases.*

Keywords: *purulent-inflammatory diseases of the hand, gas chromatography mass spectrometry, microbiomes, bacterial translocation, microbial markers.*

Introduction

Issues of etiological diagnosis and treatment of purulent-inflammatory diseases of the hand continue to worry practicing surgeons, despite the long history of studying this medical and social problem. Over the past decade, the frequency of occurrence among patients has not tended to decrease, and the severity of the purulent-inflammatory process itself often increases [1,2]. Among all suppurative processes of soft tissues and bones, purulent diseases of the cyst continue to take first place, accounting for 15% of cases first-time patients seeking medical care [3,4].

One of the factors determining the effectiveness of therapeutic measures for purulent-inflammatory diseases is the time and quality determination of the etiological factor. Existing phenotypic identification methods based on the cultivation of microorganisms on nutrient media have disadvantages (low speed and relatively low information content) that do not allow to form an opinion on the species composition of the microflora of the pathological focus, which in turn complicates the timely diagnosis and the appointment of adequate antibiotic therapy.

There is a need for the search and implementation of new diagnostic technologies that could provide high speed (no more than a few hours), greater productivity, sufficient sensitivity and affordability of clinical and microbiological analysis. An important requirement for diagnostic methods is the ability to obtain reliable results when working with polymicrobial biological samples containing a mixture of various microorganisms [5].

At present, the trend of personalized medicine involves the greater use of laboratory diagnostics in the routine practice of –OMIS technologies (genomics, transcriptomics, proteomics, metabolomics), the most promising of which, in light of the above problems, are metabolic research methods using chromatography-mass-spectrometry.

GC-MS allows detecting in the studied samples biological material markers - components of the microbial cell and its metabolites (fatty acids, aldehydes, alcohols and sterols) - both endogenous and exogenous microflora, without first isolating a pure culture of microorganisms, which is especially important taking into account the fact difficulties in the cultivation of anaerobes. Distinctive advantages of the method are the expressness of the analysis and the possibility of quantitative assessment of the marker content [6].

Purpose of the study is to identify microorganism markers by the GC-MS method in patients with purulent-inflammatory diseases of the hand by measuring the concentration of microbial markers in the blood and the contents of the purulent focus (wound discharge).

Materials and methods

Surgical treatment of 63 patients with purulent-inflammatory diseases of the hand was performed, in which the right hand in males was mainly affected. The right hand is mostly affected in males, of working age. The average age of patients is 40.2 years. The average number of days before seeking medical care was -3.2 days. Antibacterial therapy, until the results of the antibioticogram are ready, was carried out on the basis of the empirical principle of its purpose. The first dose of the chosen drug (we used ceftriaxone) was prescribed on the day of hospitalization, after the removal of the biological material for microbiological studies using classical culture methods and chemical analysis using the GC-MS method. The checkup began with a medical history and examination.

Before the operation, all patients were comprehensively examined by laboratory and instrumental methods. Surgical treatment was performed under conduction anesthesia, at the level of the elbow joint. The scope of surgical treatment included opening the debridement and draining the purulent foci using an squeezing band at the level of the forearm. During the operation, the contents of the purulent lesion were taken with a sterile cotton-paper swab on a plastic stick from a test tube for microbiological studies without filler (Figure № 1). Capillary blood was collected in 2 ml ETDA tubes. Repeated sampling of biological material was performed on the 3rd day of treatment.



Figure №1. Sampling of the purulent focus with a sterile cotton-paper swab.

A classical microbiological study was also carried out by sowing on solid nutrient media (vitelline salt agar, blood agar, Endo medium, Saburo medium). The determination of antibiotic sensitivity was carried out according to the standard method [7].

In order to detect markers of potential pathogens in these biological samples, the above material was studied by means of physico-chemical analysis by the GC-MS method followed by an automatic calculation algorithm proposed by G.A. Osipov (dated February 24, 2010) (Figure № 2).



Picture. 2 Gas chromatograph with mass spectrometer.

The affiliation of markers to specific microorganisms was determined using the NIST database and included program algorithm of the Sherlock instrument (MINIInc, Delaware, USA) for chromatographic identification of microorganisms by fatty acid components.

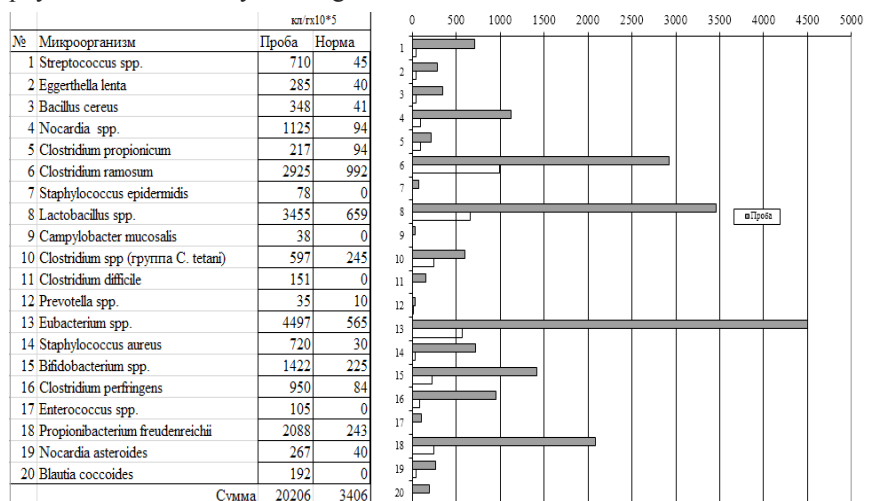
Results and its discussion

Fatty acids, hydroxyacids, cyclopropanoic acids, sterols, which are components of the phospholipid bilayer of the bacterial cell wall and membranes, as well as the result of the metabolism of microflora and microorganism, were found in the secretions of wounds and blood of patients when analyzed by the GC-MS method.

The article presents the averaged results of the concentration calculation in order to avoid overloading the volume of presentation.

In the studied samples of biological material, more than twofold excess concentrations of the following substances were revealed: 7 hexadecenic acid (a component of the cell wall), 10-hydroxystearic and 10-oxide-decenic acids (products of enzymatic hydrolysis of macroorganism tissues by microbial enzymes), isodecanoic and isodecenic acids. Representatives of clostridia (*Clostridium propionicum*, *Cl. Ramosum*, *Cl. Difficile*, *Cl. Histolyticum*, *Cl. Perfringens*) are detected by these acids. Cis-vaccenic acid (*Lactobacillus* spp.), Octadecene aldehyde (*Bifidobacterium* spp.), trans-9,10-hexodecenoic acid (*Nocardia asteroides*), 3-hydroxy-isopentadecanoic acid (*Prevotella* spp.), anteisononeadecanoic acid (*Staphylococcus* spp.), isoheptadecenoic acid (*Campylobacter mucosalis*), iso-pentadecane aldehyde (*Propionibacterium freudenreichii*), cycloheptadecanoic acid (*Enterobacteriaceae* family, in the absence of pseudomonad), dehydrocholesterol (*Eubacterium*), iso-hexadecane aldehyde (*Eggerthella lenta*), anteisotridecanoic acid (*Bacillus cereus*) (Table №1).

Table № 1 shows an example of the result of the study of wound secretions by physicochemical analysis using the GC-MS method.



The same compounds were also detected in the blood, but at a much lower concentration (above the detection limits).

In a classical bacteriological study, the contents of the purulent focus obtained from the initial operation from 63 (100%) crops in 4 (6.35%) no growth of the microbial flora was detected, in 40 (63.5%) *Staphylococcus aureus* was determined, in 9 (14.3%) – *Streptococcus pyogenes*, 5 (7.8%) – *Staphylococcus epidermidis*,

2 (3.17%) – *Escherichiacoli*, 2 (3.17%) – *Staphylococcus* «Koa-», 1 (1.58 %) – *Enterococcusfaecalis* (Fig. № 3, 4). When analyzing the results of classical bacteriological research, it was noted that microorganisms are mainly determined in the form of monoculture. In our study, 38 (66.6%) cases of mixed infection were recorded, which consists of the following microorganisms: 1) *St.aureus*+*Srt. Pyogenes*; 2) *St.aureus* +*St. epidermidis*; 3) *St.aureus*+ *Escherichia coli*; 4) *Srt. Pyogenes* +*St. Epidermidis* + *St*"Koa-".

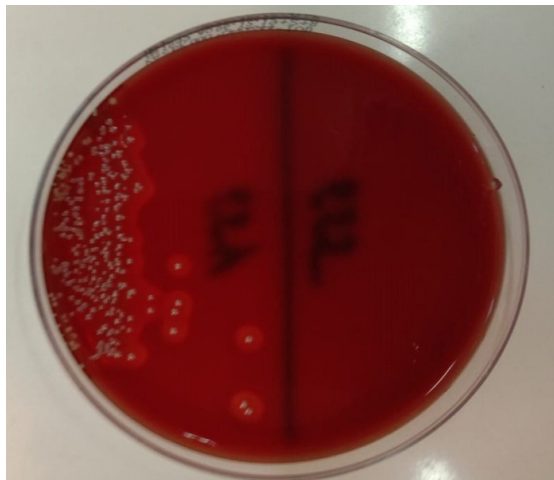


Figure №3. Colonies of *St. aureus*.



Figure №4. Colonies of *St. epidermidis*.

The results of the GC-MS method also revealed the presence of 4 (*St. aureus*, *St. epidermidis*, *Escherichiacoli*, *Str. spp.*) suspected pathogens in the inflammatory focus, which we were able to obtain by cultural methods, which confirms its viability as an express diagnostic method. Data on the composition of microbiota suggest the leading role of autoflora, mainly of anaerobic nature, in maintaining the focus of purulent inflammation that appeared in it through translocation of intestinal microflora. Anaerobic bacteria are significant components of the normal human microbiome, most colonize the colon biotope 10^{10} - 10^{12} CFU/g.

Most of the identified types of microorganisms are either difficult to cultivate or can't be cultivated. R. Berg [9] defined bacterial translocation as the passage of viable bacteria and their toxins from the gastrointestinal tract through the mucous membrane into extraintestinal sections of the macroorganism (mesenteric lymph nodes, liver, spleen, blood flow). The role of this phenomenon in the pathogenesis of surgical infection is described in detail in the works of N.I. Nikitenko [10]. The components of the cell membranes of microorganisms in the blood appear as a result of phagocytosis, enzymatic lysis by a blood protein complement or autolysis. The presence of microbial markers in the blood reflects the composition of the microbial consortia of the human body, regardless of the habitat of microorganisms or the focus of inflammation. [11] The determination of microorganism markers in the blood does not give rise to assumptions about the presence of a generalized septic process, although they are detected in comparable concentrations with the leading etiological object.

Conclusions:

1. Thus, the GC-MS method allowed us to determine the presence of bacterial translocation of intestinal microorganisms in the focus of purulent inflammation.
2. Identification of markers of microorganisms simultaneously in the blood and the focus of purulent inflammation allows us to identify them as potentially etiological agents.
3. The predominance of anaerobic microflora in the focus of inflammation emphasizes the need for the use of antibacterial drugs that are active against anaerobic flora.
4. The speed of material research using the GC-MS method is an indisputable advantage (no more than 4 hours) of this method, which allows using it as an express method for studying the composition of microbiota biotopes.

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止血的一些参数及其在现代麻疹治疗中的作用
**SOME PARAMETERS OF HEMOSTASIS AND THEIR ROLE IN THE
CLINIC OF THE MODERN COURSE OF MEASLES**

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抽象。 本文包含有关麻疹患者止血和血管壁病变的现代信息。 考虑使用诸如血小板聚集, D-二聚体, von Willebrand因子, 内皮素, 血栓调节蛋白等指标的可行性, 这些指标将揭示现阶段麻疹患者的发病机理, 诊断和治疗的新方面, 并将作为基础 制定这些患者血栓性出血性并发症的预后标准和预防措施。

关键词: 麻疹, 止血, 聚集, 内皮。

Abstract. *The article contains modern information about hemostasis and vascular wall lesions in patients with measles. The feasibility of using indicators such as platelet aggregation, D-dimer, von Willebrand factor, endothelin, thrombomodulin, which will reveal new aspects of the pathogenesis, diagnosis and treatment of measles patients at the present stage, is considered and will serve as the basis for the development of prognostic criteria and preventive measures for thrombohemorrhagic complications in these patients.*

Keywords: *measles, hemostasis, aggregation, endothelium.*

Introduction The measles problem is likely to remain relevant for a long time. The disease is extremely highly contagious. A decrease in the percentage of unvaccinated people leads to outbreaks of the disease and is the main cause of measles in Europe and other regions of the world. Given the recent increase in the incidence of measles in the Russian Federation, the relevance of the selected infectious disease study is undeniable [1,2,5].

Since the pathognomic measles syndrome - exanthema - is based on microcirculatory disorders, damage to the walls of blood vessels in the form of perivascular edema, hemorrhages, and in cases of necrosis, it is obvious that changes in the hemostatic system accompanied by vascular damage play an important role in the pathogenesis of these disorders [3].

It is known that measles virus invades through the mucous membranes of the upper respiratory tract and conjunctiva and then concentrates in human tissues and organs. The input receptor is the membrane protein CD46 expressed by platelets. This fact suggests that platelets play an important role in the pathogenesis of measles, since the appearance of exanthema entails the development of hemorrhages, necrosis, which can lead to thrombohemorrhagic syndrome. The development of severe complications, such as measles encephalitis, keratitis with complete loss of vision, panencephalitis, pneumonia, as well as a high risk of termination of pregnancy are a likely consequence of the manifestation of undecided thrombohemorrhagic syndrome [4]. However, according to the literature, studies at the current level of the vascular-platelet link of hemostasis and endothelial factors in measles patients have not been conducted.

The determination of such indicators as Ddimer, endothelial factors will allow us to identify new aspects of the pathogenesis, diagnosis and treatment of measles patients at the present stage and will serve as the basis for the development of prognostic criteria and preventive measures to prevent thrombohemorrhagic complications in these patients. [7]

Purpose. Determine the significance of the identified violations to assess the severity of the course, features of clinical manifestations, prognosis of the disease.

Patients and methods. Measles patients (60 patients diagnosed with measles, verified by ELISA, were hospitalized in the specialized department of the Infectious Diseases Clinical Hospital № 2 of Moscow in 2017 - 2018)

The age of the patients was 42.8 ± 6.8 years, males (61.1%) prevailed. Patients were admitted, on average, on the 36th day of illness during the peak period (2nd day of the appearance of rashes). An acute onset with febrile condition was noted in 71.3% of cases, and in other cases subfebrile condition was recorded within 4 days. The duration of the febrile period was 8.5 ± 0.3 days. On examination, patients noted: dry cough (in 80.6% of patients), poly-lymphadenopathy (in 73.1% of cases), hyperemia and tonsil hypertrophy (in 69.4% of patients), as well as hepatomegaly with an increase in direct bilirubin level (6.2%) and transaminase activity (23.8%).

Exanthema syndrome in the form of a rose-papular rash appeared at the height of the disease, on average, on the 4th day, and in 4 patients examined on the 6th day, the hemorrhagic component of the elements was attached and petechiae were recorded and a positive symptom of "pinching".

The studies were carried out in the clinical department of infectious pathology of the CRIE of the FSSCPHW on the basis of the Moscow Clinical Hospital № 2.

In the control group to assess the physiological level of hemostasis indicators were included 25 healthy individuals.

Platelet aggregation activity was determined on an LA 230 NPO BIOLA aggregometer (ADP inducer, at a base concentration of $2 \times 10^{-5} \mu\text{m}$) and evaluated by the degree of (V%) and aggregation rate (S%).

The von Willebrand factor activity was determined on an LA 230 aggregometer (NPO BIOLA), von Willebrandtest reagent NPO "Renam", Ddimer on an automated coagulological analyzer Sysmex CS5100, reagent: D-Dimer INNOVANCE, "Siemens". The quantitative determination of endothelin and thrombomodulin in blood serum was performed by ELISA using an Anthos 2010 instrument using the following sets: Endothelin 138 "Biomedica immunoassays" (Austria), thrombomodulin "Hycult Biotech" (Netherlands). Statistical data processing was performed using the STATISTICA 10 software Stat.Soft.Inc using parametric and nonparametric methods.

Research results and discussion. In 80.6% of cases, measles was characterized by an acute onset with a rise in body temperature to febrile values, while the rest recorded subfebrile condition with a transition to high pyrexia within 4 days. During this period, patients noted a dry barking cough with the development of hoarseness, profuse discharge of a mucous character from the nose, photophobia, severe weakness, intense headache of a spilled character, sleep disturbance. From the first days of fever, patients developed symptoms of catarrhal conjunctivitis and scleritis in the form of vascular injections with manifestations of pain during movement of the eyeballs.

In 80.1% of cases, at the time of admission of patients to the hospital, lymphadenopathy was noted. Palpable mainly submandibular, anterior and middle cervical lymph nodes, painless and not fused with the surrounding tissues. The mucous membrane of the oropharynx was hyperemic, enanthema was noted in the soft and hard palate, as well as hypertrophy of the tonsils. In 65.8% of cases, Belsky-Filatov-Koplik spots were recorded on the mucous membrane of the cheeks, which persisted, on average, until the 9th day of illness.

According to the literature, one of the main symptoms that are taken into account in the differential diagnosis of infectious diseases that occur with exanthema is the staging of rashes characteristic of measles: first they appear on the face, by the beginning of the 2nd day they spread to the neck, upper chest and upper limbs, and towards the end - on torso and lower limbs [5,6]. However, in the 11 patients we observed, the timing of the appearance of rash elements was reduced to several hours. Rashes were represented by roseola and papules, prone to fusion, as a result of which the rash acquired a rose-white-papular nature in all patients observed.

Currently, a direct dependence of hemostasis on pathological disorders of the immune system in many infectious diseases has been established. It is proved that activated platelets are a powerful and versatile agent of immune and inflammatory effector cells. They establish a connection between hemostasis and the immune system, recognizing the functions of signaling, transmitting biological information and organizing complex physiological and pathological inflammatory reactions [8]. In this regard, one of the objectives of this study was to study the state of the vascular-platelet link of hemostasis.

The platelet count ranged from 93 to 430 x 10⁹/l, while thrombocytopenia was recorded in 76.1% of cases.

V was 58.0 ± 2.4%, however, in 43.5% of patients, its decrease was noted. The average values of the degree of platelet aggregation indicated an increase in their functional activity (see table. 1). However, a quarter of patients noted a decrease in the degree of aggregation, on average, to 27.4%, among them in half - up to 20%. At the same time, 25.6% of patients recorded maximum values of hyperaggregation. Moreover, the rate of aggregation did not statistically significantly change, and only in patients with minimal values of aggregation did the rate decrease. In 70.6% of cases, the second wave of aggregation was recorded, including among patients with reduced degree and rate of aggregation. It is important to note that in patients with the presence of single petechiae platelet aggregation was reduced, on average, to 20% and there was no second wave on the aggregatogram.

One of the markers of vascular wall damage is von Willebrand factor. It provides the attachment of platelets to the site of the damaged vessel [9]. All observed patients showed a statistically significant increase in the activity of von Willebrand factor to 167.8 ± 8.8%, which indicates continued inflammation and damage to the vascular wall in patients with measles. Moreover, the minimum values in patients exceeded the average in patients of the control group by more than 1.5 times.

The D-dimer test is a definitive test for suspected thrombotic disorders. An increase in the concentration of D dimers above average values was recorded in 75% of cases in this study, while in 35% of cases the values were significantly higher than 1000 ng/ml, which indicates a risk of increased thrombosis (see table 1).

Table 1. *Changes in hemostasis in measles patients*

Groups	Statistical Parameters	Platelets			vWF (%)	D-dimer (ng/ml)
		Amount	V (%)	S (%/min)		
Control	M±m	358,2±10,4	49,3±3,3	58,6±2,0	61,2±4,8	468,3 ± 20,4
	min/ max	245/440	43/57	45/81	60/68	338/680
	mediana	358,4± 7,6	45,1± 2,2	54,5±2,1	61,2±4,6	405±35,6

Patients	M±m	149,5± 8,1**	58,0 ± 2,4*	54,1± 3,9	167,8±5,6**	1340±58**
	min/ max	93/430	18/99	17/94	116/248	865/1590
	mediana	130,9± 7,5**	53,0± 3,4*	50,1± 3,5	159,1±3,9**	1293,4±54,6**
Note. V (%) – degree of aggregation; S ((%) – rate of aggregation; vWF (%) – von Willebrand factor; ** p<0,001; * p<0,05.						

A total analysis of the entire population of measles revealed a decrease in platelet aggregation ability, which corresponds to the hypocoagulation phase of DIC. The phase of hypercoagulation, which is primary and short in time, was determined in several patients hospitalized in the hospital in the first hours of the disease. Since most patients were hospitalized on the 36th day of the disease in a moderate state, they were already in the “compensatory” hypocoagulation phase of DIC. Thus, in patients with measles, the course of the infectious process is accompanied by disorders in the platelet link of hemostasis, mainly in the form of platelet hypoaggregation, which only occasionally manifests clinical symptoms.

The activity of von Willebrand factor was increased, which indicates persistent signs of inflammation and damage to the vascular wall in patients with measles.

Table 2. *Changes in endothelin and thrombomodulin in measles patients with a summary analysis (M ± m)*

Metric/Unit	Patients (n = 60)	Control (n = 25)
Endothelin (pm/l)	5,10±1,12*	0,34±0,05
Thrombomodulin (pg/ml)	988±287*	3280±234

The differences are significant in comparison with the control: p< 0,05*

During the height of (6.5 ± 0.5 day of illness), an increase in the concentration of endothelin by 1.5 times from the control values was noted, which indicated the possibility of manifestation of vasoconstriction, as a result of which the blood rheology may change. As is known, thrombomodulin (CD141) is an integral membrane protein involved in the process of protein activation with thrombin with the exception of the latter from thrombosis. In this study, a sharp decrease in CD141 was detected compared with the control group.

Thus, the revealed increase in the concentration of endothelin against the background of a sharp decrease in thrombomodulin indicates the development of vasoconstriction, which borders on the risk of increased thrombosis. In this regard, the study of these indicators is relevant for assessing the severity of the course, prognosis and directions of pharmacotherapy of measles patients in order to prevent thrombohemorrhagic complications.

Conclusion. The results of this study showed that the development of the infectious process in the body of measles patients is accompanied by severe disorders in the vascular-thrombocyte link of hemostasis in the form of significant damage to the vascular wall, which, in turn, is accompanied in the first stages by an increased consumption of platelets to restore the endothelium, since they contain vascular endothelial growth factor and thus are the only uniform blood elements that carry out regenerative processes in the damaged vascular wall. The fact of isolation of measles virus by platelets as a primary barrier to the pathogen invasion cannot also be ruled out. These processes require an increased consumption of blood platelets, therefore, by the time the rashes appear, platelet deficiency occurs, manifested by thrombocytopenia, but the cells retain functional activity with a moderate increase. However, the identification of platelet hypoaggregation in some cases gives reason to consider platelet germ depletion, which may affect the development of hemorrhagic syndrome in these patients.

Thus, currently in patients with measles, there are violations of the state of the vascular-platelet link of hemostasis, and they can be decisive in character for the severity of the course and outcomes of the disease. Therefore, to determine the criteria for the risk of complications from hemostasis, as well as for the prognosis of the disease, it is necessary to continue a further, more detailed study of the dynamics of all links of hemostasis in patients with measles.

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分形美的物理本质

THE PHYSICAL NATURE OF THE FRACTAL BEAUTY

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注解。在这项工作中已经考虑了分形美的物理描述。已经讨论了关于选择大脑皮层中的分形图像的空间频率的概念的争论。分形及其傅立叶图像的缩放参数的稳定性得到了特别的关注,表明了特定大脑部位进行快速光信号处理的能力。快速的傅立叶视觉信号处理使人感觉舒适并在考虑分形物体时引起美感。这项研究的结果使人们能够从物理角度解释视觉艺术疗法在医学中的功效,并对现代美学的某些陈述进行物理解释。

关键词: 光信号, 分形美, 图像的傅立叶变换, 缩放, 结构自相似, 类自然物体, 艺术疗法。

Annotation. *Physical description of the fractal beauty has been considered in this work. The arguments for the concept of selection of the spatial frequencies of fractal images in the brain cortex have been discussed. Special attention has been paid to the stability of the scaling parameter of a fractal and its Fourier image, indicating the ability for rapid optical signal processing in particular brain sites. Rapid Fourier processing of visual signals makes one feel comfortable and causes the sense of beauty when contemplating a fractal object. The results of this study enable one to explain the efficiency of visual art therapy in medicine from the physical viewpoint, as well as to give a physical interpretation to some statements of modern aesthetics.*

Keywords: *optical signals, fractal beauty, Fourier transforms of images, scaling, structural self-similarity, nature-like objects, art therapy.*

Introduction

The phenomenon of the fractal beauty has become the subject of attention for many researchers [1-3]. In the literature various aspects of the attractiveness of fractal images are considered. In particular, great attention is paid to the features of image processing in the cerebral cortex. Corresponding studies have formed an independent scientific direction of neuropsychology - neuroaesthetics [4-6]. However, the representations used in this field need to be expanded and

deepened. In this respect, the concept of works [7-9] is noteworthy. In those publications the beauty of fractals is explained by the high efficiency of frequency filtering of fractal images when they are processed in the cerebral cortex. It is assumed that the human visual system contains neural complexes possessing the properties of two-dimensional space-frequency Fourier or Gabor filters [9]. There is a set of relatively "narrow" filters tuned to the perception of different spatial frequencies. If the shape of the spatial frequency distribution matches in different spectral intervals, then the signal processing occurs quickly and with small energy expenditure. Thereby, a person develops a sense of comfort that causes excitation in the cerebral cortex of pleasure centers. This forms a feeling of beauty and emotional uplift when natural objects and works of art are contemplated. The creative abilities of the individual, in particular, are improved. Frequency analysis simplifies recognition of familiar objects with enlarged or reduced sizes. In this case, only the harmonic structure is fixed in the memory system. This makes identification of the image more economical, independent of the real size of the object. Therefore the operative memory of the brain requires a smaller volume. Features of the perception of visual information about fractal objects are used in fractal art therapy. Features of processing of visual information about fractal objects are used in fractal art therapy - a new field of modern medicine [10-13]. It is based on the therapeutic effect of human perception of fractal objects and processes. At present, extensive statistical material on the use of fractal artherapy to people has been accumulated with the aim of improving general health, prophylaxis and treatment of mental illnesses. It shows that the beauty of fractals affects the emotional state of the patient. Based on the concept of frequency selection and taking into account the features of the spatial spectra of fractal structures, one can find the physical reason for their aesthetic and therapeutic effects on the human condition.

The aim of this work is to solve the problem of the relationship between the fractal properties of the image of an object and its Fourier spectrum. Particular attention is paid to the stability of the spectral characteristics to random and deterministic changes in the structure of images.

Properties of artificial fractals

At the initial stage of this work various types of fractal and fractal-like objects are considered and the spatial spectra corresponding to them are determined. As a rule, with a few exceptions, structures with fractal features were characterized by fractal spectra. An illustration of this fact is shown in figure 1. It shows the characteristics of a two-dimensional fractal structure. It was modeled by using the expression for the two-dimensional band-bounded Weierstrass function [14]

$$W(x, y) = \sum_{n=0}^{N-1} b^n \sum_{m=1}^M \sin \left[K \cdot b^n \cdot \left(x \cdot \cos \left(\frac{2 \cdot \pi \cdot m}{M} \right) + y \cdot \sin \left(\frac{2 \cdot \pi \cdot m}{M} \right) \right) + \phi_{n,m} \right],$$

where x, y - transverse coordinates; C - the normalization constant; $b > 1$ - the spatial frequency scaling parameter; D is the fractal dimension ($2 < D < 3$); K is the main spatial wave number; N and M - the number of harmonics; $\phi_{n,m}$ - the phase specified in the interval $[-\pi; \pi]$. Depending on the distribution of this quantity according to a given or random law, the above formula will describe either the deterministic structure of the object, or stochastic. Particular attention in the course of numerical modeling was given to fixing the self-similar properties of spatial spectra and to determining their characteristic scaling coefficients. Figure 1a shows a graph of the Weierstrass function for $\phi_{n,m} = 0$, and figure 1b shows its Fourier spectrum. The following parameter values were used: $C=0.04, b=2, D=2.21, K=1.5, N=15, M=15$.

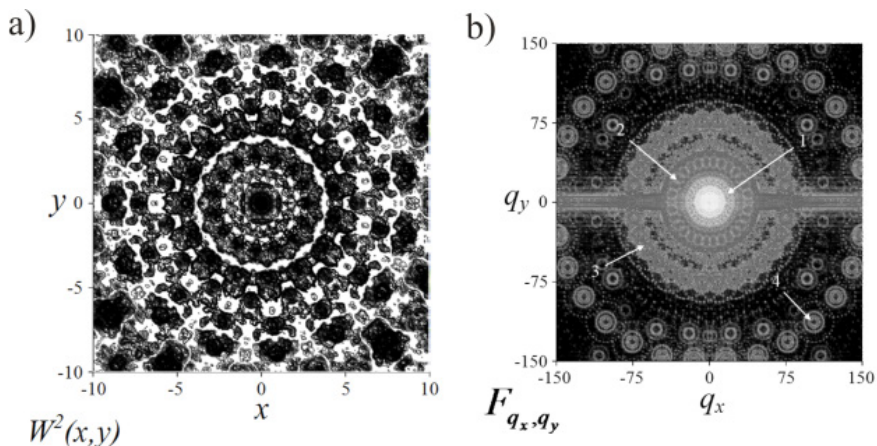


Figure 1. Graphical representation of the function $W^2(x, y)$ (a) and its Fourier spectrum $F(q_x, q_y)$ (b). $F(q_x, q_y)$ - amplitude coefficients; x, y coordinates and spatial frequencies q_x, q_y are presented in arbitrary units; the phase $\phi_{n,m}$ is fixed.

The spectrum of Weierstrass function consists of a spectral maxima system. It forms ring-shaped maxima distributions at different distances from the zero frequency. These annular distributions of the maxima are labeled 1-4. The number of maxima in each ring is the same. The ratio of the radii of the rings r_i/r_{i-1} is equal to the value $\xi = b = 2$. This indicates the self-similar nature of the Fourier spectrum of the Weierstrass function. Calculations show that the form of the spectral components distribution depends weakly on the change in the parameters of the function ($C, D, K, N, M, \phi_{n,m}$). Thus, an increase in the fractal dimension D leads only to

the appearance of some additional satellites in the spectral maxima located along the rings without changing the overall configuration of the spectral distribution.

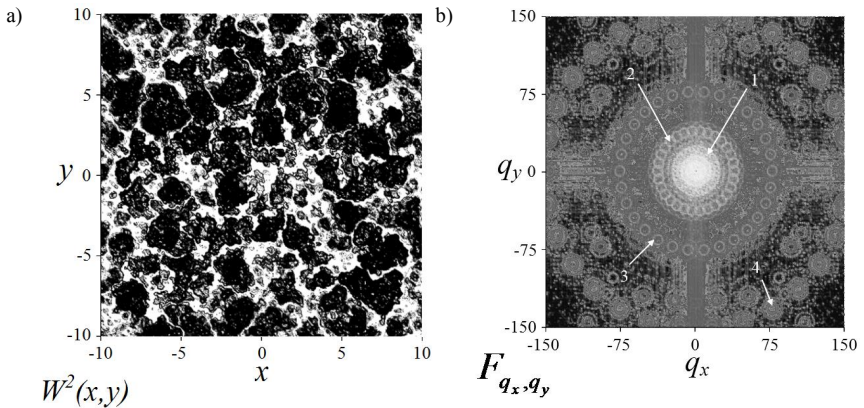


Figure 2. Graphical representation of the function $W^2(x, y)$ (a) and its Fourier spectrum $F(q_x, q_y)$ (b); random phase.

The structure of the image changed significantly when the phase value $\phi_{n,m}$ acquired a random distribution while preserving the values of other parameters. In this case, the image became speckle-like (figure 2a). Despite significant changes in the intensity distribution, the shape of the spectrum did not change radically (figure 2b).

Properties of nature-like fractals

According to one of the beauty criteria used in the discussion of aesthetic categories, pleasant objects are those whose structure and shape are close to natural formations (of the ground, sea coast, clouds, trees, bushes, etc.). The above-considered fractal structures have quite a complex abstract shape. There is also the possibility of constructing other fractal objects that will be similar to natural ones. One example of such an object is the fern leaf image that can be easily constructed via the known algorithm [15] (figure 3a). The fractal nature of the leaf is due to similarity of its side fragments with a leaf shape as a whole. The level of structure of the above leaves can be characterized by the ratio of lengths of the offshoots on the fern leaf. This ratio, which determines the scaling coefficient, was found to be $\xi \approx 1.18 \pm 0.01$. The Fourier transforms of fern leaf images were calculated using the FFT method. A thorough analysis of their structure revealed that it also possesses scaling, as seen in figure 3b Fourier image has self-similar individual fragments. For convenience, one of them is circled by a solid line. A comparison of the segment lengths of this fragment, marked with a dotted line and numbers 1–7, reveals that the length ratio of segments 1–2, 2–3, 3–4, 4–5, 5–6, and 6–7,

as in the case of a fern leaf image, is close to the same scaling coefficient ($\xi \approx 1.2 \pm 0.02$). It is notable that the scaling coefficient in the Fourier transforms is the same for of fern leaves illustrated in figure 3a.

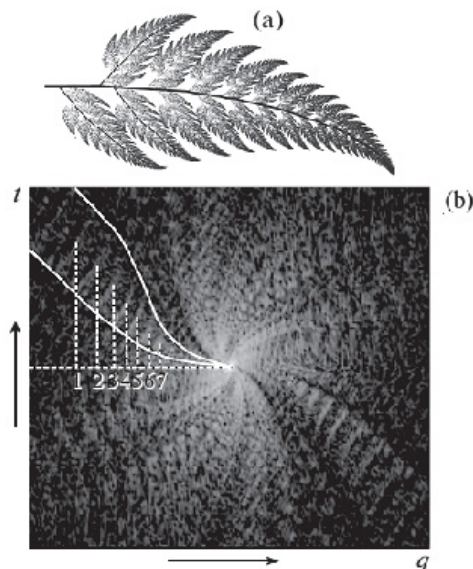


Figure 3. (a) Fern leaf image and (b) its Fourier transform. The white line outlines one of the self-similar elements. The length ratio of segments 1–7 defines the scaling coefficient.

Conclusion

Thus, the observed stability of the Fourier transforms and their scaling properties explains to a large extent the reasons for the aesthetic value of fractal images. Given that numerous natural objects possess fractal signs [16], these results allow the interpretation of one of the main statements of modern aesthetics. According to this statement, the strongest emotional impact on a person is exerted by structures whose geometry is close to that of natural objects. The results obtained during the optical and physical trials enable one to rationally explain the high efficiency of fractal art therapy, which finds multiple conformations in medical practice. The simulation performed in this study reveals that natural objects are characterized by self-similarity, which highlights the fractal signs in spatial spectra. This determines the aesthetic value of the environment to a large extent. In spite of the great diversity of systems and processes their study combines fractal methods of analysis. Due to their universality, it becomes possible to search for the most common regularities that determine the properties of various structures.

Acknowledgments

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双绞线的反向光散射研究

**STUDY OF REVERSE LIGHT SCATTERING OF A TWISTED
THREAD**

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抽象。考虑使用一种新的光学非破坏性方法来监视双绞线的几何参数的可能性。该方法的事实在于，螺柱螺纹被旋转偏振面的平面偏振光照射。然后，根据测得的以已知角度散射的光束的可变分量的值，构造反向散射的角度图。通过此图中最大值的位置来判断所研究螺纹的受控参数。在各种性质的纱线样品上，研究了正常照明下具有旋转偏振平面的非偏振和平面偏振光的反向散射角度图。在所研究的细丝的相同样本上，研究了与反向散射图的角度值相对应的照明区域的微图像。研究表明，所提出的方法能够评估线的机械扭曲角度和线股中单丝的角位置。

关键词：无损检测双绞线的几何参数；后向散射反射光的偏振；漫射光散射；反向散射角图。

Abstract. *The possibility of using a new optical non-destructive method for monitoring the geometrical parameters of a twisted thread is considered. The method consists in the fact that the studied thread is illuminated by plane-polarized light with a rotating plane of polarization. Then, according to the value of the measured variable component of the light flux scattered at a known angle, an angular diagram of backscattering is constructed. The controlled parameters of the investigated thread are judged by the location of the maxima in this diagram. On yarn samples of various natures, the angular diagrams of backscattering under normal illumination by non-polarized and plane-polarized light with a rotating plane of polarization were studied. On the same samples of the studied filaments, microimages of illuminated areas corresponding to the angular values of backscattering diagrams were studied. Studies show the promise of the proposed method for assessing the angle of mechanical twist of the thread and the angular position of monofilaments in strands of thread.*

Key words: *non-destructive testing; geometrical parameters of a twisted thread; backscatter; polarization of light in reflection; diffuse light scattering; backscatter angular diagrams.*

Introduction

In [1], it was proposed, and in [2], an optical method for controlling the straightness coefficient of fibers in fiber tapes under illumination with unpolarized light was described in detail, which is suitable for monitoring during production. It also describes the operation of a laboratory setup for measuring the angular diagrams of backscattering of semi-finished products of spinning production in unpolarized light, and it is shown that the angular diagram of light scattering for all studied semi-finished products has the form of an ellipse. It has been established that in relation to the semiaxes of this ellipse, one can judge the degree of straightness of the fibers in the materials under study.

In [3], a method was proposed for controlling the optical anisotropy of light scattering of flat fibrous materials, based on measuring the angular diagram of backscattering of plane polarized light under normal illumination of the studied material with plane polarized light with a plane of polarization rotating around the axis of the light beam. This method has a higher resolution than the method [1].

In [4], the proposed method was used to control the anisotropy of the angular distribution of fibers in semi-finished products of spinning and paper.

In [5], the capabilities of the method for controlling the value of mechanical twisting of textile threads were investigated, and in [6] the possibility of determining by this method the direction of twisting of the studied threads was shown.

In Figure 1 shows a diagram of an experimental setup explaining the method proposed in [3].

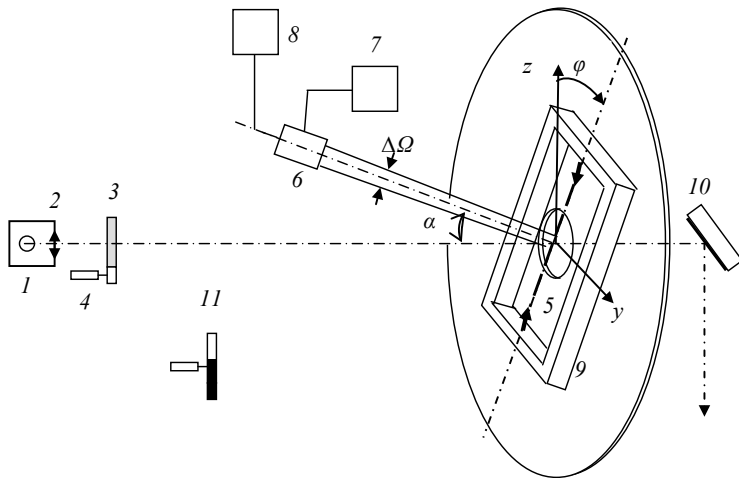


Figure 1. The device according to the method of [3] for removing angular diagrams of back light scattering of twisted threads

The light from source 1 (a white LED emitting non polarized light in the visible region of the spectrum) through a telescopic lens 2 and a polarizer 3 (polaroid film), driven by a motor 4, with a parallel beam normally incident on the surface of the studied filament 5. As the photo detector, a photomultiplier tube (PMT) 6 is used, which is powered by a stabilized rectifier 7 and detects the light scattered by the material at an angle α to the optical axis in a constant solid angle. The alternating voltage component with the PMT is measured with a digital voltmeter 8. The thread 5 is fixed in a special holder 9 in a tense state. The holder with the thread can rotate around the axis of the incident light beam and can be set to any angle φ in the range $0-2\pi$ with an accuracy of $\pm 10^0$. Mirror 10 deflects the light passing by the filament aside from the photo detectors.

Comparative measurements of the angular light scattering diagrams according to the method of [1] were carried out on the same setup (Figure 1) in the absence of a polarizer 3 - 4. Instead, a modulator 11 was installed, which periodically interrupted the light beam. In this case, the voltmeter 8 measured the amplitude of the alternating voltage, proportional to the luminous flux entering the PMT according to the method [5].

To explain the features observed in the angular diagrams for filaments twisted from various materials, a hypothetical model was put forward [2] for the processes occurring during light scattering, which relates these features to differences in the polarization of light when reflected from different parts of the studied objects.

Research results and their analysis

In the present work, for experimental substantiation of the assumptions advanced in [2], the angle diagrams obtained using the setup shown in Figure 1, with corresponding computer images of the illuminated sections of the yarn samples taken on the setup shown in Figure 2.

White LED 1 at the same angle α as in the installation in Figure 1, a parallel beam illuminates the studied thread 2. The thread is fixed in the horizontal plane of the table 3, which can rotate around a vertical axis in the range $(0 - 360)^0$. The rotation angle of the studied thread φ relative to that indicated in Figure 2. The position is fixed using the pointer 4. The image of the illuminated portion of the thread, created by the light scattered in the direction of the vertical axis, can be visually observed through a telephoto microscope (5) and captured by a web camera 6 connected to computer 7.

The well-known fact of the reversibility of light rays was used in this installation. If the light in the experiment (Figure 2) falls on the object under study at the same angle α at which it is fixed in the experiment on the installation (Figure 1) under normal illumination of the object, then the image observed in the installation (Figure 2) - During the genesis of the object, areas created by light scattered or reflected in the normal direction (along the vertical axis) will be observed.

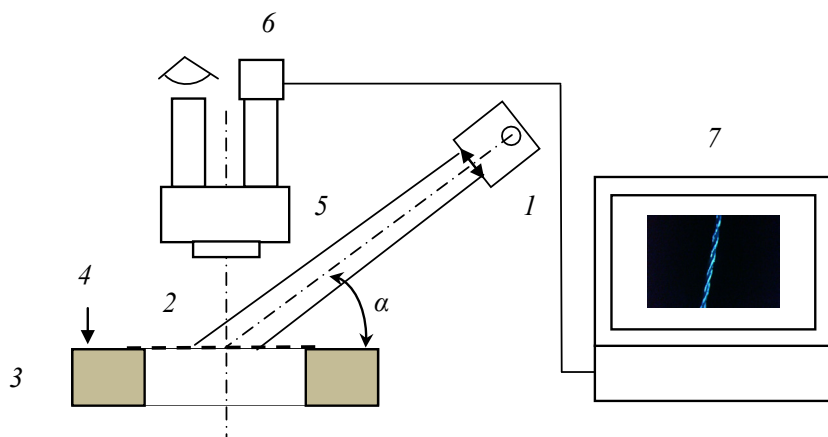


Figure 2. Installation diagram for observing light scattering of a thread

In the present work, in the facilities presented in Figure 1 and Figure 2, samples of filaments were studied, the microimages of which are shown in Figure 3: *a* - thread twisted from two copper lacquered wires with a diameter of $d = 0.3$ mm (S twist); *b* - black lavsan industrial thread 130 l, twisted from 3 strands (Z – twist, $K = 280$ l / m); white lavsan industrial thread 260 l, twisted from 3 strands (Z – twist, $K = 285$ l / m).

In Figure 3 shows the parameters of the twist period T , diameter d , and twist angle β of the thread.

The relationship of these parameters with the parameter Δ is determined by the formula [2]

$$\operatorname{tg} \beta = \pi d / T = \pi d / (n \Delta), \quad (1)$$

where n is the number of strands in the studied thread.

According to this formula and the data obtained from the analysis of microimages in Figure 3, the values of the twist angle for the studied threads were calculated: $\beta_a = 23^\circ$; $\beta_b = 28^\circ$; $\beta_c = 36^\circ$.

The choice of samples is dictated by the fundamental difference in their optical properties.

The thread twisted from the copper varnished wires reflects practically all incident light. In this case, partial polarization of light occurs upon reflection from a transparent varnish. The black thread twisted from strands absorbs, reflects and scatters the incident light. Moreover, reflection and diffraction scattering of light occurs on the illuminated surface areas of the thin monofilaments that make up the strands. A white filament twisted from strands consisting of twisted thin transparent complex filaments strongly scatters and partially flatly polarizes light when it is reflected from ordered near-surface illuminated fiber groups.

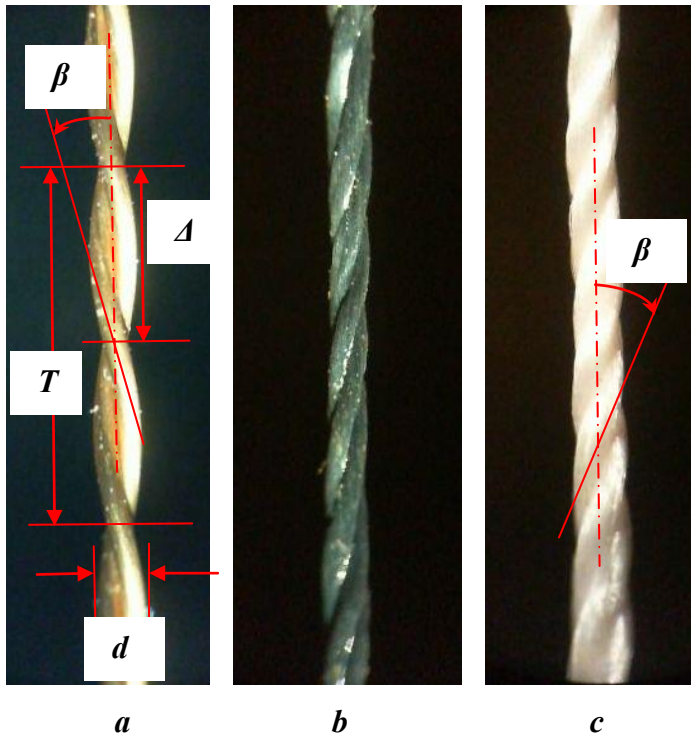
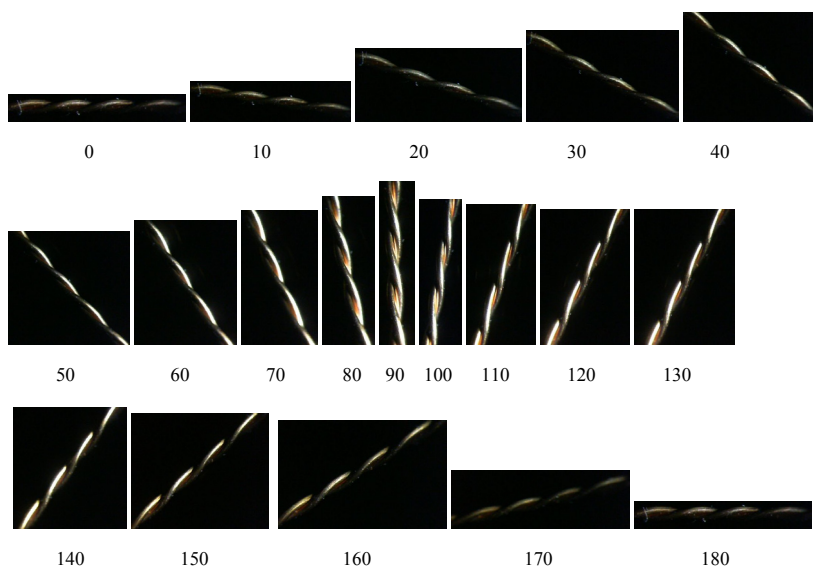
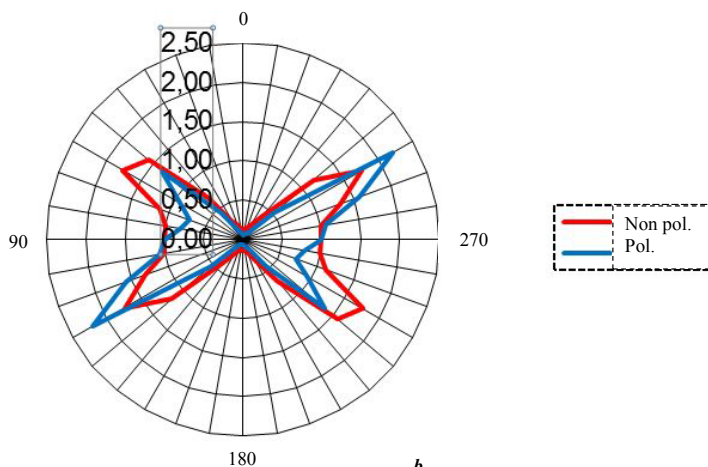


Figure 3. Images of the studied threads:
a - wire thread (2 strands, S - twist); *b* - black (3, Z); *c* - white (2, Z)

In Figures 4, 5 and 6 shows the results of studies of light scattering for a metallic filament (Figure 3-a), black (Figure 3-b), and white (Figure 3-c) lavsan threads, respectively.



a



b

Figure 4. The study of light scattering of a metal thread: *a* - visual pictures of light scattering in the taken direction of the indicated angles according to the scheme of Figure 2; *b* - the corresponding angular light scattering diagrams obtained according to the scheme of Figure 1 for non-polarized illumination (Non pol.) and polarized (Pol.)

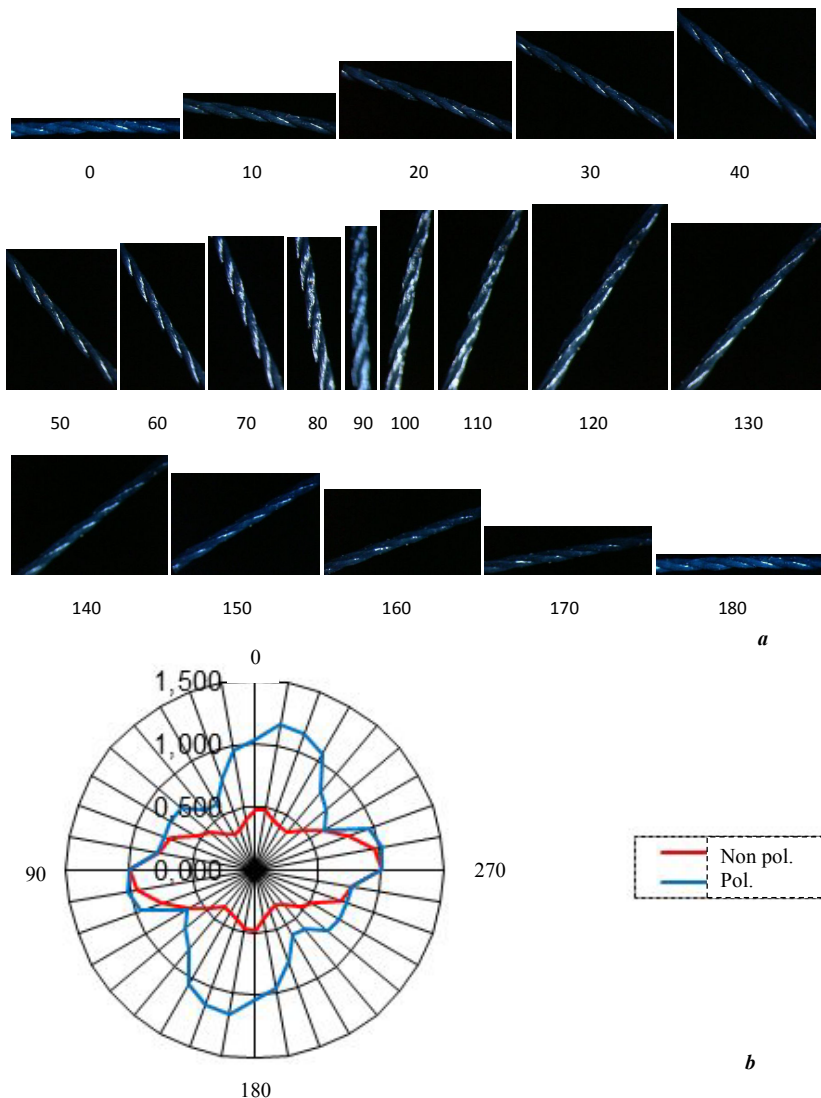


Figure 5. Study of light scattering of a black thread: a - visual pictures of light scattering, taken in the direction of the indicated angles according to the scheme of Figure 2; b - the corresponding angular light scattering diagrams obtained according to the scheme of Figure 1 for non-polarized lighting (Non. Pol.) and polarized (Pol.)

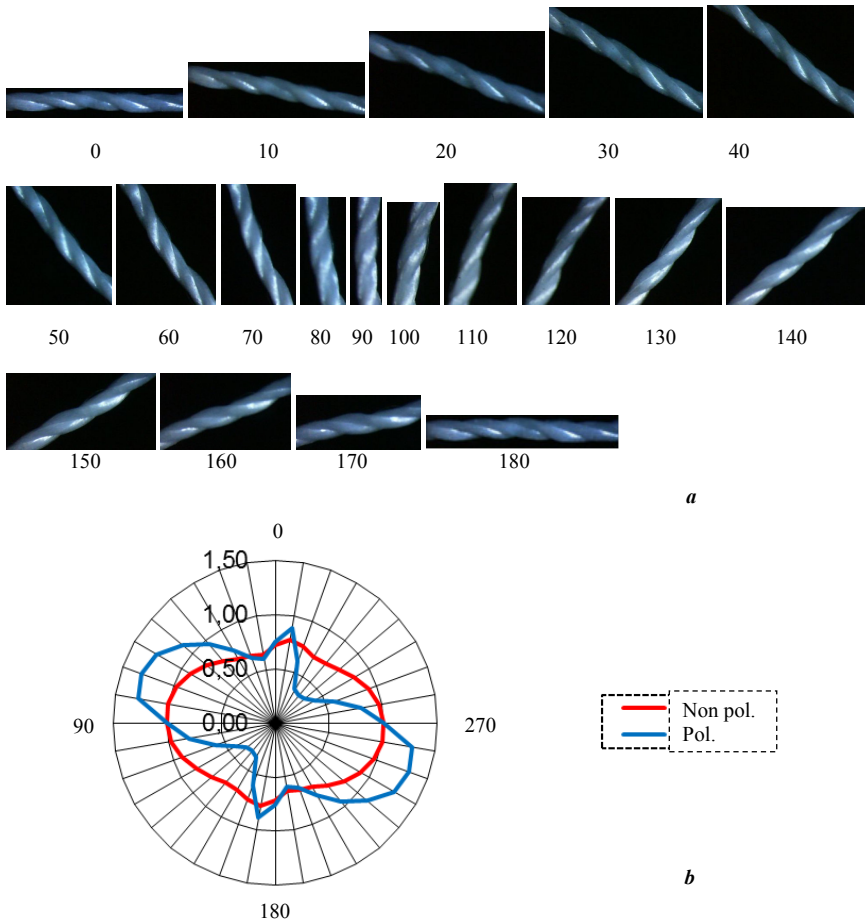


Figure 6. Study of light scattering of a white thread:
a - visual pictures of light scattering taken in the direction of the indicated angles according to the diagram of Figure 2; *b* - the corresponding angular light scattering diagrams obtained according to the scheme of Figure. 1 for non-polarized lighting (Non. Pol.) and polarized (pol.)

In the upper part of the Figures 4-*a*, 5-*a*, 6-*a* micro images of the filament taken on the installation (Figure 2) are shown at the indicated angles of rotation of the filament relative to the initial position, when the direction of the filament sting in the plane of incidence of light.

The lower part of the figures (Figures 4-*b*, 5-*b*, 6-*b*) shows the angular light scattering diagrams for the same filament, obtained according to the scheme of Figure 1 for non-polarized (Non pol.) and polarized (Pol.) lighting. All angular light scattering diagrams in the figures correspond to the vertical position of the studied filament and are normalized to the value of the signal measured at an angle $\varphi = 90^\circ$.

Obviously, when the filament is rotated through an angle $\varphi = 180^\circ$, the uniformly twisted filament with the correct centering comes to a state identical to the original position at $\varphi = 0^\circ$. In this case, the values obtained in the angular diagram of backscattering at angles φ and $(\varphi + 180^\circ)$, should coincide.

Therefore, to reduce the error in the process of constructing angular diagrams in Figures 4-*b* - 6-*b*, the experimental data obtained at angles φ and $(\varphi + 180^\circ)$ were averaged.

From a comparison of the angular diagrams of backscattering obtained under non polarized and polarized illumination in Figures 4-*b* - 6-*b*, we can draw the following conclusions:

1. For all samples of the studied filaments, the maxima of the angular diagrams of the scattered light when illuminated by polarized light and non-polarized light coincide within the measurement error.

2. The difference lies in the fact that these maxima in the diagrams taken under polarized illumination are more pronounced. Especially in Figures 5-*b* and 6-*b*

The observed features can be explained, remaining within the framework of the theory proposed in [3], by the fact that when light is reflected from the surface of the filament under investigation, the light vector always preferentially polarizes in the direction perpendicular to the plane of incidence of light. The fraction of a plane-polarized component depends on the angle of incidence of light on the fiber under study, on the geometry and the fiber and its constituent fibers, and on the optical properties of the fiber material. In general, when illuminated with non-polarized light, the photo detector in the installation of Figure 1 come two components of the light flux - not polarized F_1 and plane-polarized F_2 .

The plane-polarized component is distinguished in the method [3] when illuminated by plane-polarized light with a plane of polarization rotating with an angular velocity ω . In this case, the studied thread serves as an analyzer with a rotating polarizer. Therefore, luminous flux arrives at photo detector 6 (Figure 1), consisting of a component with a polarization plane $F_1 / 2$ rotating with an angular velocity ω , which does not depend on time, and component F_2 , modulated according to the Malus law:

$$I = F_1 / 2 + F_2 \cos^2 \omega t = F_1 / 2 + F_2 (1 + \cos 2\omega t) / 2. \quad (2)$$

The amplitude of a variable signal with a frequency of 2ω is measured with a voltmeter 8 (Fig. 1), which carries information about the geometric structure of the investigated thread.

In the used device (Fig. 1), the angle of light reflection at one-time reflection from different sections of the studied filament is always less than the Brewster angle. Therefore, $F_2 < F_r$.

In the case of a metal thread, the angular diagrams of backward scattering (Figure 4-b) are clearly pronounced X - shaped. In the case of black (Figure 5-b) and white (Figure 6-b) threads, they differ significantly.

This difference is due to the difference in the optical properties of these filaments. A metal thread reflects almost all light, a black thread reflects and scatters when re-reflections from neighboring monofilaments, a white thread reflects and strongly scatters light when it penetrates deeply into the volume of the thread.

In the case of a metal thread, the maximum in the angular light scattering diagram (Figure 4-b) is observed at an angle of 120° (300°). From the data in Figure 4-a shows that in this case the light is reflected from a portion of the strand oriented at an angle of twist when the incident light is perpendicular to this direction.

In the case of a black thread, the maxima in the angular diagram (Figure 5-b) are observed 3 groups of maximas at angles of $70^\circ - 80^\circ$ ($270^\circ - 280^\circ$); $90^\circ - 100^\circ$ ($270^\circ - 280^\circ$) and $160^\circ - 170^\circ$ ($340^\circ - 350^\circ$).

From the data in Figure 5-a it follows that the first group of maxima is associated with the reflection of light from a portion of the strand oriented at an angle of twist when the incident light is perpendicular to this direction.

The second group of maxima is associated with the reflection of light from sections of monofilament in twisted strands oriented at an angle of twist of the strands when the incident light is perpendicular to this direction.

The third group of peaks is associated with the reflection of light from monofilaments of twisted strands in the direction along these sections of monofilaments.

In the case of a white filament, when illuminated by non-polarized light, the angular diagram (Figure 6-b) is an ellipse elongated along the $90^\circ - 270^\circ$ axis with one weakly pronounced maximum located at an angle of 170° (350°). When illuminated by polarized light in the angular diagram, two groups of maxima are observed at angles of 70° (250°) and 170° (350°).

The first group is connected, as can be seen from Figure 6-a with the reflection of light from a portion of the strand oriented at an angle of twist when the incident light is perpendicular to this direction.

The second group - with the reflection of light from monofilaments of twisted strands in the direction along these sections of monofilaments.

All experimental data shown in Figures 4 - 6 are obtained with an angular interval of 10° , which determines the error and uncertainty of the actual position of the scattering maxima. In Figure 7 shows the images of threads obtained by the method of Figure 2, taken at a more accurate value of the angles at which the observed luminous flux is maximum, and a larger increase.

The data presented in this figure confirm the correctness of the model proposed above to explain the observed in Fig. 4 - fig. 6 features.

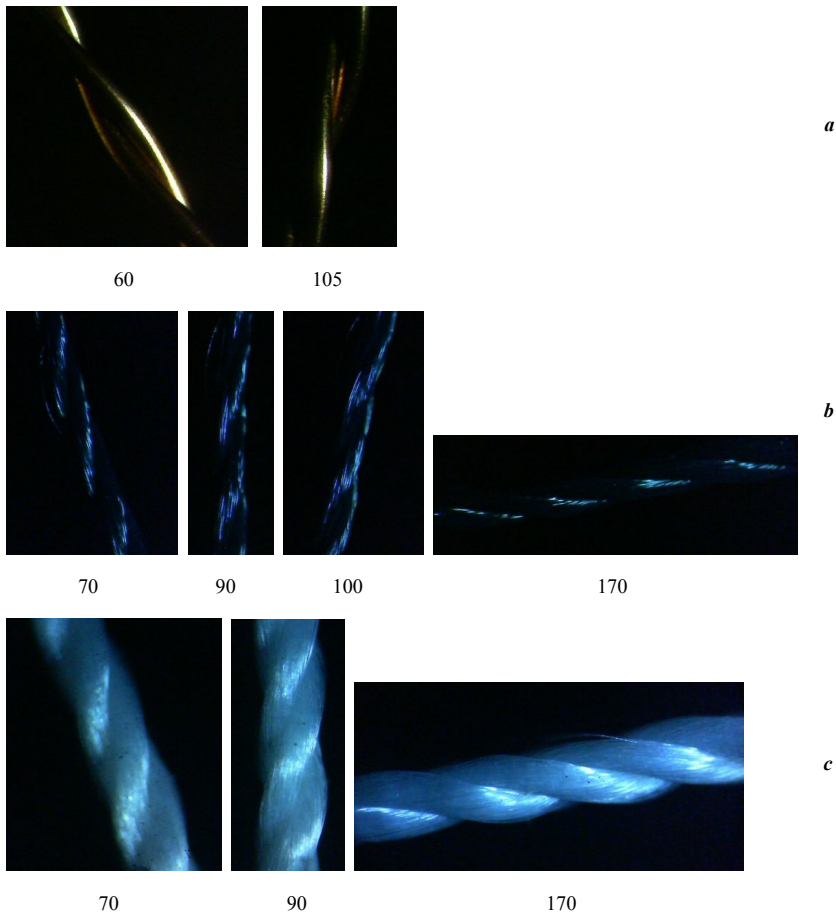


Figure 7. Microimages of the studied threads, taken for the indicated angles on the device (Figure 2), for copper (a), black (b) and white (c) threads

Main conclusions

1. On samples of filaments of various nature, the angular diagrams of backscattering under normal illumination by non-polarized and plane-polarized light with a rotating plane of polarization were studied.
2. On the same samples of the studied filaments, micro-images of illuminated areas corresponding to the angular values of the backscattering diagrams were studied.
3. The studies show the promise of using the optical method proposed in [3-5] for estimating the angle of mechanical twisting of the thread and the angular position of monofilaments in strands of the thread according to the parameters of its backscattering pattern.

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酸-烃乳液系统 (AHES) – 碳酸盐非均质油藏选择性BZT技术中用于包封酸运输的多功能化学成分

**ACID-HYDROCARBON EMULSION SYSTEM (AHES) –
MULTIFUNCTIONAL CHEMICAL COMPOSITION FOR
ENCAPSULATED ACID TRANSPORT IN THE TECHNOLOGY
OF SELECTIVE BZT OF CARBONATE HETEROGENEOUS
RESERVOIRS**

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抽象。该研究的目的是基于各种化学原料的酸-烃乳化体系 (AHES)，用于碳酸盐岩储层钻井区域的复杂处理。

该工作的目的是对酸-烃乳液系统的理化性质进行科学的开发和研究，以增加疏水性乳液向储层的渗透深度来提高碳酸盐油储层的加工效率，例如乳状液中酸性微球与地层岩石的反应速度（多个）下降的结果，从地层的孔隙表面冲洗掉了沥青质树脂质饱和的油膜，并调节了流变参数疏水性第一乳液随时间变化。

作为研究的结果，开发了具有特定组分和组分浓度范围的酸-烃乳液体系的配方，其特征于一组最佳的理化参数。预期结果-在PJSC “TATNEFT” 设施中提高BZT井的效率和成功。

关键词：酸烃乳液体系产能酸处理渗透率

Abstract. *The object of the study is the acid-hydrocarbon emulsion system (AHES), based on the initial chemical reagents of various classes, for complex treatments of the borehole zones of carbonate reservoirs.*

The purpose of the work - is a scientifically-based development and study of the physicochemical properties of an acid-hydrocarbon emulsion system to increase the efficiency of processing a carbonate oil reservoir by increasing the depth of penetration of a hydrophobic emulsion into the reservoir, as a result of a multiple (an order of magnitude) slowdown of the reaction rate of acid micro-

globules in the emulsion with the formation rock, washing off the oil film saturated with asphaltene-resinous substances from the pore surface of the formation and regulating the rheological parameters of hydrophobic first emulsion over time.

As a result of the studies, a formulation of an acid-hydrocarbon emulsion system with a specific component and concentration range of components was developed, which is characterized by an optimal set of physicochemical parameters. Expected results - increased efficiency and success of BZT wells at the facilities of PJSC "TATNEFT".

Keywords: *acid-hydrocarbon emulsion system, well productivity, acid treatments, permeability*

An analysis of the results of scientific research, field trials and practical achievements in the field of hydrochloric acid treatments (HAC) and acid stimulation of the productivity of carbonate formations in Tatarstan, Russia and the world [1-3] shows the lack of effectiveness and success of the technologies and methods of HAC. In many respects, this result is due to the complexity of the natural object of influence - carbonate heterogeneous reservoirs saturated with asphalt-resinous, highly viscous oil. Carbonate deposits, as a rule, are micro- and macro-heterogeneous in structure, complex in lithological-facies characterization and diverse in pore-fracture structure. All this causes great risks and uncertainties in the directed (selective) and controlled technology for pumping process liquids and chemical compositions into planned hydrocarbon-saturated intervals in thickness and remoteness (zonal-lateral geometry) of the chemical exposure object [2,3].

Among the variety of modern trends and areas of scientific and applied work aimed at improving the efficiency of acid technologies, their impact, effectiveness and success, it is necessary to distinguish three scientific and technological aspects:

- controllability of the injection and pressurization of the chemical reagent flow over the thickness of the formation(s), the main mechanism being the so-called "deviation" of the active acid from unnecessary (risky) treatment of fractured, as a rule, water-saturated intervals (zones and interlayers that are potentially dangerous and prone to flooding);
- adjustable lateral depth of chemical exposure, it is a tool for involving previously unworked zones, lenses and intervals not covered by drainage in the development;
- periodic removal of a film of high molecular weight colmatants, enveloping the surface of the pore-fracture channels and reducing the flow of oil to the bottom of the wells. Basically, these are surface-highly active components of viscous oil (asphaltenes, resins, naphthenic acids, metalloporphyrin complexes, etc.), sparingly soluble and difficult to remove with regular solvents [4].

Thus, the task of synthesizing a composite material with predetermined properties was the justification and development of a chemical composition with the following functional properties and parameters:

- high dissolving activity of the carbonate component of the reservoir;
- the composition should “work” (dissolve calcite, dolomite) both in the near borehole zone of the reservoir and in remote reservoir intervals far from the well (at least 3-6 m or more laterally), i.e. the ability to transport acid deep into the reservoir;
- the predominant direction of such an acid effect should be oil-saturated intervals of the reservoir, both in thickness and depth of treatment, minimizing the impact on fracture intervals, temporarily blocking and deflecting the main flow of acid;
- simultaneously with acid solubility, the composition should be chemically active with respect to high molecular weight organic colmatants, which form the basis of oil film in the pores and channels of the reservoir.

Therefore, the composition should be a structured material, with adjustable viscosity and rheology of behavior, containing hydrochloric acid and a highly active hydrocarbon solvent as the basis. There is only one colloidal system that satisfies these conditions - a hydrophobic highly concentrated emulsion, the dispersed phase of which is globules (a kind of capsule) of hydrochloric acid, and the dispersion medium of which is represented by a hydrocarbon solvent. Moreover, this encapsulated acid must be reliably armored with a surfactant emulsifier, as the lifetime (aggregative stability) of the emulsion should be relatively high and amount to several tens of hours (time for preparation, injection into the reservoir, advancement along the collector to the calculated depth and adjustable decay into constituent ingredients).

Hydrophobic emulsions were prepared in laboratory conditions using a typical sample propeller stirrer by sequentially dissolving a certain amount of emulsifier in a calculated amount of solvent, mixing them for 5-10 minutes (the two components are mutually soluble), then a calculated amount of an aqueous solution was added in a dosed (gradually) dosage form (gradually). inhibited hydrochloric acid of 10-15% concentration, while stirring speed (pace) was gradually increased from 400-500 min⁻¹ to 1000-1200 min⁻¹. In this case, the consistency of the emulsion visually grows. The emulsification process was continued until a homogeneous emulsion of light yellow (cream) color with a characteristic viscosity (consistency) was obtained. The emulsion readiness was determined by periodically measuring the electrical stability value and dispersion control by photographing the emulsion drop on a microscope. The mixing time until ready AHES (experimentally determined) is 18-20 minutes. A further increase in the time of emulsification does not lead to an increase in parameters; they stabilize at the same level.

To determine the degree of washing out of an oil film saturated with asphaltene-resinous substances (ARS), core samples were placed in a native freshly selected well oil for 1 day, then the samples were dried for 1 day to form a solid ARS film on cores, weighed, then these cores were placed in solvents, hydrochloric acid or AHES of various formulations. After a certain time, the degree of washing out the oil film with ARS from the core surface was recorded, or the residual core mass after reaction in acid or AHES was determined by periodic weighing. Thus, the degree of film wash-off from the core material or the degree of dissolution of the core with the ARS film was determined by the gravimetric method.

The dissolution rate (dissolving capacity) of AHES for carbonate was evaluated by gravimetric method on natural cores, in which a cube of core material with a certain area and mass was placed in the test composition. The change in mass for a fixed time determined the dissolution rate of the carbonate material. Compared with the rate of dissolution of 15% hydrochloric acid on a similar core material (the geometric dimensions of all the cubes were the same in the experiments).

Aggregate stability was determined by the time of onset of acid release (as a separate phase) from the emulsion and complete acid release, which was recorded visually.

The results of experimental studies to determine the AHES formulation are shown in tables 1,2 and figures 1-4.

Table 1 – Results of laboratory tests in determining the formulation of AHES

№ of proto-type	Emulsifier volume % / ml	Volume of HCl (15%), % / ml	Solvent volume % / ml	Electrosta-bility, V	Appearance of AHES	Aggregate stabil-ity, days
1 (1)	E1 5% / 15 ml	78% 234 ml	P1 17%/51 ml	132	High viscosity cream fluid emulsion (dev.)	Separation into hydrocarbon and acid phases in 24 h - 36 h
2 (1)	E1 5% / 15 ml	75% 225 ml	P1 20%/60 ml	67	Cream fluid emulsion (BZT)	Separation into hydrocarbon and acid phases in 24 h - 36 h
3 (1)	E2 5% / 15 ml	75% 225 ml	P1 20%/60 ml	29	Cream fluid emulsion (BZT)	Separation into hydrocarbon and acid phases in 24 h - 36 h
4 (1)	E2 5% / 15 ml	78% 234 ml	P1 17%/51 ml	18	High viscosity cream fluid emulsion (dev.)	Separation into hydrocarbon and acid phases in 24 h - 36 h

№ of proto-type	Emulsifier volume % / ml	Volume of HCl (15%), % / ml	Solvent volume % / ml	Electrosta-bility, V	Appearance of AHES	Aggregate stabil-ity, days
5 (1)	E3 5% / 15 ml	75% 225 ml	P1 20%/60 ml	29	No emulsion was obtained	–
6 (1)	E3 5% / 15 ml	78% 234 ml	P1 17%/51 ml	32	No emulsion was obtained	–
7 (1)	E1 5% / 10 ml	70 % 140 ml	P2 25%/50 ml	164	Cream fluid emulsion	Separation into hydrocarbon and acid phases in 24 h - 36 h
8 (1)	E1 5% / 10 ml	80 % 160 ml	P2 15%/30 ml	61	No emulsion was obtained	–
9 (1)	E1 5% / 10 ml	75 % 150 ml	P2 20%/40 ml	81	Cream fluid emulsion (BZT)	Separation into hydrocarbon and acid phases in 24 h - 36 h
10 (1)	E1 5% / 10 ml	78 % 155 ml	P2 17%/35 ml	59	High viscosity cream fluid emulsion (dev.)	Separation into hydrocarbon and acid phases in 24 h - 36 h

A change in the visual aggregative state of emulsions over time shows a tendency to delamination and gradual decay of the emulsion system.

Microscopic studies showed the finely dispersed structure of AHES; globules in the range from 1–2 μm to 10–20 μm are distinguished.

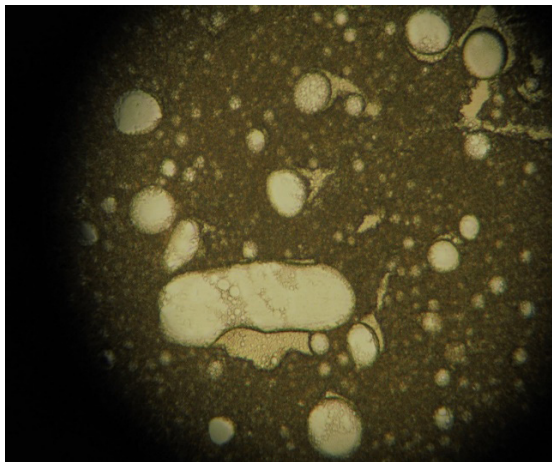




Figure 1– The microstructure of the acid-hydrocarbon emulsion system 1 (1), 2 (1)

An emulsion was prepared according to the recipe: 7% emulsifier, 25% solvent P2, 68% HCl (15%). The reaction rate in the emulsion was determined in comparison with HCl (15%) with carbonate core samples under n.c. The results of laboratory tests are shown in table 2.

Table 2 – The results of experiments to slow down the reaction rate in the emulsion compared to HCl (15%)

Time (τ), min	Sample weight (m), g		Solubility, %	
	HCL (15 %)	AHES	HCL (15 %)	AHES
0	19,547	20,259	-	-
5	10,331	20,223	47	1,7
20	0	20,024		

The dissolution rate of the core sample in AHES is 256 times slower than in HCL (15%), which provides in-depth delivery of acid to remote areas of the reservoirs.

The above research results allowed us to simulate the processes of passage of the acid-hydrocarbon emulsion system in the reservoir. Two experiments were carried out:

1) object of study – AHES with the recipe: emulsifier E1 5% (10 ml), hydrochloric acid HCl (15%) 70% (140 ml), solvent P2 25% (50 ml). Study material: chalk and river sand;

2) object of study – AHES with the recipe: emulsifier E1 7% (21 ml), hydrochloric acid HCl (15%) 68% (204 ml), solvent P1 25% (75 ml). Material of research: carbonate fragments.

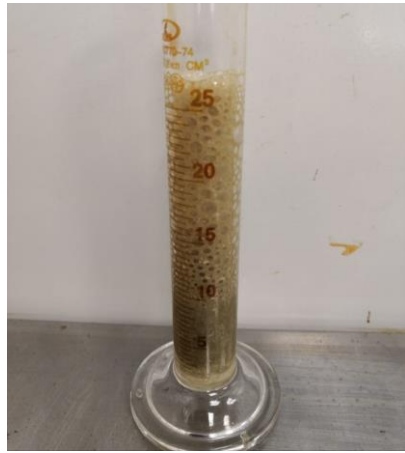


Figure 2 - Acid-hydrocarbon emulsion system (first recipe)

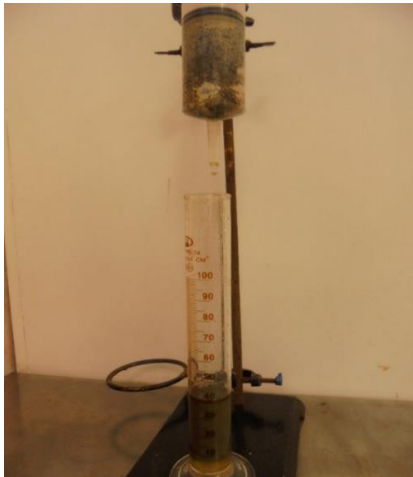


Figure 3- Acid-hydrocarbon emulsion system (second recipe)

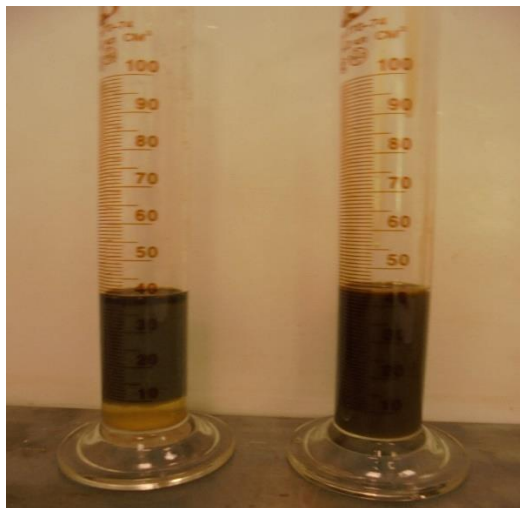


Figure 4—*Liquids released from acid-hydrocarbon emulsion systems*

Figure 4 shows that in the first cylinder, the infiltrate from the porous medium after 20 h is represented by hydrochloric acid released from the microemulsion (lower layer) and a solvent with a part of the emulsion (upper layer). Thus, it can be argued that, as it moves deeper into the reservoir, AHES breaks down into the initial components — acid and solvent — the active processing ingredients of the emulsion, which provide a comprehensive physicochemical effect on the depth intervals of the reservoir. In the fractured interlayers of the reservoir, the AHES infiltrate in the second cylinder, which is a coarse dispersed emulsion prone to decomposition into acid and solvent, will have a profound effect.

The research results showed the optimality of the content of ingredients in AHES within the specified limits. With an increase in the solvent content in the emulsion, aggregative stability and electrical stability decrease. With a decrease in solvent content, viscosity increases, oil washing is reduced, dispersion is changed, stability is also reduced. The decrease in the concentration of emulsifier E1 below 3% wt. leads to a decrease in aggregative stability and electrostability, the size of acid globules increases, the slowdown of the reaction and washing are reduced. With a decrease in the concentration of hydrochloric acid less than 10%, a decrease in the dissolving ability of the emulsion is observed. The increase in the concentration of hydrochloric acid more than 15% wt. leads to a decrease in aggregate stability, electrical stability, to an increase in the reaction rate, the viscosity of the emulsion decreases sharply.

The combination of solvent (P1 or P2) and emulsifier E1 found in the ratio of 15-35 / 3-5 gives the external, dispersion medium of the emulsion a new technical property - to effectively dissolve an oil film saturated with asphaltene-resinous substances (ARS), enveloping the pore surface of the reservoir rock, which enhances the effect of increasing rock permeability in BFZ. This effect is due to the chemism of enhancing the process of dissolution, dispersion and removal of film oil with ARS in a solution of aromatic hydrocarbons of solvents, apparently in this aspect there is a synergistic effect of the components and concentrations of surfactant emulsifier E1 and solvent P1 or P2.

The developed AHES formulations are distinguished by a new set of physicochemical properties that allow qualitatively and efficiently penetrate deep into the reservoir and transport active acid to deeper reservoir intervals. This technical result is achieved by the fact that the found combination of component-recipe ratios of ingredients provides the effect of slowing down the reaction rate of an acid emulsion by 200-250 times in comparison with a 15% aqueous hydrochloric acid solution. Known solutions in this area are characterized by a slowdown of only 20-25 times. The effectiveness (quality) of the new hydrophobic acid emulsion in this aspect is increased by an order of magnitude.

Another distinguishing feature is the established microdispersion mechanism for processing porous, differently permeable reservoir materials with an acid emulsion. Through relatively highly permeable pore channels (cracks and microcracks), the hydrophobic acid emulsion itself moves and deeply penetrates the formation, since its dispersed characteristics of emulsified globules are in the range from 1-3 microns to 8-10 microns; these globule sizes are at least 3-5 times smaller than the characteristic sizes of cracks and microcracks; this ratio of dispersions to channel diameters ensures their passage into the interior of the reservoir.

The composition and quality of AHES changes when moving in relatively small pore channels with lower permeability. It has been established that when pumping and injecting into such channels, it is not the initial emulsion that moves, but the microemulsion (that part of the dispersions that have a resolution of 1-3 microns to 4-5 microns). It is this microemulsion that transports acid globules through the collector and provides acid treatment in depth. The developed AHES formulation with specific component and concentration ranges of ingredients is characterized by an optimal set of physicochemical parameters.

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改善汽车行业钢材性能和质量的有效方法

AN EFFECTIVE APPROACH TO IMPROVING THE PROPERTIES AND QUALITY OF STEELS FOR THE AUTOMOTIVE INDUSTRY

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抽象。已经显示出,用于汽车工业的已生产和正在开发的钢的性能和质量的改善需要关于钢中发生的转变动力学的可靠数据。基于研究Nb(C, N), Ti(C, N)和Ti₄C₂S₂沉淀形成动力学的结果,已开发出有效的方法来显著改善各种类型的难结合性质的复合物汽车车身板用钢。已经开发出具有独特性能的新型热轧和铁素体钢硬化工艺,以及用于从相同化学成分的IF钢生产各种强度等级和拉拔等级的轧制产品的暗盒技术。

关键词: 车身板, 相沉淀, 动力学, 延展性, 强度, 使用性能, 生产技术。

Abstract. *It has been shown that the improvement of the properties and quality of produced and new developing steels for the automotive industry requires reliable data on the kinetics of the transformations occurring in the steel. Based on the results of studying the kinetics of the formation of Nb(C,N), Ti(C,N), and Ti₄C₂S₂ precipitates effective approaches have been developed to significantly improve the complex of difficult-to-combine properties of various types of steels for automobile body sheet. New hardened during hot stamping and ferritic steels with a unique set of properties as well as cassette technology for the production of rolled products of various strength classes and drawing categories from IF steels of the same chemical composition have been created.*

Keywords: *automobile body sheet, phase precipitates, kinetics, ductility, strength, service properties, production technology.*

Currently, steels for automobile body sheet are becoming more knowledge-intensive and high-tech materials due to the rapid increase in requirements for a complex of indicators of the level and stability of technological, service properties, quality, while reducing costs, intensifying the production process. Over the past 5-10 years, the majority of these requirements have grown several times [1]. The development of new types and grades of steel pursues the goal of achieving extremely high values of strength up to 2000-2300 MPa, ductility (relative elongation up to 50-60%), formability, and fatigue and corrosion resistance. No less significant is the decrease in the content of non-metallic inclusions, and the amount or complete elimination of surface and other metal defects. Important is the fact that in most cases it is necessary to ensure high values of not one of the indicated parameters, but the whole complex, as a rule, difficult-to-combine indicators, for example, strength, ductility, formability, corrosion resistance, and other properties.

To solve the formulated extremely complex problem, it is necessary to develop and use fundamentally new approaches in the field of materials science and steel metallurgy. In particular, low alloy steels for automobile body sheet and other types of steels with a yield strength of up to 700 MPa and satisfactory indicators of other properties have been developed using traditional methods based on controlling the mechanisms of solid solution, grain boundary, and dispersion hardening [2]. In this case, the choice of the composition and parameters of the temperature-deformation treatment of steel, as a rule, is carried out using thermodynamic calculation or simplified empirical relations. However, achieving higher strength of steel is difficult or even impossible without taking into account the kinetic features of the proceeding phase and structural transformations in steel. A similar problem occurs in pursuance of obtaining high ductility, formability, for example, ultra-low carbon IF steels. For this, it is necessary to achieve complete purification of the solid solution from the interstitial elements, which is determined by the kinetics of the formation of carbide, carbonitride, carbosulfide, and other types of phase precipitates. A clear understanding of kinetic laws of phase precipitation is even more important when it is necessary to obtain a set of high indicators of difficult-to-combine properties, in particular, strength, ductility, formability, fatigue and corrosion resistance, since in this case a number of requirements for the structural state of steel should be provided.

To take a step forward in formulated direction, experimental and theoretical methods have been developed and a detailed investigation has been carried out of the formation kinetics for key types of phase precipitates. The kinetic regularities of niobium carbonitride precipitation [3] were studied in the absence and presence of

previous deformation using low-carbon low-alloy steel with model chemical composition (wt.%): C - 0.11, Mn - 1.72, Nb - 0.05. It was found that in the absence of deformation, its precipitation has significant kinetic difficulties. Even with a high degree of supersaturation and supercooling (more than 300°C) of the solid solution, a long time interval is necessary for the formation of any significant amount of nanoscale precipitates of this phase - at least 20-40 minutes of isothermal aging at 900°C of steel previously subjected to complete dissolution of Nb(C,N) at 1200°C. After deformation with a reduction of 50% during isothermal holding at 900°C, the formation of nanoscale (3-5 nm) niobium carbonitride precipitates is accelerated significantly: it begins at exposure time of about 10 s and ends within 250-300 s (Fig. 1) [3]. The established time interval for the precipitation of niobium carbonitride is quite long in comparison with the commonly used in practice modes of temperature-deformation treatment of steel. It can lead to incomplete implementation of this process and the preservation of phase-forming elements in a solid solution. This conclusion is in good agreement with the results of studies of a large number of laboratory and industrial steel samples. In addition, direct experimental evidence was obtained on the fundamental dependence of the quantity and mechanism of the formation of nanoscale niobium carbonitride precipitates, depending on the regime of the previous heat treatment of steel. In particular, preliminary cooling to room temperature and subsequent heating to a holding temperature of 700°C leads to a significant increase in the number of carbonitride precipitates formed. Moreover, their nucleation and growth occurs in ferrite, in contrast to precipitates originating in austenite during cooling from high temperatures.

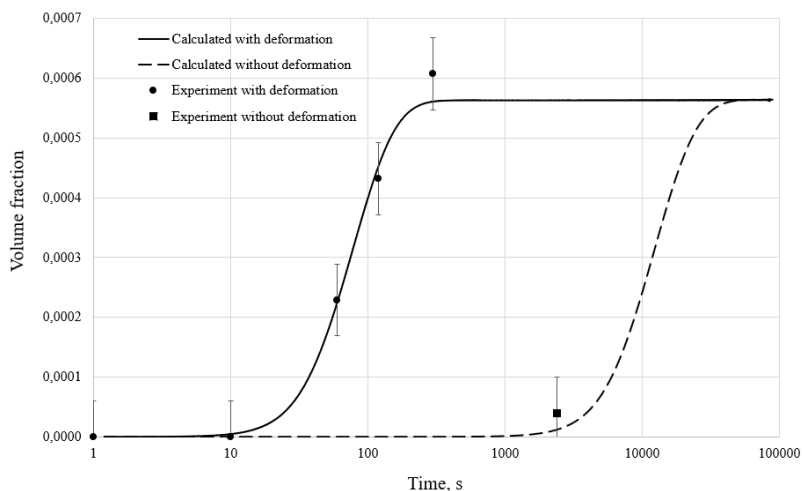


Figure 1. Isothermal diagram of precipitation of Nb(C,N) at 900°C

The kinetics of the formation of titanium carbide precipitates in the presence of deformation was studied on low-carbon steels of two model compositions 1, 2 (wt.%): C - 0.070, 0.063 ; Mn - 1.64, 1.61; Ti - 0.090, 0.096; Mo - 0.22, 0.21; N - 0.009, 0.003, respectively. It was found that the formation of nanoscale TiC precipitates is much slower (Fig. 2) than Nb(C,N). At 900°C it begins only in no less than 80-90 s, ends in more than 1000 s, and accelerates significantly with increasing concentration of Ti in the solid solution. In particular, the concentration of titanium in the solid solution in steel of composition 2 is higher than in steel of composition 1 due to the lower nitrogen content, and TiC precipitation is much faster, nevertheless the rate of this process remains at a much lower level compared to Nb(C,N). As a result, the formation of austenitic TiC precipitates during the temperature-deformation treatment of steel practically does not occur. However, due to the conservation of phase-forming elements in a solid solution, there are all the prerequisites for the formation of TiC precipitates during $\gamma \rightarrow \alpha$ phase transformation of steel (interphase), as well as in ferrite. For the formation of the most effective interphase precipitates, the following condition is necessary: the rate of their formation should be comparable with the rate of phase transformation of steel.

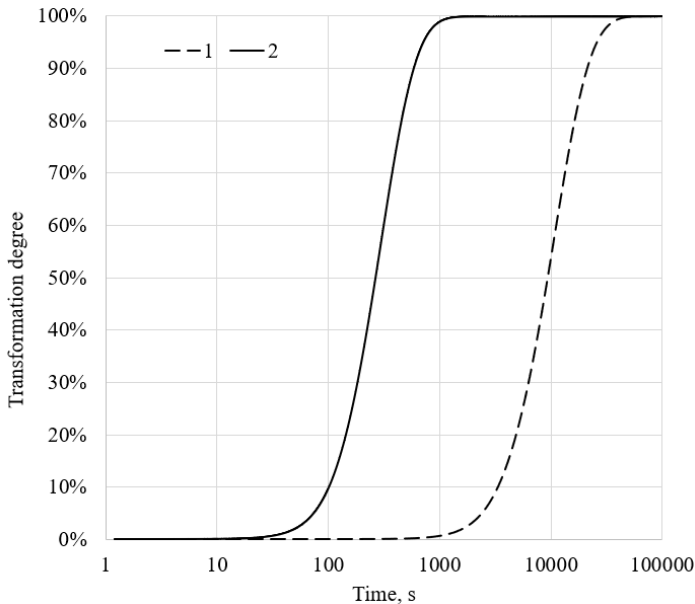


Figure 2. Isothermal diagram of precipitation of TiC at 900°C

The kinetics of strain-induced precipitation of $\text{Ti}_4\text{C}_2\text{S}_2$ was studied on ultralow-carbon steel of the model composition (wt.%): C - 0.004, Si - 0.02, Mn - 0.1, 8 P - 0.006, S - 0.014, Ti - 0.09, Al - 0.05, N - 0.004. It has been established that the “nose” of the C-shaped curve, corresponding to the extreme combination of the action of thermodynamic and kinetic stimuli for the formation of precipitations, is at a temperature of about 940°C. In the case of the presence of TiS precipitates in the steel, the formation of $\text{Ti}_4\text{C}_2\text{S}_2$ precipitates at 910–950°C by heterogeneous nucleation on the surface and the conversion of TiS to $\text{Ti}_4\text{C}_2\text{S}_2$ occurs rather quickly and ends in 20-30 s. Thus, there are all prerequisites for the complete removal of carbon from a solid solution to $\text{Ti}_4\text{C}_2\text{S}_2$ during hot rolling of steel and its completion at 910–950°C. Studies were performed on steels with a low sulfur content up to 0.004 - 0.005 wt.% in the absence or low TiS content. It was found that the formation of $\text{Ti}_4\text{C}_2\text{S}_2$ precipitates occurs through independent nucleation and growth of nuclei of this phase. This leads to a significant increase in the time of complete transformation, reaching values of more than 1000 s. As a result, predominant carbon binding occurs not in $\text{Ti}_4\text{C}_2\text{S}_2$, but in TiC and can create the preconditions for its conservation in solid solution.

Based on the established laws of the kinetics of transformations, the principles have been formulated for improving the production technology of existing and developing new types of steel. In particular, it was shown that in order to obtain high indicators of ductility (relative elongation of 50-60%) and formability of economical, ultralow-carbon Ti-IF steels subjected to recrystallization annealing in aggregates, both periodic and continuous, it is necessary to ensure complete binding of nitrogen and carbon, mainly in TiN and $\text{Ti}_4\text{C}_2\text{S}_2$. This is ensured by the using high temperatures of hot rolling end (~920-930°C) lying in the region of austenite stability, even with a low coefficient of titanium excess - less than 1.1. In this case, the achieved carbon concentration in steel is not a critical parameter and may be 0.006 - 0.007 wt.%. To form favorable $\text{Ti}_4\text{C}_2\text{S}_2$ precipitates of relatively large sizes, the sulfur content in steel should be at the level of 0.007 - 0.008 wt.%. The complete removal of carbon from the solid solution of hot-rolled steel leads to a favorable decrease in the yield strength, an increase in its processability, as well as ductility and formability of the finished cold-rolled steel.

The possibility and conditions have been established for producing cold-rolled and galvanized steels of various strength classes and drawing categories from ultralow-carbon IF, IF-HS steels of the same chemical composition annealed in both periodic and continuous aggregates using cassette technologies. In particular, it has been shown that the cold-rolled and galvanized products, both with a low yield strength (110 - 170 MPa) and 180 strength class, and with a relative elongation of more than 50% can be produced from IF steel of the same composition. The use of increased degrees of reduction at the final stage of hot rolling favors an increase

in the set of properties of cold-rolled steel. To ensure the complex of properties of rolled steel of 180 strength class, it is advisable to set the content of carbon and phosphorus closer to the permissible upper limit of 0.004-0.005 and 0.010-0.014 wt.%. From steel of the same chemical composition, it is possible to produce cold rolled and galvanized products of 180 and 220 strength classes.

A new generation of steels has been created for the manufacture by advanced methods of hot stamping of products and parts for the automotive industry of various strength categories with the tensile strength of up to 2300 MPa with good ductility. High strength characteristics of metal products are ensured not only by the world-traditional transformation of the austenitic structure of steel into martensite but also due to the formation of a volumetric system of nanoscale carbide, carbonitride precipitates induced by deformation. As shown above, this is especially effective in the case of microalloying with niobium.

In order to simultaneously achieve high difficult-to-combine indicators of strength, ductility, formability, fatigue and corrosion resistance, and other service properties, a new generation of steels for automobile body sheets has been developed, hardened by formation of a dispersed ferritic structure and a volumetric system of nanoscale phase precipitates. Two microalloying systems were studied: Ti, including together with Mo, and a more complex, in the general case, including V, Nb, Ti, Mo. It has been shown that the efficiency of using complex microalloying is low due to the required rather high level - about 0.2, 0.1, and 0.1 wt.% of V, Nb, and Ti content, respectively, and their significant expenditure on the formation of poorly effective austenitic precipitates. Additionally, Mo microalloying is advisable, because it stimulates an increase in the nucleation rate and a decrease in the growth rate of carbide, carbonitride precipitates of microalloying elements. On the contrary, during Ti microalloying, including together with Mo, mainly interphase and/or ferrite precipitates are formed, which have a significantly more intense beneficial effect on the indicators of difficult-to-combine steel properties. This allows using a simple production technology to manufacture steels with economical composition (wt.%): C - 0.03 - 0.06, Mn - up to 1.5, Ti + Mo - up to 0.4 and simultaneously high values of strength (up to 700 - 900 MPa), ductility (elongation up to 20 - 25%), formability (hole distribution coefficient of about 100%), and fatigue and corrosion resistance. Titanium concentration is a key factor, and its increase causes a favorable increase in the number of carbide precipitates and, accordingly, indicators of the properties of steel.

The possibility of heterogeneous nucleation on the surface of the present inclusions (precipitates) allows, as noted above, to significantly accelerate the formation of complex precipitates. Including the deposition of cementite on the surface of the present carbide, nitride, sulfide, oxide-sulfide precipitates can simultaneously increase the strength, ductility, formability, and corrosion

resistance of steels for automobile body sheets (Fig. 3). In particular, this, together with the controlled deposition of aluminum nitride on the surface of manganese sulfide precipitates, is a key technique for significantly increasing the ductility and formability of low-carbon steel sheets. As a result, they can be used to replace much more expensive IF steels.

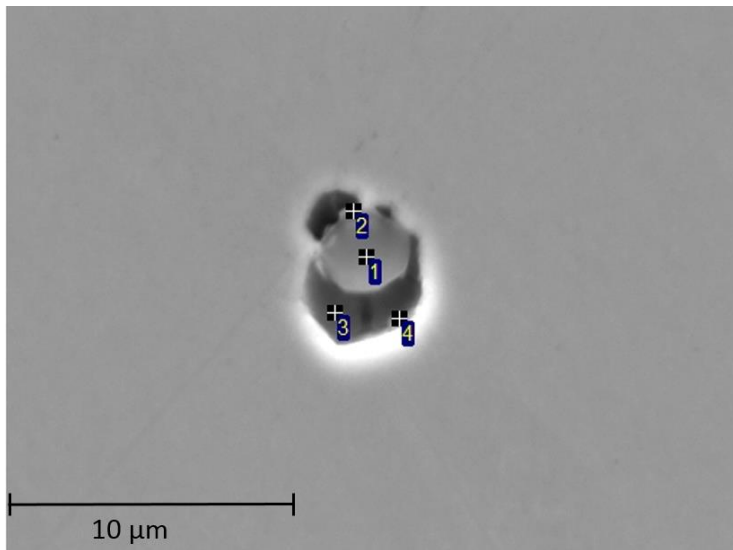


Figure 3. The precipitation of cementite on the surface of complex non-metallic inclusions of MnS and aluminum-magnesium spinel (1 - MnS, 2 - aluminum-magnesium spinel, 3,4 - cementite)

Conclusion

Thus, controlling the kinetics of the formation of $\text{Nb}(\text{C},\text{N})$, $\text{Ti}(\text{C},\text{N})$, $\text{Ti}_4\text{C}_2\text{S}_2$ precipitates and others can significantly improve the level of properties of existing and developing new types of steels with previously unattainable set of indicators of difficult-to-combine characteristics, while reducing costs. In particular, this approach allows one to achieve high ductility (elongation of 50-60%) and formability of cold-rolled and galvanized products from low-carbon and ultralow-carbon IF, IF-HS steels for automobile body sheets. No less significant is the creation of cassette technologies for the production of rolled products of various strength classes and drawing categories from IF steels of the same chemical composition. The developed steels for hot stamping make it possible to obtain finished products for the automotive industry with extremely high strength up to 2300 MPa. Finally,

new ferritic grade steels, for the first time, possess simultaneously high strength, ductility, formability, impact and corrosion resistance, and other properties.

The presented approach can be used to fundamentally improve the indicators of properties, quality of not only steels for automobile body sheets, but of a number of other types of steels.

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水产养殖生物资源作为食物和生物活性物质的来源
**AQUACULTURE BIORESOURCES AS A SOURCE OF FOOD AND
BIOLOGICALLY ACTIVE SUBSTANCES**

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抽象。对蛋白质的需求取决于人体新陈代谢的效率和蛋白质的利用。在这方面，开发具有保护因子，具有免疫调节特性并满足人群功能性营养要求的专业产品似乎很重要。为了满足人们在确保产品质量和安全方面的需求，建议使用由十个压电传感器组成的多传感器系统“电子鼻”来评估鱼和鱼产品，其工作基于级别的神经符号模型，描述嗅球的运作机制。应该注意的是，经过适当技术处理的鱼蛋白具有很高的消化率（高达93–95%），这大大超过了陆生动物肉的相似蛋白。此外，鱼蛋白的良好消化率与结缔组织蛋白含量低（占鱼蛋白总量的5–7%），弹性蛋白几乎完全不存在以及胶原蛋白易于消化和胶合有关。因此，水产养殖生物资源可作为食物和生物活性物质的来源，在许多方面可提供营养方面的生理规范，可用于开发纠正和维持人类健康的产品。

关键词：食品，水产养殖生物资源，食品蛋白质，“电子鼻”，氨基酸，均衡营养，必需营养素。

Abstract. *The need for proteins is determined by the efficiency of metabolism and utilization of protein by the body. In this regard, the development of specialized products enriched with protective factors, possessing immunomodulating properties and meeting the requirements of the functional nutrition of the population seems relevant. In order to meet the needs of the population in ensuring the quality and safety of products, it is proposed to use the multisensor system “electronic nose” consisting of ten piezosensors to evaluate fish and fish products, the*

work of which is based on a multi-level neural semiotic model that describes the mechanism of operation of the olfactory bulb. It should be noted that fish proteins after proper technological processing are characterized by high digestibility (up to 93–95%), which significantly exceeds the similar proteins of meat of terrestrial animals. Also, good digestibility of fish proteins is associated with a low content of connective tissue proteins (5–7% of the total amount of fish proteins), an almost complete absence of elastin, and easy digestibility and glutinization of collagen. Thus, aquaculture bioresources serve as a source of food and biologically active substances, which in many respects provide physiological norms in nutrition and are useful for developing products that correct and maintain human health.

Keywords: food products, aquaculture bioresources, food protein, "electronic nose", amino acids, balanced nutrition, essential nutrients.

Introduction

In the modern world, there is a problem of lack of dietary protein and due to the increase in the population on the planet, the lack of protein will continue. With a daily protein intake of 70 g in the world, there is only about 60 per inhabitant. Since 1992, the consumption of animal protein products has decreased by 25–35% in Russia and the consumption of carbohydrate-containing foods (potatoes, baked goods, pasta) has increased significantly. The average per capita protein intake decreased by 17–22%: from 47.5 to 38.8 g/day of animal protein (49% versus 55% recommended); in low-income families, the consumption of total protein per day does not exceed 29–40 g. According to the RAMS Institute of Nutrition, the annual deficiency of dietary protein in Russia exceeds 1 million tons [<http://food-chem.ru>].

Lack of dietary protein is not only an economic, but also a social problem in the modern world. Not all countries have animal products available to the general public.

However, it should be noted that the need for proteins is determined by the efficiency of metabolism and utilization of protein by the body. At the same time, the relationship between the amount of protein supplied with food and the state of the body is a little more complicated. WHO experts note that the human body's intake of protein in amounts below the recommended minimum requirement (35–40 g/day) causes protein deficiency.

Rational nutrition of the population is one of the main conditions for normal growth, physical and neuropsychic development, and resistance to diseases of various etiologies. The nature of nutrition affects the harmonious development of a person, physical and psychological health, development of intelligence and is a factor in ensuring the body's immune status. In this regard, the development of specialized products enriched with protective factors, possessing immunomodulating properties and meeting the requirements of the functional nutrition of the

population seems relevant. All balanced foods should contain ingredients that give them functional properties. Such ingredients include minerals, vitamins, oligosaccharides, dietary fiber, etc. Satisfying the need for protein can be done at the expense of animal and vegetable proteins. The main sources of animal protein are milk and dairy products, meat, fish and eggs. Recently, the use of aquatic biological resources, including aquaculture, has become increasingly popular.

The creation of innovative products based on products of pond fish farming and aquaculture is possible with the targeted use of industrial biotechnology methods in the framework of the social policy of the Russian Federation. To ensure protein nutrition, it is necessary to include 40-60 g of fish daily in the diet of the population. Pond fish are one of the reserves for increasing high-value food products, as they are not inferior, and in some cases superior to the oceanic in quality and ratio of the main essential ingredients. Creating a sustainable assortment of products of mass consumer demand is of great economic and social importance, since with high nutritional value they are much cheaper than oceanic and marine fish, and the volumes and types of pond fish can be easily planned by targeted breeding, catch and fattening. The most popular in the food market of the Central Black Earth region are carp, silver carp, perch, pike and grass carp. In a processed form, they were used as objects of research in the laboratory conditions of the department of quality management and technology of aquatic biological resources of FSBEI HE VSUET.

Mass characteristics of the main and secondary products and waste generated during the processing of pond fish are known [5]. Carp and silver carp contain 16-22% of proteins, lipids - from 5 to 8%, as well as compounds necessary for humans: essential amino acids, polyunsaturated fatty acids, including unique (eicosapentaenoic and docosahexanoic), which are not found in other products. Fish meat is rich in vitamins A, E, C, B and minerals [1].

Given the prospects for growing demand for fish products and functional food products, an in-depth study of the chemical composition and scientific design of recipes will expand and diversify the range of fish products, win a new customer and ensure positive production indicators, as well as organize the maximum processing of aquaculture biological resources with zero waste production. Rational use of fish raw materials will significantly improve the nutrition structure and will contribute to the creation of a domestic market of products of functional importance. The development of the production of products from pond fish, however, leads to the need to improve the analytical base for effective and universal monitoring of the quality and safety of products at all stages of production. Here, express and instrumental methods are of undoubted interest.

Materials and methods

Solving the problem of supplying the population with food products based

on fish and seafood (hydrobionts), the mining and processing sub-sectors of the fishing industry make an important contribution to ensuring the country's food security. Specialists need to create a new production strategy taking into account modern ideas about quality and food safety management systems. In the field of scientific support of state guarantees for the safety and quality of fish products, the priority is the development and improvement of product testing methods for certification and conformity assessment.

One of the main factors of safe fish consumption is an objective assessment of its suitability, which is based on both organoleptic and physico-chemical methods. In this regard, the creation of portable devices for the rapid determination (express control) of the degree of suitability of fish for food and at the same time accessible to the consumer is of particular relevance. In order to meet the need for ensuring the quality and safety of products, it is proposed to use the multisensor system "electronic nose", consisting of ten piezosensors, to evaluate fish and fish products. The work of such a system is based on a multi-level neural semiotic model that describes the mechanism of work of the olfactory bulb of a person. "electronic nose" can continuously evaluate the freshness or origin of fish products, which previously was carried out exclusively by experienced experts or a group of experts. The "nose" can perform analysis without interruption caused by expert fatigue. An additional advantage of the artificial sense of smell system is the speed of action, which allows it to be used for online control of food production.

The amino acid composition of aquaculture bioresources was studied by capillary electrophoresis on a Kapel-105 device.

Results and discussion

To determine the freshness (shelf life from the moment of capture), a sample of the analyzed fish was placed in a glass cell, then detected by a microcompressor (fast. 150 ml/min) for 2–3 min was taken into the gas phase. The selected pairs were sent by a microcompressor to the "electronic nose", including six sensors. The results of the investigated samples of pond fish (studies were carried out after 48 hours after the fish "fell asleep") are presented on sensograms (Fig. 1) [7].

It is known that pike, being a predator, feeds on zooplankton and various animals living in the water. From the sensogram presented in Fig. 1c, it is clear that the aroma of pike meat is less pronounced than; silver carp and perch (Fig. 1a and 1b). A similar situation can be observed on the example of carp (Fig. 1d).

The sensogram of grass carp presented in Fig. 1e, indicates the presence of a grassy aroma less pronounced than that of silver carp (Fig. 1a), although the former is also considered a herbivorous fish and eats algae. Perhaps this is due to the peculiarities of the chemical composition of grass carp.

As can be seen in fig. 1, all sensograms differ and depend primarily on the type of fish, lifestyle, conditions and nature of nutrition.

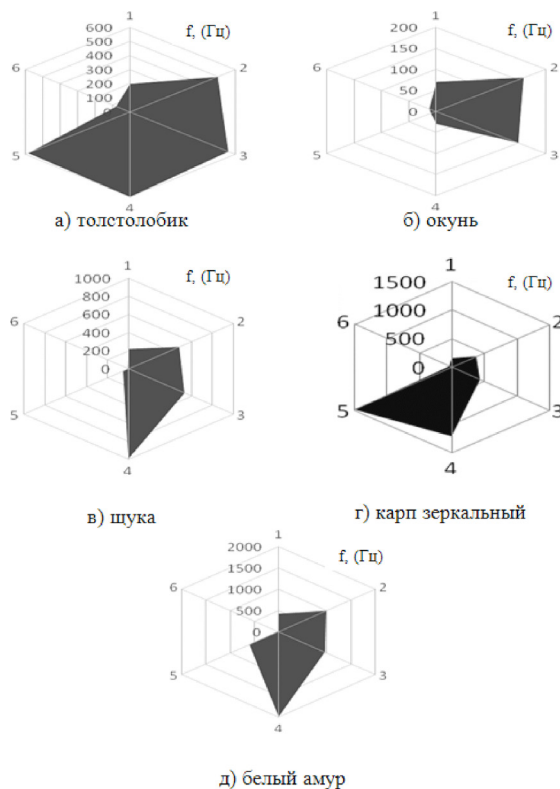


Fig. 1. Sensograms of investigated samples of pond fish: - sensor signal, Hz; 1,2,3 - sensors sensitive to aldehydes, ketones, ethers; 4, 5, 6 - sensors sensitive to water vapor

The main components in the formation of taste and aroma are amino acids and amides: histidine, glutamic and aspartic acids, glutamine, threonine, phenylalanine, leucine, etc. These substances are formed and accumulate during autolysis during the breakdown of proteins, as well as peptides related to extractive muscle substances of fish tissues (glutathione, carnosine, anserine) (Fig. 2) [1].

As can be seen in Fig. 2, the meat of the analyzed pond fish contains a complete set of proteinogenic amino acids. Particular attention is paid to a high proportion of aspartic and (1.28-1.56%) and glutamic acids (1.75-2.16%), which are known to be chemical precursors of taste and aroma. In addition, aspartic acid is involved in the immune system and the synthesis of DNA and RNA (the main carriers of genetic information), and also contributes to the conversion of carbohydrates into glucose and subsequent storage of glycogen [4, 5].

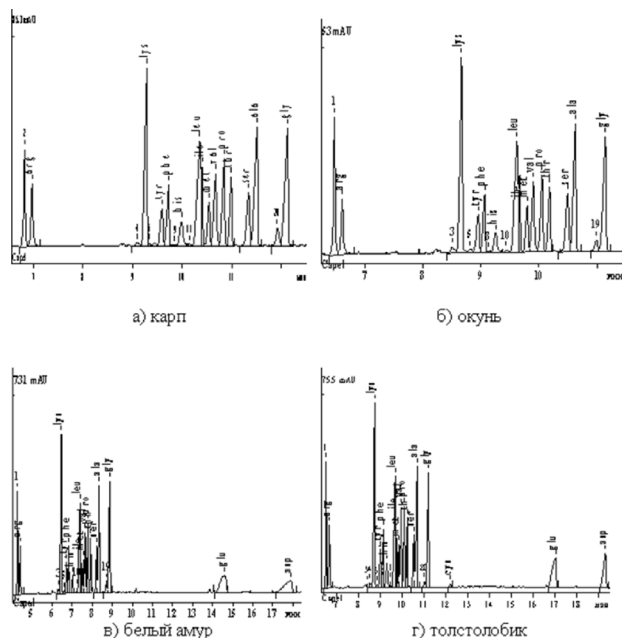


Fig. 2. Electrophoregrams of the studied fish species

Glutamic acid is able to attach ammonia, turning into glutamine, and transfer it to the liver, where then urea and glucose are formed. Monosodium glutamate has become the most popular flavor in the world. The high content of lysine (1.16 - 1.64%) has an antiviral effect, especially against viruses that cause herpes and acute respiratory infections; Maintains energy levels and keeps your heart healthy. In addition, lysine has a mild antidepressant-like effect.

With a lack of lysine, we can feel: fatiguability, fatigue and weakness, poor appetite, growth retardation and weight loss, inability to concentrate, irritability, hemorrhages in the eyeball, hair loss, anemia and reproductive problems, digestive disorders. With a lack of lysine, the formation of new muscle and connective tissue slows down. Lysine enhances the effect of arginine, increases the level of carnitine in the presence of vitamin B₃ (thiamine) and iron. Of great interest is the content of leucine (0.93-1.32%), which is an important link in the biosynthesis of cholesterol and other steroids. Leucine is also a branched amino acid necessary for the construction and development of muscle tissue, protein synthesis by the body, and to strengthen the immune system. Lowers blood sugar and promotes rapid healing of wounds and bones. With a lack of leucine, body weight decreases, changes occur in the kidneys and thyroid gland. A deficiency of this amino acid can be due to either poor nutrition or a lack of vitamin B₆ [4].

Based on the data obtained, it can be seen that a considerable proportion also falls on the content of alanine in the studied pond fish samples (0.81-1.26%), which is an important source of energy for the brain and central nervous system. It strengthens the immune system by producing antibodies; actively involved in the metabolism of sugars and organic acids. Its lack leads to an increase in the need for branched amino acids. It is important that the proteins of the muscle tissue of fish are more complete and promising in the creation of culinary readiness products, since to a large extent they can cover the daily needs of a person in protein nutrition. However, it should be noted that the quantitative deficiency of isoleucine and leucine and phenylalanine+tyrosine can be corrected by the additional introduction of any excipients into the prescription composition and by combining protein resources.

It should be noted that fish proteins after proper technological processing are characterized by high digestibility (up to 93–95%), which significantly exceeds the similar proteins of meat of terrestrial animals. This is due to the fact that myosin (which makes up the bulk of the protein substances of fish muscle tissue) is more easily denatured under the influence of heat and is more likely to be digested in the human gastrointestinal tract by pepsin and chymotrypsin than myosin from meat from terrestrial animals. Also, good digestibility of fish proteins is associated with a low content of connective tissue proteins (5–7% of the total amount of fish proteins), an almost complete absence of elastin, and easy digestibility and glutinization of collagen. The digestibility of fish meat is also determined by the ratio of proteins and fats in tissues. In the absence of fats (lean fish) or too much fat (higher than protein) in the tissues and organs of fish, the digestibility of proteins decreases. The complete digestibility of proteins and the best commercial and nutritional quality of fish products are manifested with the same protein and fat content [2, 3, 5].

Thus, comparing different types of muscle tissue of fish, it can be noted that the proteins of grass carp, common carp, and silver carp are best balanced in amino acid composition, and proteins of pike and perch are approximately equivalent. On the whole, the data presented confirm that there is no ideal amino acid ratio in the muscle tissue of pond fish, but they are not inferior in value to the meat proteins of warm-blooded animals (the utilitarian coefficient for beef is 0.74, the indicator of comparable redundancy is 15.1%) and may well improve balanced diet, being an important additional source of leucine, valine, threonine, and phenylalanine [6, 8].

In conclusion, it should be noted that aquaculture bioresources serve as a source of food and biologically active substances. The purposeful and dosed use of fish products from them, in many respects provides physiological norms in nutrition and is useful for the development of products that correct and maintain human health.

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进行计算实验以求解具有双重非线性扩散的交叉扩散自相似方程
**CARRYING OUT A COMPUTATIONAL EXPERIMENT TO SOLVE
 THE SELF-SIMILAR EQUATION OF CROSS-DIFFUSION WITH
 DOUBLE NONLINEAR DIFFUSION**

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抽象。 在本文中, 我们研究了具有双重非线性扩散的交叉扩散自相似方程解的定性性质。 在解比较定理的基础上建立了以上性质, 并获得了自相似解的渐近性。 给出了计算实验的结果。

关键字。 生物种群, 交叉扩散, 扩散反应, 自相似方程, 可变密度。

Abstract. *In this paper, we study the qualitative properties of solutions of the self-similar equation of cross-diffusion with double nonlinear diffusion. The above properties are established on the basis of the solution comparison theorem, and the asymptotics of self-similar solutions are obtained. The results of a computational experiment are presented.*

Keywords. *Biological population, cross-diffusion, diffusion reaction, self-similar equation, variable density.*

1. Introduction. In region $Q = \{(t, x) : 0 < t, x \in \mathbb{R}\}$ we consider a parabolic system of two quasilinear reaction-diffusion equations with double nonlinear diffusion

$$\begin{cases} \frac{\partial u_1}{\partial t} = \frac{\partial}{\partial x} \left(D_1 u_1^{m_1-1} \left| \frac{\partial u_1}{\partial x} \right|^{p-2} \frac{\partial u_1}{\partial x} \right) + k_1(t) u_1 (1 - u_2^{\beta_1}) \\ \frac{\partial u_2}{\partial t} = \frac{\partial}{\partial x} \left(D_2 u_2^{m_2-1} \left| \frac{\partial u_2}{\partial x} \right|^{p-2} \frac{\partial u_2}{\partial x} \right) + k_2(t) u_2 (1 - u_1^{\beta_2}) \end{cases} \quad (1)$$

$$u_1|_{t=0} = u_{10}(x), \quad u_2|_{t=0} = u_{20}(x),$$

which describes the process of a biological population of Kolmogorov-Fisher type in a nonlinear two-component medium, the diffusion coefficients of which are equal to $D_1 u_1^{m_1-1} \left| \frac{\partial u_1}{\partial x} \right|^{p-2}$, $D_2 u_2^{m_2-1} \left| \frac{\partial u_2}{\partial x} \right|^{p-2}$, where m_1, m_2, p, b_1, b_2 - positive real numbers, $u_1 = u_1(t, x) \geq 0$, $u_2 = u_2(t, x) \geq 0$ - required solutions [1-5].

Below, we study the qualitative properties of the problem under consideration by constructing a self-similar system of equations for (1).

2. The main results. We construct a self-similar system of equations by the method of nonlinear splitting proposed by M.M. Aripov.

$$\text{Replacement in (1) } u_1(t, x) = e^{-\int_0^t k_1(\zeta) d\zeta} v_1(t, x), \quad u_2(t, x) = e^{-\int_0^t k_2(\zeta) d\zeta} v_2(t, x),$$

$$u_2(t, x) = e^{-\int_0^t k_2(\zeta) d\zeta} v_2(t, x),$$

will lead (1) to the form:

$$\begin{cases} \frac{\partial v_1}{\partial \tau} = \frac{\partial}{\partial \eta} \left(D_1 v_1^{m_1-1} \left| \frac{\partial v_1}{\partial \eta} \right|^{p-2} \frac{\partial v_1}{\partial \eta} \right) - k_1(t) e^{[(\beta_1 k_2 t - (m_1 + p - 3) k_1 t)]} v_1 v_2^{\beta_1}, \\ \frac{\partial v_2}{\partial \tau} = \frac{\partial}{\partial \eta} \left(D_2 v_2^{m_2-1} \left| \frac{\partial v_2}{\partial \eta} \right|^{p-2} \frac{\partial v_2}{\partial \eta} \right) - k_2(t) e^{[(\beta_2 k_1 t - (m_2 + p - 3) k_2 t)]} v_1^{\beta_2} v_2, \end{cases} \quad (2)$$

$$v_1|_{t=0} = v_{10}(\eta), \quad v_2|_{t=0} = v_{20}(\eta).$$

Choosing $\tau(t) = \frac{e^{[(m_1 + p - 3) k_1] t}}{(m_1 + p - 3) k_1} = \frac{e^{[(m_2 + p - 3) k_2] t}}{(m_2 + p - 3) k_2}$, we obtain the following system of equations:

$$\begin{cases} \frac{\partial v_1}{\partial \tau} = \frac{\partial}{\partial \eta} \left(D_1 v_1^{m_1-1} \left| \frac{\partial v_1}{\partial \eta} \right|^{p-2} \frac{\partial v_1}{\partial \eta} \right) - a_1 \tau^{b_1} v_1 v_2^{\beta_1} \\ \frac{\partial v_2}{\partial \tau} = \frac{\partial}{\partial \eta} \left(D_2 v_2^{m_2-1} \left| \frac{\partial v_2}{\partial \eta} \right|^{p-2} \frac{\partial v_2}{\partial \eta} \right) - a_2 \tau^{b_2} v_1^{\beta_2} v_2 \end{cases} \quad (3)$$

$$\text{where } a_1 = k_1 ((m_1 + p - 3)k_1)^{b_1}, \quad b_1 = \frac{\beta_1 k_2 - (m_1 + p - 3)k_1}{(m_1 + p - 3)k_1},$$

$$a_2 = k_2 ((m_2 + p - 3)k_2)^{b_2}, \quad b_2 = \frac{\beta_2 k_1 - (m_2 + p - 3)k_2}{(m_2 + p - 3)k_2}.$$

In order to obtain a self-similar system for the system of equations (3), we first find a solution to the system of ordinary differential equations

$$\begin{cases} \frac{d\bar{v}_1}{d\tau} = -a_1 \tau^{b_1} \bar{v}_1^{\beta_1} \bar{v}_2^{\beta_1}, \\ \frac{d\bar{v}_2}{d\tau} = -a_2 \tau^{b_2} \bar{v}_1^{\beta_2} \bar{v}_2, \end{cases}$$

of form $\bar{v}_1(\tau) = c_1 \tau^{-\alpha_1}$, $\bar{v}_2(\tau) = c_2 \tau^{-\alpha_2}$, where $c_1 = 1$, $\alpha_1 = \frac{b_2 + 1}{\beta_2}$, $c_2 = 1$, $\alpha_2 = \frac{b_1 + 1}{\beta_1}$.

And then the solution to system (3) is sought in the form

$$v_1(t, \eta) = \bar{v}_1(t) w_1(\tau, \eta),$$

$$v_2(t, \eta) = \bar{v}_2(t) w_2(\tau, \eta),$$

and $\tau = \tau(t)$ is obtained as

$$\tau_1(\tau) = \int_0^\tau \bar{v}_2^{(p-2)}(t) \bar{v}_2^{(m_1-1)}(t) dt = \begin{cases} \frac{1}{1 - [\alpha_1(m_1 + p - 3)]} (T + \tau)^{1 - [\alpha_1(m_1 + p - 3)]}, \\ \ln(T + \tau), \\ (T + \tau), \end{cases}$$

$$\text{если } 1 - [\alpha_1(m_1 + p - 3)] \neq 0,$$

$$\text{если } 1 - [\alpha_1(m_1 + p - 3)] = 0,$$

$$\text{если } m_1 + p = 3,$$

$$\text{if } a_1(m_1 + p - 3) = a_2(m_2 + p - 3).$$

Consider a self-similar solution of the form for system (3)

$$u(t, x) = f_1(\xi), \quad v(t, x) = f_2(\xi), \quad \xi = |x| / (T + t)^{1/p} \quad (4)$$

Then substituting (4) in (3) with respect to $f_1(\xi), f_2(\xi)$ we obtain a system of self-similar equations:

$$\begin{cases} \frac{d}{d\xi} (f_1^{m_1-1} \left| \frac{df_1}{d\xi} \right|^{p-2} \frac{df_1}{d\xi}) + \xi \frac{df_1}{d\xi} + \mu_1 (f_1 - f_1 f_2^{\beta_1}) = 0, \\ \frac{d}{d\xi} (f_2^{m_2-1} \left| \frac{df_2}{d\xi} \right|^{p-2} \frac{df_2}{d\xi}) + \xi \frac{df_2}{d\xi} + \mu_2 (f_2 - f_2 f_1^{\beta_2}) = 0, \end{cases} \quad (5)$$

If $\beta_i = [3 - (p + m_{3-i})] / (p - 1)$, then equation (5) has an exact solution of the form $\bar{f}_1(\xi) = A(a - \xi^\gamma)_+^{n_1}$, $\bar{f}_2(\xi) = B(a - \xi^\gamma)_+^{n_2}$, where

$$n_1 = \frac{(p-1)}{m_1 + p - 3}, \quad n_2 = \frac{(p-1)}{m_2 + p - 3}, \quad \gamma = p / (p-1)$$

$$(b)_+ = \max(0, b)$$

3. Computational experiment. A computational experiment was carried out to solve a system of models of two competing populations with double nonlinear diffusion, and the following results were obtained (Table 1 and Table 2).

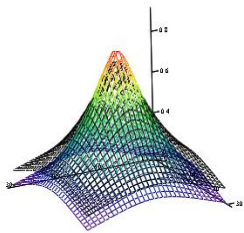
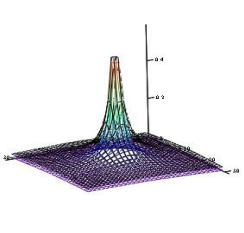
Table 1

Fast diffusion. As an initial approximation, we must take:

$$u_0(x, t) = (T + t)^{-\alpha_1} (a + \xi^\gamma)^{\gamma_1}, \quad v_0(x, t) = (T + t)^{-\alpha_2} (a + \xi^\gamma)^{\gamma_2},$$

$$\xi = \frac{|x|}{\tau^{\frac{1}{p}}}, \quad \gamma = \frac{p}{p-1}, \quad \gamma_i = \frac{p-1}{q_i},$$

Parameter values must be $\gamma_1 > 0, \gamma_2 > 0, q < 0$.

Parameter values	$x=1; t=1$	$x=3; t=20$
$m_1 = 1.5, m_2 = 1.4, p = 1.4$ $eps = 10^{-3}$ $\beta = 5$ $m_i + p - 3 < 0$		

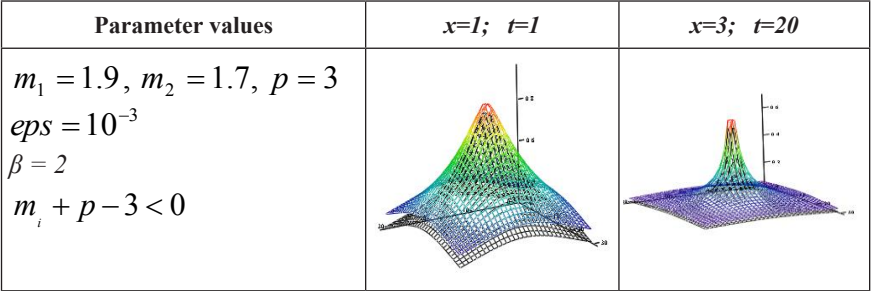


Table 2

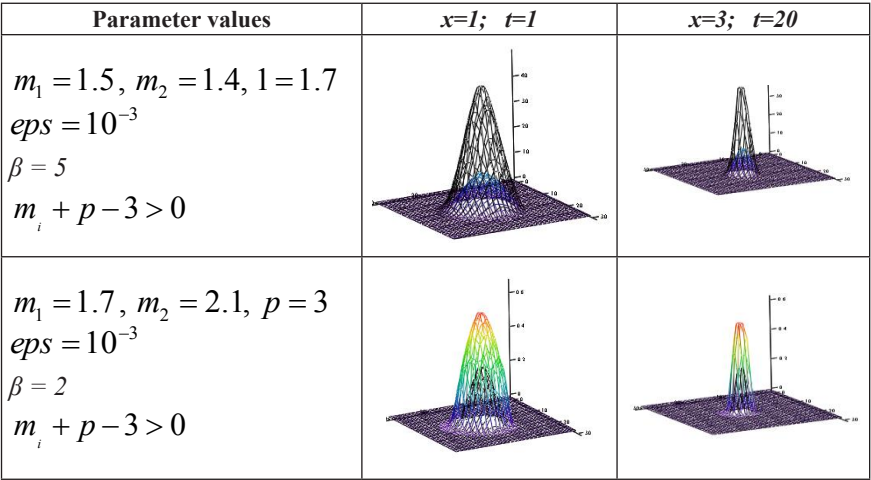
Slow diffusion. As an initial approximation, we must take:

$u_0(x,t) = (T+t)^{-\alpha_1} (a-\xi^\gamma)_+^{\gamma_1}, \quad v_0(x,t) = (T+t)^{-\alpha_2} (a-\xi^\gamma)_+^{\gamma_2},$

$\xi = \frac{|x|}{\tau^{\frac{1}{p}}}, \quad \gamma = \frac{p}{p-1}, \quad \gamma_i = \frac{p-1}{q_i},$

$i = 1, 2, \quad q_i = p + m_i - 3$

Parameter values must be $\gamma_1 > 0, \gamma_2 > 0, q > 0$.



4. Conclusion. In this paper, we study the properties of solutions to the problem of a biological population with double nonlinearity. The main research method

is a self-similar and numerical approach. It is proved that the system allows a self-similar analysis of the solution, thanks to which new phenomena are established, such as the finite propagation velocity of the disturbance, the spatial localization of solutions.

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具有初始信息不确定性的土地肥力定性评估

QUALITATIVE ASSESSMENT OF LAND FERTILITY WITH THE UNCERTAINTY OF INITIAL INFORMATION

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抽象。 本文讨论了评估形式化较差过程状态的方法, 以及应用模糊评估系统利用模糊信息维护土壤肥力的方法。

关键字。 模糊集理论, 隶属函数, 预测, 模糊逻辑。

Abstract. *The article discusses approaches to assessing the state of poorly-formalized processes and applied fuzzy assessment systems to maintain soil fertility with fuzzy information.*

Keywords. *Theory of fuzzy sets, membership function, forecast, fuzzy logic.*

1. Introduction. A qualitative assessment of land fertility can be made in the form of predicted crop yields. This task is the most difficult, justification of other indicators largely depends on its correct solution. In order for the level of these indicators to be more real, it is necessary to take into account the quality of soils, various doses of fertilizer application, the actual level of productivity in recent years, the possibility of increasing soil fertility, land reclamation.

One of the main criteria for soil fertility is the yield of a given crop and a given variety. The degree of fertility depends on the type of soil and its moisture. In turn, soil types are in a certain correspondence with temperature and air humidity, as the resulting climate parameters.

2. Main part. It has been established that the fertility of different soil types is quantitatively best characterized along with moisture reserves, bulk density, closely related to such generally recognized components of fertility as the amount of humus, nitrogen, phosphorus, etc.

For the adoption of management decisions, it is quite acceptable to use the phases of the development of crops (budding, fruit formation, ripening) as stages.

Based on experimental data, a quantitative expression of the relationship of soil fertility can be obtained.

$$y = a_0 + a_1x_1 + a_2x_2 + \dots + a_7x_7 + a_8x_8. \quad (1)$$

Here $a_0 \in [-0,95; -0,91]$; $a_1 \in [-0,27; -0,23]$; $a_2 \in [-0,0022; -0,0018]$;
 $a_3 \in [0,0038; 0,0042]$; $a_4 \in [0,0028; 0,0032]$; $a_5 \in [-0,51; -0,47]$;

$a_6 \in [0,11; 0,15]$; $a_7 \in [-0,052; -0,048]$; $a_8 \in [0,038; 0,042]$.

In this problem, the state of the system is the content of humus in the soil, %.

x_1 - soil bulk mass, g/cm³;

x_2 - plowing depth, cm;

x_3 - dose of phosphorus, kg/ha;

x_4 - potassium dose potassium, kg/ha;

x_5 - soil nitrogen content, %;

x_6 - soil organic carbon content, %;

x_7 - daily average temperature, %;

x_8 - soil moisture, %;

As can be seen from equation (1), with an increase in the content of organic carbon in the soil, soil moisture, and applied doses of phosphorus and potassium by one unit, the amount of humus in the soil increases on average by [0.11; 0.15], respectively; [0.038; 0.042]; [0.0038; 0.0042]; [0.028; 0.032]. An increase in the volumetric mass of the soil, the nitrogen content in it, and the depth of plowing by one unit reduces the content of humus in it by an average of [0.23; 0.27]; [0.47; 0.51] and [0.0018; 0.0022], respectively.

For the first phase of crop development, one can obtain the equation

$$z_1 = b_0 + b_1x_{11} + b_2x_{12} + \dots + b_7x_{17} + b_8y, \quad (2)$$

where $b_0 \in [-175; -165]$; $b_1 \in [-0,0012; -0,0008]$; $b_2 \in [-0,196; -0,192]$;

$b_3 \in [0,21; 0,25]$; $b_4 \in [0,018; 0,022]$; $b_5 \in [0,0068; 0,0072]$;

$b_6 \in [-0,082; -0,078]$; $b_7 \in [0,0018; 0,0022]$; $b_8 \in [0,195; 0,199]$.

Here: x_{11} - dose of phosphorus added, kg/ha;

x_{12} - dose of nitrogen added, kg/ha;

x_{13} - watering rate, m³/ha;

x_{14} - sum of effective temperatures, C^0 ;

x_{15} - soil surface temperature, C^0 ;

x_{16} - relative air humidity, %;

x_{17} - soil moisture, %;

y - soil humus content, %;

z_1 - number of fruits on a bush.

The second phase is described by the equation

$$z_2 = c_0 + c_1 x_{21} + c_2 x_{22} + c_3 x_{23} + \dots + c_7 x_{27}, \quad (3)$$

where $c_0 \in [621; 625]$; $c_1 \in [-0,32; -0,28]$; $c_2 \in [-0,082; -0,078]$;

$c_3 \in [-0,56; -0,52]$; $c_4 \in [-0,022; -0,018]$; $c_5 \in [1,80; 1,90]$;

$c_6 \in [0,028; 0,032]$; $c_7 \in [0,83; 0,87]$.

Here: z_2 - number of fruits on a bush;

x_{21} - dose of nitrogen added, kg/ha;

x_{22} - dose of phosphorus added, kg/ha;

x_{23} - watering rate, m³/ha;

x_{24} - sum of effective temperatures, C^0 ;

x_{25} - soil surface temperature, C^0 ;

x_{26} - relative air humidity, %;

x_{27} - plant standing density, thous/ha;

The state of crops during the ripening period corresponds to the expression

$$z_3 = d_0 + d_1 x_{31} + d_2 x_{32} + \dots + d_7 x_{37} + d_8 z_2, \quad (4)$$

where $d_0 \in [-47; -43]$; $d_1 \in [-0,012; -0,008]$; $d_2 \in [0,097; 0,101]$;

$d_3 \in [-0,042; -0,038]$; $d_4 \in [-0,015; -0,011]$; $d_5 \in [-0,052; -0,048]$;

$d_6 \in [2,70; 2,77]$; $d_7 \in [0,31; 0,35]$; $d_8 \in [0,34; 0,37]$.

Here: z_3 - number of fruits on a bush;

x_{31} - plant standing density, thous/ha;

x_{32} - dose of nitrogen added, kg/ha;

x_{33} - dose of phosphorus added, kg/ha;

x_{34} - watering rate, m³/ha;

x_{35} - sum of effective temperatures, C^0 ;

x_{36} - soil surface temperature, C^0 ;

x_{37} - relative air humidity, %;

Yield as the final state of the plant, depending on the conditions in the previous stages, is described by the equation

$$z_4 = f_0 + f_1 y + f_2 z_1 + f_3 z_2 + f_4 z_3, \quad (5)$$

where $f_0 \in [28; 30]$; $f_1 \in [-4,1; -3,7]$; $f_2 \in [-1,47; -1,43]$; .

$f_3 \in [-0,95; -0,91]$; $f_4 \in [2,32; 2,37]$.

The solution to this problem will give the optimal value of the controlled parameters and productivity.

The adoption of optimal solutions reduces to such non-negative values of x_{ij} , that satisfying (1) - (4) provide maximum functional (5) [2]. The estimated yield was 50 c/ha, while the actual one was 33 c/ha. Yield growth can be achieved by implementing pre-sowing measures (for example, plowing to a depth of 40 cm instead of 30) and vegetation periods (for example, by increasing the humus content from 0.7% to 1%).

3. Conclusion. Using the models built above, it is possible to determine not only a actually possible crop, but also a potential crop on the field. The solution to the problem gave the optimal values of the parameters that determined the potential yield on the field.

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具有双重非线性的生物种群模型的应用

APPLICATION OF BIOLOGICAL POPULATION MODELS WITH DOUBLE NONLINEARITY

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抽象。 在本文中, 我们研究了具有双重非线性的Kolmogorov-Fisher型生物种群问题的全局可解性, 以及基于自相似分析的问题的定性性质及其在预测传染病中的应用。 考虑中的问题的质性是基于一对自相似方程的质性的研究。 为了构造自相似方程, 使用了非线性分裂算法。

关键词: 生物种群流行病模型自相似方程预后传染病

Abstract. *In this paper, we study the global solvability of a Kolmogorov-Fisher-type biological population problem with double nonlinearity and the qualitative properties of solving a problem based on self-similar analysis and its use for predicting infectious diseases. The qualitative properties of the problem under consideration are based on the study of the qualitative properties of the self-similar equation. To construct a self-similar equation, a nonlinear splitting algorithm is used.*

Keywords: *biological population, epidemic model, self-similar equation, prognosis, infectious disease.*

1. Introduction. Methods for predicting infectious morbidity have been actively developing since the beginning of the XX century. In recent years, the number of works on this topic has been growing rapidly thanks to the deployment of surveillance information systems and the emergence of large volumes of statistics available for analysis. Epidemiological forecasts are carried out for different periods and, depending on them, serve different purposes. Thus, a short-term prognosis for several weeks in advance is used in operational management and in identifying epidemic outbreaks of disease. The most useful can be considered a medium-term forecast for a period of two months to six months [1], used in tactical management. Of course, it is less accurate than short-term, but leaves enough time to prepare for possible emergencies and conduct preventive measures. When making strategic decisions, one cannot do without long-term forecasts for the year ahead and more. Achieving

high quality of such forecasts in most cases is impossible, nevertheless, they are required, for example, when assessing the required volumes of production of drugs and vaccines, equipping medical facilities and training personnel.

Consider several types of models with which you can better understand the consequences of reproduction progression and limitations on it. These simple mathematical models are used in evolution, genetics, ecology, biophysics, demography, medicine, etc. Classical regression analysis is the most popular incidence prediction method. The task of regression is to find estimates of unknown parameters and the formation of a functional relationship between the incidence and the factors that determine it. Among the regression models, two groups should be distinguished [2]: non-adaptive models, for the estimation of the parameters of which all available data are used, and adaptive models, the parameter values of which are calculated on the basis of a moving observation window. To consider the progression of reproduction in the simplest situations, one does not have to take into account the genetic structure of the population, but should concentrate all attention on the change in the population size u in time t .

An important representative of methods based on machine learning is fuzzy sets and artificial neural networks. The methodology of fuzzy sets and artificial neural networks is widely known and well suited for solving problems whose analytical study is difficult. Artificial neural networks is a directed weighted graph whose vertices model the functioning of biological neurons. The vertices receive incoming signals and, with a sufficiently large value of their weighted sum, convert them into an outgoing signal. The training of artificial neural networks consists in calculating the coefficients of connections between vertices, which determine the strength of incoming signals, and is performed on the basis of empirical data: statistics on the incidence and, if any, values of factors that determine it [3,4].

Classical epidemic spread models describe the dynamics of the spread of diseases using systems of differential equations. The first works that laid the foundation of modern mathematical epidemiology were published at the beginning of the XX century [5].

2. Solution of the problem. let us consider in region $Q = \{(t, x) : 0 < t, x \in R\}$ the quasilinear reaction-diffusion equation with double nonlinearity

$$\frac{\partial u}{\partial t} = \frac{\partial}{\partial x} \left(D u^{m-1} \left| \frac{\partial u}{\partial x} \right|^{p-2} \frac{\partial u}{\partial x} \right) + k u (1 - u^\beta), \quad u|_{t=0} = u_0(x) \geq 0, \quad x \in R, \quad (1)$$

which describes the process of a biological population of Kolmogorov-Fisher

kind, whose diffusion coefficients are equal to $D u^{m-1} \left| \frac{\partial u}{\partial x} \right|^{p-2}$, where m, p, β

- positive real numbers, $u = u(t, x) \geq 0$ - desired solution.

In this paper, we study the global solvability of a biological population problem of the Kolmogorov-Fisher type with double nonlinearity and the qualitative properties of solving the problem based on self-similar analysis. These qualitative properties of the problem under consideration are carried out on the basis of a study of the qualitative properties of the self-similar equation for (1). To construct a self-similar equation, the nonlinear splitting algorithm is used [6-8].

Note that the replacement in (1) $u(t, x) = e^{kt} v(\mathbf{t}(t), x)$ will bring (1) to the form:

$$\frac{\partial v}{\partial \tau} = \frac{\partial}{\partial x} \left(D v^{m-1} \left| \frac{\partial v}{\partial x} \right|^{p-2} \frac{\partial v}{\partial x} \right) - k e^{[(\beta - (m+p-3)k)t]} v^{\beta+1}, \quad (2)$$

$$v|_{t=0} = v_0(x) = u_0(x).$$

where

$$\tau(t) = e^{[(m+p-3)k]t} / (m+p-3)k, \quad m+p-3 \neq 0, \quad (3)$$

without changing the initial data.

Given (3), equation (2) is rewritten as follows:

$$\frac{\partial v}{\partial \mathbf{t}} = \frac{\partial}{\partial x} \left(D v^{m-1} \left| \frac{\partial v}{\partial x} \right|^{p-2} \frac{\partial v}{\partial x} \right) - k_1 \mathbf{t}^b v^{b+1}, \quad (4)$$

where $k_1 = k((m+p-3)k)^b$, $b = \frac{(\beta - (m+p-3))}{m+p-3}$.

In order to obtain a self-similar equation for equation (4), we apply the splitting algorithm, according to which we first find a solution to the ordinary differential

equation $\frac{d\bar{v}}{d\tau} = -k_1 \tau^b \bar{v}^{b+1}$.

Then, we have $\bar{v}(\tau) = c(\tau + T_0)^{-\gamma}$, $T_0 > 0$, where $c = \left[\frac{\beta k_1}{b+1} \right]^{-\frac{1}{\beta}}$, $\gamma = \frac{b+1}{\beta}$.

And then the solution to equation (4) is sought in the form $v(t, x) = \bar{v}(t) w(\mathbf{t}, x)$, and the function $\tau = \tau(\mathbf{t})$ is obtained as

$$\tau(t) = \int_0^t \bar{v}^{(m+p-3)}(t) dt = \begin{cases} t^{1-[\gamma(m+p-3)]} / (1-\gamma(m+p-3)), \\ \ln t, \\ t, \end{cases}$$

если $1-\gamma(m+p-3) \neq 0$,

если $1-\gamma(m+p-3) = 0$,

если $m+p=3$.

Then for $w(\tau, x)$ we get the equation

$$\frac{\partial w}{\partial \tau} = \frac{\partial}{\partial x} \left(D w^{m-1} \left| \frac{\partial w}{\partial x} \right|^{p-2} \frac{\partial w}{\partial x} \right) + \psi(w - w^{\beta+1}), \quad (5)$$

where

$$\psi = \begin{cases} \frac{1}{(1 - [\gamma(m + p - 3)])\tau}, & \text{если } 1 - [\gamma(m + p - 3)] > 0, \\ \gamma c^{-(\gamma(m + p - 3))}, & \text{если } 1 - [\gamma(m + p - 3)] = 0. \end{cases} \quad (6)$$

Which shows the invariance of the above transformation. Now consider a self-similar solution

$$w(\tau, x) = f(\xi), \quad \xi = |x| / \tau^{1/p}. \quad (7)$$

for equation (5)

Then substituting (7) into (5) in case $1 - [\gamma(m + p - 3)] > 0$, respect to $f(\xi)$ it is easy to obtain the self-similar equation:

$$L(f) = \frac{d}{d\xi} (f^{m-1} \left| \frac{df}{d\xi} \right|^{p-2} \frac{df}{d\xi}) + \frac{\xi}{p} \frac{df}{d\xi} + \mu(f - f^{\beta+1}) = 0, \quad \mu = \frac{1}{1 - [\gamma(m + p - 3)]}. \quad (8)$$

Let us build the upper solution for equation (1).

If $\beta = [3 - (p + m)] / (p - 1)$, then equation (8) has an exact solution of the form $\bar{f}_{\pm}(\xi) = A(a \pm \xi^{\gamma})_+^n$,

where $n = (p - 1) / (p + m - 3)$, $\gamma = p / (p - 1)$, $(b)_+ = \max(0, b)$

The properties of solutions of equation (8) in the case $p = 2$, $m = 1$, were studied in detail in [8]

Consider $u(0, x) \leq z_{\pm}(0, x)$, $x \in R$. Then, for the solution of problem (1) in the domain Q , the following estimate takes place

$$u(t, x) \leq z_{\pm}(t, x) = (T + t)^{-\gamma} \bar{f}_{\pm}(x), \quad \xi = |x| / \tau^{1/p}.$$

Here $\bar{f}_{\pm}(x)$ is the function defined above.

3. Computational experiment.

First, we consider a model of the “natural” course of the epidemic (without medical intervention). It is clear that the epidemic model may include the influence of factors of various levels. So, one could take into account the laws governing the activity of bacterial cells, the degree of susceptibility to infection of individuals, the likelihood of interactions of carriers of infection with healthy people and many other factors. Since our goal is only to create an illustrative model, we abstract from many factors.

Suppose there are u healthy people, and at time $t = 0$ one sick person (source of infection) falls into this group. Suppose that no removal of patients from the group occurs (there is no recovery, no death, no isolation). We will also assume that a person becomes a source of infection immediately after he is infected.

It is possible to complicate the model, assuming, for example, that at time t not 1 person is sick, but several (b). In addition, suppose that after a short period of time, the patient recovers and receives immunity.

So, depending on the timing of forecasting and available statistics, it is advisable to use one or other approaches (Table 1). The basis for the analysis is the time series of incidence, which can be supplemented by data of various nature - for example, the characteristics of weather conditions. The frequency of data collection is determined by the type of infection, the current epidemiological situation and organizational capacity. In Western countries, incidence statistics tend to be updated daily. In particular, epidemiological data on the coronavirus Covid-19 for epidemics is collected daily. All methods considered in this work can be illustrated by the example of predicting the incidence of coronavirus.

For two months, the attention of the world community has been riveted to the Chinese city of Wuhan; an epidemic of deadly coronavirus flared up here.

At the end of last year, the first cases of a new fatal disease were recorded in the Chinese city of Wuhan. It is caused by coronavirus. It is now known that in just a couple of weeks the virus mutated and began to be transmitted from person to person. At the same time, it became known that infection can occur even during the incubation period, which lasts 10-14 days.

According to recent data, the total number of Covid-19 cases in the world exceeded 130,582. China, South Korea, Italy and Iran occupy the first lines in the number of infected.

Table 1
Comparative analysis of the prognosis of Covid-19 patients

Date	The actual number of cases of coronavirus Covid-19	The number of cases according to the biological population model (1)	The number of cases according to the epidemic model	The number of cases according to the model of deep neural networks	The number of cases according to the neuron-fuzzy model
25.01	1320	1046	7757	10616	1320
26.01	2014	1922	8311	10991	2014
27.01	2798	2960	8905	11882	2798
28.01	4593	4136	9541	12778	4593
29.01	6065	5437	10222	13684	6065
30.01	7818	6852	10953	14605	7818
31.01	9826	8372	11735	15546	9826
1.02	11953	9990	12573	16512	11953

2.02	14557	11700	13472	17509	14557
3.02	17391	13498	14434	18541	17391
4.02	20630	15380	15465	19612	20630
5.02	24554	17342	16570	20725	24554
6.02	28276	19381	17754	21886	28276
7.02	31481	21495	19022	23098	31481
8.02	34886	23680	20381	24364	34886
9.02	37558	25934	21837	25687	37558
10.02	40554	28255	23397	27072	40554
11.02	43006	30643	25068	28522	43006
12.02	45031	33093	26859	30041	45031
13.02	60174	35606	28778	31633	60174
14.02	64242	38179	30834	33300	64242
15.02	66903	40812	33036	35049	66903
16.02	68915	43502	35396	36881	68915
17.02	71448	46250	37925	38803	71448
18.02	73390	49052	40634	40818	73390
19.02	75203	51909	43537	42932	75203
20.02	75683	54819	46647	45149	75683
21.02	76699	57782	49979	47474	76699
22.02	77831	60797	53550	49914	77831
23.02	78799	63862	57375	52472	78799
24.02	79375	66977	61474	55157	79375
25.02	80892	70141	65865	57973	80892
26.02	81735	73353	70571	60928	81735
27.02	83092	76613	756127	64029	83092
28.02	84408	79920	81013	67282	84408
29.02	86230	83273	86801	70695	86230
1.03	88012	86671	93002	74277	88012
2.03	89740	90115	99645	78035	89740
3.03	92855	93603	106764	81979	92855
4.03	94793	97135	114390	86118	94793
5.03	97430	100710	122562	90461	97430
6.03	101167	104328	131317	95018	101167
7.03	104268	107989	140698	99801	104268
8.03	108444	111691	150749	104821	108444
9.03	111947	115435	161518	110088	111947
10.03	116693	131317	173057	118118	116693
11.03		140698	185419	124858	122104
12.03		150749	198665	132650	128248

13.03		161518	212857	141610	128842
14.03		173057	228062	151854	154012
15.03		185419	244354	163505	156901
16.03		198665	261810	176692	179145
17.03		212857	280513	191547	190764
18.03		228062	300552	208206	214618
19.03		244354	322022	226812	236308
20.03		272068	345026	247512	272068
21.03		304327	369673	270458	304327
22.03		335366	396082	295805	335366
23.03		374708	424376	323715	374708
24.03		417348	454692	354355	417348
25.03		463371	487173	387894	463371
26.03		525300	521975	424510	525300
27.03		590287	559263	464381	590287
28.03		657915	599215	507694	657915
29.03		721330	642021	554639	721330
30.03		772226	687884	605410	772226
31.05		856910	737024	660207	856910
01.04		934825	789674	719235	934825
02.04		1005227	846086	782703	1005000
03.04		1072164	906527	850826	1070000
04.04		1138915	971286	923821	1130000
05.04		1208347	1040671	1001913	1200000
06.04		1270274	1115013	1085331	1270000
07.04		1340804	1194665	1174306	1360000
08.04		1440096	1280007	1269079	1440000
09.04		1511104	1371446	1369891	1510000
10.04		1807296	1469417	1476991	1631000
11.04		1936577	1574387	1590631	1710000
12.04		2074900	1686855	1711068	1840000
13.04		2223018	1807358	1838565	1950000
14.04		2381822	1936468	1973388	2155810
15.04		2551971	2074802	2115810	2329063

4. Conclusion. There is no universal way to predict epidemics and incidence. The optimal approach should be chosen by comparing the results obtained using various techniques based on empirical data. It is often difficult to give preference

to one forecasting method - several approaches give results of comparable quality. In order to form a rational forecast from many competing ones, it is advisable to use the methods of decision theory, in particular multicriteria analysis.

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技术在应用任务中的数据挖掘和集成技术的应用
**APPLICATION OF TECHNOLOGY FOR DATA MINING AND
INTEGRATION IN APPLIED TASKS**

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抽象。 由于传统的数学建模方法在解决形式化较差的问题(包括与风险相关的任务)方面的功能有限,因此在本文中,我们考虑使用数据挖掘技术。 它们基于人工智能方法,尤其是基于这种理论和方法基础的软计算方法(软计算,软计算)和计算智能领域-智能计算技术。 这些领域的主要组成部分是模糊集理论,模糊推理,遗传算法,人工神经网络和神经网络计算。

关键词: 模糊集, 优化, 多准则任务, 风险, 决策。

Abstract. *Due to the limited capabilities of traditional methods of mathematical modeling in solving poorly formalized problems, including tasks associated with risk, in this paper we consider the use of data mining technology. They are based on artificial intelligence methods and, especially, soft computing methods (Soft Calculation, Soft Computing) and the areas of Computational Intelligence that originate on this theoretical and methodological base - intelligent computing technologies. The main components of these areas are the theory of fuzzy sets, fuzzy inference, genetic algorithms, artificial neural networks and neural network computing.*

Keywords: *Fuzzy set, optimization, multi-criteria task, risk, decision making.*

1. Introduction. Computational Intelligence (CI) technology makes it possible to obtain solutions with accuracy acceptable for practice by training on available source data, available in a limited, incomplete volume, and also presented in a qualitative form [1-3].

The fuzzy logic created in the 60s by Professor Lotfi Zadeh, developed by Bart Cosco and other scientists, first embodied by American firms in commercial systems for managing complex technological processes, managed to be born three times in its nearly half-century existence. This field of knowledge is one of the few scientific fields ever created in the USA, developed in Japan and re-recognized by the Americans after the hopeless loss of a strategic initiative. The second birth of fuzzy logic contributed to the emergence of a new scientific direction in the framework of this science - research in the field of economic and financial analysis based on Fuzzy technology (Fuzzy Economics) [1,2].

Businesses (especially large ones) are constantly having new problems that require adequate scientific formulation and resolution. Therefore, under these informational conditions, it is considered most expedient to involve analysis methods based on obtaining high-quality data estimates based on modern world trends in economic science, which can rightfully be considered the direction of soft computing (Fuzzy technology).

CI are created to solve a variety of problems. The CI of the project develops the configuration of objects taking into account the set of limitations inherent in the problem. Examples include genetic engineering, the development of large integrated circuits, and the synthesis of complex organelle molecules. Design is very closely associated with planning, and many developers of any system have a mechanism for developing and determining plans to achieve the desired project. When developing development plans for any configuration, the design system can evaluate them in the context of problematic requirements and avoid unnecessary research on a large scale.

Learning CI diagnose, configure, and correct the student's condition. Teaching students to detect faults in electrical circuits; An example of this is the training of sailors in working with an engine on a ship and the training of medical students in the choice of antimicrobial therapy.

The article discusses methods for predicting and assessing the risk of crop failure, based on fuzzy withdrawal rules. They allow you to get solutions with accuracy acceptable for practice, by training on available source data, available in a limited, incomplete volume, and also presented in a qualitative form [4].

2. Solution of applied problems. The risk assessment model is described using fuzzy inference rules:

$$\bigcup_{p=1}^{k_j} \left(\bigcap_{i=1}^n x_i = a_{i,jp} - c \text{ } \forall \text{ } w_{jp} \right) \rightarrow r = f(x_1, x_2, \dots, x_n) \dots$$

Here $a_{i,jp}$ - linguistic term that evaluates the variable x_i in line number jp ;

w_{jp} - rule weight coefficient with serial number jp ;

$r = f(x_1, x_2, \dots, x_n)$ - fuzzy rule output.

Three types of models for assessing the risk of under-harvesting based on fuzzy withdrawal rules have been developed.

1. Risk assessment model whose output is expressed by a linear relationship.

If $x_1^1 = H$ and $x_2^1 = H$ and $x_3^1 = H$ and $x_4^1 = C$

$$\text{Then } r_1 = 0,33 - 0,05 \frac{\sum_{j=1}^n \mu(x_1^{1j}) x_1^{1j}}{\sum_{j=1}^n \mu(x_1^{1j})} - 0,02 \frac{\sum_{j=1}^n \mu(x_2^{1j}) x_2^{1j}}{\sum_{j=1}^n \mu(x_2^{1j})} - 0,21 \frac{\sum_{j=1}^n \mu(x_3^{1j}) x_3^{1j}}{\sum_{j=1}^n \mu(x_3^{1j})} - 0,1 \frac{\sum_{j=1}^n \mu(x_4^{1j}) x_4^{1j}}{\sum_{j=1}^n \mu(x_4^{1j})}.$$

If $x_1^2 = H$ and $x_2^2 = H$ and $x_3^2 = C$ and $x_4^2 = C$

$$\text{Then } r_2 = 0,257 - 0,0393 \frac{\sum_{j=1}^n \mu(x_1^{2j}) x_1^{2j}}{\sum_{j=1}^n \mu(x_1^{2j})} - 0,112 \frac{\sum_{j=1}^n \mu(x_4^{2j}) x_4^{2j}}{\sum_{j=1}^n \mu(x_4^{2j})}.$$

If $x_1^3 = H$ and $x_2^3 = C$ and $x_3^3 = H$ and $x_4^3 = C$

$$\text{Then } r_3 = 0,18 - 0,01 \frac{\sum_{j=1}^n \mu(x_1^{3j}) x_1^{3j}}{\sum_{j=1}^n \mu(x_1^{3j})} - 0,07 \frac{\sum_{j=1}^n \mu(x_2^{3j}) x_2^{3j}}{\sum_{j=1}^n \mu(x_2^{3j})} - 0,05 \frac{\sum_{j=1}^n \mu(x_3^{3j}) x_3^{3j}}{\sum_{j=1}^n \mu(x_3^{3j})} - 0,111 \frac{\sum_{j=1}^n \mu(x_4^{3j}) x_4^{3j}}{\sum_{j=1}^n \mu(x_4^{3j})}.$$

If $x_1^4 = H$ and $x_2^4 = C$ and $x_3^4 = C$ and $x_4^4 = C$

$$\text{Then } r_4 = 0,26 - 0,02 \frac{\sum_{j=1}^n \mu(x_1^{4j}) x_1^{4j}}{\sum_{j=1}^n \mu(x_1^{4j})} - 0,05 \frac{\sum_{j=1}^n \mu(x_2^{4j}) x_2^{4j}}{\sum_{j=1}^n \mu(x_2^{4j})} - 0,03 \frac{\sum_{j=1}^n \mu(x_3^{4j}) x_3^{4j}}{\sum_{j=1}^n \mu(x_3^{4j})} - 0,134 \frac{\sum_{j=1}^n \mu(x_4^{4j}) x_4^{4j}}{\sum_{j=1}^n \mu(x_4^{4j})}.$$

If $x_1^5 = H$ and $x_2^5 = C$ and $x_3^5 = B$ and $x_4^5 = C$

$$\text{Then } r_5 = 0,202 - 0,10 \frac{\sum_{j=1}^n \mu(x_1^{5j}) x_1^{5j}}{\sum_{j=1}^n \mu(x_1^{5j})} - 0,08 \frac{\sum_{j=1}^n \mu(x_2^{5j}) x_2^{5j}}{\sum_{j=1}^n \mu(x_2^{5j})} - 0,04 \frac{\sum_{j=1}^n \mu(x_3^{5j}) x_3^{5j}}{\sum_{j=1}^n \mu(x_3^{5j})} - 0,12 \frac{\sum_{j=1}^n \mu(x_4^{5j}) x_4^{5j}}{\sum_{j=1}^n \mu(x_4^{5j})}.$$

2. Risk assessment model whose output is expressed by a fuzzy term.

If $x_1^1 = H$ and $x_2^1 = H$ and $x_3^1 = H$ and $x_4^1 = H$ with weight of 0.5

or $x_1^1 = C$ and $x_2^1 = H$ and $x_3^1 = H$ and $x_4^1 = H$ with weight of 0.5

Then $r_1 = B$.

If $x_1^2 = H$ and $x_2^2 = H$ and $x_3^2 = H$ and $x_4^2 = C$ with weight of 0.33

or $x_1^2 = H$ and $x_2^2 = H$ and $x_3^2 = H$ and $x_4^2 = B$ with weight of 0.33

or $x_1^2=H$ and $x_2^2=H$ and $x_3^2=C$ and $x_4^2=H$ with weight of 0.33

Then $r_2=BC$.

If $x_1^3=H$ and $x_2^3=H$ and $x_3^3=H$ and $x_4^3=B$ with weight of 0.33

or $x_1^3=H$ and $x_2^3=H$ and $x_3^3=C$ and $x_4^3=C$ with weight of 0.33

or $x_1^3=H$ and $x_2^3=H$ and $x_3^3=C$ and $x_4^3=B$ with weight of 0.33

Then $r_3=C$.

If $x_1^4=H$ and $x_2^4=B$ and $x_3^4=C$ and $x_4^4=C$ with weight of 0.5

or $x_1^4=H$ and $x_2^4=B$ and $x_3^4=C$ and $x_4^4=B$ with weight of 0.5

Then $r_4=HC$.

If $x_1^5=C$ and $x_2^5=B$ and $x_3^5=C$ and $x_4^5=B$ with weight of 0.33

or $x_1^5=B$ and $x_2^5=B$ and $x_3^5=C$ and $x_4^5=B$ with weight of 0.33

or $x_1^5=B$ and $x_2^5=B$ and $x_3^5=B$ and $x_4^5=B$ with weight of 0.33

Then $r_5=H$.

3. Risk assessment model whose output is expressed by a nonlinear relationship.

If $x_1^1=H$ and $x_2^1=H$ and $x_3^1=B$ and $x_4^1=C$

$$\begin{aligned} \text{Then } r_1 = & 0,33 - 0,05 \frac{\sum_{j=1}^n \mu(x_1^{1j}) x_1^{1j}}{\sum_{j=1}^n \mu(x_1^{1j})} - 0,02 \frac{\sum_{j=1}^n \mu(x_2^{1j}) x_2^{1j}}{\sum_{j=1}^n \mu(x_2^{1j})} - 0,21 \frac{\sum_{j=1}^n \mu(x_3^{1j}) x_3^{1j}}{\sum_{j=1}^n \mu(x_3^{1j})} - 0,1 \frac{\sum_{j=1}^n \mu(x_4^{1j}) x_4^{1j}}{\sum_{j=1}^n \mu(x_4^{1j})} + \\ & + 0,003 \left[\frac{\sum_{j=1}^n \mu(x_1^{1j}) x_1^{1j}}{\sum_{j=1}^n \mu(x_1^{1j})} \right]^2 - 0,004 \left[\frac{\sum_{j=1}^n \mu(x_2^{1j}) x_2^{1j}}{\sum_{j=1}^n \mu(x_2^{1j})} \right]^2 + 0,007 \left[\frac{\sum_{j=1}^n \mu(x_3^{1j}) x_3^{1j}}{\sum_{j=1}^n \mu(x_3^{1j})} \right]^2 + 0,0011 \left[\frac{\sum_{j=1}^n \mu(x_4^{1j}) x_4^{1j}}{\sum_{j=1}^n \mu(x_4^{1j})} \right]^2 \end{aligned}$$

If $x_1^{16}=C$ and $x_2^{16}=B$ and $x_3^{16}=H$ and $x_4^{16}=C$

Then

$$r_{16} = 0,184 - 0,007 \frac{\sum_{j=1}^n \mu(x_1^{16j}) x_1^{16j}}{\sum_{j=1}^n \mu(x_1^{16j})} - 0,005 \frac{\sum_{j=1}^n \mu(x_2^{16j}) x_2^{16j}}{\sum_{j=1}^n \mu(x_2^{16j})} - 0,003 \frac{\sum_{j=1}^n \mu(x_3^{16j}) x_3^{16j}}{\sum_{j=1}^n \mu(x_3^{16j})} - 0,09 \frac{\sum_{j=1}^n \mu(x_4^{16j}) x_4^{16j}}{\sum_{j=1}^n \mu(x_4^{16j})} +$$

$$+0,002 \left[\frac{\sum_{j=1}^n \mu(x_1^{16j}) x_1^{16j}}{\sum_{j=1}^n \mu(x_1^{16j})} \right]^2 - 0,0009 \left[\frac{\sum_{j=1}^n \mu(x_2^{16j}) x_2^{16j}}{\sum_{j=1}^n \mu(x_2^{16j})} \right]^2 + 0,0005 \left[\frac{\sum_{j=1}^n \mu(x_3^{16j}) x_3^{16j}}{\sum_{j=1}^n \mu(x_3^{16j})} \right]^2 + 0,0015 \left[\frac{\sum_{j=1}^n \mu(x_4^{16j}) x_4^{16j}}{\sum_{j=1}^n \mu(x_4^{16j})} \right]^2.$$

If $x_1^{27}=B$ and $x_2^{27}=B$ and $x_3^{27}=C$ and $x_4^{27}=C$

Then

$$r_{27} = 0,17 - 0,003 \frac{\sum_{j=1}^n \mu(x_1^{27j}) x_1^{27j}}{\sum_{j=1}^n \mu(x_1^{27j})} - 0,001 \frac{\sum_{j=1}^n \mu(x_2^{27j}) x_2^{27j}}{\sum_{j=1}^n \mu(x_2^{27j})} - 0,07 \frac{\sum_{j=1}^n \mu(x_3^{27j}) x_3^{27j}}{\sum_{j=1}^n \mu(x_3^{27j})} - 0,09 \frac{\sum_{j=1}^n \mu(x_4^{27j}) x_4^{27j}}{\sum_{j=1}^n \mu(x_4^{27j})} +$$

$$+0,01 \left[\frac{\sum_{j=1}^n \mu(x_1^{27j}) x_1^{27j}}{\sum_{j=1}^n \mu(x_1^{27j})} \right]^2 - 0,0005 \left[\frac{\sum_{j=1}^n \mu(x_2^{27j}) x_2^{27j}}{\sum_{j=1}^n \mu(x_2^{27j})} \right]^2 + 0,0002 \left[\frac{\sum_{j=1}^n \mu(x_3^{27j}) x_3^{27j}}{\sum_{j=1}^n \mu(x_3^{27j})} \right]^2 + 0,0024 \left[\frac{\sum_{j=1}^n \mu(x_4^{27j}) x_4^{27j}}{\sum_{j=1}^n \mu(x_4^{27j})} \right]^2.$$

In the proposed models, each input variable has its own membership functions for fuzzy terms (H, HC, C, BC, B), which are used in the equations.

The membership function is as follows:

$$\tilde{\mu}^k(x_i^j) = \frac{1}{1 + \left(\frac{x_i^j - b_k^j}{c_k^j} \right)^2}.$$

The essence of training consists in the selection of such parameters of membership functions that minimize the difference between the results of neuro-fuzzy approximation and the actual behavior of the object. For training, a system of recurrence relations is used:

$$b_k^j(t+1) = b_k^j(t) - \eta(r_i - \hat{r}_i) \frac{r_j \sum_{i=1}^m \mu^r(r_i) - \sum_{i=1}^m r_i \mu^r(r_i)}{\left(\sum_{i=1}^m \mu^r(r_i) \right)^2} \frac{1}{\mu^k(x_i^j)} \prod_{i=1}^n \mu^j(x_i^j) \frac{2c_k^j(x_i^j - b_k^j)^2}{((c_k^j)^2 + (x_i^j - b_k^j)^2)^2},$$

$$c_k^j(t+1) = c_k^j(t) - \eta(r_i - \hat{r}_i) \frac{r_j \sum_{i=1}^m \mu^r(r_i) - \sum_{i=1}^m r_i \mu^r(r_i)}{\left(\sum_{i=1}^m \mu^r(r_i) \right)^2} \frac{1}{\mu^k(x_i^j)} \prod_{i=1}^n \mu^j(x_i^j) \frac{2(c_k^j)^2(x_i^j - b_k^j)}{((c_k^j)^2 + (x_i^j - b_k^j)^2)^2}.$$

The neural-fuzzy network learning algorithm consists of two phases. In the first phase, the model value of the output of the object (r), is calculated, which corresponds to the given network architecture. In the second phase, the residual value (E_i) is calculated and the parameters of membership functions are recalculated [6-10].

3. Conclusion. Software has been developed for the intellectual processing of information to solve the problems of assessing, forecasting and making decisions on risk in poorly formalized systems.

An assessment and forecast of the risks of under-harvesting, based on the construction of approximating models using expert risk data, were obtained. Using the results of a fuzzy model for assessing the risk of crop failure, the multicriteria optimization problem of attracting investments in risky farming areas has been solved.

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世界食糖市场与前景
WORLD SUGAR MARKET & PERSPECTIVES

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抽象。 本文分析了全球食糖市场, 确定了主要的影响因素, 确定了趋势并估算了主要生产国2019/20季的食品糖产量; 它还分析了市场前景。

关键词: 市场平衡, 剩余, 需求, 价格动态, 波动性, 影响因素

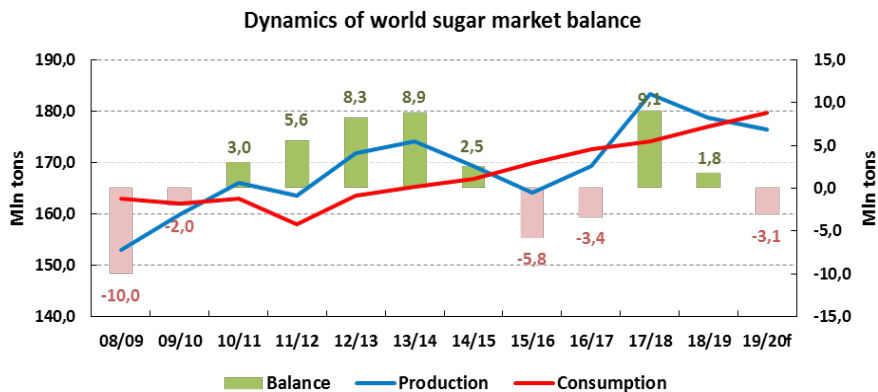
Abstract. *The article analyzes the global sugar market, determines key influencing factors, identifies trends and estimates sugar production in season 2019/20 in the main producing countries; it also analyses the market prospects.*

Key words: *market balance, surplus, demand, price dynamics, volatility, influencing factors*

In recent years the whole global marketplace has been transformed and sugar producers had to adapt their sales activities to meet the challenges. As can be seen from the chart, the main feature of the world sugar market is its cyclic nature. Depending on different factors (weather conditions, government policy, market operating environment, macroeconomics, etc.) the market can be either in surplus or in short supply.

In the last ten years the biggest deficit was in season 2008/09 as the demand exceeded the supply by 10 mln tons. As a result, the prices of sugar rocketed, which encouraged the investors to start financing the market at that point. During 2010/11-2014/15 the world sugar market faced surplus (fluctuation 3 mln to 8.9 mln tons). Then a 2-year period of deficit followed resulting in the market facing significant surplus (over 9 mln tons) in season 2017/18, which broke the world record of sugar production by beating its historical level at 183 mln tons. In fact, the record crops were harvested worldwide, particularly in Asian countries. The world market was still in surplus despite its shrinking to 1.8 mln tons in season 2018/19.

As regards the world sugar production itself, it raised by 19.6% since 2008/09 compared to its historical maximum in 2017/18. The general trend is positive although the level of production is unstable varying from season to season.



The sugar consumption has been on increase as well, however, the pace of growth has lately become slower. In fact, this trend has been triggered by consumers becoming more demanding, i.e. they have developed a new level of health-awareness in terms of food choices. Basically, consumers demonstrate upgraded preferences and demand a greater variety of products, including processed products.

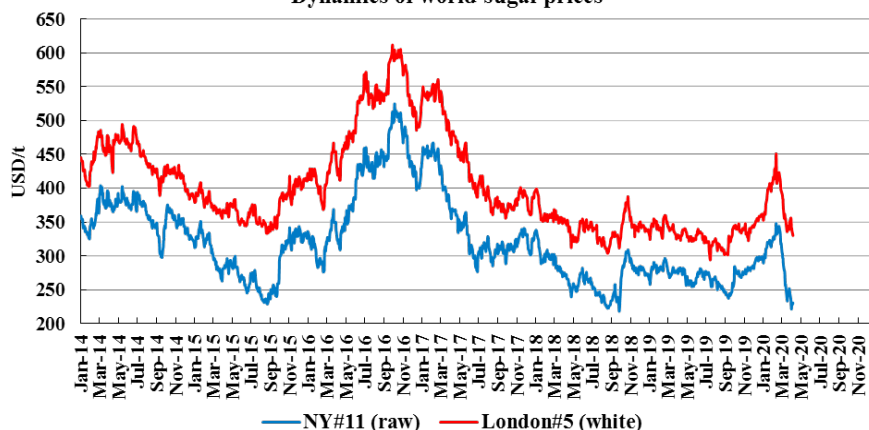
Given the policy of “sugar & health” many countries are trying to limit sugar consumption imposing taxes on sugar-containing products. In most cases, it affects sugar demand of beverage production. As a matter of fact, beverage manufacturers continue to reformulate their products to avoid new sugar taxes. This situation, for instance, holds true for Thailand where taxes double if sugar content in beverages is greater than 10 grams per 100 milliliters. In addition, FSSAI in India has been working on a draft of labeling regulation that requires product labels to display red color-coding on the front of packaged food products that have high-fat, high-sugar or high-sodium levels. Thus, these and other government measures tend to restrain the growth of sugar consumption, which on average constitutes about 1.6% per year versus 2% several years ago (according to ISO).

In the mid-term period sugar consumption will continue to rise, predominantly due to the growth of population (mainly in Africa and Asia). The annual rate of growth is expected to be about 1.5%. Besides, the competition between sugar and sweeteners will remain and their consumption will depend on consumers’ habits, preferences and purchasing power.

As far as the dynamics of world sugar prices is concerned, S&D have a big impact on price levels. Amid a big deficit in 2009 the price of raw sugar climbed dramatically from \$253 per ton at the start of the year to \$547 in December 2009. The same situation held true for white sugar – the price soared from \$330 to \$694 respectively. Since February 2010 there was a sharp fall and in May prices plummeted at \$301 for raw sugar and \$438 for white sugar. During the season 2010/11 prices of the both markets rocketed owing to the strong drought that had affected

the crops and led to the reduction of sugar production in many countries. Since 2012 the world prices of sugar were declining and in August 2015 reached \$230 and \$333 for raw and white sugar respectively. Then the world deficit supported the both markets and from September 2015 to December 2016 prices bounced off to their five-year averages. In record season 2017/18 prices bottomed out at just over \$218 for raw sugar and \$303 for white sugar. Over the first half of 2019 prices were flat and raw sugar was trading in a range from \$260 to \$280, as well as for white sugar the price level constituted \$325-\$360. In the second half of the year the market advanced again, however, high world stocks of sugar keep tension on the market and exercise downward pressure on prices.

Dynamics of world sugar prices



Oil prices have played a big role in terms of sugar price volatility. The former dropped almost four times within the period of 2014-2015 and then rose back to the \$70 level in 2019, remaining more or less unchanged during the whole year. The oil price rise provided for high demand on ethanol making its production more profitable than sugar. As a result, such key producers as Brazil switched on to ethanol production and dramatically decreased the sugar mix in 2018/19.

Regarding market prospects, it is forecasted that the global sugar S&D in 2019/20 will come back to deficit 3.1 mln tons. Unfavorable weather conditions (drought in EU, cold summer in Central and Latin America, weak monsoon in Asia) in main countries sugar producers affects the crops. A significant reduction is expected in India (-18% to level 2018/19), Thailand (-42%), Ukraine (-20%), Australia (-11%) and Mexico (-17%).

At the same time sugar production will increase in Russia, South Africa and Argentina (+29%, +2% and +2% respectively) while Brazil production will remain almost without changes (29.5 mln tons vs 29.03 mln tons in 2018/19) and will regain its leadership position.

Thus, the world sugar supply in new season will decrease primarily due to Asian countries and its growth in other ones cannot compensate such big shrinking.

Despite the market will be in short supply the world sugar balance remains heavy until the stocks dissolve. The main keeper of stocks is India whose export policy will continue to impact on global sugar market.

The key world sugar producers

	Country	14/15	15/16	16/17	17/18	18/19	19/20F
Cane sugar	India	28,30	25,10	20,30	32,50	33,20	27,10
	Brazil	35,50	33,90	38,71	38,65	29,03	29,50
	Thailand	11,30	9,79	10,00	14,70	14,60	8,40
	China	10,20	8,70	9,29	10,30	10,80	10,20
	Pakistan	5,14	5,08	7,08	6,58	5,35	4,90
	Mexico	5,95	6,01	5,96	6,01	6,43	5,34
	Australia	4,70	4,70	4,77	4,42	4,73	4,23
	Guatemala	2,98	2,82	2,72	2,75	2,97	2,92
	Philippines	2,32	2,40	2,49	2,08	2,08	2,05
	South Africa	2,11	1,65	1,54	1,99	2,18	2,22
	Argentina	1,88	1,94	1,98	1,72	1,56	1,59
	Cuba	1,90	1,49	1,75	1,00	1,35	1,30
Beet sugar	USA	7,80	8,09	8,14	8,43	8,15	7,40
	EU	17,50	13,70	16,20	19,80	16,80	16,50
	Russia	4,44	5,18	6,08	6,47	5,86	7,55
	Ukraine	1,94	1,32	2,01	2,06	1,85	1,48
Total, mln tons		143,96	131,87	139,02	159,46	146,94	132,68

Crop scale

below ave.

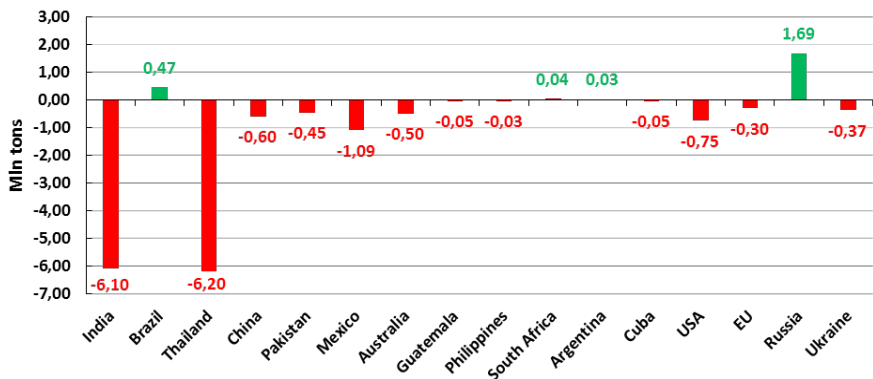
ave.

above ave.



In season 2019/20 the price dynamics of sugar will depend not only on supply, demand and stocks but also on oil market, Chinese import policy, currency fluctuation and Brexit. During the season the price corridor is expected to be between 10 and 15 lb/pound for NY#11 and \$300-\$450 for London#5 on condition that the market doesn't face new challenges.

Expectations of world sugar production change in key countries in season 2019/20



Taking all this into consideration it can be said that globally sugar market continues to adapt to economic environment following its changes as well as consumers' demand. The world sugar trade survives price volatility and strong competition between market players especially whose role is increasing in it. The perspectives look positive but they are limited by heavy balance and unstable economic and geopolitical situation in the world.

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NOTES

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