# SCIENTIFIC RESEARCH OF THE SCO COUNTRIES: SYNERGY AND INTEGRATION

## 上合组织国家的科学研究：协同和一体化

**Proceedings of the International Conference**

**Date: June 28**

上合组织国家的科学研究：协同和一体化
国际会议

参与者的英文报告


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


2022年6月28日，中国北京
June 28, 2022. Beijing, PRC

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

(June 28, 2022. Beijing, PRC)

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## RELEVANT PROBLEMS OF  REGIONAL NETWORK MANAGEMENT IN A COMMERCIAL BANK

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抽象的。　文章明确了银行网点作为管理对象的特点，确定了网点的三个管理层次，制定了各级管理的管理任务。　根据办公室网络功能的特殊性，已经确定了评估其有效性的系统必须满足的一些要求。
关键词：银行网点管理 银行系统 有效管理
*Abstract. The article formulates the features of a network of banking offices as an object of management, identifies three levels of management of a network of offices, and formulates management tasks at various levels of management. Based on the peculiarities of the functioning of the network of offices, a number of requirements have been identified that must be met by systems for evaluating their effectiveness.*
*Keywords:  bank office network management, banking system, effective management*

At present, the banking system of Russia is represented mainly by banks with a geographically distributed infrastructure of client offices. As of 06.01.2022, according to the official website of the Central Bank of Russia, the banking system of the Russian Federation consisted of 330 banks, which formed a regional office infrastructure around them, consisting of 25.7 thousand objects. At the same time, it should be noted that, despite a serious reduction in the number of banks - by 70% - over the past 12 years (as of 01.01.2010, 1058 banks operated in Russia), the bank office infrastructure decreased only by 10% (as of 01.01.2010 it consisted of 28.5 thousand objects). Of course, the size of the regional office structures of specific banks is very different from each other - from a few offices to several thousand offices. For example, the office network of PJSC Sberbank currently has 13.2 thousand facilities, that is, more than 50% of the entire regional banking infrastructure. But, despite such enormous differences, the problems of managing the office network that banks face are the same. At the same time, in the context of

currently expanding sanctions and reducing the profitability of the banking products that remain available, the task of creating an effective model for managing a network of banking offices that can respond to environmental changes in real time becomes crucial [1, 2].

As a **control object**, an office network has a number of serious features [3, 4]:

1. the presence of two parallel processes: optimizing the location of network offices (opening new offices, closing inefficient offices, determining the appropriateness of using a specific office format) and maintaining existing offices;

2. the need for simultaneous management of the network as a whole (at the federal and regional levels) and each individual office;

3. the use of both almost completely identical and completely different offices in format;

4. the need for interaction between office and ATM infrastructure;

5. significant territorial remoteness of the object of management from the subject of management;

6. functioning of the object and the subject of control in different time zones;

7. the need to integrate the object and subject of management into a single structure of a banking organization, subordinating the interests of the object of management to the overall goals of the organization, building a system for effective interaction of a single office with other divisions of the bank.

The presence of several levels of the control object is a rather difficult to implement feature of building an effective management system for the bank's office infrastructure. There are at least three levels of management, each of which is characterized by its own goals, objectives and management tools:

1. First level – management of the entire network of offices at the federal level from a single center.

2. The second level – management of a network of offices at the regional level (in a specific region).

3. The third level – management of a specific office.

Management of the entire network of offices at the first, federal, level is carried out in two directions: firstly, centralized management of the network of offices as a whole, and secondly, centralized management of a specific network office.

The goal of effective management of the network of offices as a whole, both at the federal level and at the level of a separate region, is to maximize the financial result from the activities of the entire infrastructure - federal and intra-regional, respectively. The maximum result of the network of offices is achieved with the maximum total income of the network and the minimum total costs of the network, consisting of complementary and interchangeable offices. At the same time, it is wrong to say that the maximum result of the network is always achieved with the maximum results of each specific office, since situations are possible when the

closure of a particular unprofitable office will lead to a decrease in the financial result of the network, and not to its increase, and, conversely, the closure of a profitable office can lead to to increase the profit of the network, not to decrease. Due to the possibility of servicing a client in any of the offices, we should talk about the bank's clients as a whole, and not about the clients of a particular office, and, accordingly, about the income from servicing these clients in the entire banking network, and not in a particular office. Thus, firstly, the concept of a positive financial result or loss of a particular office ceases to be sufficient to make a decision on the satisfactory or unsatisfactory development of the office, and, secondly, it is necessary to develop and implement an adequate system for evaluating the activities of offices, which will provide a management apparatus with transparent information in real time about the state of each specific office.

When making any management decision, especially the decision to open or close an office, the interchangeability and complementarity of offices, as well as competition between them, must be taken into account. The competition between offices will lead to the fact that the opening of the next office will serve not to develop the client base, but to redistribute the existing one. The decision to open adjacent offices may be appropriate only when one office cannot cope with the client flow. But in this situation, we should not talk about competing, but about complementary offices. The decision to close an office must necessarily be accompanied by an understanding of which office will continue to service the accumulated client base. The closure of the office should not lead to an increase in the total profit of the network due to the exclusion of the unprofitable component, but to an increase in the financial result with an unreduced amount of the revenue side.

Controlling the network at the federal level involves the implementation of certain actions and the development of certain decisions:
• identification of regions and cities of interest to the bank;
• selection of suitable office formats for use;
• development of quality requirements for office placement;
• calculation of the optimal number of offices;
• optimization of the existing office network [5].

Each office is a locally isolated element of the system, which differs from other offices in the composition and structure of the client base, geographical and economic features of the location, and personal interests of the management. With all these differences, the network of bank offices must fulfill common goals, using methods that are also network-wide in modern banking networks. Therefore, at the level of centralized management of a particular bank office, the tasks of the management structure should be as follows:
• development and implementation of an adequate system for evaluating the activities of offices, which, firstly, will allow evaluating the performance of the

tasks assigned to the office, and secondly, will provide a mechanism for managing transparent information in real time.

• development of a system of regulations, rules, norms and standards that guide and regulate the activities of the office, ensuring the dynamics of the office in the direction of solving the tasks assigned to it and monitoring their observance.

• Replication of the successful experience of other offices to manage this particular office.

• Development of a motivation system for office staff.

When developing an effective system for evaluating the activities of offices, a combination of two types of indicators is necessary: aggregate cost indicators of the financial result of offices and the network as a whole and quantitative or volumetric indicators that reflect the most important areas of development for the bank (the number of customers who have bought or expressed a desire to buy a certain product or use a certain service, the volume of liabilities of a certain type and urgency, the volume of assets of a certain type and urgency) [6]. Indicators of the second type can also be aggregated.

The most serious problem in developing an aggregate measure of office valuation lies in the choice of how to determine it. Any banking office is part of a single banking organism. Attracting and serving office customers, which brings commissions and interest income, is the result of the activities of all banking divisions, and the costs of ensuring the office's performance are not limited solely to the costs associated with the maintenance of the office premises and the salary of its employees.

The redistribution of income and expenses between all participants in the technological process is carried out in accordance with certain internal regulations for the bank and agreements between divisions, which should take into account all the essential features of the relationship between the office and other divisions of the bank. One of the most difficult tasks that must be solved for the successful development and effective operation of an adequate system for evaluating the performance of offices is the task of determining the fair share of income earned by the office and the completeness of the bank's expenses spent on servicing and maintaining the office's clients.

However, the assessment of the office only by the value of the financial result is, since it does not always allow taking into account the significance of certain quantitative and / or volume indicators for the long-term effective functioning of the bank. Therefore, the aggregate indicator of the office performance assessment should be supplemented with indicators reflecting the compliance of the office with the planned one for each office or the ideal system of strategic indicators for offices of this type.

The need to develop a **system of regulations, rules, norms and standards** is

due to the fact that the object of management - the bank office - operates remotely from the central office, and the ways and methods by which the office achieves its goals cannot be controlled in real time. A number of social aspects of the effective functioning of the office, such as customer service mode, waiting time for a client in a queue, the speed of order fulfillment, service culture can be taken into account in an aggregate indicator very indirectly, and often conflict with the aim of maximizing the financial result. For example, the waiting time for a client in a queue directly depends on the number of cash register personnel, that is, often a reduction in customer service time is possible only with an increase in the office staffing table, and an increase in the wage fund will lead to an increase in costs, i.e. to a decrease in financial results.

Another illustrative example is the involvement of customers interested in cashing out. In this situation, the fulfillment of the task of maximizing the financial result contradicts the requirement of minimizing the bank's reputational risks.

The issues of reducing banking risks also conflict with the office's desire to reduce its expenditure side - it is much cheaper to pay for the service of collectors and transport a large amount of money at once than to transport small amounts day after day, but pay for regular trips of collectors.

Thus, the central office must determine a set of factors that are significant for itself, which are not reflected in the **system for evaluating the activities** of offices or contradict it, and develop a **system of regulations, rules, norms and standards** that governs:
  • **what** services the office offers to clients;
  • **to which** clients these services can be offered;
  • **how** these services should be offered to customers (methods of presentation of services);
  • **what** technology is used in the implementation of a particular service;
  • **what** should be the minimum and maximum norms and standards that ensure a reasonable level of office expenses from the point of view of banking risks and ensuring the quality of customer service.
  • **How** should relationships be built between the office and other divisions of the bank

Such a system of regulations should not be absolutely the same for all offices, since a number of restrictions depend on the characteristics of a particular office (for example, the maximum limit for keeping cash at the office cash desk). If it is expedient to use different norms and standards, the central office must develop a clear dependence of specific values on the specific conditions of the offices.

Different office formats suggest the following differences:
  • Features of the implementation of management functions, different distribution of powers and responsibilities between the management apparatus of the central office of the bank and the management of the office directly on the spot.

• Tasks facing the office (expansion of the client base or maintenance of the existing client base).

• Target customer segment (corporate customers only, retail customers only, both customer segments).

• The range of services provided to clients.

• Office staff (availability of an active customer acquisition service or only front office staff, limited to operating and cash workers)

The choice of a specific format depends on many factors, among which the determining factors are the bank's assessment of the business potential of the region under consideration, the adopted management model for a particular office, and the bank's priority client segment.

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以定价为例，在制裁和 COVID-19 大流行的背景下确保轧管企业的经济安全
# ENSURING THE ECONOMIC SECURITY OF PIPE-ROLLING ENTERPRISES IN THE CONTEXT OF SANCTIONS AND THE COVID-19 PANDEMIC ON THE EXAMPLE OF PRICING

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抽象的。 以国民经济的基础部门之一——轧管业为例，揭示了当前关于新兴的 COVID-19 大流行对俄罗斯经济领域发展的影响的热点问题．分析了新型冠状病毒导致的制裁和封锁期间轧管企业的贸易情况，揭示了它们对管材价格上涨的影响。 一些国家反危机措施与轧管业务的矛盾和矛盾暴露无遗。 考虑了克服 COVID-19 大流行对管道行业和俄罗斯经济安全造成的负面危机后果的可能方法。
关键词: 经济安全、管道公司、封锁、制裁、COVID-19、定价

*Abstract. The topical issue of the present time about the consequences of the impact of the emerging COVID-19 pandemic on the development of the economic sphere in Russia is revealed, using the example of one of the basic sectors of the national economy - the pipe rolling industry. An analysis was made of the trade of pipe-rolling enterprises during sanctions and lockdowns caused by new strains of coronovirus, their impact on the growth in prices of pipe products was revealed. The inconsistency and inconsistency of some state anti-crisis measures and the pipe rolling business is revealed. Possible ways to overcome the negative crisis consequences of the COVID-19 pandemic for the pipe industry and the economic security of Russia are considered.*

*Keywords: economic security, pipe companies, lockdowns, sanctions, COVID-19, pricing*

**Introduction**

In conditions when our state is conducting a special operation in Ukraine and is under the influence of numerous sanctions packages from the countries of the

Western world, the unfavorable macroeconomic situation caused by the COVID-19 pandemic has not disappeared, which, apparently, will continue to have a negative impact on the state of all spheres of the world economy. At the beginning of the year, the situation on the market remained quite difficult due to a partial freeze in demand, a decline in production in certain industries and disruptions in the supply chains of products and raw materials. At the same time, tough government measures to combat the pandemic, primarily mass vaccination, have yielded real results. At the same time, the pipe-rolling industry relatively quickly moved to recovery, largely due to the well-established demand for its products.

The logistical chaos that began as a result of the COVID-19 lockdowns is now becoming more and more horrifying as a result of numerous sanctions.

The economic security of the state is characterized by the possibility of its constant economic development, maintaining its self-sufficiency in any crisis situations, including the military situation, accompanied by challenges, risks and threats due to the constantly changing world and domestic market conditions.

Properly balanced indicators of the volume and structure of domestic production allow the state to maintain its self-sufficiency in the stochastic system "export-import".

**The impact of the COVID-19 pandemic on the development of the economic sphere in Russia on the example of the pipe industry**

The State Strategy for the Economic Security of the Russian Federation, developed to address such key issues, determines the state's strategy on the world stage: identifying existing and potential threats and, as a result, developing countermeasures to clearly develop and develop competitive advantages.

Today, the Russian economy is facing new long-term systemic challenges, internal and external threats in the economic sphere, reflecting both global trends and internal development barriers.

A significant change in economic conditions on the market is a consequence of the Special Operation of the Russian Federation in Ukraine, but the lockdowns of the pandemic have also made a negative contribution. Many companies have become unable to enforce transactions, both internationally and domestically.

But the main challenge of today is the historical all-encompassing Russophobia of the Western world.

The financial, economic and socio-political situation in Russia is subject to the negative influence of the policies of the US and the EU, the main thread of which is the artificial creation of crisis phenomena aimed at undermining the fundamental principles in ensuring the national security of the Russian Federation. The Energy Security Doctrine of the Russian Federation[1] characterizes emerging challenges and threats and develops measures to counter these processes.

[1]Energy Security Doctrine of the Russian Federation, (Approved by Decree of the President of Russia dated May 13, 2019 N 216.) URL: https://minenergo.gov.ru/node/14766

The pipe-rolling industry of the Russian Federation is included in the structure of its industrial complex as one of the strategically important ones, influencing the sustainable financial and economic development of the entire state. Therefore, ensuring the economic sustainability of the development of these enterprises depends on the introduction of high-tech production methods and modern economic management technologies that need to be developed directly in our country, which is once again confirmed by sanctions from the West banning the export of innovative technologies [1].

Due to the unpredictability of new waves of the pandemic, which negatively affects the work of the entire global economy and, of course, as a result, the pipe industry of the Russian Federation, any forecasts for 2022 are extremely cautious.

**Foreign trade of pipe rolling enterprises during sanctions and lockdowns from the COVID-19 pandemic**

The Russian pipe-rolling industry is an exporter of its products to more than 80 countries of the world [2]. In 2018, Russian pipe-rolling enterprises supplied 2.5 million tons of steel pipes abroad. In 2019, exports decreased by 15.3% and amounted to only 2.1 million tons of products. According to statistics, 2020 was characterized by an even greater drop in exports, already by more than 26% compared to 2019, which amounted to only 1.5 million tons. The rate of decline in sales has decreased and in 2021 by more than 27% compared to 2020 [3], [4]. A significant decrease in exports of pipe products is expected in 2022, associated with the announcement of an embargo by Western countries. All this is the result of severe economic sanctions and the negative impact of lockdowns.

For the successful economic development of the Russian pipe industry and the neutralization of negative changes in the structure of its foreign trade, only joint, mutually beneficial actions of the state and business can achieve a policy of effective regulation and strategic planning in the global and domestic market of pipe products.

And, if sanctions are a practically unpredictable, uncontrollable process that "hit the sick" (dependence on imported equipment, technologies, etc.), which can only be combated by counter-sanctions and an emphasis on import substitution of high-tech pipe-rolling industries, the consequences of the COVID-19 pandemic, accompanied by numerous lockdowns, have almost already led to a global crisis. In one of his speeches, Marriott International CEO Arne Sorenson said that the current global economic situation, caused by the coronovirus pandemic, is causing financial damage more than after the September 11, 2001 attacks and during the 2008-2009 crisis combined [5], [6], [7].

**The impact of sanctions and lockdowns from the COVID-19 pandemic on the growth in prices for pipe products**

Today there is a redistribution of sales markets for pipe products - both external and internal.

COVID-19 has disrupted the usual links between the manufacturer and the end consumer, and has also made significant changes to the logistics sector as a whole. Its spread dealt a huge blow to the world's logistics and supply chains, which have been debugged over the years. The Russian steel pipe market is no exception - in many countries, due to quarantine, problems caused by lockdowns, and lower incomes of the population, production and demand for pipe products and metallurgical raw materials for them have significantly decreased. For the time being, things like border closures, volatile exchange rates, reduced purchasing power and a general state of uncertainty among end-users have led to a decline in cargo traffic on a global market. This trend continues to this day. In addition, Russian pipe manufacturers are experiencing a large surplus of their products and are forced to further reduce the utilization of production capacities [8].

The logistical pandemic chaos has made its own negative adjustments to the prices for finished pipe products, that is, their significant increase and, accordingly, changes in agreements and contracts.

Let us consider in more detail the process of pricing for tubular products. Technological (generalized) manufacturing processes for some types of pipes are given in the Appendix. They clearly show that any process of complex production begins with the purchase and preparation of raw materials. In particular, for LLC "TMK-INOX" and LLC "KIBERSTAL", engaged in the production of stainless steel pipes, the raw material is finished sleeves, supplied mainly from China and India, for other plants, the raw material can be "Steel circle" or "Sheet rolled" (cold or hot rolled), etc., it can also be scrap, for pipe plants with steelmaking shops (for example, the Volzhsky Pipe Plant (VTZ)).

The main Russian suppliers of blanks for pipe-rolling enterprises are NLMK, Severstal, Chelyabinsk Metallurgical Plant, VTZ and others. But their products also depend on regular deliveries and shipments of raw materials (scrap and alloying additives). Due to the cancellation of metal exports, more players should appear on the domestic market, the metal market will also be in surplus in the coming months and this will put pressure on its value, and, accordingly, on the cost of pipe products. But on the other hand, the cost of steel is not decreasing, but only growing due to the lack of many consumables within the country. The spontaneity of the waves of the pandemic and sanctions packages against our state do not make it possible to make long-term forecasts for the cost of production. For heavy plate and grade steels, costs are growing strongly: ferroalloys have risen sharply in price due to the rise in the cost of nickel.

One way or another, there will be a surplus in the market. But metallurgical production cannot stop, this is not a conveyor. Companies will look for new sales niches, new customers, move around the market or "work for a warehouse".

On March 10 this year, Deputy Head of the Ministry of Industry and Trade Viktor Yevtukhov held a meeting with representatives of the metallurgical industry, at which he demanded a reduction in prices for hot-rolled steel and other metal

products[2]. Those intermediaries who refuse may leave the market, he warned.

In addition, it should be taken into account that for the metallurgical industry (an exception for the military-industrial complex), an excise tax on liquid steel and alloying elements was introduced from 2022. The Decree entered into force on the day of its official publication ("Tax Code of the Russian Federation (Part Two)" dated 08.05.2000 N 117-FZ (as amended on 05.28.2022)). With regard to liquid steel smelted in open-hearth, induction or electric steelmaking furnaces, the excise tax will be calculated according to a special formula. At the same time, the share of mass of ferrous scrap in the total mass of raw materials used for the production of such steel must be at least 80% per month.

But the cost (USD/ton) of alloying additives from January 2020 (the beginning of the pandemic) to May 2022 increased: $Cr$ – from 187.7 to 392.5; $Ni$ – from 15907 to 48078; $Si$ – from 1463.5 to 4819.5; $Mn$ – from 4.25 to 5.71.

The same trend for other alloying components (on average, an increase in cost by 50%).

The main foreign suppliers-importers are China and India. According to the expert assessment of the Spetsstal Association, the volume of Russian imports of the main types of products for pipe-rolling plants in June 2022, compared to February, has already decreased by 39%. According to experts, the supply faced two main problems:

The first is a sharp rise in the ruble exchange rate and payment for supplies. A number of importers (who had time) simply asked to postpone the shipment.

The second is the destruction of supply chains and problems with settlements.

The wave of a new strain of coronovirus in China is making adjustments to the shipment of semi-finished products for the Russian pipe industry, both by sea and by rail.

But it should also be taken into account that the first country where the recovery of business activity began was China. A large-scale government program to stimulate the economy and finance large infrastructure projects contributed to a sharp increase in domestic demand for steel products and subsequently increased prices for steel products around the world. According to the European analytical

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[2]Deputy head of the Ministry of Industry and Trade demanded that metallurgists reduce prices — RBC (rbc.ru) (https://www.rbc.ru/business/12/03/2022/622ccdf69a794753a7deb243?ysclid=l4fuzw2f5n928740630 )

publication Bloomberg,[3] the global structure of steel producers at the end of 2021 has the undisputed leader - China (*fig. 1*).
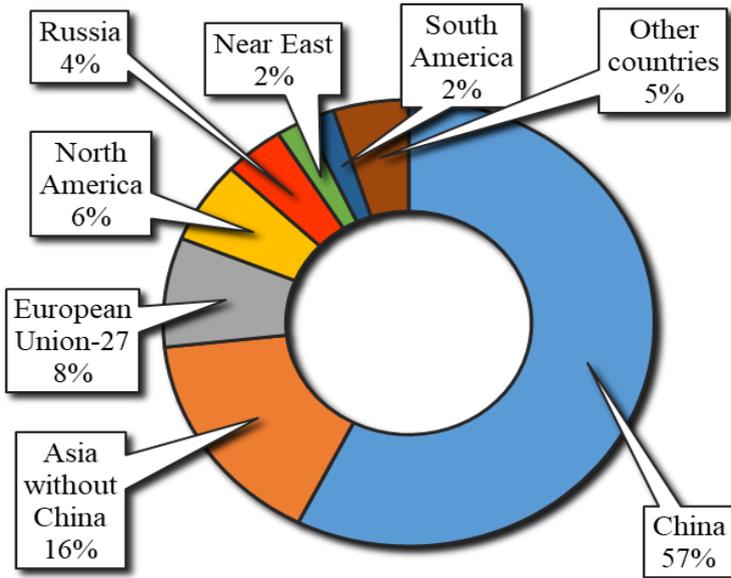


***Figure 1.** Structure of steel production by regions for 2021, %*
**Source:** Compiled by the author according to the European analytical publication Bloomberg

In order to maintain demand in the domestic market, the Government of India introduced export duties on metallurgical products, including stainless steel flat and long products, at a rate of 15% (TN VED 7219 and 7222). Naturally, for Russian importers, the introduction of Indian duties will increase prices for these products.

And so, let's consider the pricing of pipe products from the point of view of the process approach (*fig. 2 and 3*).

In the current political environment, one of the main factors influencing the formation of prices for pipe products is that the entire metallurgical industry, including pipe rolling, is an oligopoly.

The most important difference between an oligopoly and other types of competition is the mutual influence of enterprises on each other. Any changes in price, sales volumes, marketing strategies, and so on, have an immediate impact on other

[3]Bloomberg.com (https://www.bloomberg.com/europe )

oligopolists. As a rule, price fluctuations lead to the fact that all market partici-pants begin to act in accordance with the first enterprise.
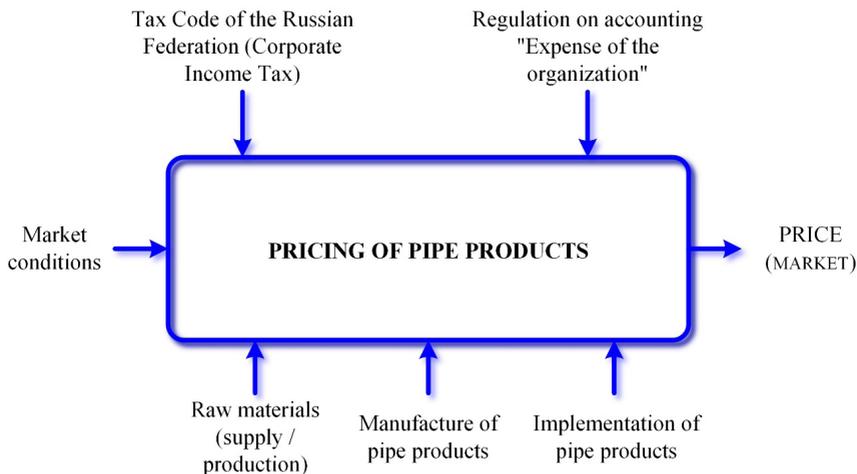


**Figure 2.** *The process of "Pricing of pipe products"*
Source: Compiled by the author
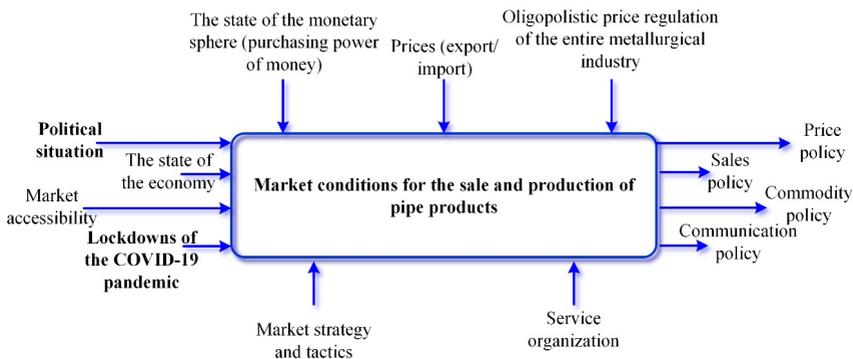


**Figure 3.** *Sub-process "Market conditions"*
Source: Compiled by the author

The main principles of pricing in an oligopoly:
 - A change in prices for one producer will lead to a change in prices for other players in the oligopoly;
 - Any price fluctuations usually occur on a contractual basis.

If firms have managed to agree among themselves on sales volumes and prices, then a cartel is formed on their basis.

Oligopolistic enterprises independently form all types of their policies, which are focused on maximizing profits. All decisions made are recorded in the order on accounting policy.

The Russian authorities are trying to negotiate with metallurgists to reduce and fix prices at this level on the domestic Russian market. Such a decision, as reported by the Ministry of Industry and Trade, was made following a meeting of the Minister of Industry and Trade Denis Manturov with top management and owners of metallurgical holdings on March 16 this year[4]. The metallurgists themselves, at a meeting with the minister, pointed out that in the near future there would be a significant increase in production costs due to market contraction after EU sanctions and ongoing COVID-19 lockdowns. According to their estimates, production in Russia may decrease from 70 million to 40-45 million tons per year, which, while maintaining the number of employees and equipment, will lead to a twofold increase in production costs.

All this has a negative impact on the economic security of the state as a whole.

According to the accounting reports and financial analysis of Russian pipe-rolling enterprises, we will draw up a diagram of the structure of production costs included in the cost of steel pipes for manufacturers[5] of finished products (*fig.* 4) and a diagram of the cost structure (*fig.* 5), which also depends on the costs associated with the fight to prevent the incidence of COVID-19.
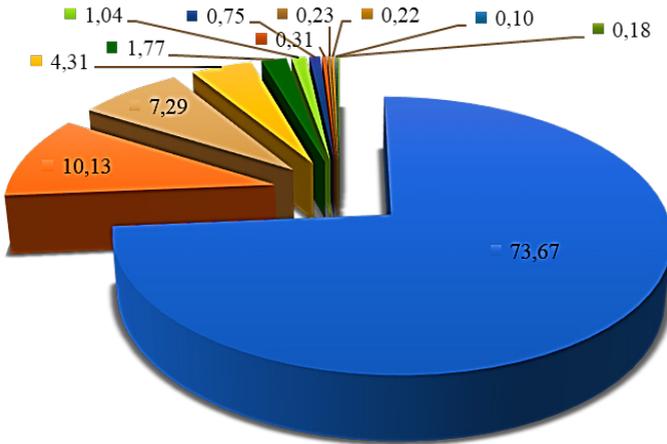


[4]The results of the meeting in the Ministry of Industry and Trade on metal prices with the heads of metallurgical companies. — INFOLOM (https://infolom.su/mpr16032022/? )

[5]Accounting statements of enterprises of the RF (audit-it.ru) ( https://www.audit-it.ru/buh_otchet/ )

Raw materials and consumables (73.67%)

Staff costs. including social security costs (10.13%)

Electricity and utility bills (7.29%)

Depreciation of fixed assets and intangible assets (4.31%)

Repair and maintenance (1.77%)

Professional services (1.04%)

Transport costs (0.75%)

Taxes (0.31%)

Production on a tolling basis (0.23%)

Import duties (0.22%)

Insurance (0.10%)

Other (0.18%)
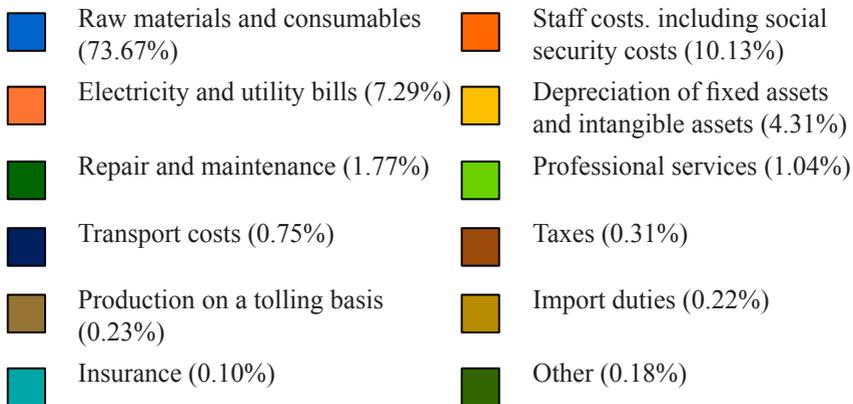
**Figure 4.** *Generalized for the pipe industry, the structure of production costs included in the cost of steel pipes*
**Source:** Compiled by the author

*Table 1.*
*Price element structure*

| Price elements | | | | |
|---|---|---|---|---|
| **Production cost** | **Profit** | **Indirect taxes (VAT, etc.)** | **Intermediary allowance (costs, profits, VAT)** | **Trade margin (costs, profits, VAT)** |
| Manufacturer wholesale price | | - | - | - |
| Wholesale (selling) price | | | - | - |
| Wholesale purchase price | | | | - |
| Retail price | | | | |
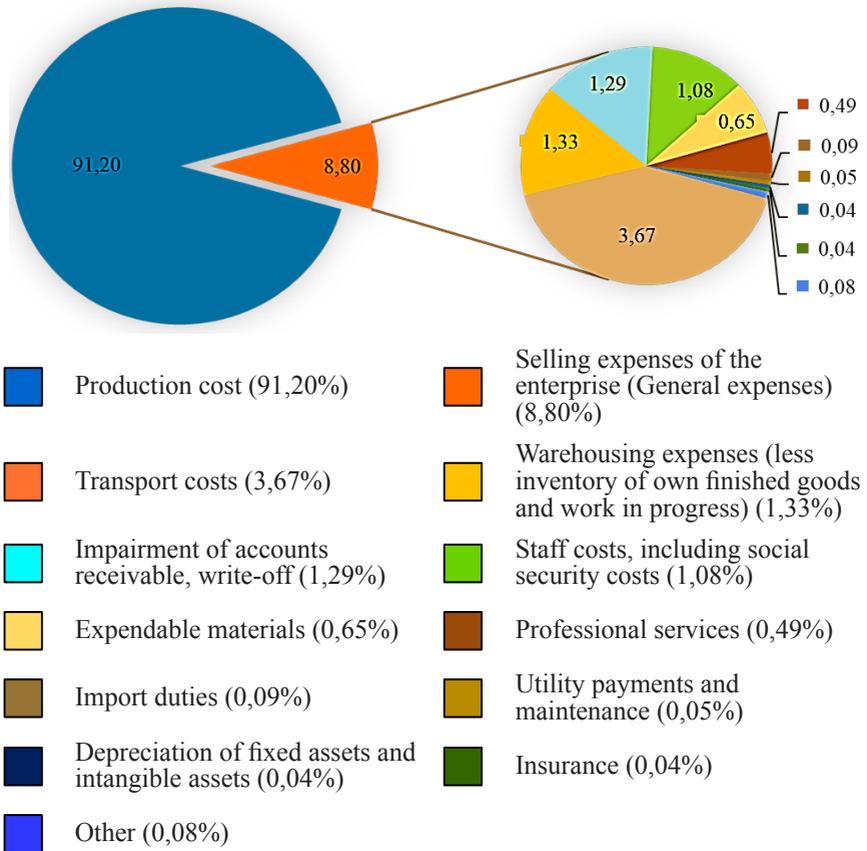
Figure 5. *The structure of the cost of steel pipes for manufacturers of finished products*

**Source:** Compiled by the author

At the same time, the selling price of a plant producing various types of steel pipes is the sum of the cost of production, rubles/ton, the marginal level of profitability of the pipe range sold, % and VAT, %. Pipe-rolling enterprises set the maximum level of profitability, which is 28.7% of the total cost.[6]

It should also be taken into account that the Central Bank of the Russian Fed-

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[6]Profitability of sold goods, products, works, services and profitability of assets of organizations by type of economic activity, in percent (in 2021) The text of Appendix N 4 is given in accordance with the publication on the website of the Federal Tax Service of Russia http://www.nalog.gov.ru/rn77/taxation/reference_work/conception_vnp/ as of 05.06.2022.

eration significantly increased the forecast for inflation in Russia for 2022 to 18-23%. Today it is 17.6%.

For the end buyer, the cost of pipe products is formed on the basis of the table "Structure of price elements" (*tab.* 1)

Thus, in today's political environment, a decline in prices for pipe products cannot be predicted in the near future. This can negatively affect not only consumers, but also the producers themselves.

**Strategic guidelines for the development of the pipe industry in the context of the COVID-19 pandemic and securing government support**

Ensuring the energy security and independence of our state poses serious challenges for the pipe industry, since the production of pipe products manufactured with the intensive use of the latest technologies has two-way interaction with the successful development of the fuel and energy complex, engineering, construction and other sectors of the national economy. A clear balance of this relationship is the key to achieving intensive economic growth and a general improvement in the quality of life of the country's population. And for this it is necessary to consolidate the efforts of all sectors of the economy, which is impossible without ensuring the planning of strategically important areas at the state level. The Government of the Russian Federation should use for this, all the resources in its hands aimed at the development and effective functioning of enterprises: improving the regulatory legal framework, improving relations between business and government, monitoring, controlling, financing, coordinating development strategies and programs, preferential taxation, etc.

**State anti-crisis measures in the context of the COVID-19 pandemic affecting the pipe industry**

When market activity began to recover in large economies (which was poorly predicted), many production capacities were not launched quickly and fully. The countries, including Russia, which did not stop their production, used the favorable market conditions to sell their products on the world market. In particular, the Government of the Russian Federation approved a set of economic stimulus measures to mitigate the effects of the economic crisis triggered by the pandemic. Fiscal stimulus measures were aimed at supporting the population and businesses. The Central Bank of Russia lowered the key rate to 4.25%. This is a record low in the history of the country. The inflation rate at the end of 2020 was 4.9%. Domestic demand for pipe products was supported by the state program of preferential

| Type of economic activity (according to OKVED-2) | 2021 | |
|---|---|---|
| | Profitability of sold goods, products (works, services), % <*> | Return on assets, % <**> |
| metallurgical production | **28,7** | 23,4 |

mortgages and subsidies for the construction industry, as well as financial incentives for the construction of refineries.

Since the second half of 2020, there has been a sharp increase in the cost of pipe products both on the global and domestic markets. The average increase in the cost of stainless steel pipes for the period from June 2020 to May 2021 amounted to 56-87%, which attracted the attention of the Government of the Russian Federation. In the summer of 2021, the Russian pipe market passed the peak of the price rise and began to decline sharply. By the beginning of September 2021, the cost of production has decreased by 15–20% compared to the maximum indicators of summer 2021.

From August 1 to December 31, 2021, the Government of the Russian Federation introduced state duties on the export of ferrous and non-ferrous metals, as well as metallurgical raw materials for the pipe-rolling industry: a general one in the amount of 15% and a special one, the amount of which depends on the type of metal or the degree of processing of products. The introduction of export duties contributed to the reduction of Russian prices, which were inflated at the beginning of the summer of 2021, for rolled products necessary for pipe makers.

The logic of the introduction of export duties is understandable, the increased duty will make exports economically unprofitable - the domestic market will be saturated, the price will decrease. But this will only work if the export duty is applied taking into account the prevailing market situation. Otherwise, the additional tax burden will lead to higher prices, which is observed today.

There are other global ways to reduce prices in the domestic market - conducting antitrust investigations and cartel conspiracies. However, in this case, in Russia it is necessary to increase antimonopoly fines, which are calculated on the basis of income for the year preceding the violation, that is, when there were no excess profits. The size of the fine in our country is limited to 4% of annual revenue and is charged for just one year, although the identified violation could last for decades. Therefore, maximum fines of billions of rubles in Russia are prescribed in exceptional cases, while in the US and the EU, a fine of billions of dollars or euros is the norm.

Apparent demand for pipe products in physical terms began to decline in the spring of 2021. Since by that time the quotations for flat products had exceeded the level of early November 2020 by 60-80%, and this rise in price went further along the production chain, causing prices to rise.

In a growing market, apparent demand is always higher than real demand due to the speculative component. And until about June 2021, there was indeed a shortage of certain types of pipe products in Russia. There was a jump in prices, which played a significant role in the fact that the government, which for a long time did not dare to resort to drastic measures, decided to introduce export duties.

As soon as prices swayed in the direction of decline, all processes turned in the opposite direction. Apparent demand has fallen, because now consumers are interested in postponing purchases for as long as possible. A number of companies in some segments of the market began to sell short, trying to force suppliers to provide new discounts, and at the same time increase their share in the shrinking market. In July 2021, this trend developed most actively in the welded pipe sector.

Also in July 2021, pipe-rolling companies were able to find a way out by increasing exports to non-CIS countries, while the duties had not yet come into force. In some cases, in particular, in the Asian direction, these supplies resembled a giveaway, but the "surplus" was removed from the Russian market. However, this did not prevent the decline.

Today's introduction of excise taxes on liquid steel and alloying elements, which has come into force, has already led to an even greater rise in the cost of Russian pipe products, not only in the external, but also in the domestic market.

**Conclusion**

The global economic crisis is largely due to new and new waves of the COVID-19 pandemic, commensurate in scale with the tsunami... The unpredictable emergence and spread of coronavirus strains is highly likely to remain the leading factor in determining demand for all types of products, including pipes, throughout 2022 and probably 2023. The nature of demand will depend on the introduction/strengthening of quarantine measures, the timing of the recovery of individual market sectors and the impact of potential government stimulus measures in different countries, including investment in infrastructure. The world will never be the same again. Serious changes are coming in the organization of the entire world economy, social structure and energy markets. It looks like the crisis that the coronavirus brought with it will be the deepest economic recession since the Great Depression of the 1930s.

So maybe Russia should adopt the experience of Franklin Roosevelt as an experience of complex macroeconomic regulation of the market economy of the state, which then led to a reasonable compromise between the interests of private capital and the rest of society. After all, the current situation requires our state to consolidate all the industrial, financial and political forces of the country in order to preserve the economic sovereignty of the state. The time has come to make urgent cardinal decisions.

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使用预测模型评估地区的可持续发展
# USING FORECAST MODELS TO ASSESS THE SUSTAINABLE DEVELOPMENT OF TERRITORIES

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抽象的。 文章中指出，能够确保准确规划可持续发展轨迹的方法之一是预测。 已经开发了许多预测模型，其中一些依赖于历史数据的使用。 为了建立领土可持续发展的数字理由，可以使用地区和市级官方当局发布的时间序列数据。随着领土可持续发展参数的各种组合，内生和外生过程影响的增加或减少，所研究的现象或过程的实际值对时间的依赖性可以采取各种形式。

关键词: 预测，模型构建，稳定性参数，领土发展。

*Abstract. It is noted in the article, that one of the methods, allowing to ensure accurate planning of the trajectory of sustainable development is forecasting. Many forecasting models have been developed and some of them rely on the use of historical data. For the purposes of building a digital justification for the sustainable development of the territory, time series of data published by official authorities at the regional and municipal levels can be used. With various combinations of parameters of sustainable development of territories, an increase or decrease in the influence of endogenous and exogenous processes, the dependence of the actual values of the phenomenon or process under study on time can take various forms.*

*Keywords: forecasting, model building, stability parameters, territory development.*

**Introduction**

Sustainable development of territories implies activities carried out in the interests of present and future generations and aimed at the rational and efficient use of land, natural and other resources. An integrated and systematic approach to the spatial organization of territories should contribute to their sustainable development. In this regard, when territorial planning, difficult tasks are solved to harmonize economic, environmental, social and other aspects of sustainable development of territories [1-6]. Of particular importance is the problem of forecasting the sustainable development of the territory based on the use of such statistical tools as a time series.

Quantitative data that can be described by a time series is influenced by three groups of factors: 1) factors reflecting a trend (trend); 2) factors that form cyclical and seasonal fluctuations of the series; 3) factors reflecting the influence of a random component (unpredictability).

The process of building a model begins with a graphical analysis of the initial data and identification of existing dependencies. A simple strip chart can reveal the presence of increasing or decreasing trends, or oscillatory movements around some average value of the analyzed indicator or their group. If there is no trend component of the time series, it can be identified by moving average or exponential smoothing. It is also advisable to use the "predict.ets.seasonality" function of MS Excel to identify the seasonality factor in the values of the dynamic series.

Find a correlation between individual values belonging to the same repeating periods - January 2022 to January 2021, February 2022 to February 2021; can be calculated by calculating the autocorrelation coefficients obtained by shifting the correlation coefficient by several time intervals.

To build a model, you need:

1. Align the initial data with a moving average and center it between two neighboring values.

2. Calculate quantitatively the share of the seasonal component in the original data.

3. After its identification, carry out deseasonalization - to eliminate the influence of the seasonality factor on the dynamics of the phenomenon or process under study.

4. Identify an increasing, decreasing or fluctuating trend and calculate the forecast model taking into account the direction of the trend and the seasonality factor.

5. Determine the absolute and relative errors of the calculations performed to assess the suitability of the model as a whole.

Socio-economic data usually contain three components, each of which in turn is formed under the influence of a trend, seasonal fluctuations and a random component. When determining the sum of these values, an additive model is built,

when a product is multiplicative.

**Materials and methods**

For the purposes of modeling the parameters of sustainable development, one of the parameters published by the Ministry of Finance of the Russian Federation was chosen from the section of brief information on the execution of the consolidated budget of the Russian Federation and state off-budget funds – tab. 1.

*Table 1.*

*Table of initial data. State budget expenditures on environmental protection, accumulated since the beginning of the year in (billion rubles) [7]*

|      | Jan  | Feb  | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   |
|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 2011 | 0.4  | 2.0  | 4.2   | 6.6   | 8.7   | 11.2  | 14.1  | 16.6  | 19.6  | 23.0  | 26.5  | 38.6  |
| 2012 | 2.4  | 5.4  | 9.0   | 12.3  | 13.9  | 16.3  | 22.1  | 24.0  | 27.1  | 32.7  | 35.3  | 43.2  |
| 2013 | 1.0  | 5.9  | 8.1   | 13.9  | 16.4  | 19.7  | 25.2  | 27.6  | 31.9  | 36.2  | 39.1  | 47.0  |
| 2014 | 2.8  | 4.9  | 8.4   | 15.0  | 23.1  | 26.4  | 32.7  | 41.8  | 45.6  | 51.5  | 59.1  | 70.2  |
| 2015 | 2.7  | 13.0 | 18.0  | 30.2  | 33.9  | 39.9  | 48.1  | 50.3  | 54.7  | 59.5  | 62.8  | 71.7  |
| 2016 | 0.7  | 14.8 | 22.0  | 32.4  | 39.8  | 52.7  | 57.7  | 60.3  | 65.4  | 69.6  | 71.5  | 84.0  |
| 2017 | 13.1 | 30.8 | 40.2  | 46.3  | 54.6  | 66.3  | 73.0  | 76.6  | 90.0  | 101.6 | 107.3 | 116.3 |
| 2018 | 14.3 | 21.7 | 35.0  | 48.2  | 62.9  | 79.9  | 93.2  | 103.3 | 107.9 | 116.3 | 120.0 | 148.3 |
| 2019 | 4.1  | 49.3 | 67.0  | 87.2  | 105.6 | 121.0 | 141.7 | 154.1 | 168.6 | 182.7 | 197.8 | 250.3 |
| 2020 | 39.3 | 72.7 | 91.0  | 114.5 | 131.7 | 138.4 | 155.4 | 167.3 | 205.2 | 221.9 | 241.8 | 303.9 |
| 2021 | 7.7  | 66.1 | 107.9 | 156.6 | 193.1 | 231.4 | 264.0 | n/a   | n/a   | n/a   | n/a   | n/a   |

The nature of the relative changes in the volume of funds allocated for environmental protection measures allows us to speak with some caution about the gradual equalization of the volume of budget expenditures and their more uniform allocation during the calendar year. The graph of relative changes was built with the exception of three external values in individual months – fig. 1.
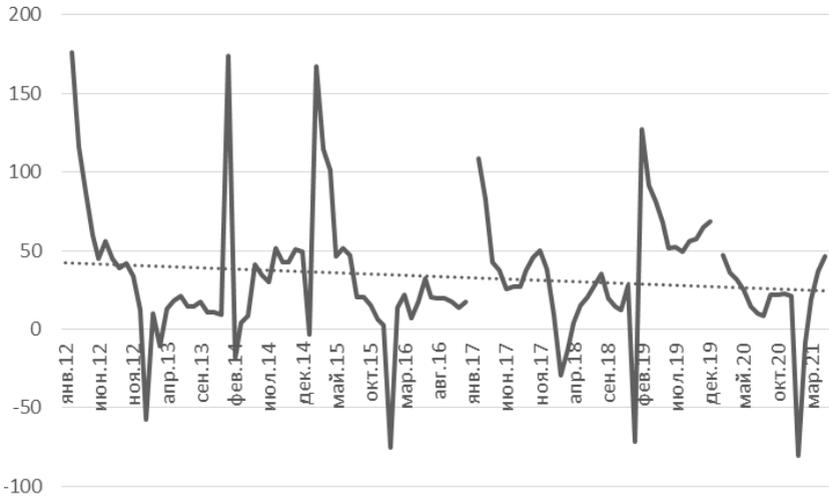
***Figure 1.*** *Amplitude of change in monthly expenditures on environmental protection, in % month to month of the previous year*

The construction of the autocorrelation function made it possible to determine the time interval in which the correlation is the highest. All autocorrelation coefficients are quite high and positive, thus there is a relationship between all time periods. The first-order autocorrelation coefficient is quite high - there is a trend component. The maximum autocorrelation coefficient is in the 12th period - the oscillation period repeats exactly one year later. When calculating the seasonal component, no violations were identified - table 2.

***Table 2.***
*Assessment of the seasonal component, billion rubles*

| Years | Months | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| 2011 | | | | | | | | | | | 12.1 | 24.0 |
| 2012 | -12.5 | -10.0 | -6.8 | -4.0 | -2.9 | -1.2 | 4.0 | 5.3 | 7.6 | 12.6 | 15.1 | 23.0 |
| 2013 | -19.2 | -14.3 | -12.3 | -6.8 | -4.5 | -1.5 | 3.7 | 5.7 | 9.7 | 13.7 | 16.4 | 24.3 |
| 2014 | -19.9 | -17.9 | -14.7 | -8.7 | -1.2 | 1.2 | 6.3 | 14.2 | 16.5 | 20.7 | 27.3 | 38.1 |
| 2015 | -30.1 | -20.9 | -16.9 | -5.8 | -3.3 | 1.7 | 9.1 | 10.7 | 14.6 | 19.1 | 22.5 | 31.4 |
| 2016 | -39.9 | -26.0 | -19.1 | -9.5 | -3.0 | 9.0 | 13.1 | 14.9 | 19.2 | 22.6 | 23.4 | 34.7 |

| 2017 | -37.6 | -21.2 | -13.0 | -8.1 | -1.0 | 9.4 | 14.4 | 15.6 | 26.2 | 35.0 | 39.2 | 48.6 |
|------|-------|-------|-------|------|------|-----|------|------|------|------|------|------|
| 2018 | -52.8 | -45.3 | -32.4 | -20.2 | -6.9 | 8.2 | 19.7 | 28.4 | 31.9 | 38.4 | 41.2 | 68.7 |
| 2019 | -77.9 | -35.7 | -21.4 | -4.7 | 10.0 | 21.3 | 37.3 | 44.4 | 52.9 | 59.5 | 68.9 | 118.9 |
| 2020 | -94.1 | -62.8 | -46.7 | -25.0 | -9.1 | -3.5 | 11.4 | 20.1 | 54.6 | 67.2 | 86.2 | 149.9 |
| 2021 | -146.7 | -90.8 | -53.3 | -11.1 | 17.0 | | | | | | | |
| Seasonally adjusted component for the additive model | | | | | | | | | | | | |
| | -56.9 | -38.3 | -27.5 | -14.2 | -4.3 | 0.7 | 8.1 | 12.1 | 19.5 | 25.1 | 28.2 | 47.3 |
| Seasonally adjusted component for the multiplicative model | | | | | | | | | | | | |
| | 0.1 | 0.4 | 0.6 | 0.8 | 0.9 | 1.0 | 1.1 | 1.2 | 1.3 | 1.4 | 1.5 | 1.8 |

To determine the values of the trend component, the results of regression analysis in the MS Excel package were used. The values of the parameters of the pair regression equation (-18.85; 1.32) were obtained, the significance level was estimated, which was much less than 0.05, the proportion of the variance of the dependent variable, which is explained by the independent variable, was determined - 0.57, the residuals were considered for the absence of pronounced dependencies, and on their basis the coefficient of determination is determined.

The values of state budget expenditures obtained from additive and multiplicative models, taking into account the general assumptions for the implementation of such forecasts, allow us to proceed to a discussion of their results.

**Results and discussion**

Based on the results of forecasting the values of the expenditure part of the state budget for the implementation of environmental measures in 2022 and 2023, we can talk about the continuation of the trend towards their increase in absolute terms - fig. 2, 3.
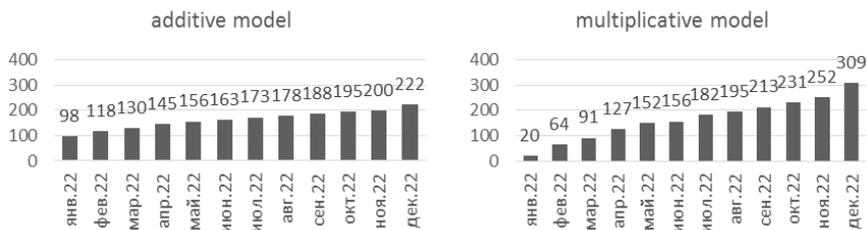


*Figure 2. Forecast values of state budget expenditures for environmental protection measures in 2022, billion rubles*
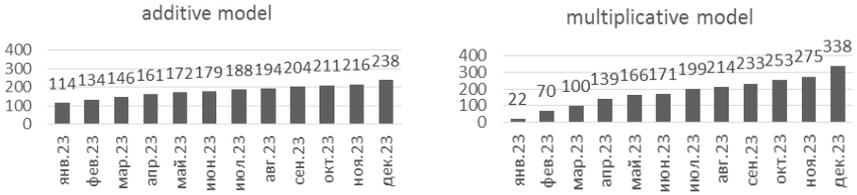
*Figure 3. Forecast values of state budget expenditures for environmental protection measures in 2023, billion rubles*

The general forecast model based on the sum of the factors is shown in fig. 4. It is obvious that the additive model poorly takes into account the changed amplitude of 2019-2020, while the coefficient of determination was 79.5%, which characterizes it as a potentially probable model.
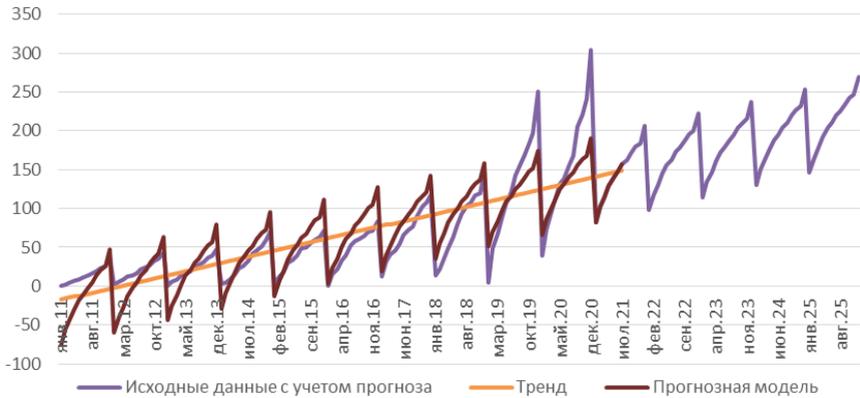


*Figure 4. Additive model for forecasting budget expenditures for the implementation of environmental measures until 2025, billion rubles*
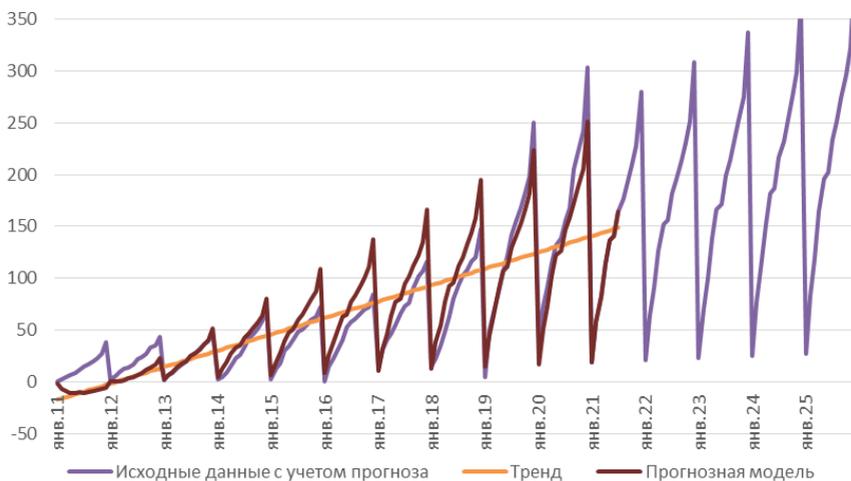
***Figure 5.*** *Multiplicative model for forecasting budget expenditures for the implementation of environmental measures until 2025, billion rubles*

The coefficient of determination for the multiplicative model was 89.4%. A graphical reflection of the predicted values is shown in fig. 5. Obviously, the multiplicative model better matches the actual values and will more accurately predict the values of budget expenditures in the near future.

### Conclusion

Based on the results of the analysis, it is possible to draw the following main conclusion: the use of predictive models in socio-economic studies of various kinds helps to plan the control impact on the development of territories and justify the proposed measures for a sustainable impact on the existing potential of regional and municipal structures.

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大都市生活环境质量研究的方法论
# METHODOLOGICAL ASPECTS OF THE STUDY OF THE QUALITY OF THE LIVING ENVIRONMENT IN THE METROPOLIS

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抽象的。 在文章中，作者对形成舒适城市环境的基本原则进行了思考和分析。 按照改进后的方法计算指标指标和指标组，并对得到的实验数据进行分析。 应该指出的是，本文提出的指标可以被公共当局有效地用于评估旨在创造舒适城市环境的计划的实施情况。
关键词：环境、大都市、住房存量、生活质量、工程基础设施、景观美化、土地资源、专题地图。

*Abstract. In the article, the authors considered and analyzed the basic principles of the formation of a comfortable urban environment. In accordance with the improved methodology, index indicators and index groups were calculated, and the experimental data obtained were analyzed. It should be noted that the indicators proposed in this paper can be effectively used by public authorities to assess the implementation of programs aimed at creating a comfortable urban environment.*

*Keywords: environment, megapolis, housing stock, quality of living, engineering infrastructure, landscaping, land resources, thematic maps.*

**Introduction**

Purpose of the study – to improving the methods of the study of the quality of the living environment in a metropolis.

In the literature, it is generally accepted to define the formation of a comfortable urban environment as a set of measures aimed at creating conditions for ensuring favorable, safe and affordable living conditions for the population. There are such basic principles for the formation of programs for the formation of a comfortable urban environment as a systematic approach, public participation, the creation of a public space, "everything starts from the yards", fixing responsibility for the maintenance of a landscaped area, etc. In our opinion, it is also important the principle of optimizing the economic and social parameters of ensuring the quality of the living environment [1].

In Russia, the assessment of the quality of the urban environment is regulated by the Order of the Ministry of Regional Development of the Russian Federation dated September 9, 2013 № 371 "On Approval of the Methodology for Assessing the Quality of the Urban Living Environment". At the same time, for large cities, it is necessary to analyze the existing methodology for assessing the quality of the urban environment, followed by the development of measures to improve its quality [2].

It should also be noted that in the modern world, people increasingly want to live in a pleasant, well-maintained place, away from the noise of highways, with their own playground and park not far from home. There are many requirements for a place where a person spends most of his life. Each unit of society seeks to create such an environment around itself that would satisfy all its needs [3].

As of January 1, 2022, in Russia, according to statistics, there are 15 cities with a million inhabitants (megacities) with a total population of more than 33.5 million people. The largest cities are Moscow, St. Petersburg and Novosibirsk with the official population of 12.7 million people, 5.4 million people and 1.6 million people, respectively [4].

**Materials and methods**

Let's assess the quality of the urban environment on the example of St. Petersburg, which is an important economic and scientific center of Russia, a major transport hub. It should be noted that 18 districts of the city are administrative-territorial units. The Central District (hereinafter referred to as the CD) of the existing 18 districts of the city ranks first in terms of quality of life. On its territory there are the main Temples, 11 major universities, many libraries, etc., all conditions have been created for the comfort of the disabled, 110 gardens, 12 comprehensive schools, etc. There are 17 hospitals and polyclinics in the district. The territory of the Central District of the city of St. Petersburg occupies 17.12 sq km (1.2% of the total city area).

Note that the CD housing stock is not uniform in terms of the quality of construction. So, out of 2474 residential buildings CD 1270 are houses of the old fund that have not undergone major repairs, 962 are houses of the old fund with major repairs.

The housing stock for 2019 is 8 million 431 thousand square meters of total area (17.12 sq. km.). The population density is 13.0 thousand people per 1 sq. km.

The housing stock by number of storeys and form of ownership is classified as follows: a) by number of storeys (tab.1) and b) by type of ownership (tab. 2)

*Table 1.*

*Floors of the housing stock of the Central district of the city of St. Petersburg*

| Number of storeys | Total area, ha | Specific weight, % |
|---|---|---|
| Houses of medium-storey and multi-storey residential buildings | 229.72 | 99.7 |
| Low-rise residential buildings, including individual housing construction (IHC) | 0.76 | 0.3 |
| Total | 230.48 | 100.0 |

*Table 2.*

*Form of ownership of the housing stock of the Central District of the city of St. Petersburg*

| Number of storeys | Total area, ha |
|---|---|
| City property | 252.46 |
| Property of the Russian Federation | 205.99 |
| Property of citizens and legal entities | 327.59 |
| Public green spaces | 69.82 |
| Green spaces for general use, taking into account the issued city rights | 89.21 |
| Land under the road network | 318.28 |
| Urban forests | - |
| Lands under water bodies | 241.76 |
| Unlimited state property | 360.99 |
| Total | 1866.10 |

On the basis of the foregoing, it is reasonable to note that multi-story and mid-rise residential buildings predominate in the CD housing stock.

Next, we calculate indicators, indices and groups of indices for assessing the quality of the urban environment (hereinafter - UE). To begin with, it is necessary

to calculate the quality of housing and the proportion of the population living in dilapidated housing. By 2021, there will be about 250 residential non-relocated emergency houses in the CD. Next, we will calculate the share of the housing stock, which is provided with a centralized infrastructure. To do this, you need to know the total area of residential premises (tab. 3).

Then we calculate the amount of municipal solid waste removed per capita. To calculate, we take data on the amount of waste removed and the population, i.e.: N=1077t./210899=5.1 tons per capita per year.

*Table 3.*

*Engineering provision of the Central District of the city of St. Petersburg*

| Indicator | Unit of measurement | Availability in 2020 |
|---|---|---|
| Water supply: | | |
| Total water consumption (total) | thous. cub. m/day | 1779 |
| Including: | | |
| For household and drinking purposes | thous. cub. m/day. | 1334 |
| For production needs | same | 11 |
| Approved groundwater reserves | thous. cub. m/day | 38,8 |
| Total specific water consumption | l/day per person | 249 |
| Specific domestic and drinking water consumption | l/day per person | 185 |
| Sewerage: | | |
| Total wastewater inflow (total) | thous. cub. m/day | 102 |
| Including: | | |
| Domestic sewerage | thous. cub. m/day | 91,0 |
| Industrial sewerage | thous. cub. m/day | 11 |
| Performance of sewage treatment plants | thous. cub. m/day | - |
| Heat supply: | | |
| Total heat load | Gcal/h | 2817 |
| Including: | | |
| Connected heat load by district heating zones | Gcal/h | 2299 |
| Total power of local heat sources | " | 1050,0 |
| Gas supply: | | |
| Annual gas consumption | mill. n.cub.m/year | 198 |
| Including: | | |

| For household needs | same | 198 |
|---|---|---|
| Sanitary cleaning of the territory: | | |
| Volume of household waste | thous. cub. m.<br>thous. t. per year | 543,2<br>123,0 |
| Waste incineration and waste processing plants | unit | 0 |
| Improved landfills | unit/ha | 0 |

Let us analyze the diversity of residential development - an indicator that characterizes the degree of monotony of urban development. An increase in this indicator stimulates city authorities to comply with urban planning regulations in the city and improve the overall quality of residential development projects. You need the number of residential buildings of the most common and the second most common type and the number of residential buildings of all types [5-11].

**Results and discussion**

In the historical center, including in the Central District, residential and cultural buildings and structures were built of brick. Since the end of the last century, houses made of mixed materials began to appear (formula 1).

$$\frac{\max h1 + \max h2}{\Sigma h} = N \tag{1}$$

N= (2350+124)/2474=1 units

Next, consider the services of residential development, for this we need $Sf^1$ - he area of functionally diverse sections of the residential area. To assess diversity, infrastructure facilities with purpose functions other than residential areas (bank, shop, administration, etc.) are analyzed. $S_{tot}$ - is the total area of the residential area. Note that the larger the area of the residential zone is recognized as diverse, the less exclusively sleeping monotonous areas it has (formula 2).

$$\frac{Sf^1}{Stot} = N \tag{2}$$

N= 6576/8431 thous. sq.m. = 0.78 units.

Next, we will calculate the share of apartment buildings located on land plots for which state cadastral registration has been carried out in the total number of apartment buildings (formula 3).

$$\frac{MKDzu}{MKD} * 100 = N \tag{3}$$

N= 5267 / 5484*100%=96%

The next criterion is the street-road network (hereinafter - SRN). We will determine the safety of the road network, in connection with this, we will calculate the proportion of those killed in RTA. For the calculation, data on the total population and the total number of residents injured in RTA are taken (formula 4).

$$\frac{Di}{Dtotal} = N \tag{4}$$

N=0/214 572=0

Let's calculate the share of the UDS, while this indicator - is an indicator of the quality of the UDS (formula 5).

$$\frac{Puds}{Pk} * 100 = N, \tag{5}$$

where $P_{uds}$ – length of streets in km, and Pk – storm sewer length.

N=132/127*100%=96,2%

Further, using GLONASS, we determine the traffic congestion. The average score is 5. Next, we will calculate the number of streets with a developed service sector, namely, the indicator is 171 out of 235 streets in the district.

Next, we determine the share of pedestrian accessibility, namely: the degree of pedestrian accessibility from residential buildings to infrastructure facilities, taking into account the complexity of the geometry of the road network, the presence of pedestrian crossings, sidewalks in 10 minutes from each building by the shortest path along the street road network (800 m).

We also note that the share of priority objects of social, transport and engineering infrastructure accessible to disabled people and other low-mobility groups of the population is 56%.

Next, we calculate the following indicator, namely: we calculate the share of green spaces for common use. This requires data on the total area of green spaces and the area of green spaces within the city limits (formula 6).

$$\frac{Ototal}{Ovs} * 100\% = N \tag{6}$$

N=3,2/4,4*100%=73%

Consider the level of landscaping, determined by interpreting satellite images with further determination of the proportion of the area covered by vegetation (fig. 1). Based on fig. 1 we note that 18% is covered with vegetation. A thematic map of green spaces is also presented for the convenience of calculating the real area covered with vegetation (fig. 2).

***Figure 1.*** *Space image of the Central District of St. Petersburg*
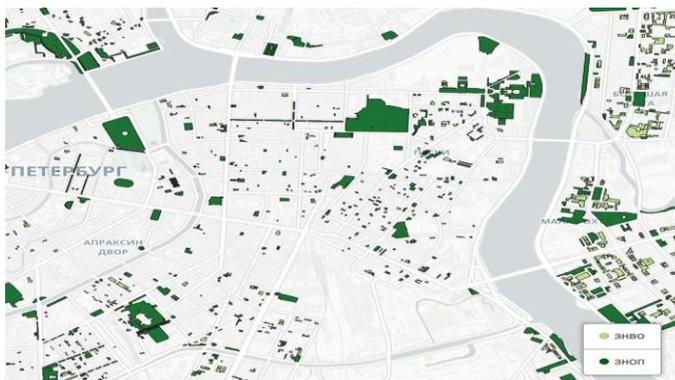


Legend:
PGS – public green spaces,
GSIQG – green spaces of intra-quarter gardening
   ***Figure 2.*** *Thematic map of the Central District of St. Petersburg*

Next, we consider the state of green spaces (hereinafter referred to as GS) in the city, which evaluates the bioproductivity of GS as a direct consequence of the entire state of the environment, directly related to the state of the atmosphere, the level of pollution of soils and surface waters in the city. In order to find out the state of green spaces, we decipher the satellite image (figure 1) again and calculate the vegetation index as the share of the territory with green spaces of high biomass

density in the total area of greenery in the city.

So the share of the total area of the district covered with vegetation is 20%. This is a relatively insignificant indicator, estimated at 3 points.

Next, consider the variety of services in green areas (hereinafter - GA). It should be noted that parks and squares are a full-fledged public space to meet the various needs of different socio-cultural groups of citizens.

To do this, we analyze the services that exist within the boundaries of the public GA and the total area of these territories (formula 7).

Mobile cafes and palaces are located in gardens and squares. There are several playgrounds in the Tauride Garden. However, in other squares there are no such services, in connection with this:

$$\frac{\sum iCi}{\text{Ovs}} = N \qquad (7)$$

N=58/4,4=13,2, which is worth 5 points.

The next indicator in this criterion is the proportion of the population with access to public GA in the total population. To calculate it, you need the population that lives within a radius of 800 m and the total population. This indicator shows the ability to visit parks or natural landscapes often and without spending time on transport for walks, sports, quiet recreation or work outside the office, which makes life more convenient.

N=86468/210899*100%=41%, which is worth 5 points.

Next, we calculate the area removed by mechanized cleaning.

$$\frac{\text{Ymec}}{\text{Pvs}} = N \qquad (8)$$

N= 13,2/17,12 = 0,77 sq km, i.e. 77% of the total area of the district.

Consider the concentration of cultural heritage objects, process information on the number of cultural heritage objects and the area of the city (formula 9).

$$\frac{\sum iKi}{\text{Pvs}} = N \qquad (9)$$

N=1140/17,12=84,11

Consider the degree of development of public and business zones CD. The index is calculated as the ratio of the average number of public and business organizations in the area to the area of the CD itself. There are 134 social and business organizations on the territory of CD, which means 2996/1712 = 1,75 units/ha is the level of development.

And the last index is an indicator of the design of urban space. This is an integral indicator calculated on the basis of a cumulative assessment of 3 parameters: the presence of an approved regulation for the placement of advertising structures; the share of residential buildings in respect of which facades have been repaired

in the total number of houses requiring facade repairs; share of buildings equipped with architectural lighting in the total number of buildings.

In St. Petersburg, the number of houses in respect of which the repair of facades was carried out: N=121/192*100%=63%. The total score for this indicator is 9 points.

On the basis of the foregoing, we note that it is impossible to diversify residential development in CD without compacting development or demolition of historical buildings. It should also be noted that the share of green areas for common use is extremely small relative to the total area of the SP, only 18%, i.e. 4 points.

Moreover, it should be noted that the years of development and the location relative to other areas of the city do not allow the placement of any industrial and agricultural production, as well as other types of exploitation of the territory that can damage the historical landscape.

**Conclusion**

In conclusion, it can be noted that the methodological approach proposed in this paper to the study of the quality of the living environment in a metropolis can be used by government bodies to assess the effectiveness of the implementation of programs to create a comfortable urban environment.

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境内园林绿化管理组织：国外经验
# ORGANIZATION OF LANDSCAPING MANAGEMENT OF THE TERRITORY: FOREIGN EXPERIENCE

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抽象的。 文章考虑了外国在领土景观管理领域的经验。 值得注意的是，领土的改善程
度是定居点质量的指标之一； 公民的生活质量取决于城市改善领域的发展水平。 此外，景观管理作为调节聚居区社会经济发展、协调私人和公共利益的机制中最重要的环节之一的作用越来越大。
关键词：景观美化，管理组织，景观设计，环境，绿色城市，建成区。

***Abstract.*** *Foreign experience in the field of landscaping management of territories is considered in the article. It is noted that the level of improvement of the territory is one of the indicators of the quality of settlements; the quality of life of citizens depends on the level of development in the field of urban improvement. Moreover, the role of landscaping management as one of the most important links in the mechanism of regulation of socio-economic development of settlements, coordination of private and public interests is increasing.*

***Keywords:*** *landscaping, organization of management, landscape design, environment, green cities, built-up areas.*

## Introduction
Currently, more than half of the world's population lives in cities, which, ac-

cording to scientists, produce up to 80% of humanity's greenhouse gas emissions. Growing urbanization can lead to a reduction in the area of arable land, a decrease in green spaces, drinking water, and other negative consequences.

The European Green Cities Index aims to measure and evaluate the environmental performance of 30 leading European cities both in general and in a number of specific areas (carbon dioxide, energy, buildings, transport, water, waste and land use, air quality, environmental management). In the overall ranking of cities, Copenhagen is in the lead, Stockholm is in second place, Oslo is in third place, and in such an area as environmental management, 4 cities have the best results at once - Brussels, Copenhagen, Helsinki and Stockholm. There is a strong correlation between wealth and a high overall ranking in the index. Nine of the 10 largest cities in the index have a GDP per capita (measured in purchasing power parity) of more than 31,000 euros, which allows these cities to invest more in environmental protection and effectively organize urban landscaping management [1].

**Materials and methods**

Landscaping and green spaces are very important for the life and functioning of cities. With the acceleration of urbanization, the desire of urban residents for greenery is becoming stronger.

At the same time, the landscaping subsystem includes: parks (hydro-, meadow-, forest parks, parks of culture and recreation, parks - monuments of gardening art, sports, children's, historical, national, memorial, etc.), recreational areas, gardens, squares and sites, as well as monuments of cultural and historical heritage, squares, boulevards, avenues, beaches. The subsystem is a set of landscaped areas of various functional purposes, united in an interconnected system of infrastructure of settlements. Green spaces of settlements are their complex system and are divided into a number of categories according to the functional principle. Thus, the green spaces of settlements effectively fulfill their purpose in terms of: the formation of the aesthetics of the improvement of settlements; protection of water sources and hills from erosion; wind and noise protection; air pollution control; the formation of the most comfortable working conditions, life and recreation of the population [2-4].

The system of landscaping of settlements is characterized by great complexity, which is associated with: the complexity of the processes occurring in settlements in the conditions of active interaction between the anthropogenic and natural environment; close dependence on the processes of development of settlements, reduction in the area of green areas with the expansion of buildings; a variety of functions and types of green spaces that form a gardening system, etc. [5,6].

At the same time, the city should have about 40% of green spaces, and at least 20% in public facilities (parks, squares). If this norm is not met, the population may begin to experience such problems as oxygen starvation, poisoning with

harmful emissions from transport and factories.

It is worth adding that urban planners in countries such as Poland, the Czech Republic, Bulgaria and Germany have already achieved a fairly high degree of environmental friendliness. The landscape composition of streets, boulevards, squares, parks is attractive for its beauty and artistic value. Many parks are of historical value, and other parks are of great importance in promoting the cultural heritage of people.

In the last ten years, both in Russia and abroad, great importance has been attached to the landscaping of historical centers through the reconstruction and demolition of densely built-up areas [2,7].

**Results and discussion**

Next, we will consider foreign experience in more detail. Let's start with Germany. It should be noted that Berlin is one of the greenest cities in Europe, with more parks, gardens and forests than in any other European city (fig. 1). It is literally green. Locals can enjoy over 2,500 patches of green space, all of which are a piece of nature in the city and a habitat for wildlife. The vast green expanse of the Tiergarten can be traced back to 1527, when it was built first as a hunting ground and then as a dazzling spectacle of the Baroque period by the Prussian kings. By the end of World War II, Berlin's largest man-made park was converted into land and agricultural zones, and also served as a source of firewood. There are far fewer cars on the roads than in many other cities and a fantastic public transport system. In addition, people are encouraged to recycle through a take-back system where consumers can get €0.25 back for each recycled plastic bottle.
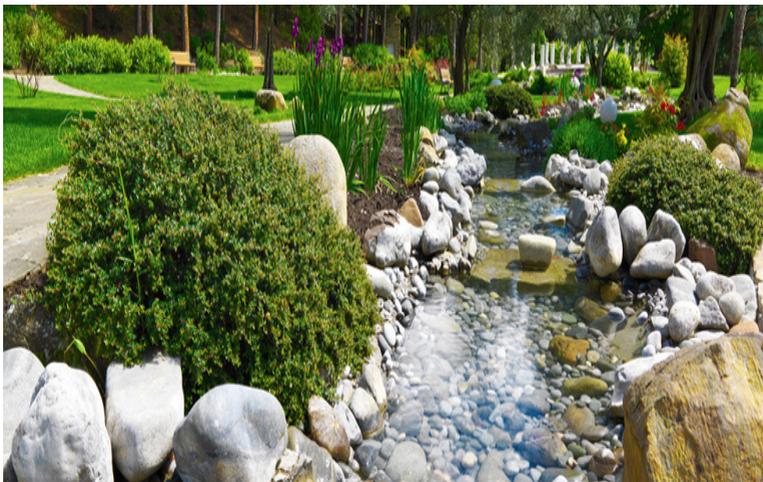


***Figure 1.*** *Landscaping and gardening in Germany*

Next, consider Lisbon, which has been designated "European Green Capital 2020" by the European Commission (fig. 2). In 2017, Lisbon launched a bike-sharing scheme in which two-thirds of the fleet are e-bikes to encourage cycling in the city's more mountainous areas. The company also promotes alternative fuel vehicles and boasts one of the world's largest charging networks for electric vehicles with 516 locations across the city. Lisbon strives to protect and enhance its natural areas while providing its citizens with quality outdoor recreational spaces. The city involves a wide range of stakeholders such as citizens, businesses, universities and international partners in its city innovation policies and programs.



*Figure 2.* *Landscaping and gardening in Lisbon*

Let's move on to Switzerland, which is generally known for its high quality of life (fig. 3). This means that it has a very safe environment, making it a good place to live, with high health and environmental ratings. The city has also been praised for its green spaces, lack of traffic jams, and water quality [5,8].
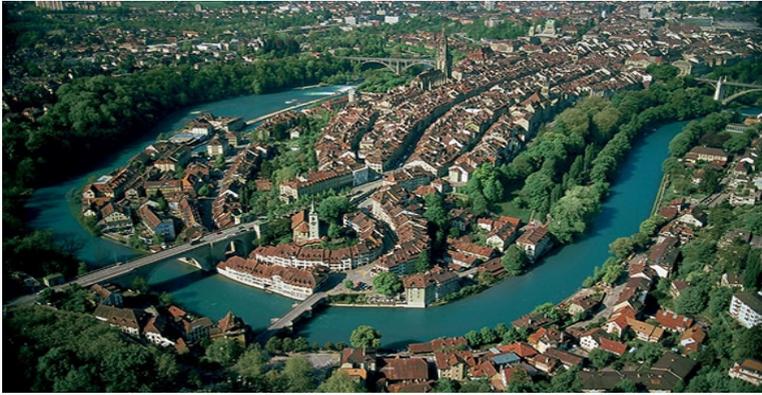
**Figure 3.** *Landscaping and gardening in Switzerland*

Amsterdam is ranked as one of the best cities in terms of water supply, transport, waste and land use in the European Green Cities Index (fig. 4). There is a huge number of pedestrian areas and bike paths, making walking or cycling the most popular mode of transport in this city (38% share). Public transport is next in line (its share is 24%), which includes buses, trams, canal boats and local trains. At the same time, 43% of the waste is recycled and used as fuel for their city bus network. In addition to all this, there are more electric vehicles on the streets of Amsterdam, as they have more than 300 charging stations. Even though Amsterdam has a decent amount of water, its water consumption is only 53 cubic meters per inhabitant per year, while the average water consumption is 105 cubic meters.



**Figure 4.** *Landscaping and gardening in Amsterdam*

Consider London, which takes landscape very seriously and is one of the greenest cities in Europe (fig. 5). It is he who is considered one of the greenest cities according to Cities Digest. This is mainly due to the fact that quite drastic measures have begun to be taken here to combat environmental pollution. The government has decided to start fighting pollution and plans to become carbon-free within the next decade. London has many green spaces, including in the form of parks, nature reserves and wildlife habitats. For a long time, British park culture was considered a model. Its elements were used in many park ensembles of the 18-19th centuries, including in Russia. In general, love for parks and green spaces is a national trait of the British.



*Figure 5. Landscaping and gardening in London*

Note that, with over 450 kilometers of cycle paths, Copenhagen won the European Green Capital in 2014 (fig. 6). Their goal is to achieve carbon neutrality by 2025, which is one of the reasons they really promote cycling. Initially, it was planned that by 2015 50% of people would ride bicycles, now about 45% of people ride a bike to work or school, which means that there is not much left to solve this problem.

***Figure 6.*** *Landscaping and gardening in Denmark*

Vienna is well known for its water resource initiatives (fig. 7). According to the European Green Cities Index, Vienna ranks second in the water category, thanks in large part to its water efficiency and sanitation policies. Water is collected through mountain springs, the difference in height between the mountain and the city is used, and with the help of the gravitational energy of this process, it is also used to hone electricity. Modern science and practice convincingly prove that innovative technological changes are the main factor in the long-term development of any country, a factor in its overall wealth and well-being of all citizens. In the development of the area of improvement, an important place is also occupied by the use of modern latest innovative technologies.



***Figure 7.*** *Landscaping and gardening in Vienna*

Further, we note that Helsinki is known for its achievements in the field of waste processing (fig. 8). This helps meet the city's energy needs in a more environmentally friendly way. In addition, many Helsinki residents choose to cycle or walk, further reducing pollution.



*Figure 8. Landscaping and gardening in Finland*

**Conclusion**

It is worth noting that with the transition to a market economy, the emergence of various forms of land ownership, the role of landscaping management increases as one of the most important links in the mechanism for regulating the socio-economic development of settlements, harmonizing private and public interests.

The contrasting combination of nature and architecture can enhance the drama and brightness of creative solutions in public spaces. Only through a creative design process can high artistic effects be achieved. The development of a socially oriented economy of the country is reflected in almost all spheres of human activity. The sphere of urban improvement is no exception [9].

The generalization of foreign experience has shown that not only finances, but also the activity of civil society play an important role in the management of landscape design of urban areas. Much in the life of cities depends on the concrete participation of citizens in solving environmental problems.

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在执法中使用人工智能的概念
# THE CONCEPT OF USING ARTIFICIAL INTELLIGENCE IN LAW ENFORCEMENT

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抽象的。文章反映了作者对在执法中使用人工智能概念的设想。给出了作者对人工智能概念的定义、类型，以及在执法中使用人工智能的概念的定义。制定了在执法中使用人工智能的目标、目的和原则。列举了可用于执法目的的人工智能技术，以及人工智能在执法中的主要应用领域。讨论了在执法中使用人工智能的问题和风险。讨论了在执法中使用人工智能概念实施有效性的标准以及实施该概念的机制。
关键词：概念；人工智能;强大的人工智能；弱人工智能；人工智能技术；非接触式测谎仪；执法;打击犯罪战略；社会评价。

*Abstract. The article reflects the author's vision of the concept of using artificial intelligence in law enforcement. The author's definition of the concept of artificial intelligence, its types, as well as the definition of the concept of using artificial intelligence in law enforcement is given. The goals, objectives and principles of the use of artificial intelligence in law enforcement are formulated. The technologies of artificial intelligence that can be used for law enforcement purposes are listed, as well as the main areas of application of artificial intelligence in law enforcement. The problems and risks of using artificial intelligence in law enforcement are discussed. The criteria for the effectiveness of the implementation of the concept of using artificial intelligence in law enforcement and the mechanism for implementing the concept are discussed.*

*Keywords: concept; artificial intelligence; strong artificial intelligence; weak artificial intelligence; artificial intelligence technologies; contactless polygraph; law enforcement; crime counteraction strategy; social rating.*

The concept of using artificial intelligence in law enforcement can become an important element in the strategy of combating crime.

Under *the concept of using artificial intelligence in law enforcement* (hereinaf-

ter referred to as – the Concept), it is proposed to understand a *system of views* on the use of artificial intelligence technologies in law enforcement, a document that defines the *goal, objectives, principles, priorities, directions, forms* of application of artificial intelligence in law enforcement, and also contains a *mechanism for their implementation*.

The concept can become a basic document on the organization and legal regulation of relations in the field of the use of artificial intelligence technologies for law enforcement purposes. It can be approved both by a departmental normative legal act and by a joint interdepartmental order.

*Artificial intelligence* is proposed to be understood as a set of technological solutions that allow simulating human cognitive functions (including self-learning and searching for solutions *without a predetermined algorithm*) and obtaining results when performing specific tasks that are comparable to the results of human intellectual activity, as well as superior to the results of human intellectual activity.

*According to the degree of compliance with the results of human intellectual activity*, it is customary to single out *"strong"* and *"weak"* artificial intelligence.

*"Weak" artificial intelligence,* the most common today, *does not seek to reproduce a person in the full range of his inherent capabilities,* but solves particular applied problems.

At the same time, when solving particular applied tasks, artificial intelligence is able to perform them much better than natural human intelligence, surpassing it in such cognitive processes as, for example, memory and thinking.

*"Strong" artificial intelligence* is designed to most fully reproduce human cognition, that is, its mental cognitive processes (including memory, thinking, speech). In the future, artificial intelligence can become a digital equivalent of all elements of the structure of the human psyche – mental processes, properties, states and formations, in a certain sense, replace a person.

*Artificial intelligence technologies* are proposed to be understood as technologies based on the use of artificial intelligence, including computer vision, natural language processing, speech recognition and synthesis, intelligent decision support and advanced methods of artificial intelligence.

*The purpose* of the implementation of the Concept is proposed to be an increase in the efficiency of law enforcement.

The *objectives* of the implementation of the Concept are proposed to include:

firstly, improving the legal regulation of the use of artificial intelligence in law enforcement;

secondly, the development of infrastructure and organizational and staff support for the implementation and operation of artificial intelligence technologies;

thirdly, the formation of the readiness of law enforcement officers to use artificial intelligence technologies;

fourthly, improving the efficiency of law enforcement management;

fifthly, increasing the effectiveness of law enforcement activities in terms of the main indicators of departmental and non-departmental rating;

sixthly, increasing the productivity of law enforcement officers;

seventhly, the creation of conditions for cooperation on the application of artificial intelligence, both at the level of interdepartmental interaction and in the field of international cooperation.

The *principles* of implementation of the Concept may include:

firstly, legality, protection of the rights and freedoms of man and citizen, ensuring the security of society and the state;

secondly, security, minimizing the risks of using artificial intelligence technologies;

thirdly, transparency, explainability of the work of artificial intelligence;

fourthly, systematic approach, economic feasibility and focus on solving the most pressing problems of law enforcement;

fifthly, technological sovereignty, ensuring the necessary level of independence of law enforcement agencies in the field of artificial intelligence technologies;

sixthly, interdepartmental and international interaction with executive authorities, local governments, the scientific community, and other interested parties.

seventh, the inadmissibility of monopolization of activities in the field of artificial intelligence.

What are *the modern and promising artificial intelligence technologies in law enforcement that can be used in law enforcement?* We are talking about the following technologies:

data mining, including forecasting the development of the operational and investigative situation in criminal cases, as well as the operational situation (crime rate, social tension, social rating);

the use of artificial intelligence to plan law enforcement activities and support management decision-making in law enforcement agencies;

computer vision (object recognition), biometric identification by photo and video, as well as a digital portrait;

automation of routine (repetitive) production operations, including individual software robots-assistants customized for specific use;

speech recognition and synthesis, including voice assistants;

implementation of accounting and registration actions;

control technologies for robots and robotic complexes;

automated systems that allow real-time authentication of subjects of access to computer information by keyboard handwriting;

technologies for analyzing heterogeneous information in order to preventively

identify signs indicating a possible increase in crime, social tension, signs of the onset of riots, extremist actions, acts of vandalism;

integrated solutions that ensure the transition from paper workflow to electronic, supported by automated workstations of law enforcement officers;

automated processing of applications and reports about crimes, administrative offenses, incidents with the preparation of draft instructions for their resolution;

artificial intelligence technologies for autonomous robots and robotic systems that provide solutions to law enforcement tasks, including inspection of the scene of an incident, patrolling, inspection of dangerous objects (for example, with the potential presence of explosives, poisonous and other substances);

artificial intelligence technologies for unmanned aerial vehicles intended for patrolling the territory, detecting crimes and administrative offenses by preliminary legal assessment of the actions of persons, fixing relevant events to form an evidence base, transferring information to interested law enforcement entities;

support systems for planning and making managerial decisions, including for determining the best options for conducting investigative actions and operational-search activities;

support systems for the development and further verification of investigative and operational-search versions in the detection and investigation of crimes;

systems for non-contact, remote recognition and evaluation of the psycho-emotional state of an individual, groups of persons in the process of questioning and observation (non-contact polygraph), including during operational-search activities and investigative actions;

analysis of existing and developing regulatory legal acts for the presence of conflicts and development of proposals for improving the regulatory framework;

analytical systems, including the search and acquisition of data to predict future criminal events;

complex automation of the procedure for examining the scene and preparing procedural documents using 3D scanning technologies and mathematical modeling;

risk assessment and forecasting of threats from organized criminal groups in the field of information technology, digitalization of the economy;

modeling of crime events (forensic diagnostics) based on its traces (forensic identification), including incomplete data, by analyzing big data, information from the array of criminal cases in order to put forward and verify investigative and operational-search versions and determine the algorithms for the actions of the investigator and the detective;

identifying signs of seriality;

increasing the efficiency of handwriting and habitoscopy studies;

conducting forensic tomography or virtual autopsy without physical autopsy;

building virtual models of crime scenes and their physical modeling based on 3D printing technology 3D visualization;

recognition of illegal actions during financial transactions, conclusion of economic and other contracts; recognition of signs of crimes, as well as suspicious and abnormal behavior of legal entities and individuals in the field of finance, trading and investment; recognition of transactions and transactions that have signs of money laundering, obtained by criminal means, financing of extremism and terrorism, as well as operations in illegal markets;

biometric systems that allow real-time identification of citizens by fingerprints and palm prints, venous pattern of hands, images of faces and irises, tattoos, scars, voice; recognize persons suspected (accused) of committing crimes, detect suspicious, deviant (untypical) behavior, determine individual phenotypic (that is, obvious, observable and measurable) signs of a person based on the analysis of biological material seized from crime scenes;

systems for detecting deviant (untypical) and asocial behavior of people, including in crowded places, systems for remotely determining the psycho-emotional state of people, non-contact polygraph devices.

What are the *areas of application* of *artificial intelligence technologies in law enforcement*? The areas of application of artificial intelligence technologies in law enforcement are:

firstly, *the protection of public order and ensuring public safety* (including the suppression, preventive measures, prevention of crimes and administrative offenses);

secondly, *the detection, suppression, disclosure and investigation of crimes* (including operational-search, forensic activities and procedural activities – inquiry and preliminary investigation);

thirdly, *the provision of public services;*

fourthly, *the provision of law enforcement activities* (scientific, pedagogical, personnel, information, financial, logistical support and other types of support).

*The mechanism for implementing the concept* should include, *firstly*, scientific and methodological support for artificial intelligence technologies in law enforcement; *secondly*, training and retraining of law enforcement personnel; *thirdly*, maintaining contacts with developers of artificial intelligence technologies, the possibility of prompt advisory assistance on the use of artificial intelligence technologies in law enforcement; *fourthly*, the readiness of law enforcement agencies to implement artificial intelligence technologies.

*The readiness of law enforcement agencies to implement artificial intelligence technologies*, from our point of view, should be assessed in three categories: *firstly*, technical readiness; *secondly*, the readiness of personnel; *thirdly*, readiness for organizational and staff changes.

*The criteria of the effectiveness* of the use of artificial intelligence technologies in law enforcement, from our point of view, should be, *firstly*, an improvement in the performance of operational activities, *secondly*, an increase in the productivity of law enforcement authorities.

What are *the problems and risks* of using artificial intelligence technologies in law enforcement and what are *the ways to solve them*?

The main problems of using artificial intelligence for law enforcement purposes include the following:

*firstly,* the lack of legal personality of artificial intelligence and the corresponding status of decisions made on the basis of artificial intelligence technologies;

*secondly,* the lack of guarantees that the decisions made by artificial intelligence comply with legal and moral standards (ethical standards);

*thirdly,* the impossibility of an unambiguous interpretation of decisions generated by artificial intelligence, in other words, the low reliability of decisions generated by artificial intelligence systems and the impossibility in some cases of a complete justification of such decisions, and as a result, the lack of confidence in such decisions;

*fourthly,* the need to organize the training of artificial intelligence systems with the involvement of the most qualified specialists in the relevant subject area, while, as a rule, it is necessary to use a sufficiently large array of initial data and "training" tasks; the inability to fully comply with the requirements for the protection of personal data when they are used to train artificial intelligence systems; the way to solve this problem may lie in the development of artificial intelligence training systems based on computer models that do not require the involvement of "qualified specialists".

At the same time, we see the main way to eliminate these problems, first of all and mainly *in the legal regulation* of artificial intelligence technologies, for which we propose to develop and adopt:

firstly, regulatory legal acts regulating the use of artificial intelligence in the main areas of law enforcement in the relevant law enforcement agencies;

secondly, administrative regulations (including the use of the results of the work of artificial intelligence for making procedural and managerial decisions; organizing training for artificial intelligence systems);

thirdly, departmental standards, which should resolve issues of unification of concepts and terms, security and transparency of artificial intelligence technologies.

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在设计和研究活动的条件下开发技术大学学生的智力潜力
# DEVELOPMENT OF THE INTELLECTUAL POTENTIAL OF STUDENTS OF THE TECHNOLOGICAL UNIVERSITY IN THE CONDITIONS OF DESIGN AND RESEARCH ACTIVITIES

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抽象的。 本文介绍了 KNRTU 附加专业教育系统中基于项目的学习的经验，与组织研究活动的创新方法、旨在培养有竞争力的专家的一套专门的方法、工具和形式的实施有关。

关键词：项目式学习，智力潜力，技术大学，附加专业教育，技术领导学校

*Abstract. The article presents the experience of project-based learning in the system of additional professional education KNRTU, associated with innovative methods of organizing research activities, the implementation of a specialized set of methods, tools and forms aimed at training a competitive specialist.*

*Keywords: project-based learning, intellectual potential, technological university, additional professional education, Technoleader school*

Currently, the problem of implementing innovative forms of education in an engineering university and developing the most productive educational models is being updated in order to create conditions for identifying and developing talents and professional growth of scientific, engineering and entrepreneurial personnel, obtaining new knowledge through the development and support of fundamental research, formation effective communication system in the field of science, technology and innovation.

Analysis of the research of scientists (N.P. Lyubetsky, I.N. Emelyanova, Yu.V. Pushkarev, G.N. Artamonov, etc.) allows us to determine the intellectual potential of a student's personality as a complex characteristic of a certain level of development of its intellectual, professional and creative capabilities ; as a dynamic, open system that changes under the influence of internal and external factors and contributes to the creation of innovations.

From these positions, the intellectual potential turns out to be embedded in a person as a hidden opportunity that needs to be formed in the direction necessary

for society for further development and improvement.

In order to develop the intellectual potential of talented youth, prepare them for successful work in innovative and inventive fields, KNRTU implements a program of additional professional education at the Technoleader school, focused on an applied approach to learning.

The Technoleader School is a multi-level educational complex educational infrastructure of KNRTU, aimed at mastering knowledge in terms of various levels of practical and theoretical training of the most gifted students, combining teaching, learning and research.

Involvement of leading teachers in the educational process of the school with author's teaching methods connects the educational and creative process of cognition into a single educational space that forms the creativity of thinking, the ability to act in online technologies, the ability of students to demonstrate a high level of knowledge in various engineering fields.

Approbation of the scientific results of students is carried out at various sites, competitions, seminars, which makes it possible to identify the most talented students focused on a qualitative result.

An important task of the school is interaction with representatives of manufacturing companies, the implementation of internship programs designed to improve the level of knowledge and skills of students.

The result of the training is the ability of gifted students to present the results of innovative educational practices in the context of engineering invention.

The key attention at the school is given to project-based learning, which makes it possible to synthesize knowledge from different areas with the allocation of key specialization. When developing team and individual projects according to the profile of training, the formation of innovative engineering thinking in a student, aimed at implementing technical and scientific developments, developing soft skills and hard skills competencies, comes to the fore.

An important direction in the development of the intellectual potential of students in the course of project-based learning at the Technoleader school is the implementation of the STEM approach, where the study of subject areas takes place using interdisciplinary learning based on problematic tasks, the integration of tasks by modules, and the creative application of universal learning activities. The development of intellectual potential takes place in the conditions of the formation of the ability to generate new ideas, the ability to draw analogies, and solve problem-creative tasks. As a result, the interest and motivation of students for learning increases, a new research position is formed, aimed at expanding the external capabilities of students.

In the course of working on projects, program participants get acquainted with priority areas for the development of science, technology and technology, become

students of additional modules aimed at developing students' business thinking, economic knowledge, IT skills, knowledge of a foreign language in the field of professional communication; improve communicative and personal qualities during training sessions. The learning itself is built on the basis of a problem-oriented learning activity that combines scientific principles, technology and design.

The development of design and research competencies of students is facilitated by the integrity of the system of engineering and technical training. The research and innovation activities of the program participants are based on the ability of students to determine the strategic goals and objectives of project products, analyze their results, predict and evaluate the consequences of their decisions.

Project thinking of an individual in the conditions of development of intellectual potential contains the ability to correctly set goals and objectives, choose tools to achieve them, anticipate and predict the results of one's work.

The foregoing allows us to conclude that participation in educational design and research work in the context of the development of intellectual potential should be subject to the following tasks:

- a clear focus on modern engineering, digital technologies in terms of improving the quality characteristics of the project, its properties and purpose;

- integration of knowledge from various fields of science, engineering, technology, creativity, economics, production, management processes;

- implementation of the results of projects and their practical application based on the systematization of the basic foundations of engineering and design;

- study of the problems of project activities, taking into account their leading nature, the methodology of the experiment, search information activities, laboratory work, the study of theoretical and practical material.

Intellectual potential is a form of development of intellectual activity, subject to the creation of an innovative platform that forms the desire of a student with a high score to develop his knowledge. In this regard, in the conditions of the Technoleader school, an annual program of events is implemented, within the framework of which networking is held with students, participation in hackathons, trainings and case studies is organized, meetings are held with leading professors and experts from KNRTU and foreign universities, excursions to industrial enterprises are organized.

The conducted research allows us to conclude that the supervising function of an engineering university in the development of the intellectual potential of students is associated with innovative methods for organizing design and research activities, the implementation of a specialized set of methods, tools and forms aimed at preparing a competitive specialist. Additional educational programs provide the opportunity to build individual educational trajectories for each student, implement a fundamentally new educational model aimed at identifying the sci-

entific and creative potential of students, competent methodological support and accompanying students in their independent educational and cognitive activities.

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通用能力的发展：分析企业与大学之间的互动
# DEVELOPMENT OF UNIVERSAL COMPETENCIES: ANALYSIS OF INTERACTION BETWEEN CORPORATIONS AND UNIVERSITIES

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抽象的。文章致力于普遍能力形成的动态发展方向，它决定了高等教育机构与雇主互动的战略眼光和策略。新十年（2030 年被认为是最接近的基准）评估年轻专家能力的方法是通过整合国有企业和企业的模式来考虑的，同时考虑到区域发展的特殊性。评估能力的完整系统的形成应与开发方法论方法的发展同时进行，同时考虑到效率的要求。基于对大学和主要雇主的职位的分析和系统化，包括企业大学、公共当局的代表以及旨在建立一个发展领导潜力的系统的公共组织，一个系统的模型提出了普遍能力的形成。
关键词：领导力，能力，人才培养，人事管理，青年政策

*Abstract. The article is devoted to the dynamically developing direction of the formation of universal competencies, which determines the strategic vision and tactics of interaction between higher educational institutions and employers. Approaches to assessing the competencies of young specialists in the new decade (2030 is considered as the nearest benchmark) are considered through the integration of models of state corporations and businesses, taking into account the peculiarities of regional development. The formation of an integral system for assessing competencies should go hand in hand with the development of methodological approaches to their development, taking into account the requirements of efficiency. Based on the analysis and systematization of the positions of not only universities and key employers, including corporate universities, representatives of public authorities, as well as public organizations whose activities are aimed at building a system for developing leadership potential, a model of a system for the formation of universal competencies is proposed.*

*Keywords: leadership, competencies, personnel training, personnel management, youth policy*

The specificity of projective planning and management is currently manifested in the field of personnel training with a special breadth. The state initiated an ac-

tive review of youth policy, how it is implemented in universities (in particular, we are talking about the development and implementation of new models of university career centers), as well as the emergence of new projects in the field of assessment and development of universal managerial competencies. This should contribute to the growth of the efficiency of the process of advanced personnel development and prompt response to the needs of the labor market. The study of the results obtained in the implementation of a wide range of activities over the past decade makes us return to the assessment and management of the results of the formation of graduate students' competencies, taking into account the characteristics of the labor market in the context of a balance of interests of all stakeholders, not only from the standpoint of the formation and adjustment of the strategy, but also the achievement effectiveness.

There is a wide range of research on what an employer expects from a university graduate, and the demand of employers is directed to young personnel, from the training and education of future specialists, to managers and leaders of the knowledge economy.

The experience of the largest employers in terms of the profile of competencies and their demand was analyzed on the basis of the corporations Russian Railways, Rosatom, Sberbank, etc. [1-3]. Their choice was determined by the scale of HR brand development programs, the volume of events held, as well as integration with state competency development programs. Despite the obvious specifics of companies when working with personnel, it is possible to distinguish the following common features.

In the past few years, employers have become more open to the labor market, this is due to a sharp change in the profile of activity, when various high-tech areas, projects and tasks arise that radically change the fundamental processes in companies, both within the companies themselves and in terms of interaction with customers and contractors (for example, quantum communications, digitalization, unmanned train driving for Russian Railways). This generates demand from employers for employees with new competencies, which also leads to the actualization of the processes of interaction with educational institutions and partners. A significant number of professions in companies, including new ones, are a certain challenge for HR departments in terms of staffing and closing staffing needs.

A study by the Russian company HeadHunter, conducted for 2021 [4] based on vacancies offered for young professionals, demonstrates a certain feature of the requirements of employers, which consists in the almost complete absence of requirements for Hard Skills, and the first three places are occupied by such requirements as teamwork, competent communication and speech, as well as computer skills. At the same time, the largest high-tech employers demonstrate the stability of the requirements for hard and soft skills in terms of maintaining their balance:

the basic requirements are based on professional skills, and personal characteristics are considered as advantages through which employees are selected for higher positions.

Each company has developed its own competency models, profiles, the most relevant is, firstly, the ability to work in conditions of uncertainty and a turbulent world, limited resources, when it is necessary to solve problems that the company has not encountered before. Secondly, it is the ability to think systematically, to have critical thinking and pragmatism, which is associated with a large amount of information and the need to critically identify and comprehend factors in order to make the right decision. Thirdly, we are talking about the ability to analyze, creative thinking and the ability to offer something new, which is important when launching projects that have the characteristics of efficiency, novelty and originality. Fourthly, it is the experience of mistakes, the ability to live through your mistakes and failures, draw conclusions and become stronger. Such a set of competencies is usually called the "four Cs", the skills of a new generation - creativity, critical thinking, cooperation and communication.

Until recently, higher education institutions were not disposed to letting their internal processes of employers into the educational process (and often a model was implemented in which an educational organization trained specialists without taking into account the requirements of employers, and they, in turn, had to finish training specialists). Gradually, the two systems - the labor market and the education system - became interpenetrating (for example, the state corporation Russian Railways built a network of railway universities; Sberbank has a network of partner universities and universities of key interaction). This integration of companies with the education system has its own characteristics and requires special attention (employers are characterized by the position that universities do not prepare in the right way, that the output is not the specialist that the employer needed; in turn, higher education institutions claim that employers incorrectly formulate requests, give instructions on the topic of which specialist should be trained).

The complexity and inconsistency of the positions of the main players leads to the need to find solutions, working tools for building collaborations. In particular, the example of the largest employer company in the Russian Federation, the state corporation Russian Railways, is illustrative in building a network of educational institutions. So at the beginning of 2020, a program was developed and approved at the level of the sectoral Ministry of Transport with specific measures in nine areas: the program includes almost the entire range of interaction, starting with educational programs (the company accepts all educational programs) and the logistics of higher educational institutions (the company Russian Railways has assumed obligations to equip university educational sites). The second component is the simulator (profile simulator laboratories have been opened, which

are equipped from the factory with real simulators, software solutions, etc.). It is important that company representatives participate in the life of educational institutions, attending lectures and master classes on a regular basis to student groups (the company assigned a high-ranking leader to each department, board members have a standard for the number of lectures). This is a kind of information feed for both students and teachers in terms of getting to know new information technologies and changes in the life of the company. Also, an effective tool is to conduct hackathons and quizzes with specific cases that are on the agenda directly in the company itself. Young scientists are supported through a wide range of various grants for the most promising scientific developments. Working with teachers involves visiting production sites, participating in the production process (within the established standard for the number of hours). A competency model for each profession and each direction was developed in the context of professional and managerial competencies, and then it was launched in educational institutions (teachers and vice-rectors are assessed competencies). Evaluation of the effectiveness of the program is associated with the results of students passing evaluation procedures after graduation - a testing system (currently, the requirements apply to the training of students of the target set), which allows you to form a digital profile of each department and the corresponding educational institution.

The above example of Russian Railways clearly demonstrates the process of educating future employees in accordance with the characteristics of the company's corporate culture. The advantages of this format were also appreciated by representatives of the IT industry, opening departments in higher educational institutions in order to immediately select the best personnel as well.

Features of work in the training of young professionals and academic cooperation are demonstrated by the leader of the financial sector - the company Sber. In particular, a list of 25 key educational institutions with which partnership is developing was determined (at the same time, the company has its own partner network - about 300 higher educational institutions are partners in various programs, from practice to joint laboratories, i.e. the depth of cooperation may be different). When developing a strategy for working with youth, the company proceeds from the position that modern youth will change about 15-20 professions, several cities, etc. during their lives. When attracting young people, it is important that they, in accordance with the cultural code of the organization, remain within the perimeter of the organization, growing within the company. At the same time, when recruiting, there are attempts to introduce a segment approach, taking into account various areas of activity, identifying what unites specialists (for example, Data Science, IT, cybersecurity). Also, representatives of the "first line" who participate in sales, support customers in call centers, etc. have specific unifying features. The company also singles out a separate segment of professionals, which include HR,

lawyers, etc. Within each segment, complex interaction mechanics and a complex selection of specialists arise. The company implements about 60 educational programs, which are distributed throughout the country from the Far East to the Baltic and the Black Sea coast, and this approach, according to the company, allows you to keep business in touch with the student audience, and not with educational institutions. The company uses its own educational portal to promote its programs as an interaction tool, and also holds a summer school for teachers, which allows the employer to be in dialogue with the academic environment. The creation of an alliance in the field of artificial intelligence [5] allows the company to carry out the processes of accreditation of educational programs (professional public accreditation). The company considers awareness (both in the choice of work and education) along with the ability to learn to be a key competency for future employees and students, which encourages educational institutions to think about the model of return on investment in education, packaging of an educational product, creating value in terms of educational programs. It should be mentioned that the company also implements the Career of the Future program through the portal, within which experts - representatives of SBERA talk about changing the set of professions, what modern professions are like under the influence of technology penetration. Focusing on the development of T-shaped specialists [6] is a promising direction for the company, with an emphasis on deep professional skills of employees and breadth of views for sustainable development in a changing world.

The experience of the state corporation Rosatom in many respects, as mentioned earlier, is similar to the examples above, with certain nuances, the mechanism of basic departments, equipped spaces and focus on the competence of specialists in a modified M-shaped model is used.

The companies decided to start working from the school bench, focusing on close work with the teaching community and with parents (Parents League, Parents' Meeting projects), thereby creating teacher-parent-child communities in the cities where the company operates. In general, and internal company research shows that the community is a very energy-intensive story. And the more people are involved in the communities around the company, the more aura of potential future employees can be formed. This makes it possible to immerse yourself in the corporate culture and see the organization from the inside.

As recent changes, we highlight the fact that for all large employers it becomes obvious that people within companies are migrating, and all the programs that companies do for their employees, they do not only for each other, but also for the region, for the country. An example of a value-oriented project that makes a significant contribution to the development of the regions is the Rosatom project "Academy Mayak" (Nizhny Novgorod) - an educational and cultural center that implements youth work programs, as well as for the business community. This is

a kind of missionary position of the company, and in this sense the cycle of value formation is inevitable: the mission, when employers realize that they are raising personnel not for themselves, but for the country as a whole, allows the formation of a new class of managers and scientists, and this is a completely different level of development competencies and awareness.

Summing up, we can say that the systematic work of corporations with universities should become a significant area, because after school, some kind of socialization takes place in them, young people grow up, they develop competencies that will be useful to them later in life. These competencies, in the Federal State Educational Standards called universal competencies, variously called at the company level (both corporate basic, universal, or over-professional, managerial, soft skills, etc.), are complex in their formation and, moreover, adjustment.

The Russia - Land of Opportunities project has launched a process for assessing managerial supraprofessional competencies at universities, which is not a competition. This is a mass assessment for the development of universal competencies at universities for their subsequent development. Based on the results of the year of work, a slightly sad picture was formed: a basic set of competencies was rated, 800 employers were surveyed, all major employers participated in the survey. We selected 11 core competencies and assessed 120,000 students studying at 50 universities. Unfortunately, there was no longitudinal study, it was not possible to assess the change in competencies over time, from the first to the fourth year. Nevertheless, the assessment was carried out with systemic psychometric tools that allow you to scan a person's profile quite deeply. It was found that competencies fall from the first to the fourth year: only two competencies grow - information analysis and decision making, these competencies are formed due to the fact that people learn. And competence - following rules and procedures - is growing. And those competencies that are responsible for creativity, thinking, strategizing and achieving results have an inverse correlation with the competency of following rules and procedures. The more students are immersed in a certain framework of rigid educational programs, the less able to develop students get as a result. This is the key problem of the education system, which emerged during the year, which was brought to the attention of the rectors' community.

Therefore, the key task is to create competency centers in order not only to evaluate and develop them, but to give every young person an understanding that after leaving the university a student is in demand. The biggest problem for young people is that by the fourth year they lose faith in themselves and faith in the future (this is part of the stress tolerance scales). And this can be raised if employers are really interested in coming to universities.

Another aspect of the development of cross-professional competencies is the development of entrepreneurship, especially technological entrepreneurship: al-

most 40% of young people at universities want to start their own business (an example of a program is the work of Sberbank with Novosibirsk State Economic University to develop mechanisms to support young entrepreneurs who have their own set of competencies).

The university and employers have always faced various ideological tasks. And as practice shows, professional competencies undoubtedly need to be developed, everything is based on them and the employee himself grows, but they are quite easy to build up, get, it just takes time. As for cross-professional competencies, they are very difficult to change, especially in what is called communication skills, information analysis, but it is they that allow you to integrate into new directions, grow and develop, and career centers as a single entry point and the transformation of university tasks are not easy to teach and train to employer standards are important indicators of ongoing change. Regional specifics in terms of interaction between companies and the public sector should also be directly aimed at building an image of the future, taking into account the peculiarities of the resource base of the region, the level of economic diversification, the degree of development of the knowledge economy, the orientation of educational institutions, etc.

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低龄智力障碍学生教育动机形成问题研究
# THE PROBLEM OF STUDYING THE FORMATION OF EDUCATIONAL MOTIVATION IN YOUNGER STUDENTS WITH MENTAL RETARDATION

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抽象的。 这篇文章证实了研究精神发育迟滞年轻学生学习动机的相关性，以及开发诊断工具的必要性。 描述了研究学校动机结构中主要动机的改编和修改方法，并介绍了这些方法的刺激材料。
关键词：教育动机，智力低下的学龄儿童，教育动机的诊断，智力迟钝的学龄儿童的适应方法。

*Abstract. The article substantiates the relevance of studying learning motivation in younger students with mental retardation, the need to develop diagnostic tools. Adapted and modified methods for studying the predominant motive in the structure of school motivation are described, and stimulus material for the methods is presented.*

*Keywords: Educational motivation, younger schoolchildren with mental retardation, diagnostics of educational motivation, adapted methods for younger schoolchildren with mental retardation.*

The complexity and multidimensional nature of the problem of motivation determines the plurality of approaches to understanding its essence, nature, structure, and functions of motives as structural units of the motivation system.

Motivation determines the success and outcome of activities, including educational ones, because only if there is a motive for the activity being implemented, the individual makes the necessary efforts to achieve the goal.

The problem of educational motivation becomes especially relevant when studying children with mental retardation due to the fact that the existing defect in mental development negatively affects the formation of the motivational sphere in children of this category as a whole. Research by psychologists points to the immaturity of the motivational sphere of students with mental retardation, their weak

cognitive activity, the underdeveloped severity and short duration of motives for activity, the limited and unstable nature of its motives, and the insufficient formation of social needs. The underdevelopment of the motivational sphere in students with mental retardation leads to low results in mastering the curriculum and low school performance.

In addition, timely identification of the features of the development of motivation for educational activities of students with intellectual disabilities is necessary for a deeper understanding of the psychology of children in this category and for improving the methods of diagnosis, training and education, and the implementation of a full-fledged correction.

Features of learning motivation in schoolchildren with mild mental retardation are highlighted in the works of N.G. Morozova, Zh.I. Namazbayeva, V.G. Petrova, B.I. Pinsky, S.Ya. Rubinstein, O.N. Tolstikova, I.P. Ushakova and others. The issues of formation of motivation for educational activity of mentally retarded children in the learning process were studied by V.V. Voronkova, S.V. Kudrina, N.N. Kuzmina et al.

The purpose of this article is to describe adapted diagnostic methods for diagnosing learning motivation in younger students with severe multiple disabilities, including moderate mental retardation (MCDD).

An analysis of the scientific and methodological literature shows that today there are insufficiently developed methods for diagnosing educational motivation in students with mental retardation, corresponding to the level of their intellectual, cognitive development. In this regard, it is necessary to develop a methodology for diagnosing educational motivation in this category of students.

The diagnostic complex was developed to identify the level of formation of educational motivation in children with MCDD of primary school age. The diagnostic complex will be tested on children with MCDD, in the defect structure of which there are such disorders as moderate mental retardation; SNR of moderate degree, indicating the absence or mild severity of behavioral disorders associated with chromosomal disorders (Down's Syndrome); moderate mental retardation, with significant behavioral disorders; SAD moderate, atypical autism with mental retardation. Concomitant syndrome of the final diagnosis: 1408; Childhood autism due to other causes. MAIN SYNDROME: 1507, Dissociated mental retardation, comorbid syndrome: 1406.

The need to develop adapted methods for children of this empirical group is due to the fact that existing methods are inaccessible for children of this category to understand, instructions and stimulus material are too complex and their application cannot give reliable results.

The choice of diagnostic methods was carried out based on the positions of such authors as N.G. Morozova, B.I. Pinsky, V.G. Petrova, M. Rutkowski, I.M.

Solovyov, I.P. Ushakova and others. We admitted the possibility of including the following diagnostic methods in the diagnostic complex: the "Study of educational motivation" method (modified version of M.R. Ginzburg); methodology "Choose what is interesting" (modification of the methodology "Choose a place") (school and game motivation); technique "Color what you like" (game, educational motivation), observation map.

The methods chosen as the basis were modified and adapted to the capabilities of younger students with mental retardation.

The adaptation consisted in simplifying the stimulus, visual material, instructions and assessment system. Let's take a look at these methods in more detail.

***Methodology "Study of educational motivation" (modified version of M.R. Ginzburg).***

The modification of the methodology consists in selecting color pictures that are simple and understandable for perception to work with students with mental retardation. The verbal instruction was also simplified in order to avoid misunderstanding by students with mental retardation of complex instructions and loss of interest in the task.



To evaluate the results, a scoring system and criteria for a qualitative assessment of the formation of the leading motive for attending school by students with mental retardation were developed.

*External* - the child does not show his own desire to go to school, he attends school only under duress.

*Training* - the child likes to study, likes to go to school.

*Game* - at school, the child only likes to play, walk, communicate with children.

*Positional* - a child goes to school not in order to master learning activities, but

in order to feel like an adult, to raise his status in the eyes of children and adults.

*Social* - a child goes to school not to be educated, to learn something new, but because he knows that he needs to study in order to get a profession in the future, - that's what parents say.

*Mark* - the child goes to school to earn stars/fives, for which parents and the teacher praise.

The scores of the selected pictures are summed up and on their basis, the levels of motivation are revealed according to the evaluation table.

***Method "Choose what is interesting" (Modification of the method "Choose a place").*** This technique involves the individual diagnosis of a student with mental retardation and involves working with cards, as in the previous technique. Younger students with mental retardation are invited to choose from the proposed pictures those that are most interesting and which depict what the child would like to do at a given time. Based on the selected picture, a conversation is built, during which a conclusion is made about the predominant motive for attending school in a student with mental retardation.

The modification of the methodology consists in the fact that the stimulus material for the methodology is combined into thematic groups: school and out-of-school situations (6 cards for each category) and cards with school supplies and toys (9 cards each).



A system of quantitative and qualitative assessment of the formation of school motivation in students with mental retardation based on the results obtained has been developed. The child's choice of a school or out-of-school situation is fixed. Depending on the type of prevailing cards, a conclusion is made about the predominance of school or game motivation in a child.

*Sufficient level of motivation (7-10 points)* – school motivation was formed, the child chose cards depicting school situations and school supplies.

*Average level of motivation (3-7 points)* – the child has formed school and play motivations for attending school, because the child mainly chose school situations and school supplies, however, game situations and cards with the image of toys were chosen. The child justifies his choice by the fact that the pictures show a change and the children play with the toys they brought with them.

*Low level of motivation (2-3 points)* – game motivation prevails, the child chooses only cards with game situations and with the image of toys.

**Method "Color what you like".** The essence of the technique is that the child is invited to color a picture from ready-made options (an image of school and game situations, toys and school supplies). Based on the picture chosen by a child with mental retardation, a conclusion is made about the predominant motive for attending school.
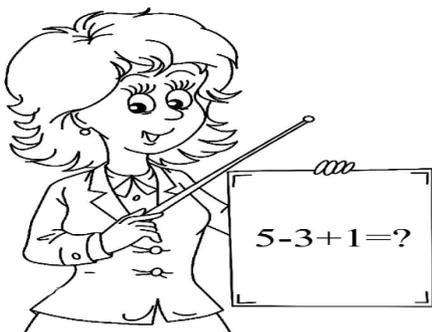


Grading system according to this method.

*Low level (2-3 points)* – game situation (swings in the school yard, playroom, toys). They are characteristic of children with a positive attitude towards school, but with a predominance of game motivation.

*Intermediate level (3-7 points)* – non-educational situations (school building, students at recess). They testify to the high school motivation and educational activity of the child, the presence of cognitive educational interests.

*Sufficient level (7-10 points)* – learning situation (teacher with a pointer, students at their desks, school supplies). They testify to the high school motivation and educational activity of the child, the presence of cognitive educational interests.

**Methodology "Determining the forced internal position of a schoolchild among older preschoolers" (Ilyina, 2007).** This technique is a simplified and adapted version of Ilyina's technique, because the author's version of the methodology is intended for preschool children and contains questions about kindergarten. As a basis, we took questions related to schooling and adapted for students

with mental retardation. The questions have been simplified in order to ensure understanding of the meaning of the questions, complex questions have been divided into several simple ones while maintaining the meaning.

Younger students with MCDD will be asked the following questions::

1. Do you like going to school?

2. Would you like to go back to kindergarten or not go to school?

3. What do you like to do at school?

4. Do you like to read?

5 Do you like to read books by yourself or listen when adults read?

6. What do you like most about school?

7. Do you like school uniforms and school supplies?

8. Imagine that you were allowed to wear a school uniform and use school supplies at home. They were allowed not to go to school. Do you agree with this? Why?

9. Imagine that we are playing school with you. What will you be: student or teacher?

10. Imagine that we are playing school with you. What will be longer for us - a lesson or a break?

A scoring system was developed to evaluate the results.

On the basis of a quantitative assessment, the levels of school motivation in younger students with mental retardation were identified:

*Sufficient level of motivation (14-20 points)* – the child has formed educational motivation, the school attracts the child with educational activities, school supplies and school uniforms are also attractive to the child. The child attends school at will, not under duress.

*Average level of motivation (7-13 points)* – the child has school motivation, but the game one prevails. The school attracts the child not by the educational side, but social and play motives prevail, that is, the child attends school to play, and not to gain knowledge.

*Average level of motivation (7-13 points)* – the child has not formed school motivation, game motivation prevails. The child does not like to go to school, he is not attracted to the educational process, school supplies and school uniforms. It is characterized by activities characteristic of younger children. School attendance is not voluntary.

The observation map is an assessment of the formation of school motivation in students with mental retardation according to the following criteria:

– the prevailing emotional state at school: depressed, elevated;

– arbitrariness of attention in the classroom: distracted in the classroom by extraneous stimuli, knows how to keep attention on the topic of the lesson;

– independence in educational activities: does not know how to independently

solve educational problems; independently solves educational problems, shows interest in them, organizes his own activities;

– the ability to follow the teacher's instructions in the classroom: does not know how to follow the instructions, forgets the teacher's requirements in the very first minutes; follows the instructions and knows how to keep it until the end of the task;

– participation in learning activities in the classroom: does not know how to join in a joint discussion of the topic of the lesson; actively participates in the lessons;

– attitude to assessments: indifferent attitude to assessments; good grades motivate for activity, bad grades cause negative reactions, lower mood;

– preparation for lessons: he does not know how to prepare his workplace for the lesson on his own, does not get the necessary school supplies, textbooks, notebooks out of his backpack; independently prepares his workplace for the lesson, correctly takes out all the accessories necessary for the lesson.

Thus, the insufficient level of the methodological arsenal for studying the nature of educational motivation in younger students with mental retardation necessitated the adaptation and modification of known methods necessary for diagnosing the predominant motive in the structure of school motivation of students with intellectual disabilities. The methods proposed by us can be used by teachers-defectologists, educational psychologists working with children with mental retardation of varying severity, for the timely identification and correction of the leading motive in the structure of school motivation and to increase the level of formation of educational motivation.

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多次卧推的训练方法
# TRAINING METHODS FOR THE MULTI-REP BENCH PRESS

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抽象的。 文章介绍了作者在多次重复卧推中训练方法的主要规定。 它还提供了有关在经典卧推（力量举卧推）训练的现有训练背景下，在多重复"卧推"学科"民间推举"中展示提高性能的准备过程的组织数据。
关键词：多次重复卧推，民间推举，俄罗斯卧推，训练方法，训练计划。

*Abstract. The article describes the main provisions of the author's training methodology in the multi-repetitive bench press. It also provides data regarding the organization of the process of preparing for demonstrating increased performance in the multi-repetition "bench press" discipline "folk press", against the background of training existing for training in the classic press (bench press in powerlifting).*

*Keywords: multi-repetitive bench press, folk press, Russian bench press, training methodology, training program.*

### Sate of the problem

The relevance of the problem under study is dictated by the steadily increasing popularity of the multi-repetition bench press, which is accompanied by an increase in the number of competitions of various levels. However, the number of materials published in official publications on the organization of training for both beginners and already experienced athletes in a particular "bench" specialization is still not enough. In addition, to date, there are still no clearly formulated general approaches to the construction of the training process, following which could ensure the achievement of high results in this competitive discipline.

Currently, in the presence of a large number of alternative federations similar to powerlifting federations ("alternative" are federations that are not accredited by the relevant territorial executive authority, and the latter has the right to accredit only one regional sports federation for each sport on its territory), there is a large

distribution and, as a result, those who cultivate the multi-rep bench press, namely the two existing varieties of it: the folk press and the Russian bench press, have gained popularity. The federation of the last of them, as an interregional public organization, was created in Russia only in 2008, after which the active popularization of this discipline began. The discipline "People's Bench Press WPC" was developed as a division of the WPC federation (WPC is the most powerful alternative sports organization for powerlifting - World Powerlifting Congress (World Powerlifting Congress). The branch of the WPC in Russia is the Powerlifting Organization AWPC/WPC Russia) [5]. In the International Powerlifting Federation IPF (International Powerlifting Federation) and in its representative office in Russia, which is the FPR (Powerlifting Federation of Russia), there is no multi-rep bench press in any of its manifestations as a separate competitive discipline.

Nevertheless, alternative federations regularly hold competitions in the national and Russian bench press and are guided by the rules for performing these disciplines, which do not differ significantly from each other. The essence of the multi-repetitive bench press, carried out in accordance with the rules of any such federation, is to "shake" the established weight the maximum number of times in one approach, in compliance with all technical rules and commands of the judges on the platform. By its effect on the body, this exercise makes high demands on the possession of a high level of development of special strength endurance [3]. The outward similarity of the multi-repetitive bench press with one of the basic exercises of power triathlon does not mean at all that the training methods in these disciplines are similar. In powerlifting, the main criterion is the magnitude of the developed effort. In multi-rep presses, the ability to produce the maximum amount of work in the time allotted for the set (i.e., power) [6].

At the same time, the "folk bench press" (FP) is a bench press, the weight of which is equal to the weight of the athlete's own body (or half of its own weight for females and younger age categories for male athletes), a multiple of 2.5 kg upwards of athlete's weight.

And the "Russian bench press" (RP) is a bench press, the weight of which is determined by the choice of the athlete himself from the proposed categories of bar weight: 35 kg (this bar weight category exists only for females and for younger age categories of males) and then there are such weight categories of the bar as 55, 75, 100, 125 and 150 kg. In a number of regions of Russia, there are even separate Russian Bench Federations (RBF), in which they practice many of their competitive disciplines with different options for performing and evaluating this exercise.

A distinctive feature of both the folk and Russian bench press is its mass character and accessibility: unlike the maximum weight press for one time, which requires certain basic training due to the specifics of the technique and high injury risk and the mandatory assistance of at least one insurer, try your hand at the multi-

rep press and almost anyone can evaluate the level of physical fitness, because a relatively small weight of the projectile without an obvious risk to health can be lifted a certain number of times, even without the help of a belayer, almost any healthy person. Also, in the folk press it is easy to compare the results: whoever was able to "shake" "his weight" more times is stronger, and with equal results in the number of times, the one whose weight is greater is considered stronger, and if the weight of the bar was the same for several athletes, the advantage is given to the athlete whose own weight is less.

In addition, this type of bench press can be useful for those who, for some reason (physiological limitations, medical contraindications, etc.) cannot "press" maximum and submaximal weights, but do not want to lose all skills in this movement or simply cannot part with his favorite exercise [4].

**The main content of the article**

This section of the article presents the main methodological provisions (formulated by the authors) aimed at ensuring (if they are accepted for use) an increase in performance in the indicated "pressure" competitive disciplines, as well as a description of a specific training methodology based primarily on many years of training experience and performances at the competitions of the first of the authors of this article.

Being far from the most outstanding and titled athlete, during his performances at competitions under the auspices of the AWPA/AWPC (Amateur World Powerlifting Alliance/Amateur World Powerlifting Congress) and NAP (National Powerlifting Association) federations, this author, guided by what is described below, was able to achieve such results that allowed him to become a multiple winner and winner of the championships and championships of the East of Russia, Russia, Asia, Eurasia, CIS, the Open National Cup, the Open Cups of Eurasia and the World in AWPA/AWPC and NAP national bench press and NAP Russian bench press. In addition, he fulfilled the standard of the master of sports of international class according to the AWPC and NAP versions in the folk press. His best results: bench press weighing 75 kg for 37 reps and bench press weighing 55 kg for 100 reps (own weight category up to 75 kg);

Summarizing the existing experience of training and performing in competitions in multi-repetition bench press, allows the authors of the article to present to the public the following five basic provisions of training, which can be useful for specialists and individuals independently involved in this discipline.

1. Initially, try to provide yourself with a good power base. If you want to perform well in the multi-rep press, you need to work the weight in the bench press in your standard strength training significantly higher than your own body weight. For example, if your body weight is 75kg, then for good results in a multi-rep bench press, you should confidently bench press at least 100kg for 6-8 reps in 3-4 sets.

2. Follow systemic consistency in training. For guaranteed progress in the multi-rep press, it is necessary to train it at least twice a week throughout the entire period of training.

3. Skillfully distribute the load during the approach. You should not overly part when doing bench presses, doing a large number of repetitions at once until complete muscle failure. It is necessary to break your approach into stages in such a way as not to "acidify" at the end of each of them, leaving strength for the next stage, and to allow the muscles to rest in a position when the barbell is on straightened arms or on the chest. In our case, in the folk press, it always looks like this: $20 + 5 + 3 + 2 + 1 + 1 + 1 + 1 + 1$ ... (performed 20 repeated presses, rested a little, holding the barbell on straightened arms or on the chest, then performed 5 bench presses and rested again, and so on according to the scheme to failure).

4. To a greater extent, master the skill of resting while holding the barbell on straightened arms, which is allowed by the official rules (unlimited number of times, but no more than 5 seconds per stop and within the allotted time for the exercise). One point is very important here: if for some reason your arms at the elbows do not fully extend, that is, the angle at the elbow does not reach 180 degrees and the elbow joint does not "insert" (the elbows are not "off"), then this technical you should not abuse the technique, because you will not only not be able to unload the working muscle groups of the hands, but also add a static load to them. However, it is worth noting that the ability to "turn off" the elbows in some cases can be developed by regularly methodically stretching the biceps of the shoulder (biceps). You will be lucky if by nature your elbow joints can "overextend" i.e. straighten more than 180 degrees: this will undoubtedly give you some advantage. In addition to the hands, it is necessary in this position to remove the load from the deltoid muscles, moving the hands slightly forward and up in relation to the body.

5. Use in the press "beating" from the chest. Techniques for bench press "on one" at the maximum weight of the barbell and multi-repetitive bench press are very different. In order to save strength, from the position of the barbell on straightened arms, the elbows "relax" somewhat, allowing the barbell, under its own weight, when accompanied by its hands, at first to somewhat deform the chest "flatten it", and play on its desire to take on its usual shape, which will allow the projectile to "spring " from the chest, after which, at the point of the trajectory, when the inertia of the bar begins to fade, it is "pressed" to the required fixation position. The rebound makes it easier to pass the initial phase of the upward movement of the bar [2]. Keep an eye on the position of the elbows, optimally between the shoulder and the body there should be an angle of about 45 degrees. Do not forget about the work of the legs (without touching the bench and its supports and without tearing them off the platform), the power impulse from the active interaction of the legs with the support is necessarily transferred to the hands.

Currently, there are several techniques for high-rep bench presses, including the reverse grip bench press technique (palms facing you). This is a completely separate bench press technique, which some athletes even call "another exercise". It is also worth noting that in most federations, the reverse grip is prohibited, so this technique is not considered in this article.

The strongest "multi-rep athletes" use interval technique, in which each individual repetition is performed with an interval of up to 5 seconds. As a rule, with this technique, the grip is somewhat narrower than with the classic bench press. It must be understood that with this technique, the likelihood of "acidification" of the muscles decreases, but due to the increase in time spent on the implementation of the approach, the static-dynamic load on the muscles and ligaments increases significantly. As a result, in the training of athletes using this technique, as a rule, there is a static training, in which a barbell equal to or slightly exceeding the weight used in the competition is held in the barbell position on straightened arms.

After listing the main author's provisions and considering the existing techniques for performing the "bench" exercise, we present a variant of the training program in the multi-repetition bench press. Whether you are training the multi-rep bench press in addition to the classic bench press, or you plan to train and prepare for the multi-rep bench press only, we recommend that you do this 2 times a week with an interval of 3-4 days between workouts (for example, Monday and Friday, Monday and Thursday, Tuesday and Friday, etc.). You can devote days free from bench training (1-2 per week) to training the muscle groups least involved in the bench press (back, legs), or arrange a circuit training or cardio training.

If you are training a multi-rep bench press in addition to the classic bench press, then it will be enough for each such workout after completing all the working sets of the classic bench press to perform 1-3 sets of the multi-repetitive bench press, depending on your level of training, training week and the effort expended on the classic bench press. As a rule, with this construction of the training process, no additional exercises are required in the current workout, since you will already receive a sufficient load on all the muscle groups involved in the bench press. At the same time, if you train exactly the folk press, then you need to vary the weight of the bar in the range from -10 kg from your own weight (d.m.) to +5 kg to your own weight. If your own weight is not a multiple of 2.5 kg, you must round it up to the nearest suitable value.

The training program in the folk press, here it will be just a small addition to the classic bench press training (the latter is described, for example, in sources 1, 2 and 3 of the bibliography), is designed for 12 weeks in accordance with our vision of the problem of achieving better results in this exercise and is shown in table 1.

*An example of the author's workout plan for folk bench press*

| Cycle | Week | 1-st workout | 2-nd workout |
|-------|------|--------------|--------------|
| 1 | 1 | 1) classic bench press<br>2) FP – (s.v.-10 kg) x max | 1) classic bench press<br>2) FP – s.v. x max |
|  | 2 | 1) classic bench press<br>2) FP – 2 x (s.v.-7.5 kg) x max | 1) classic bench press<br>2) FP – 2 x (s.v.+2.5 kg) x max |
|  | 3 | 1) classic bench press<br>2) FP – 2 x (s.v.-5 kg) x max | 1) classic bench press<br>2) FP – 2 x (s.v.+5 kg) x max |
| 2 | 4 | 1) classic bench press<br>2) FP – 2 x (s.v.-10 kg) x max | 1) classic bench press<br>2) FP – 2 x s.v. x max |
|  | 5 | 1) classic bench press<br>2) FP – 2 x (s.v.-7.5 kg) x max | 1) classic bench press<br>2) FP – 2 x (s.v.+2.5 kg) x max |
|  | 6 | 1) classic bench press<br>2) FP – 2 x (s.v.-5 kg) x max | 1) classic bench press<br>2) FP – 2 x (s.v.+5 kg) x max |
| 3 | 7 | 1) classic bench press<br>2) FP – 3 x (s.v.-10 kg) x max | 1) classic bench press<br>2) FP – 3 x s.v. x max |
|  | 8 | 1) classic bench press<br>2) FP – 3 x (s.v.-7.5 kg) x max | 1) classic bench press<br>2) FP – 3 x (s.v.+2.5 kg) x max |
|  | 9 | 1) classic bench press<br>2) FP – 3 x (s.v.– 5 kg) x max | 1) classic bench press<br>2) FP – 3 x (s.v.+5 kg) x max |
| 4 | 10 | 1) classic bench press<br>2) FP – 3 x (s.v.-10 kg) x max | 1) classic bench press<br>2) FP – 3 x s.v. x max |
|  | 11 | 1) classic bench press<br>2) FP – 3 x (s.v.-7.5 kg) x max | 1) classic bench press<br>2) FP – 3 x (s.v.+2.5 kg) x max |
|  | 12 | 1) classic bench press<br>2) FP – 2 x (s.v.-5 kg) x max | 1) classic bench press<br>2) FP – 1 x (s.v.+5 kg) x max |

When training the Russian bench press, it is enough to work with exactly the weight that you will order at the competition. It doesn't make much sense to vary the weight of the bar when training the Russian press, because in any case, its weight will always be significantly less than your own. In this article, under the Russian bench press, a barbell bench press of a weight much less than one's own is considered, since an equal or close to your own weight is the same folk press, and a much larger one is unlikely to be a multi-rep. Therefore, when referring to Table 1, it should be borne in mind that the classic bench press here means training the bench press with a weight significantly exceeding one's own, with exercises of any direction, whether it be working approaches with a small number of repetitions, "walking" or "auxiliary" exercises.

If within the same training you want to train both folk and Russian bench press,

then in this case, at the first training session, simply replace the folk press with a weight slightly less than your own, with the Russian bench press with the same number of approaches. The second workout, in which you will train the folk press with a weight equal to or slightly more than your own, leave it unchanged.

Standard preparation for competitions in the bench lasts, as a rule, 8-12 weeks, which is divided into several meso- or microcycles (depending on their duration). In the first week of training after the working sets of the classic bench press, in any case, you should not do more than one set in the multi-rep bench press, because, firstly, this exercise in itself is quite an energy-intensive exercise, and secondly, you have already spent enough strength for the first training session. weeks. For the next 2-5 weeks (depending on the total duration of training and your capabilities), you need to do 2 sets of multi-rep bench presses, and with each subsequent week you should strive to do more repetitions both in the first, most important approach, and in the sum of both relatively the previous week with the same load. The remaining weeks, up to the final workout, which must be completed a week before the competition, you must already do 3 sets of multi-repetitive bench press according to the same principle as described earlier. If you feel that it is necessary to unload the body a little and reduce the load before the competition, then it is allowed to do the final workout or do not 3, but 1-2 sets all week.

If you do not train the classic bench press or perform "heavy" dumbbell presses or bench presses in the Smith machine during training, but aim your training specifically at the multi-rep bench press, then this exercise becomes the first and only bench press in your workout and, as a result, appears the need to increase the tonnage of the workout by increasing the number of approaches. In this case, in the first week you will do 3 sets, the next 2-5 weeks 4 sets and the remaining weeks 5 sets in each workout. In the final workout or week, it is also allowed to reduce the training volume, but already to three approaches. Also, with this option for building the training process, after completing all the planned approaches of the multi-repetitive bench press, you can include 1-2 additional exercises for small muscle groups (deltoids, biceps and triceps of the shoulder) in the workout, but be careful: you should not "score to failure" muscles that have already received a sufficiently large load.

When performing training approaches of a multi-repetitive bench press, we do not recommend "giving all the best" to them at 100%, that is, until complete muscle failure. Once you feel like you can do just a few more reps and you're pretty good at it, you can end this set. Thus, you will work at 90-95% of your maximum and be able to perform a sufficiently large number of repetitions in all sets, otherwise you may only be enough for the first 1-3 sets and the productivity of the workout will be lost. "Giving all the best" at 100%, using all the resources of the body, is necessary only at competitions, when you need to do only one, the most important approach.

Adequate rest between sets is also very important. You should not approach the bar strictly every 3 or 5 minutes, when you have not yet had time to recover from the previous approach. The multi-repetition bench press is an exercise that primarily trains strength endurance, and implies a long stay under load, especially in the Russian bench press (from 1 minute to several tens of minutes), therefore, it takes more time to recover from such loads than after any others. Thus, if necessary, rest between sets of a multi-repetitive bench press can reach 10 minutes, but no more, you should not "cool down" and stretch the workout unnecessarily.

**Conclusion**

The described methodology for training a multi-repetitive bench press will be effective for athletes of an initial and intermediate level of training (estimated with competitive results in the national bench press up to 40 repetitions and in the Russian bench press up to 100 repetitions). For athletes of a higher level, this technique may not be effective enough in view of the fact that this category of athletes uses too large total tonnages and longer workouts in their training due to a very high number of repetitions in each of the approaches.

This training option was repeatedly tested, on the recommendation of the authors, in the practice of preparing a number of "bench pressers" (about 20 people) for competitions and proved to be effective. For example, before the development and application of this technique, one of the athletes had the following results shown at the competitions in the multi-repetitive bench press: national bench press in December 2018 - 25 repetitions of a 75 kg barbell bench press (1 adult AWPC category was completed), Russian bench press in April 2019 - 59 repetitions of a bench press weighing 55 kg in the weight category up to 82.5 kg (the standard of the master of sports of the NAP was fulfilled).

Having first started implementing the described methodology during training in the multi-repetitive bench press in September-December 2019, at the Russian bench press competition in November 2019, the athlete showed the result of 85 repetitions of the bench press with a weight of 55 kg in the weight category up to 82.5 kg (44.1% increase, the standard of the ELITE of the Russian bench press NAP was met), and in December of the same year, at the national bench press competition, they showed the result of 28 repetitions of the barbell bench press weighing 80 kg (an increase of 12.0%, the standard of the candidate for the master of sports AWPC was met ). Using the methodology described in the article, this athlete achieved the following results: Russian bench press in September 2020 - 100 repetitions of a 55 kg barbell bench press in a lighter weight category up to 75 kg (69.5% increase, an attempt to update the Russian NAP record), national bench press in December of the same year - 36 repetitions of a bench press weighing 75 kg (an increase of 44%, the standard of the master of sports of international class

AWPC was met) and in December 2021 - 37 repetitions of a bench press weighing 75 kg (an increase of 48%, the standard of the master of sports of international class NAP was fulfilled).

Visualize the dynamics of the growth of results in the multi-repetitive bench press for the specified athlete during the testing of the given methodology figures 1 and 2.
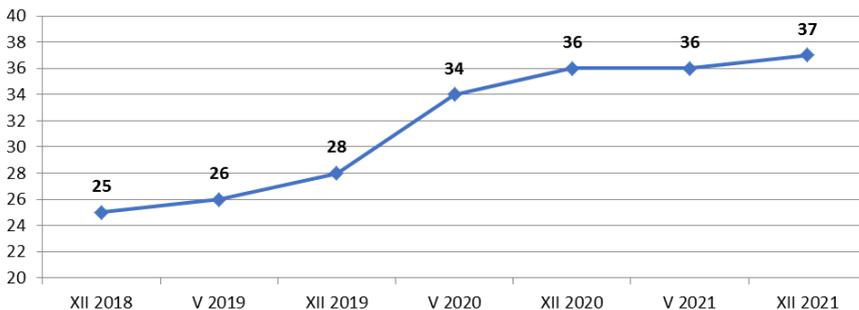


***Figure 1.*** *Growth of results (number of times) in the folk press (athlete A. Av - uh).*
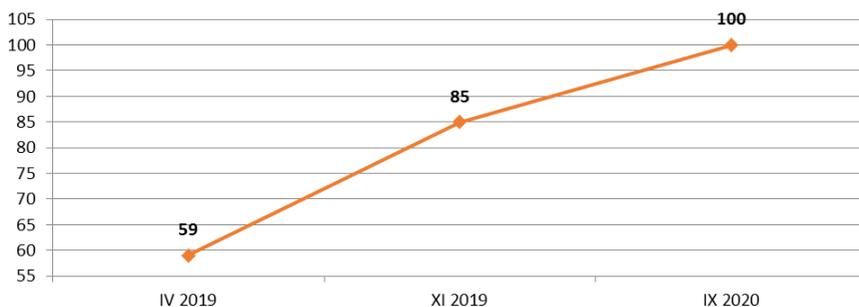


***Figure 2.*** *Growth of results (number of times) in the Russian bench press (athlete A. Av – uh)*

And one more tip for those who are interested in this article. Approach the training process "with your head", listen to your body, adjust the load when necessary, work intuitively. A competent approach to the training process (including recovery and nutrition) and due diligence in training will certainly bear fruit in the form of progress in strength indicators, and over time, victories in competitions!

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基洛夫地区俄裔德国人的年龄因素和言语行为
# AGE FACTOR AND SPEECH BEHAVIOR OF RUSSIAN GERMANS OF THE KIROV REGION

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抽象的。在过去的 20 年中，由于科学家对俄罗斯和独联体少数民族命运的高度关注，学术界对语言与环境之间的关系问题的兴趣激增。这导致对他们的历史、文化和语言的研究数量增加。研究语言多样性、语言的消亡和消失之间的关系正在成为 20 世纪至 21 世纪之交众多著作的主题。语言的命运，它们的当前存在和未来是人类的首要任务，因为语言是世界的哲学。它是关于世界的知识体系，体现在其语言结构和规则中。从这个意义上说，语言就是世界本身，世界的消亡对人和世界都是不可弥补的损失。

本文的目的是介绍对基洛夫地区德裔少数民族语言行为的研究结果，该结果反映了外语环境中社会人口因素影响下所表现出的特征，特别是在"年龄"因素的影响。工作中使用了以下方法：收集语言材料时的现场方法；通过随后的文本转录不断固定方言材料的方法；社会语言学问卷调查法和被问者访谈法等。在分析材料时使用这些方法可以高度客观和可靠地考虑检测到的现象。正如我们的研究表明的那样，在基洛夫地区的德国民族中，德语和俄语的使用区域分布以及语言作为母语的选择在很大程度上取决于告密者的年龄。

我们相信这篇文章会引起参与德国岛屿方言问题的科学家的兴趣。

关键词：德国民族社区，言语行为，社会人口因素，年龄

***Abstract.*** *Over the past 20 years, there has been a surge in academic interest in the problem of the relationship between the language and the environment, caused by great concern among scientists about the fate of national minorities in Russia and the CIS. This led to an increase in the number of studies of their history, culture, and language. The study of the relationship between linguistic diversity, the extinction and disappearance of languages is becoming the topic of numerous works at the turn of the XX – XXI centuries. The fate of languages, their current existence and future are the first priority for humanity, since the language is the philosophy of the world. It is the system of knowledge about the*

*world embodied in its linguistic structure, in its rules. In this sense, the language is the world itself, the death of which will be an irreparable loss both for the person and for the world.*

*The purpose of this article is to present the results of the study of the speech behavior of the German ethnic minority of the Kirov region, which reflects the features manifested under the influence of socio-demographic factors in the foreign language environment, in particular, under the influence of the factor "age". The following methods are used in the work: field methods when collecting linguistic materials; the method of continuous fixing of dialectological materias with subsequent transcription of texts; the method of sociolinguistic questionnaire and interviewing of the questioned, etc. Using these methods when analysing the material allows to consider the detected phenomena with a high degree of objectivity and reliability. As our studies show, the distribution of the areas of use of German and Russian among ethnic Germans of the Kirov region, as well as the choice of the language as a native language, are largely determined by the age of informants-speakers.*

*We believe that this article will be of interest to scientists involved in problems of German island dialectology.*

***Keywords:*** *German Ethnic Community, Speech Behavior, Socio-Demographic Factors, Age*

**Introduction**

Recently, the concept "speech behavior" has again been put forward by linguists, psychologists and sociologists to the forefront of studies.

This is due to the fact that it is a complex phenomenon that requires "grounding in view of the paradoxical state of modern science, first of all, linguistics, in which the word does not keep pace with the thought and in which the terms begin to lose their basic functional and semantic attributes" [1].

Some scientists compare the speech behavior with the process of choosing the best option for constructing a socially correct statement [2] or with the person's emotions and actions which are determined by the communicative situation and expressed using the language and non-verbal means [1]. Other researchers consider the speech behavior as a human speech activity [3].

In our study, the sociolinguistic concept is accepted: the "speech behavior" is the person's behavior determined by the speech activity, which reflects both internal and external features, manifested under the influence of factors that determine the process of the speech behavior in the foreign language environment.

It is necessary to note the factors determining the speech behavior of the individual are divided into internal – linguistic proper and external – extralinguistic. Extra-linguistic factors in its turn are divided into: 1) factors of the socio-demo-

graphic nature (socio-economic, geographical, socio-historical living conditions, absence or presence of mixed marriages, gender, age, nationality, level of education, profession, participation in public life); 2) factors of the situational-variable nature (theme, situation, nature of relations between communicants, their social status).

Particular attention in this work is given to the study of the socio-demographic parameter "age", which significantly affects the speech behavior of Russian Germans of the Kirov region living in the foreign language and foreign dialect environment. The relevance and novelty of the study in the Kirov region is determined by the general linguistic, historical-linguistic, sociolinguistic significance of island dialectology connected with the study of development and functioning of dialects (languages) in the foreign-dialect, foreign-language and foreign-national environment, that is, in the situation where separate ethnic-language groups exist in isolation from the main ethnic environment.

**Research Methodology**

The aim of this work is to analyze the speech behavior of Russian Germans in the Kirov region, taking into account their age, which helps to characterize entire generations regarding their use of different language options. Our observations, firstly, supplement the factors of the socio-demographic nature that affect the speech behavior of Russian Germans in the region under consideration, and secondly, they correlate with general studies conducted by Russian scientists in the field of studying sociolinguistic aspects of the speech behavior [3, 4]. Methods of direct observation, audio recording of speech and content-analysis and functional analysis of the speech of Russian Germans of different ages were used in this study.

**Research Results**

One of the most significant factors of the socio-demographic nature that affects the speech behavior of Russian Germans in the Kirov region is the age. Based on the analyzed material, it should be noted that the functions of the German language among representatives of the older, middle and younger generations of the Kirov region is different. To identify the use of languages, depending on the age of the informants, we turn first of all to the definition of the concept "age". L. I. Moskalyuk believes that "age is not just a chronological quantity, a unit of time, time periods that replace each other ... the age factors serve to characterize individual groups-collectives, examples of which are: groups of the same age (interest groups, entertainment groups, etc.), or generations in the family, forming groups of different ages " [5].

As studies of the speech behavior of Russian Germans in the Kirov region showed, the age factor helps to characterize entire generations regarding their use of different language options. Each age group of Russian Germans has its own

characteristics, a significant role in the formation of which is assigned to different historical eras, and the use of language systems is considered in the context of the most important historical events of a certain time, which played a significant role in the speech behavior of ethnic Germans and should be taken into account when describing linguistic characteristics of representatives of different age groups. In this case, we can talk about the linguistic competence and the linguistic behavior of a certain generation. Based on the three age groups identified by us, we will try to characterize the speech behavior of Germans who have been living in the Verkhnekamsk district of the Kirov region since the 1940s of the XX century.

First of all, we consider the criteria for distinguishing age groups, which according to each scientist are largely subordinate to the goals of the study. As a rule, several age groups are distinguished, the difference between which varies in the range from 25 to 10 years. In this case, it seems necessary for the criterion for distinguishing age groups among the Germans of the Kirov Region to consider the main points of their history, namely: 1) the period until 1941 – the time of development of the German ethnic group under more or less liberal national policies, which resulted in the formation of the Volga German Autonomous Republic (1924), as well as the formation of national regions in many areas of compact German residence in the outskirts and south of Russia, in Transcaucasia, Crimea, etc.; 2) the period from 1941 to 1955 – the beginning of the Great Patriotic War and the mass forced deportation of Germans to the northern and eastern regions of the country, life in the deportation areas under the supervision of special commandant's offices, forced labor in "labor armies"; 3) the period from 1955 – the abolition of special commandant's offices, partial rehabilitation of the Germans, the possibility of free movement and mass migration to new areas of permanent residence [6]. P. Hilkes and V. A. Manykin adhere to a similar criterion for distinguishing age groups, offering three main age groups that are closely related to the above three historical layers: 1) the first generation ("older") – persons born before 1933; 2) the second generation ("middle") – persons born from 1933 to 1956; 3) the third generation ("younger"), persons born since 1957 [7, 4].

For a more detailed and objective study, we distinguish two subgroups of the older generation: the first subgroup of the older generation – people born before 1933, the second subgroup of the older generation – people born before 1937, where the main criterion for distinguishing these subgroups is the language competence of the Russian Germans, knowledge of not only the dialect, but also the literary German language, the ability to speak, read and write in the language of their ethnicity.

We will adhere to the classification of P. Hilkes and V. A. Manykin. The representatives of the older generation, born before 1933 (the first age subgroup of the older generation) and born before 1937 (the second age subgroup of the older

generation), find enough strong knowledge of the native dialect language; therefore, when collecting the dialect material, we consciously focused on the elderly, expecting from them the highest level of the language competence. Of the 35 informants-speakers interviewed during the dialectological and ethnographic expeditions (from 2000 to 2009), 21 are from the first age subgroup of the older generation, 5 belong to the second age subgroup of the older generation, 5 are from the middle and 4 are from younger generations. The analysis of the data revealed that the Russian Germans of the first subgroup grew up in a more or less homogeneous (German) ethnic environment and had the opportunity to study at a national school, where all subjects were taught in German. Most of them came from Ukrainian (17 people), as well as Volga colonies (9 people). All the above mentioned places of compact residence of Germans had the status of national regions before the start of World War II (except for of the Volga German Republic, which maintained its status until August 1941), which meant the use of the German language in almost all areas of everyday life, including such an important aspect, as national schools teaching all subjects in native German [see 8]. All representatives of the older generation noted that they attended a German school. The number of years spent in school ranges from 1 to 8, depending on the age of the informant-speaker: the younger the interviewee, the less he/she studied at a national school. Generations of Germans who grew up in conditions of such national "communities", wherever these "communities" are, firmly identified themselves with the German nation, preserving national traditions, life and culture of their historical homeland. Written German was studied at a German elementary school and only the oldest representatives of the first age subgroup could freely use it later. The ability to write in Latin letters for people studying in an elementary school in German was lost after graduation, but reading skills were preserved. The results of the survey showed that a large number of informants regularly read the Bible, spiritual literature in German. For this part of the informants, the German language is the language of their childhood, school years, the language in which their parents read to them, and the language that identifies their national culture.

The second age subgroup of the older generation includes 5 informant-speakers born between 1934 and 1937. This is the most tragic period for Russian Germans, including years of repression that started with the beginning of World War II and led to mass deportation of Germans from the European part of the former USSR to the north and east in 1941. Representatives of this generation are characterized by the fact that only the oldest of them were born in the old pre-war colonies on the Volga, in Ukraine or in the south of Russia. Four informant-speakers of the second age group called Ukraine their homeland and one informant – the Volga region. As for education, the Germans of this group studied in comprehensive Russian schools where German was taught as a foreign language. It should be noted that

representatives of the older generation, whose childhood was in the years of the war, did not master the written German language at all, since their level of education is an elementary school where teaching was in Russian, that is, they can write in German only in Cyrillic, read only in Russian or not at all. All representatives of this generation were able to graduate from high school, learn German in the framework of the scholl subject "Foreign language".

The main distinguishing feature of the speech behavior of all representatives of the older generation is that they use the German language in the form of one of dialects. This is the language option that most respondents speak. All informant-speakers of this age group belong to the German national minority and call the German dialect their native language.

As for the middle and younger generations, they, although they understand German, refuse to speak their native language in most cases, since, according to them, they cannot find the right word, they cannot reproduce it. Representatives of the middle and younger generations do not know the German language, since there is no need for this; some of them study the language because they are planning to leave for Germany, and only a few know and study the language in order to communicate with the older generation. The German language for representatives of the middle and younger age groups is the language of their parents and grandparents, a school subject, but, as observations show, it is rarely their mother tongue. In this case, the German language plays a secondary role, since Russian Germans do not need to use it in speech. Thus, the displacement of the native language, the dialect is taken place. And this is true not only for the extra-family, but also for the intra-family sphere of communication. As the results of the study show, the Russian language has become a necessary form of communication, with the help of which mutual understanding is achieved.

### Summary

So, the distribution of the spheres of use of the German and Russian languages among ethnic Germans of the Kirov region, as well as the choice of language as a native language, is determined by the socio-demographic factor "age".

It should be noted that the possibility of learning German in the family and school, as a necessary condition for high-level language competence, as well as the possibility of its full application in all areas of everyday life, depend to a large extent on the socio-political conditions in which this or that ethnic community is.

As for Russian Germans of the former Soviet Union, the older generation of this ethnic group had both opportunities, the realization of which was ensured by the existence of the Volga German Republic and national regions within the European part of the USSR. For subsequent generations of ethnic Germans the possibilities of studying and applying the German language in everyday life are sharply limited or practically reduced to zero.

Thus, the data obtained as a result of the study allow us to conclude that in the conditions of dispersed resettlement of Russian Germans, the loss of linguistic and cultural ties occurs rather quickly, and by the third generation the level of language proficiency of their nationality language may come to naught or remain at the level of the school curriculum, because the acquired communication skills are not applied in practice or they are rarely used.

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电影制片人陈凯歌的京剧艺术报道
# BEIJING OPERA ART COVERAGE BY FILMMAKER CHEN KAIGE

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抽象的。 文章献给中国大陆第五代电影人的代表人物——陈凯歌，他可以说是他这一代的文化历史现象。 在他的作品中，对京剧艺术的主要特征进行了详尽的描绘。 这篇文章讨论了这位导演作品中最重要的两部电影，它们都以京剧为主题，并反过来为陈凯歌带来了国际知名电影节的奖项和国际认可。
关键词：中国电影，第五代导演，陈凯歌，《霸王别姬》，《梅兰芳》。

*Abstract. The article is devoted to the representative of the fifth generation of filmmakers in mainland China - Chen Kaige, who can be considered a cultural and historical phenomenon of his generation. In his work, the main features of the art of Peking Opera are traced in great detail. The article discusses the two most important films in the work of this director, dedicated to the theme of the Peking Opera, and which in turn brought Chen Kaige international awards from eminent film festivals and international recognition.*

*Keywords: Chinese cinema, the fifth generation of directors, Chen Kaige, "Farewell My Concubine", "Mei Lanfang".*

Thirty years ago, Chinese cinema itself was practically unknown to the rest of the world. In the international film community, Chinese cinema was often understood as the cinema of Hong Kong, and for the vast majority of viewers, its essence could be summed up in one word - "kung fu". The cinema of mainland China in the mass consciousness of the same Europeans was strongly associated with communist propaganda, if they even thought about what mainland China is.

The emergence of the fifth generation of filmmakers, energetic and full of new ideas, became possible only after the end of the "cultural revolution". It is to them that the emergence of new ideas in cinema and the formation of cinema art free from the ideology of the "cultural revolution" belongs.

The main merit belongs to the "brothers" of this very generation: Zhang Yimou and Chen Kaige. Once starting together, but eventually diverging in different di-

rections, they became a kind of "antipodes", reflecting all the contradictory nature of the mysterious Chinese culture[1].

Chen Kaige (Chin. simp. 陈凯歌, born August 12, 1952, Beijing, China) is a Chinese film director and a multiple winner of international film awards. The representative of the so-called "fifth generation" of Chinese filmmakers [2]. Chen Kaige was born into the family of a director and film actress. Chen Kaige's father is a well-known Chinese film director Chen Huaikai, and his mother is an actress who also worked at a film studio. Chen's childhood passed in an atmosphere of well-being, prosperity and familiarity with the world of classical Chinese and Western culture, but even at school, the future apologist for "independent thinking" was involved in the whirlpool of the "cultural revolution" and, by his own bitter admission, participated in a public action of persecution of his own father. After graduating from high school, Chen goes "for re-education" to the remote southern province of Yunnan, where he works on a rubber plantation and then serves in the military for five years. The years spent away from home, however, only strengthened the humanistic worldview and craving for creativity laid down in childhood. In 1978, Chen Kaige entered the Beijing Film Institute. It was from the students of this, the first after the "cultural revolution" recruitment, that a cohort of young innovators and rebels was formed by the mid-80s, who were looking for their ways in the desert of sickened "party realism", later known as the "fifth generation" of Chinese cinema.

Zhang Yimou often criticizes the habit of journalists to unite all the filmmakers of that issue into some kind of single ideological team. Zhang Yimou himself believes that their film works are very, very different. However, they have one thing in common: they draw their inspiration not only and not so much from Chinese traditions, but from the traditions of Western cinema. They were the first to enrich Chinese cinema with a new visual brilliance, combining elements of Chinese traditional art and literature with Western film storytelling. Filmmakers of the "fifth generation" draw themes and ideas for their works from their own life experiences during the period of the "cultural revolution". Thus, they open up opportunities for an impartial analysis and the broadest possible discussion of the problems of the modern history of China and socialist society as a whole[3].

The fate of Chen Kaige is truly the fate of an artist, in its usual Soviet sense. The life of one of the most famous Chinese directors in the world was not easy, as mentioned earlier, during the Cultural Revolution, "in order to re-educate in the communist spirit", he was even exiled to rubber plantations and even at a young age he had to participate in the public persecution of his father. But it was Chen Kaige who, in 1993, became the first Chinese to receive the Palme d'Or at Cannes. Chen's feature film debut was Yellow Earth in 1984. With this film, the young director immediately attracted attention: The Yellow Earth was included in

the competition of the Locarno festival (Switzerland) and was awarded the Silver Leopard prize there. This film became not only an event of the international film year, but also a starting point for a new stage in the history of Chinese cinema. In 1988, Chen was invited to the Cannes Film Festival for the first time, but his film Farewell to My Concubine by Bawang be ji («霸王别姬», 1993), which brought him a large number of awards, including the Palme d'Or and the BAFTA (British Film Academy Award).

From 1988 to 1989, Chen did an internship in the US, but he didn't manage to meet the right producer or project there. He found his triumphant project in Asia thanks to Hong Kong producer and former Taiwanese movie star Xu Feng. In the film adaptation of Lilian Li's novel "Bawan Says Goodbye to the Concubine" (1992), philosophical "thoughtfulness" was balanced by a clear and dynamic plot, historical retrospection - by approaching the political realities of modern China, oriental paraphernalia - by the multicultural theme of transvestism and forbidden eros. Chen's skill and a trio of outstanding performers raised the life story of the Beijing opera actors and their friend from the dating house to the level of a historical mural, reflections on the fate of an entire country.

The film "Farewell, My Concubine" is a sentimental and tragic story about the actors of the Peking Opera who devoted their lives to serving art, the story of friendship and betrayal. The historical background of the story was the Sino-Japanese war, the coming to power of the Communist Party and the terrible purges of the "cultural revolution" (the director's "Hongweibing" past was very useful here).

Chen Kaige in one film touches on a huge number of taboo topics and painful issues, from homosexuality to a painful obsession with creativity. The film immediately receives worldwide recognition, in the future, the test of time will show that it was its undoubted artistic merits, and not just an acute social orientation, that made the film a universally recognized masterpiece of Chinese cinema.

Asian cinema is very different from what the European is used to seeing in all sorts of avant-garde works by the masters of auteur cinema. First of all, this is a fundamental difference in a special exotic, where there is a completely different worldview, other rules and decorum, a different mentality of being. Peking Opera is just a vivid example of an incomprehensible, but attractive art. It is she who acts as the main idea in the famous film of the director.

Chinese opera is a theatrical and acrobatic performance in which all roles are performed by men without exception. The originality of musical accompaniment, "female" vocals, reminiscent of the uninitiated, cat "marriage songs", a riot of colors in costumes delighted and amazed not only strangers, but also the local population. Becoming a member of the theater troupe and breaking out into famous artists is the ultimate dream for many boys who have devoted themselves to comprehending great art from a young age. The main characters of the picture

went through fire and water, tempering their bodies and character in endless training and punishment for any offense.

On the one hand, the main idea of the film is the theatre, its "life" and its history - first hard training, then the main characters - stage stars. But Chen Kaige uses opera as a kind of embodiment of one of the strongholds of national self-consciousness, as a figurant of past traditions and values. The death of the empire clearly creates the main idea of the picture. The consequences of the Cultural Revolution turned out to be catastrophic - the complete collapse of everything past in a country with a population of more than a billion people.

And the peculiar love triangle that arises in the picture unequivocally tries to tell the viewer about the throwing that the great people experienced. The performer of the role of a concubine, like a clear conscience, is trying to convince his brother on stage how base it is to love a brothel worker. Treason or even betrayal of His Highness the Peking Opera - this is how this vice is regarded and condemned, as if the most terrible of sins. But the lofty idea of service also has the other side of the coin - too complete identification of oneself with the stage image of the concubine, which leads to shameful sins, resulting, in the end, also in opium surreal nonsense.

The main focus of the film is on the most terrible crime against the Chinese people and culture of China - the Cultural Revolution (1965-1976). The film shows how the chaos and violence that the country descended into broke people and their destinies. And as a result, Peking opera was forgotten in China for ten years, like everything that had to do with tradition. Peking Opera productions have been suspended for eleven years. But, in the end, art is revived, and our actors again put on the opera "Farewell, my concubine", and again play their role to the end [4].

"Farewell, my concubine" is the title of a Peking Opera production of the same name. The national flavor is hidden behind stormy colors, incredible costumes, perfect choreography, bizarre music and peculiar singing. And as an artistic film, the creation of the Chinese director looks monumental, although it is very difficult for a person who is little familiar with the history of the Middle Kingdom to perceive. For in every minute there is a desperate pain about the oblivion of national traditions, about their destruction: either under the yoke of the Japanese occupiers, or from the destructive Red Revolution[3].

It's hard to make a definitive opinion on this film. On the one hand, it is shown that all these changes put an end to the old school, in which the upbringing of actors was based on violence. On the other hand, at what cost did these improvements come.

The story is told in an expressive film language, characteristic of the director's manner. Chen Kaige's film was hard to perceive by an unprepared viewer, like many other works of the "new cinema". The best achievements of the "new cinema" were the result of young directors rethinking the traditions of Chinese

cinema. And although in the end the "new cinema" did not take shape as an independent artistic movement, it undoubtedly influenced the cinematography of the PRC as a whole.

Unfortunately, the breakthrough of auteur Chinese cinema to the West did not take place on the scale that was expected: only the festival audience favorably accepted such films, and the problems of the Chinese people were too far from the mass Western audience. The irony of the "fifth generation" is that in the West they were accepted only as nonconformists: in a different form they were simply uninteresting there. At home, they were still treated with extreme caution precisely because of the non-conformism that was excessive for the Chinese audience.

Having received the "Palme d'Or" and a number of other international awards, the master returned to his homeland and fell silent for seven whole years. What happened to him during these years is unknown.

However, by the mid-2000s, Chen Kaige returns to the cinema where the main idea is about the individual and their fate, and he shoots a biographical drama about the legendary Peking Opera actor Mei Lanfang.

A dramatic and not very biographical film about the life of the great Peking Opera artist Mei Lanfang. Includes such highlights of his life as:

- the path to glory;
- romance with actress Meng Xiaodong;
- touring in capitalist America;
- patriotism during the war with Japan.

Mei Lanfang (1894 - 1961) is the most famous Peking Opera performer in China and in the world. He became famous for the performance of female roles "tribute". Has been on tour in Japan, America and the USSR. Deservedly considered a major reformer of the Peking Opera. It can be said that the main result of his activity was not so much acquaintance with this genre of foreigners, but the fact that Peking opera began to be considered an art, and artists - creators. Before Mei, "jingju" (Peking opera) was more of an entertainment for the imperial court[6].

Having risen to prominence in his early twenties, Mei rose to extraordinary fame by experimenting and transforming Peking opera. In the 20s of the 20th century, he staged some modern plays, tragic and revealing at the same time, this interweaving of lyricism, tragedy and sarcasm hidden deep, deep inside is a feature of many Chinese works of art, for example, it is worth remembering "Dream in the Red Tower". However, later, moving away from modernity, Mei Lanfang rewrote and created many plays based on traditional plots - some of them are still considered gems of the art of Peking opera.

In China, everyone knew his name, his talent and skill were truly extraordinary. However, in the late 60s - early 70s, during the era of the Cultural Revolution, the name of the artist, who thundered all over the world, was forgotten. At

that time, they fought against dissent - so much so that they destroyed traditional culture, considering it to be the bearer of truths that were fundamentally contrary to communism. Peking Opera then also suffered and fell into decay. When the Cultural Revolution died down and the time for reform and openness came, many traditions of Peking opera were revived, Mei Lanfang was remembered, but it has not been possible to revive the former splendor so far: there are much fewer interested and enthusiastic people. Now, among other things, programs are being carried out to familiarize the masses with traditional culture. Thus, we see that the film "Mei Lanfang" had a completely noble goal - to arouse the viewer's interest in Peking Opera.

"Mei Lanfang" "梅兰芳" is Chen Kaige's second work on the theme of Peking Opera. The film has a wonderful English title that reeks of Hollywood - "Forever Enthralled". Before us is the story of the life and theatrical work of Mei Lanfan, his ups and downs, the dramas of life and the drama on stage.

"Forever Enthralled" paints a picture of the life of the Peking Opera performers against the backdrop of China's political instability in the mid-XX century. The film was made with the approval of the actor's family. And with the permission of Mei Lanfang's son, the director raised a not very convenient topic - Lanfang's love outside the family, promising that it would be shown with respect and respect for the personality of his father.

In essence, "Forever Enthralled" exploits all the themes of "The concubine" except for homosexuality. However, Chen Kaige is no longer the perky subverter of the foundations, which he was at the beginning of his career, but a living classic, a respectable person who does not need provocations. In addition, the director had to keep the word given to Lanfang's son.

Mei Lanfang in the film is like a deity: his image is bright and unblemished. He charms, rises above people with his spirituality and dedication. And if other characters in the film are ordinary people who tend to make mistakes, then Kaige's Mei Lanfang is like a Buddha who lives by the opera. Next to him, the heroes become cleaner, insight descends on them, they understand the wrongness of their actions and rush to correct them.

Throughout almost the entire picture, Lanfang appears before the viewer exclusively in white clothes, as opposed to the rest of the characters. The hero's mistress is also dressed in white clothes - when their love with May is at its zenith. And already in the finale, she wears a white sweater over a black dress, as a symbol of the fact that Lanfang's love will remain with her forever [5].

The scene of the death of Lanfang's mentor is also symbolic, with whom he made a kind of bet that decided the fate of the Peking Opera: the old dies, giving way to change.

Chen Kaige made a quality, costumed, biopic film, and this film was warmly wel-

comed in his homeland. The film is a success in China and Hong Kong, and even in many other countries. The story of Mei Lanfang is shown subtly and heartfelt. The director grabbed the main theme of this man and atmospherically showed in his film.

The sets and costumes in this movie were all excellent. There are a lot of extras in the face of the audience in the film, and this also gives its effect to the picture. The main actors play cleanly and without falsehood, and the whole production has the spirit of the theater and the stage, and this is well felt when viewing.

This movie is not for everyone and will not be to everyone's taste. The film was nominated for several European and Asian awards, which emphasizes this significance.

Films by directors of the "fifth generation" show a rather hard look at society. But they manage to avoid direct criticism by switching the whole story to a story about people. Thus, a humiliated and trampled man becomes a symbol of the common Chinese people, who are under the repressive yoke of communist ideas and the ideas of the "cultural revolution".

Young and energetic graduates of the Academy of Cinematography said that they want to make a new, free from the ideology of the "cultural revolution" cinema. Filmmakers of the "fifth generation" draw themes and ideas for their works from their own life experiences during the period of the "cultural revolution". Thus, they open up possibilities for an impartial analysis and the broadest possible discussion of the problems of the modern history of China and socialist society as a whole.

Such a narrative subject could become a powerful irritant for the Chinese leadership. But censorship was not always able to decipher the rich symbolism of films, so some films somehow got on the screen of the country. Although, of course, some films were absolutely banned from showing in mainland China.

The first films made by the "fifth generation" directors before the events in Tiananmen Square in 1989 contained harsh criticism of the "cultural revolution".

In the late 60s - early 70s, during the era of the Cultural Revolution, in the era of the struggle against dissent, traditional Chinese culture was exterminated, it was considered the bearer of truths that were fundamentally contrary to communism. Peking Opera then also suffered and fell into decay. Chen Kaige's films show how the chaos and violence that the country descended into broke people and their destinies. It is shown how Peking Opera was forgotten in China for ten years, like everything that had to do with tradition. When the Cultural Revolution died down and the time for reform and openness came, many traditions of Peking opera were revived, but they still fail to revive their former splendor: there are much fewer interested and enthusiastic people. Now, among other things, programs are being carried out to familiarize the masses with traditional culture. Thus, we see that the films directed by Chen Kaige had a very clear goal - to arouse the viewer's interest in Peking Opera.

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论影视文化空间中的符号…
# ON SYMBOL IN THE SPACE OF TV-CINEMA CULTURE...

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抽象的。 该作品建议思考在电视文化空间中吸引公众注意力（尤其是青年观众）的可能性，以及最重要的道德类别：善、利、恶、责任、良心、耻辱、内疚的概念等，使用符号。 文章考虑在电视节目STRKDonTR "篝火旁" 中使用 "火" 的象征，让人们参与到道德上有效地理解生活的过程中。

关键词：象征、祖国、学生、科学、欢乐、责任、荣誉、良心、善良、利益、邪恶、耻辱、神话、爱、美、火、模板。

***Abstract.*** *The work suggests thinking about the possibilities of attracting public attention (in particular, the youth audience) in the space of television culture, to the most important categories of morality: the concepts of good, benefit, evil, duty, conscience, shame, guilt, etc., using symbols. The article considers the use of the symbol of "fire" in the TV program STRC "Don TR" "At the Campfire" to involve people in the process of morally - effective comprehension of life.*

***Keywords:*** *symbol, motherland, student, science, joy, duty, honor, conscience, goodness, benefit, evil, shame, myth, love, beauty, fire.*

Let's start with the obvious truth, once stated by the Canadian literary critic and sociologist G. M. McLuhan "... the content of any message cannot be considered outside the form of its expression, as well as outside the channels of its distribution".

Today is the time for convergent journalism. A journalist, director, cameraman, editor often act in one person. This is exactly how things are in the convergent mass media - the newspaper of the Rostov Oblast "OUR TIME". Naturally, its employees - in the past journalists - printers are interested in video as a channel for disseminating information and forms, methods that can contribute to the most complete and accurate reporting of the content and purpose of this video (of any genre) for which it was collected.

So, about everything in order. But first, there is one more obvious: the scientific and technological revolution, informatics have brought us all closer in many

ways today. And we can continue to use the technical achievements of the 21st century, so that mutual understanding, unity, attention to universal eternal, moral values would grow. G. M. McLuhan was also one of the first to conceptualize this: "... about the growing influence of mass media on all aspects of social development, on the formation of the mind and feelings of the person himself. Any event acquires social importance not in itself, but in connection with the transmitted mass media, messages about it". Electric technology develops and strengthens people's communication, enhances their complicity, involvement ... And thus, the most important moment of the cultural and psychological impact of electronic media on people is precisely the goal of involving and uniting the public. What do we believe in and why do we call for ourselves!? And this is the optimization of society through the return of attention to the eternal values of morality, morality, to memory, connecting the broken ties of times, which adversely affects the state of culture (its continuity) ... But, as the Bible says: "... be afraid of the wide gates !.." Easier and faster A person of today is disposed to information of a lighter, more achievable nature, as well as to one that does not turn his eyes "inside", does not awaken the "sleep of conscience" ... reflections on being, that is, on mass culture at its worst.

And then there is a need, (if we consider the mass media really one of the "culturological conductors"), to find those forms, methods of presenting information, materials on the topics of ethics, morality, patriotism, philosophy, comprehending being, which would attract viewers and lead ...

This is where the use of symbols comes to the rescue, with the help of which, in an artistic and journalistic, sometimes playful form, you can involve viewers in the co-creation of spirit, thought. Of course, by inviting the appropriate Heroes "... calling with thought behind them..."

This was done by the creators of the program "By the Campfire" at the end of the last century at the STRC "Don TR". The topics were taken on a variety of topics:

ethics, morality, patriotism, philosophy of human life. Gathered at the "telefire". And the fire, a natural telefire, united everyone. They were collected by the journalist E. Aparina and her creative team: cameramen I. Zalunin, L. Kovalevsky, director O. Chernyshova and other television specialists.

It all started with "Campfires" in the courtyards of Oblast museums: local history and fine arts. And at first the invited like-minded people, comrades, came: - workers of science and culture, activists of public organizations, students, pensioners and schoolchildren. This is such a diverse audience. Someone just wanted to appear on the TV screen, but mostly people shared their sore, exciting things. And in many respects, sincere conversations, decisions made at these nationwide gatherings on various issues of the life and existence of the local community of

people, were made under fire colors ...

It will definitely be told about these programs of the STRC "Don TR", their participants and high initiatives in the spirit of the Russian mentality. People remember them from childhood and now, when someone himself works in the field of convergent journalism, such forms of television programs are remembered more and more often, prompting the continuation and development of such work with the audience ... with the public not only on TV, but also more widely in the Internet space ... And there are already examples of this ...

And now more about the symbols (with which mankind is rich from the first years of life on the Planet) and those qualities that are able to awaken the best in us, unite, lead ...

Man is the only creature on Earth that has the gift to create and use symbols. Ernst Cassirer defined him as a "symbolic animal". A person lives both in the physical and in the symbolic universe, the components of the latter are language, myth, religion, art, history, science. Therefore, knowledge of symbolism is directly related to a person's knowledge of himself. And the world around. In fact, behind any phenomenon of cultural life lies a symbolic meaning. Thus, the symbol acts as an unshakable characteristic of culture, because by its nature, culture is deeply symbolic.

The origin of symbolism is closely connected with the desire of a person to know himself, another individual and the world around him, that is, to "see" a deep meaning behind the material objects and phenomena of the world. Its origins are lost in prehistoric times. If the history of writing, according to official science, dates back about five thousand years ago, when the first rules for organizing visual signs into a writing system were established, then the history of the symbol goes back hundreds of thousands of years to the time of the late Paleolithic, when people lived in caves , on the walls of which they depicted their religious beliefs and ideas about life with symbols. Although writing was a step forward from the primitivism of ancient symbolism, nevertheless, the signs of the written language could never completely replace the symbols that were widely used even in highly cultured societies. Moreover, thought and language are closely related to symbolism, so the language itself and the written word began to acquire a special symbolic meaning. A mystery for researchers is the fact that in different cultures, separated by spatial and temporal boundaries, there is a similarity of symbolic images, as well as the cult-mythological realities associated with them. There is no clear answer to this question in the scientific literature. As Ariel Goland writes: "... some explain the revealed similarity by diffusion of ideas, others by general laws of development, still others by the influence of similar conditions, fourth by chance coincidence ..." Pavel Florensky explained this phenomenon with the fol-

lowing two reasons: the presence of a common prehistoric grand-culture and the commonality of human psychology: to express the same idea, similar images are created at all times and among all peoples.

Carl Jung believed that "archetypes" are the basis of universal human symbolism - some innate mental structures located in the depths of the "collective unconscious". All archetypes are archaic in nature and can be considered as a kind of original image, which, as a result of unconscious activity, manifests itself in the superficiality of consciousness in the form of dreams, religious ideas and symbols.

"By symbol I understand," wrote Jung, "an image that should, as far as possible, characterize only the vague imagined nature of the spirit ... The symbol ... is as deep, mysterious and insoluble as life itself...".

"Indeed, as G. Bachelard writes in "The Psychoanalysis of FIRE", it is about revealing the impact of the values lurking in the unconscious on the very foundations of empirical and scientific knowledge. It is necessary to show the mutual reflection constantly cast by objective and universal knowledge on our subjective personal experience and vice versa. It is necessary to reveal the traces of childhood experience in scientific experience. And then we will justifiably talk about the share of the unconscious in the scientific mind, about the mixed nature of some evidence, and, studying a particular phenomenon, we will notice that the beliefs formed in completely different areas coincide.

Thus, perhaps, the fact that the fire-essence is rather social than natural has not yet been properly noted".

That is why, for working with the public in the TV program "At the Campfire", the method of working with the TV audience was chosen, somewhat intuitively, using this multi-valued and universal symbol - fire!

In any work with people, including the one that, like a television program, is associated not only with the psychological preparation for the broadcast of an individual, but also with the organization, preparation of the television space for the perception of information (including information of the senses!). If it is impossible to achieve the best by immediately obtaining an ordered multiplicity, it remains to resort to dialectic, as to a deafening noise capable of stirring up a host of dormant echoes.

"The awakening of the dialectic of thought," Arman Ptizhan rightly notes, "accompanied by images ... best of all stimulates the imagination".

Imagination, more than the impulse of life, embodies the creative power of the soul. Psychically, we ourselves are a creation of our imagination. It creates and limits, delineating the last limits of our mind. It works at the top of the mind, resembling a flame, and it is precisely in the field of metaphorization of metaphors, in the sphere beloved by the Dadaists, where, according to Tristan Tzara, fantasy undertakes an experiment, transforming once transformed forms, it is there that we

will discover the secret of the energies of change ...

Perhaps, like our colleagues from the 20th century, we will not kindle the "Campfire", but we will think about the symbol ... about the symbolic frame (a concept from cinema) ... And we use it in a number of our works ... Recently we showed a film about our oldest Rostov Naval School named after I. G.Ya.Sedov ... A graduate of the nautical classes that arose in the merchant Rostov-on-Don at the end of the 19th century. So, seeing the amazing chronicle of that time (in particular, the departure of Georgy Sedov on the ship "FOKA" to the Arctic voyage: the faces of people, equipment, a dog that saw off the sailors on the shore ...) you also feel your involvement in the history of Russia ... Here you and symbolic frames ... To be continued ... Colleagues, I invite you to the topic ...

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专家和社会服务接受者互动中的信任资源
# A RESOURCE OF TRUST IN THE INTERACTION OF A SPECIALIST AND A RECIPIENT OF SOCIAL SERVICES

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抽象的。 本文探讨了信任现象的社会心理学方法的理论方面。 作者介绍了一项关于信任对圣彼得堡社会服务机构中社会工作专家和社会服务接受者之间互动有效性影响的研究结果。 并且还开发了一个研讨会，旨在在专家和社会服务接受者的专业互动中形成信任关系。
关键词：信任、互动、专业互动、有效互动、社会工作互动、社会工作专家； 社会服务接受者

***Abstract.*** *The article deals with the theoretical aspects of the socio-psychological approach to the phenomenon of trust. The author presents the results of a study of the influence of trust on the effectiveness of interaction between a social work specialist and a recipient of social services in a social service institution in St. Petersburg. And also a workshop was developed aimed at the formation of trusting relationships in the professional interaction of a specialist and a recipient of social services.*

***Keywords:*** *trust, interaction, professional interaction, effective interaction, interaction in social work, social work specialist; recipient of social services*

Modern trends in the development of Russian society make trust an important factor in safe and comfortable social interaction in a situation of high uncertainty (pandemic, socio-economic crisis, etc.). This is fully true for interaction in the social sphere, in particular in the field of social work between a specialist and a recipient of social services. Trust in the system of subject-subject relations is a resource for effective interaction between the recipient of services and a social work specialist.

The phenomenon of trust is an interdisciplinary category that has a long history of development. F. Fukuyama, back in the 60s of the last century, formulated an approach that defines trust as a basic property and, in a sense, a condition for the

development of society [3]. He emphasized that trust is the ideas and expectations of the members of society regarding the behavior of its other members, their adherence to the social norms accepted in this society [3, p. 173].

The theoretical basis of the study was the works on social psychology (I.R. Altunina, I.R. Sarieva, N.A. Koryagina, E.V. Mikhailova, etc.) and the psychology of communication (N.A. Kormnova, N.V. Antonova, S.V. Ovsyannikova, etc.), on the theory and methodology of social work (A.B. Belinskaya, M.V. Vorontsova, L.G. Guslyakova, T.B. Kononova, etc.), social interaction ( T.S. Vavakina, Yu.Yu. Chilipenok, K.A. Remizova and others) and the phenomenon of trust (E. Giddens, F. Fukuyama, I.V. Glushko, S.D. Gurieva, M.M. Borisova and etc.). The analysis of the philosophical, sociological and psychological approaches to understanding trust makes it possible to determine the socio-psychological approach as the most optimal for revealing the phenomenon of trust. Of particular interest in this context is the work of T.P. Skripkina, who considers trust as a subjective personal attitude of a person, "a person's attitude to the world and to himself" [1, p.29].

T.P. Skripkina notes that trust is possible not only in other people, but also in relation to ideals and values, cultural objects, concepts and authoritative opinions. Trust also acts as an important condition for the functioning of interpersonal relations in a positive way, so without trust, relationships can quickly acquire a conflict character.

Trust is a socio-psychological phenomenon that implies the individual attitude of one person to another person or social group, or to certain situations and phenomena that are of particular importance to a person and are assessed by him as reliable. In the structure of trust (as a socio-psychological education), three components can be distinguished - emotional, cognitive and behavioral. Issues of trust are of particular importance in the helping professions, including social work. The lack of trust between specialists and their clients, of course, negatively affects the result of interaction.

Interaction is considered as a systematic, constant implementation of actions aimed at causing an appropriate reaction from the partner, this impact on the partner himself, and the reaction caused in turn causes the reaction of the influencer. In the field of social work, there are several levels of interaction: between a specialist and a manager, between specialists, between a specialist and a recipient of social services. At the same time, the interaction in the system "social work specialist - recipient of social services" has specific characteristics: multidimensionality; a clear focus on joint activities and results; a wide range of types of recipients of social services of social service institutions; humanistic and subject-subject nature of professional interaction. The effectiveness of interaction between a social work specialist and a recipient of social services is assessed according to the following

indicators: the ratio of the result obtained and the goal; subjective indicator of satisfaction of interaction participants; optimality of costs (energy-time, material, etc.). E.V. Tkacheva highlights the factors of effective interaction between a specialist and a recipient of social services: structural (organizational structure of the institution, type of information system, etc.); independent (the nature of relations with other subjects and institutions of social services) and intermediate (the style of communication between a specialist and a client, the nature of relations established between them, etc.) [2]. At the same time, trust influences intermediate factors.

Thus, trusting relationships are an important factor in the effectiveness of interaction in social work. The most effective situation of interaction develops when mutual trust is formed and on the condition that both the recipient of social services and the social work specialist trust themselves.

In order to identify the influence of trust on the effectiveness of interaction in social work, a survey was conducted among the recipients of social services of the SPb. SBI "Center for Social Assistance to Families and Children of the Moscow District". In total, 40 recipients of social services aged 37 to 64 years old (27 – women, 13 – men) took part in the survey.

The results obtained during the survey showed that more than half of the respondents (55%) consider it comfortable to communicate with a social work specialist, the rest described the relationship with a specialist as uncomfortable (45%). The use of open questions in the questionnaire made it possible to obtain from the clients themselves the characteristics of comfortable and uncomfortable communication with a social work specialist. The responses of the study participants were grouped according to their meaning. The respondents gave the following characteristics to comfortable communication: friendly, polite, affable; respectful ("without familiarities", "on you", etc.); restrained, businesslike, official, "on business"; warm, friendly, informal; calm, safe, "without conflicts", "without aggression"; reliable, honest (the specialist "does not be late", "fulfills obligations on time", "keeps his word", honestly reports difficulties, etc.). Uncomfortable communication received the following characteristics: unfriendly, disrespectful attitude; too friendly ("lisping", "as if I were a small child"); conflict; unreliable ("the specialist is late", the specialist "loses papers", "forgets to do what he promised"). It should be noted that the opinions of the respondents regarding some signs are directly opposite: some of the respondents call formal and restrained communication comfortable, while another part notes that they feel more comfortable when establishing informal, warm, relationships with a specialist. This leads to the conclusion that it is necessary for a social work specialist to use an individual approach to each client in his professional activities.

The presence of trust in a social work specialist was confirmed by 60% of the respondents, the remaining 40% indicated that trust in a social work specialist was

not formed, for one reason or another.

During the survey, it was possible to trace a clear relationship between the presence of trust between the recipient of social services and the specialist, and the recipient of social services' assessment of interaction with the social work specialist as effective. In all cases where the interaction in social work was clearly ineffective (two or three of the three performance indicators were not met), there was no trust between the recipient of social services and the specialist. For example, in one of the cases, the problem of a social service recipient was resolved, but not within the expected time frame for the recipient of social services. In addition, the recipient of social services noted that he was not satisfied with the very interaction with the social work specialist, his attitude. In this and similar cases, he observed a lack of trust between the social worker and the social service recipient.

The most obvious connection is observed between the trust of the recipient of social services in relation to the social work specialist and the degree of his satisfaction from the very interaction, communication, work with the specialist.

Of interest is the case when the problem of the recipient of social services was not solved at all by a social work specialist. However, at the same time, the recipient of social services noted that communication with the specialist was comfortable and pleasant for him. In this case, the formation of trust in a social work specialist was noted.

There is a relationship between the formation of trust in the recipient of social services in relation to the specialist and the effectiveness of the interaction between them.

The subsequent questions of the questionnaire helped to identify the factors that influence the formation of trust in the social work specialist by the recipient of social services. Thus, the majority of respondents (80%) confirmed the coincidence of the appearance, behavior and style of communication of a specialist with the expectations of the respondent. The rest of the respondents identified the following qualities/actions of specialists that did not meet their expectations: "the specialist was late for his appointment, I consider this unacceptable"; "I would like more benevolence"; "the specialist seemed to want to get rid of me as soon as possible"; "The specialist asked a lot of questions; I don't think they were related to my problem".

In assessing the behavior of a social work specialist, both the actions of the specialist and the subjective perception of this behavior by the recipient of social services are important.

When characterizing the factors of formation of trust / distrust in a social work specialist, the respondents provided similar answers. Thus, the formation of trust, in the opinion of the respondents, is facilitated by: the competence of a specialist ("he immediately knows how to solve problems", "understands the laws", "im-

mediately suggested a solution to the problem", etc.); confidentiality ("a specialist can be trusted with personal information"); reliability ("does what it promises on time", "is at the workplace when it should be"); respectful and polite tone in communication, etc.

The formation of distrust, according to the respondents, is facilitated by: incompetence; unreliability; disrespectful communication style ("haughtily", "like with a small child").

The majority of respondents (70%) noted that the gender of the social worker does not matter. However, one respondent (2.5%) noted that he would prefer a male specialist, and 12.5% of respondents preferred a female specialist.

It should be noted that the majority of respondents (60%) prefer a specialist with extensive experience in the field of social services, some respondents (25%) considered this criterion to be unimportant, while 15% of respondents noted that they would prefer to turn to a young specialist. The data obtained are confirmed by the results on preferences in relation to the age of the specialist.

The majority of respondents (65%) noted a preference for the average age of a specialist of 30-45 years. This distribution may be caused by the stereotype of young professionals as inexperienced and incompetent, and of older professionals as "tired" and having lost their professional "grip". Therefore, the specialist needs to demonstrate to the client his own professional competence and show that these qualities do not depend on the age of the specialist.

Describing the appearance of a specialist, the majority of respondents (70%) preferred a restrained, strict, business-like appearance of a specialist. If when answering the question about the appearance of the specialists, the respondents answered in a coordinated way, then when asked about the preference for the style of communication of a specialist, opinions were divided. Thus, half of the respondents prefer restrained, formal, business-like communication between a specialist and a recipient of social services. The rest prefer the specialist to communicate informally, at ease, and benevolently.

Like the answers to the question about the characteristics of comfortable and uncomfortable communication with a specialist), the answers to the question on preference in relation to the style of communication of a social work specialist suggest an understanding of the need to adjust the style of communication with a client to his characteristics, needs, expectations.

Based on the results of the study, recommendations were formulated for specialists on building trusting relationships with the recipient of social services and improving the effectiveness of interaction in social work. Also, in order to increase the effectiveness of interaction between a specialist and a recipient of social services, a workshop was developed aimed at building trusting relationships in the course of professional interaction. The workshop includes six sessions lasting up

to 60 minutes. The main forms of work during the workshop are mini-lectures; business games; psychological and communication exercises; elements of training sessions, etc. Let us give an approximate theme of the workshop: Trust in social work: approaches and technologies of formation; Professional communication of a specialist: a resource of trust; Formation of trusting relationships with clients (verbal and non-verbal techniques); Professional image of a social work specialist; Professional interaction of a specialist with a client: methods and technologies of trust; Trust in the professional interaction of a specialist with a client: problems and ways to overcome it.

Thus, the developed recommendations and a workshop for specialists will allow employees of a social institution to build effective interaction with recipients of social services, which will improve the quality of services provided.

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不确定条件下大学生的社会心理适应因素: 优化机会
## Factors of socio-psychological adaptation of university students in conditions of uncertainty: opportunities for optimization

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抽象的。 文章证实有必要在教育过程组织的变化、数字教育实践使用的扩大以及学生的心理特征等背景下研究学生的社会心理适应因素。 "数字一代"。给出了学生学习刚性、不确定性和自组织性的数据; 显示了它们与学生社会心理适应成分的关系。 确定优化指示指标的方向。

关键词: 社会心理适应、学生、对不确定性的容忍度、僵化、自组织、"数字一代"。

*Abstract. The article substantiates the need to study the factors of socio-psychological adaptation of students in the context of changes in the organization of the educational process, the expansion of the use of digital educational practices, as well as the psychological characteristics of students belonging to the "digital generation". The data of the study of rigidity, tolerance to uncertainty and self-organization of students are given; their relationship with the components of the socio-psychological adaptation of students is shown. Directions for optimizing the indicated indicators are determined.*

*Keywords: socio-psychological adaptation, students, tolerance to uncertainty, rigidity, self-organization, "digital generation".*

In the conditions of the "fluid world" [12, p. 246], which orients a person towards mobility in all spheres of life, the problem of adaptation requires new solutions. The need to supplement existing ideas about the socio-psychological adaptation of students, its mechanisms and optimization methods is due to at least two factors: 1) changing the conditions for the implementation of the educational process (including in connection with the processes of digitalization, distance learning, the

widespread introduction of mass educational courses, etc.) also leads to the transformation of traditional forms of interaction between the subjects of the educational process: from offline it to one degree or another, it switches to online mode, and, consequently, the social spaces in which the student integrates also change; 2) the deep involvement of young people in a variety of online practices gives rise to specific psychological traits and characteristics of activity for representatives of the "digital generation" [2; 13] and communication [3]. These phenomena are associated with the inclusion of fundamentally new practices in the pedagogical process, such as gamification [5], the use of social networks and microblogging [1], etc.

Traditionally, socio-psychological adaptation is understood as the inclusion of a person in the system of interpersonal relations, in a certain team, the acceptance of its values and norms, models of interaction; the formation of a stable sense of comfort and security in the social group; compliance with role expectations while maintaining one's own beliefs, interests, etc. [7; 11 et al.]. Taking into account the fact that the life fulfillment of modern youth takes place in a mixed reality, is associated with the formation of many network identities [13], the transfer of part of educational contacts to the online format [1], as the necessary conditions for adaptation, psychological qualities come to the fore, allowing you to successfully function in conditions of uncertainty and constant change - flexibility and tolerance for uncertainty.

The "rigidity-flexibility" construct is a system-wide property of psychological and social systems that determines their ability to perceive innovations and change the stereotypes of life while maintaining the stability of the system [4; 6]. Human perception of uncertainty T.V. Kornilova considers in two dimensions: 1) "tolerance for uncertainty" as a generalized personal property, meaning "the desire for change, novelty and originality, readiness ... to prefer more complex tasks" and 2) "intolerance to uncertainty" as "the desire for clarity, order in everything and rejection uncertainty", which correlates mainly with the regulation of cognitive strategies [8].

In conditions of simultaneous solution of many tasks, inclusion in various types of activities and leisure, the ability of the individual to self-organize is of particular importance. Self-organization is considered in modern research in a wide range: from life time management in general, the construction and implementation of long-term plans to the organization of specific activities. E.Yu. Mandrikova describes this phenomenon as "structuring personal time, tactical planning and strategic goal setting" [10, p. 59]. The effectiveness of activity is also influenced by "personal time disorganizers" – "personal characteristics that lead to ... unproductive organization of activity" and "time-unbalanced" behavior [9].

Thus, the purpose of the work is to establish the presence and nature of the relationship of socio-psychological adaptation with rigidity, tolerance for uncertainty and self-organization of the individual, and also to determine the directions for their optimization. Data on the severity of students' rigidity, tolerance for un-

certainty and self-organization were obtained by E.V. Pavlova as part of a student involvement study (2021). The hypothesis about the significance of these psychological characteristics for the socio-psychological adaptation of students was put forward and tested in the course projects of I.E. Ashchina and Ya.D. Kucherova, under the direction of E.V. Pavlova. The study sample consisted of 429 people. The research base - FSBEI HE Amur State University.

To collect empirical data, the following were used: "Tomsk rigidity questionnaire (TRQZ)" (Zalevsky G.V.), "New questionnaire of tolerance for uncertainty" (Kornilova T.V.), "Questionnaire for self-organization of activity" (Mandrikova E.Yu. ), "Personal time disorganizers" (Kuzmina O.V.), "Diagnostics of the socio-psychological adaptation of the personality" (Rogers K., Diamond R.). For statistical data processing, the following were used: one-way analysis of variance ANOVA, Ch. Spearman's rank correlation test. The calculations were made using the SPSS and STATISTICA software packages.

As a result of the diagnostics, it was found that the majority of respondents had a moderate level of rigidity, but a third of the respondents had a pronounced sensitive rigidity, reflecting a negative attitude towards changes affecting them personally (figure 1). When comparing the obtained data with the results of our previous studies (2018, the results are given in a number of publications), it was revealed that students surveyed in 2021 have a statistically significantly lower level of setting rigidity (F=8.779, p=0.0001), which may be due to more diverse educational experiences (distance learning, mastering MOOCs, etc.), prompting a reconsideration of established views. In general, students rather positively perceive changes at the cognitive level and, to a lesser extent, at the emotional level.
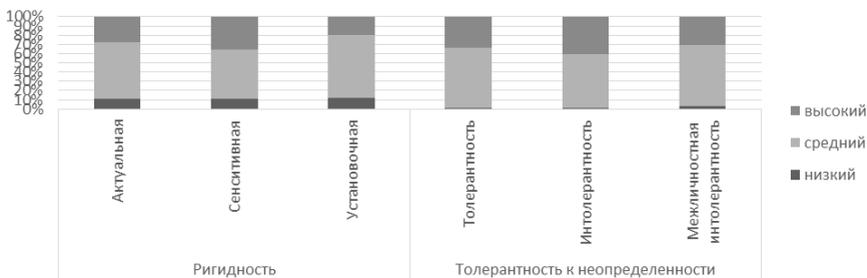


**Figure 1.** *Distribution of students depending on the level of rigidity and tolerance for uncertainty (in percent)*

As for tolerance for uncertainty, the majority of respondents at the personal level are ready for changes, novelty and originality, but at the level of cognitive activity, on the contrary, they strive for clarity and orderliness of the informa-

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tion received. In fact, they are ready to act in a situation of uncertainty, but they expect fairly clear instructions regarding such actions (which corresponds to the widespread ideas about the "algorithmic" thinking of modern youth, which is being formed, in particular, in computer games). Most students are ready for the uncertainty in interpersonal relationships that is inherent in communication in social networks. All indicators are statistically significantly higher among students surveyed in 2021: for "tolerance to uncertainty" $F=15.155$, $p=0.0001$; "intolerance to uncertainty" $F=19.358$, $p=0.0001$; "interpersonal intolerance to uncertainty" $F=19.446$, $p=0.0001$.

Evaluation of personal time disorganizers is carried out in two ways: 1) depending on the predominance of certain disorganizers in a person; 2) depending on the level of manifestation of disorganizers. The leading time disorganizers among students surveyed in 2021 are: emotional tension (in 34.59% of respondents), emotional apathy (in 23.31%), as well as their combination (in 11.28%), value time disorganizers (in 12.03%). In fact, unfavorable emotional states do not allow students to correctly allocate and use time. Since the author's method does not involve the allocation of levels of severity of time disorganizers, we assessed the normality of the distribution (by assessing the asymmetry and kurtosis) and identified the ranges of the values of the indicators. As can be seen from figure 2, in the majority of respondents, all disorganizers are moderately expressed, as is the general level of disorganization. Respondents with emotional apathy predominate among students with pronounced personal time disorganizers.
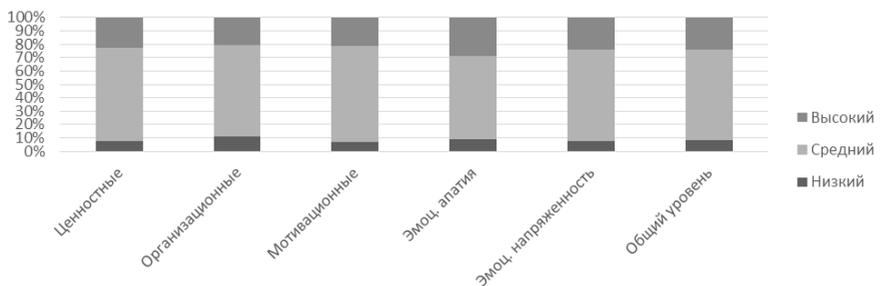


***Figure 2***. *Distribution of students depending on the severity of personal time disorganizers (in percent)*

The study of self-organization was carried out once (figure 3). Of all the processes of self-organization of activity, students are most formed fixation on the constructed plans and the use of auxiliary planning tools (the "self-organization" scale), purposefulness and perseverance are least expressed. The general level of self-organization among the majority of respondents is moderate.
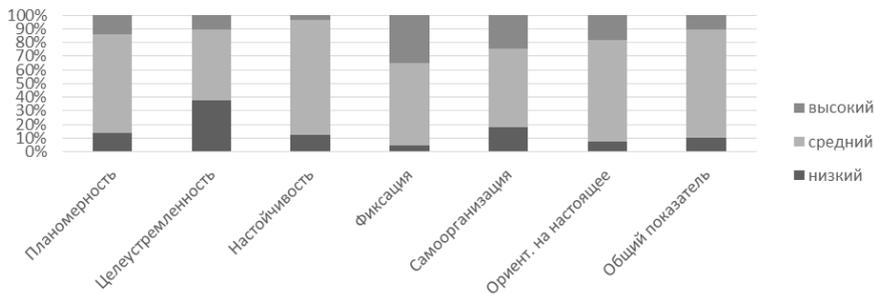
***Figure 3.*** *Distribution of students depending on the formation of self-organization (in percent)*

Thus, there is a discrepancy between the fairly pronounced indicators of flexibility and tolerance for uncertainty among the students surveyed and the manifestations of these qualities in the planning and implementation of activities. The revealed differences between the two sections (the first one was carried out before the pandemic, at the initial stage of the digitalization of the educational process in the university under consideration; the second - during the pandemic, after students mastered the skills of distance learning) suggest that they are affected by the educational context and general conditions of life. This served as the basis for putting forward a hypothesis about the role of the considered qualities for the socio-psychological adaptation of students.

To test the hypothesis of first-year students by the method of natural groups, two experimental groups (EG-1 and EG-2) were identified, for which the diagnostics of socio-psychological adaptation was additionally carried out (figure 4).
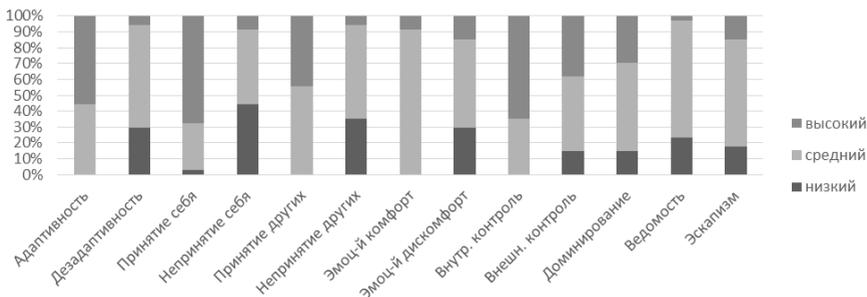


***Figure 4.*** *Distribution of students depending on the level of socio-psychological adaptation (in percent)*

It was found that a significant part of the respondents are more or less characterized by adaptability, acceptance of themselves and others, a moderate level of experiencing psychological comfort, internal control over the situation and the ability to both be led and show dominance, a moderate level of escapism. However, the sample also includes students with low rates of social and psychological adaptation.

Ch. Spearman's rank correlation criterion was used to determine the relationship of socio-psychological adaptation with the considered psychological characteristics (table 1).

*Table 1.*
*Results of correlation analysis (n=34, p≤0.05)*

| | Adaptability | Maladaptation | Self acceptance | Self rejection | Acceptance of others | Rejection of others | Emotional comfort | Emotional discomfort | Internal control | External control | Conformity | Escapism |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tolerance for uncertainty | **0,496** | -0,223 | 0,117 | -0,095 | 0,341 | -0,086 | 0,252 | 0,12 | 0,297 | -0,13 | -0,32 | -0,092 |
| Interpersonal intolerance | -0,299 | 0,443 | -0,035 | 0,24 | **-0,474** | 0,292 | -0,301 | 0,253 | -0,306 | 0,331 | 0,408 | 0,305 |
| Sensitive rigidity | -0,391 | **0,558** | -0,364 | **0,506** | -0,02 | **0,513** | -0,236 | **0,465** | 0,199 | 0,438 | 0,377 | **0,618** |
| Actual rigidity | **-0,469** | **0,507** | **-0,512** | 0,35 | -0,114 | **0,508** | **-0,51** | 0,402 | 0,011 | **0,515** | 0,321 | 0,438 |
| Purposefulness | 0,485 | **-0,642** | 0,468 | -0,485 | **0,611** | **-0,734** | 0,122 | -0,384 | 0,041 | -0,502 | **-0,613** | -0,474 |
| Persistence | 0,241 | -0,317 | 0,215 | -0,381 | 0,402 | -0,503 | -0,139 | -0,129 | 0,221 | -0,291 | **-0,549** | -0,376 |
| Fixation | 0,004 | **0,601** | -0,26 | 0,332 | -0,196 | 0,505 | 0,19 | 0,281 | 0,14 | 0,166 | 0,256 | 0,471 |
| Orientation to the present | 0,368 | -0,408 | **0,66** | -0,524 | 0,286 | -0,395 | 0,269 | -0,478 | -0,342 | -0,397 | -0,498 | -0,299 |
| Self-organization (gen.) | **0,588** | -0,333 | 0,458 | **-0,589** | 0,487 | -0,494 | 0,18 | -0,238 | 0,142 | -0,323 | -0,352 | -0,396 |
| Value-semantic disorganizers | -0,235 | 0,511 | **-0,837** | 0,366 | -0,2 | **0,533** | -0,25 | 0,418 | **0,687** | 0,338 | **0,558** | **0,61** |

| Organizational disruptors | -0,337 | 0,443 | -0,384 | 0,256 | -0,355 | **0,547** | -0,13 | 0,256 | 0,289 | 0,394 | 0,229 | 0,506 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Motivational disorganizers | -0,441 | **0,631** | **-0,54** | 0,431 | -0,527 | **0,669** | -0,289 | 0,344 | 0,256 | 0,368 | 0,221 | **0,587** |
| Emotional apathy | -0,288 | **0,892** | -0,575 | **0,756** | -0,269 | **0,644** | -0,192 | **0,836** | 0,446 | **0,781** | **0,661** | **0,657** |
| Emotional tension | -0,182 | **0,693** | -0,512 | **0,623** | -0,241 | **0,66** | -0,242 | **0,772** | **0,546** | **0,705** | 0,526 | 0,462 |
| Disorganization (gen.) | -0,495 | **0,731** | **-0,698** | **0,618** | -0,496 | **0,727** | -0,35 | **0,596** | 0,427 | **0,564** | 0,4 | **0,584** |

**Note:** only scales are shown, the correlations for which are statistically significant (corresponding values are highlighted in bold in the table)

Statistically significant relationships with the considered psychological characteristics of students were found for all components of socio-psychological adaptation, except for the "Dominance" scale. The largest number of relationships of socio-psychological adaptation was found with actual rigidity (reflecting a person's resistance to changes occurring at the current moment in time), sensitive rigidity, emotional apathy, emotional tension and the general level of disorganization in time, that is, with negative emotional and functional states. To a lesser extent, the interrelations of socio-psychological adaptation of students with the processes of self-organization described by E.Yu. Mandrikova.

To test the hypothesis of causal relationships, two versions of the developmental program were developed. In EG-1, the impact was aimed at reducing the indicators of rigidity and increasing tolerance for uncertainty, in EG-2 - at the development of self-organization and work with personal time disorganizers (in particular, at reducing the level of emotional apathy and emotional tension). The work was carried out in the classroom, in the form of training, using elements of behavioral-cognitive therapy, art therapy, positive and transcultural psychotherapy. However, the proposed programs were not implemented in full due to the transition of Amur State University to distance learning from November 2021 to March 2022. Despite the fact that changes in most indicators did not reach the level of statistical significance, during the feedback process, first-year students noted that attending the training allowed them to expand their knowledge about the world, to understand the reasons for their reluctance to be involved in certain types of intra-university activities (EG-1). Students from EG-2 noted that they learned "that you don't always have to push yourself to the limit" and that in this case "there are emotions that can be shared with other people". Interpersonal contacts improved in the groups.

Thus, rigidity, tolerance for uncertainty and self-organization of the personality are interconnected with the socio-psychological adaptation of students. To clarify the hypothesis of cause-and-effect relationships between these phenomena, the following is possible: 1) re-testing of developing programs in compliance with all necessary organizational conditions; 2) modification of developmental programs, inclusion in them of online practices that are typical for non-university communication of students.

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作为俄罗斯国策的公民积极长寿
# ACTIVE LONGEVITY OF CITIZENS AS A STATE POLICY OF RUSSIA

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抽象的。二十一世纪最重要的人口现象是全球预期寿命的增加，因此老年人在世界各国总人口中的比例适当增加。人口急剧老龄化是对现代世界的经济、产业和社会关系产生重大影响的最重要的社会问题。人口老龄化问题的重要性如此之大，以至于联合国将其与维护地球和平的问题相提并论。

科学家、政治家和整个人口对老龄化生物学的本质的理解、老龄化在生命发展、人类发展、解决一般经济和社会问题中的作用，将有助于创造一个老龄化社会协调，在其中合理利用不同年龄段人群的精神、体力和智力资源，老年人将占据最有价值的位置。

关键词：积极长寿，政府项目，人口统计

*Abstract. The most important demographic phenomenon of the XXI century was the global increase in life expectancy and, as a result, an adequate increase in the proportion of older people in the total population of countries around the world. The sharp aging of the population is the most important social problem that has a significant impact on the economic, industrial and social relations of the modern world. The significance of the problem of demographic aging is so great that the UN puts it on a par with the problem of maintaining peace on Earth.*

*Understanding by scientists, politicians and the population as a whole of the essence of the biology of aging, the role of aging in the development of life, in human development, in solving economic and social problems in general, will allow creating a society of age harmonization, in which the spiritual, physical and intellectual resources of the population will be rationally used different age*

*groups, where the elderly will occupy the most worthy place.*
   *Keywords: active longevity, government programs, demography*

   The most important demographic phenomenon of the XXI century was the global increase in life expectancy and, as a result, an adequate increase in the proportion of older people in the total population of countries around the world. The growth rate of the elderly population is much faster than the growth rate of the entire population. At the same time, the older the age group, the more intensively its number grows. The sharp aging of the population is the most important social problem that has a significant impact on the economic, industrial and social relations of the modern world. The significance of the problem of demographic aging is so great that the UN puts it on a par with the problem of maintaining peace on Earth.

   The UN Principles for the Elderly, adopted by the General Assembly of this organization back in 1991, express modern views on the place and role of older people in society. To make the life of the elderly full-blooded, providing them with independence, dignity, participation and worthy care by all members of society, the possibility of realizing their inner potential is the quintessence of these Principles. The UN principles are advisory in nature, but for government agencies and public associations they are an important guideline in understanding the social needs of older people and in organizing activities to meet them.

   **The purpose of the study** was to analyze state policy documents, the target group of which is the older generation.

   **Research methods:** analytical, descriptive, collection of official information.

   Active aging, first articulated in 2002 in the World Health Organization's Active Aging Strategy Framework, describes "the process of optimizing an individual's health, social participation and security opportunities to improve their quality of life as they age". The basic principles of active aging were included in the final document of the Second World Assembly on Aging, the Madrid International Plan of Action on Aging in 2002. The policy of active aging is aimed at developing and realizing the potential of a person, which is based on an increase in life expectancy. The dual goal of active aging policy is to ensure that all citizens can continue productive and independent lives while mobilizing the potential of an aging society for its continued sustainable development.

   In recent years, a number of policy documents have been adopted in Russia, the target group of which is the older generation. In February 2016, the Action Strategy for the benefit of citizens of the older generation in the Russian Federation until 2025 (hereinafter referred to as the Action Strategy) was approved, and in November 2016, the Action Plan for 2016-2020 for the implementation of its first stage. The Action Strategy is the first step in building a comprehensive policy framework

for older citizens and contains tasks and directions for their solution in key areas of active longevity. The main areas of state support for older citizens were developed in the Decree of the President of the Russian Federation dated May 7, 2018 № 204 "On the national goals and strategic objectives of the development of the Russian Federation for the period up to 2024" (hereinafter - Decree № 204) and, as a result, in the national project "Demography". Two of the nine national development goals for the period up to 2024, set by Decree № 204, directly relate to the quality of life of the older generation: increasing life expectancy to 78 years (by 2030 - up to 80 years); ensuring sustainable growth in real incomes of citizens, as well as growth in the level of pension provision above the level of inflation.

In addition to the national development goals outlined in Decree № 204, it is important to note a number of target indicators fixed in the national project "Demography" and directly characterizing the dynamics of the potential for active longevity: an increase in healthy life expectancy up to 67 years; reduction in mortality of the population older than working age to 361 per 10 thousand people of the population of the corresponding age; increase in the proportion of citizens systematically engaged in physical culture and sports, up to 55.0%.

The national project "Demography" includes five federal projects, three of which affect the interests of citizens of the older generation: "Older Generation", "Strengthening Public Health", "Sport — the norm of life". The "Older Generation" project is directly related to active longevity. In the other two — older citizens participate on an equal basis with other age groups.

The task of the federal project "Older Generation" is to create conditions for active longevity, develop and implement programs for systemic support and improve the quality of life of the older generation. The key directions for developing the potential of active aging in this federal project include: measures to increase the period of active aging and healthy life expectancy; creation of a system of long-term care for citizens of the older generation and the disabled; assistance in bringing social service organizations in the subjects of the Russian Federation into proper condition, as well as eliminating queues in them; organization of events for vocational training and additional professional education for persons of pre-retirement age.

The "Active Longevity" Project — is a program aimed at supporting older citizens to improve their quality of life through the prevention of cognitive impairment, as well as the creation of unique information materials to help people with dementia and their family members/caregivers who provide home care.

The aim of the project is to provide support to older citizens to improve the quality of life through the prevention of cognitive disorders, as well as the creation of unique information materials to help people with dementia and their family members/caregivers who provide home care.

The objectives of the project are:

— the formation and implementation of measures to maintain the quality of life and the creation of motivation to remain active among citizens of the older generation;

— increasing public awareness of cognitive health issues;

— prevention and provision of timely diagnosis of detection of cognitive impairment and prevention of their transition to dementia;

— providing assistance in providing medical and social assistance to patients with cognitive disorders;

— providing support to caregivers of patients with cognitive impairment;

— monitoring and analysis of domestic and foreign experience in support, treatment, provision of social services and creation of infrastructure for people with dementia and their family members who care.

The result of the implementation of the "Active Longevity" Concept will be:

At the first stage (2020-2024), by the end of which the President of the Russian Federation has set the task of increasing life expectancy at birth to 78 years, it is planned to focus the main efforts on creating conditions for improving the health status of the population in general and older citizens in particular, and on the formation of a comprehensive system of care and care, which not only improves the quality of life of those in need of care, but also contributes to an increase in life expectancy.

At the second stage (2025-2029), in the field of demographic policy, measures to reduce mortality will continue, while in the field of active longevity policy, more emphasis can be placed on creating conditions for more active involvement of older citizens in paid employment and volunteering, and also to ensure economic independence at an older age.

At the third stage (2030-2034), within the framework of which the national goal of increasing life expectancy at birth to 80 years by 2030 is set, the active aging policy can focus on further improving the quality of life of older citizens, including by expanding the participation of this category of the population in continuing education programs, creating a more comfortable living environment, and expanding intergenerational contacts.

The formed system of measures aimed at improving the welfare and socio-cultural development of older citizens, strengthening their health, increasing life expectancy and the potential for active longevity.

**Conclusion**

The results of the implementation of the goals and objectives set in the Concept will be: increasing the social activity of citizens of the older generation;

— adaptation of citizens of the older generation to the modern rhythm of life,

creation of conditions for their full life, active longevity;

— development of a system for the provision of social services, the introduction of new technologies and forms of social services and care;

— creation of a unified communication, creative, consulting, cultural and leisure platform with an accessible environment for older citizens;

— health promotion, development of physical activity, involvement in sports and the formation of a healthy lifestyle of older citizens;

— development of the volunteer movement;

— increasing the length and quality of life of older citizens by creating conditions and new opportunities for active longevity.

心灵的非物质理论
# NON-MATERIAL THEORY OF THE PSYCHE

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概括。 本文批判性地回顾了一些过时但仍然流行的医学学说，特别是希波克拉底关于大脑是所有心理过程的储存库的假设； I.M. Sechenov 关于心理作为大脑反射衍生物的假设； 知识产权 巴甫洛夫关于高级神经活动相当于心理的假设。 在他的研究中，作者提到了对野孩子的研究。 作者证明了心灵的非物质性以及大脑作为理想与现实之间的生物界面的作用。 新方法需要改变传统范式以及我们研究心理和治疗精神障碍的所有方法。
关键词：生物界面、大脑、心智、非物质理论、心理、精神障碍。

***Summary.*** *In this paper, a number of outdated but still prevailing medical doctrines are critically reviewed, in particular, Hippocrates's hypothesis of the brain as a repository of all mental processes; I.M. Sechenov's hypothesis of the psyche as a derivate of the brain reflexes; I.P. Pavlov's hypothesis of the higher nervous activity as an equivalent of the psyche. In his research, the author refers to studies of feral children. The author proves the non-materiality of the psyche and the role of the brain as a biological interface between the ideal and the real. The new approach would require changing the traditional paradigm as well as all our approaches to studying the psyche and treating mental disorders.*

***Keywords:*** *biological interface, brain, mind, non-material theory, psyche, psychic disorders.*

For two thousands of years, the problem of relation between the psyche and the brain was explained in the most primitive way, based on Hippocrates' hypothesis.

But till the modern time this problem remains mysterious and unresolved. Let me remind you that according to Hippocrates, the brain is a vessel of all mental processes. Despite the enormous progress of science, Hippocrates' hypothesis still dominates in medicine, physiology and psychology.

In the 16th century, this hypothesis was further developed by René Descartes, who dissected heads of animals, trying to find material structures of memory and thinking (1). In 1863, Ivan Sechenov, based on the ideas of Hippocrates, Descartes and Darwin, wrote his paper "Reflexes of the Brain" (2). This short article is still regarded as a revolutionary turn in our understanding of the psyche. In this paper Sechenov purely theoretically stated that the brain acts "like any other machine", driven by reactions of excitation and inhibition.

It was the time of primitive materialism, and these ideas were embraced with enthusiasm by the scientific community as well as the general public. Ivan Pavlov was inspired with Sechenov's ideas and developed the well-known theory of conditional reflexes. Later, he stated that it is the reflex, that unites the physiological and the psychological. As a result, he developed the reflex theory of the psyche. It is still popular in our time. Moreover, at the congress of physiologists in Rome in 1936, Pavlov said that we should completely abandon the term "mental" and replace it with the term "the higher nervous activity" (3).

What united all these outstanding scientists - Descartes, Sechenov, Pavlov and their followers? It was a powerful and exciting idea of discovering the material substrate of the psyche. Let me stress it once again - they did not mean finding some structures on which the psyche is based; but they tried to find the material substrate of the psyche itself.

I should remind you that dominant hypotheses about the material structures of the psyche directly influenced the therapy of mental disorders. The anatomical approach to mental structures stimulated the ideas of lobotomy and dissection of the cerebral corpus callosum. The idea of electrical activity led to multiple experiments with electroshock and attempts to read human thoughts by the EEG. New biochemical theories caused the development of a new branch of the medicine called psychopharmacology.

Metaphorically speaking, during long time scientists searched for the vessel of the soul – and finally they found it in the synaptic cleft. As a result, 90% of modern therapies for mental disorders are conducted with pharmacological substances. The target of these substances is metabolism of neurotransmitters in the synaptic cleft, but they are supposed to influence mental processes.

I am not against psychopharmacology. It relieves mental suffering. But I remember the words of the inventor of Levomepromazine Henry Lobari (4), who admitted, thirty years after the discovery of neuroleptics: "We invented just a chemical straitjacket".

What happened in modern science but was not ever noticed by the scientific community? It was a regrettable substitution of concepts! Scientists talked about studying and treating the psyche, but in fact, they were studying and treating the brain. At the same time, new pseudo-physiological and pseudo-psychological

terms were invented to describe mental processes in terms of neural flows, neuro-transmitter exchange, excitation and inhibition in the brain, and so on.

In 2008, in contrast to these traditional ideas, I introduced the hypothesis of the brain as a biological interface. This hypothesis draws a parallel between the brain and the computer hardware (from the one side), and between the psyche and the computer software (from the other side). From this perspective, teaching a child to speak a language, and human learning in general, could be seen as a language programming, conducted in a specific language, just as in technical systems.

Here is one of the main conclusions of this new theory: "Over time, the unique role of the brain will be reconsidered, and in the new framework, it will be given a more modest but no less important role of a bridge between the ideal and the real; or, in modern terms, of a biological interface".

It must be admitted that age-old attempts to reduce the diversity of mental phenomena to primitive anatomical structures, or biochemical or electro-physiological reactions, do not stand up to criticism. The very essence of mental processes is qualitatively different. We receive information, produce information, modify and verify information, exchange information and – most importantly – we transmit an ever-increasing amount of information from generation to generation. It is this ability - to preserve information on stones and papyrus, on paper and electronic devices, and to transmit it to the next generations - that makes us human and distinguishes us from animals.

The further development of my theory was related to one essential point that has long escaped the attention of physiologists and psychologists. Modern academic science generally recognizes information as non-material (5). Only its carriers - biological, paper or electronic formats - are material.

However, being non-material, any information obtains (does not initially have, but obtains) a number of quantitative and qualitative characteristics. It can be neutral, emotionally intense, frightening, true, or false. However, all these characteristics can only appear if there is a subject of perception. Moreover, the same information can cause completely different mental reactions in different subjects. Let us remember September 11, 2001, and the collapse of the World Trade Centre: we saw nationwide mourning in the United States and cheering crowds in Libya.

Actually, the information does not exist, if there is no subject to perceive it. The prevailing view of the brain as the vessel of all mental processes has led to many misconceptions which have entered our everyday speech. And in science, it has led to the well-known phenomenon of an outdated theory overload, when everything outside this dominant scientific concept is immediately discarded.

It is quite common, even for our educated colleagues, to say something like "he has a problem with his nerves" or "it's getting on my nerves", although everyone knows that nerves are just conductors. Another example is a phrase "it came

into my head". However, ideas do not come into one's head, but into one's mind. In general, the identification of the nervous and the mental - at the level of ordinary perception and even scientific knowledge - is overwhelming.

I will not dwell on the detailed explanations of the non-material theory of the psyche. If colleagues are interested in it, they can find its detailed explanation in series of my articles both in Russian and in English.

I would conclude with formulating the main ideas of this theory. It was shown that:

Firstly, the brain and the psyche are two closely related but fundamentally different systems. Secondly, the brain and nervous system are material and regulate the activity of internal organs, reflex reactions and adaptive functions of the body. Thirdly, the psyche is non-material. It is an informational structure, which is formed on the basis of language programming only in the social environment and regulates all human social functions (5-10).

This was clearly demonstrated by the unintended experiments of raising human children in animal communities. They remain representatives of the species Homo sapience. But they do not obtain a human personality, as they could only learn the language and behaviour of the animal community in which they have survived.

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三岁以下儿童急性重度并发颅脑损伤保守治疗的比较评价
# COMPARATIVE EVALUATION OF CONSERVATIVE THERAPY IN ACUTE SEVERE CONCOMITANT TRAUMATIC BRAIN INJURY IN CHILDREN UNDER THE AGE OF THREE YEARS

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抽象的。 第一天最大量的输液治疗与稳定血流动力学的需要有关，受到严重休克、失血、疼痛综合征的干扰，这代表了受伤婴儿的高度危及生命的状况。 在接下来的日子里，补偿能量损失的肠内方法发挥了主导作用。 在 2.3 组中，相对较大和较长时间的镇痛、抗炎治疗与创伤性损伤的严重程度相对应。 第3组体重最重的儿童进行了更积极的血管扩张治疗。 血管加压药给药时间最长的是第 3 组 15 天，第 2 组 7 天，第 1 组 1 天。
关键词：治疗，急性重度合并颅脑损伤，儿童。

***Abstract.*** *The largest volume of infusion therapy on the first day is associated with the need to stabilize hemodynamics, disturbed by severe shock, blood loss, pain syndrome, which represented a high degree of life-threatening condition in injured infants. In the following days, the enteral method of compensating for energy losses played a leading role. In 2.3 groups, relatively large and prolonged analgesic, anti-inflammatory therapy corresponded to the severity of traumatic injuries. More active vasodilating therapy was carried out in the heaviest children of the 3rd group. The longest administration of the vasopressor was found in group 3 for 15 days, in group 2 for 7 days, and in group 1 for 1 day.*

***Keywords:*** *therapy, acute severe concomitant traumatic brain injury, children.*

**Relevance**

Completion of the most acute period of concomitantTBI should be attributed to 16-18 days after injury. This period is naturally lengthened compared to isolated TBI (about 14 days). The main ways to optimize intensive care are to use intensive care methods as early as possible to ensure adequate regional (brain) and systemic perfusion (timely replenishment of BCC, inotropic support), to prevent the formation of additional intracranial mechanisms of CNS damage and prevent

the development of systemic disorders that are fraught with systemic hypoxemia, hypercapnia and hypodynamia (early enteral hydration and nutritional support, respiratory therapy, rational antibiotic therapy, etc.). However, the management of traumatized children, especially young children in the ICU, remains a serious problem due to the lack of information in the literature regarding the ability to reduce secondary brain damage, the correct management of severely injured children after SCTBI [1-4].

**Purpose of the study**

To study and evaluate conservative therapy for acute SCTBI in children under 3 years of age.

**Material and research methods**

The analysis of reliably significant deviations, intergroup differences in respiratory parameters and oxygen saturation, hemodynamics was carried out. The results were obtained by monitoring body temperature, hemodynamics with hourly registration of ongoing intensive care. The research data were processed by the method of variation statistics using the Excel program by calculating the arithmetic mean values (M) and the errors of the means (m). To assess the significance of differences between the two values, Student's parametric test (t) was used. The relationship between the dynamics of the studied indicators was determined by the method of pair correlations. The critical significance level was taken equal to 0.05.

Of the 20 children (tab. 1) diagnosed with severe concomitant traumatic brain injury (SCTBI) admitted to the Republican Center for Emergency Medical Care in infancy, 10 patients received intensive care in the ICU for $5.9 \pm 1.3$ days, 5 patients for $14 \pm 1.7$ days, 5 children for $31.2 \pm 5.3$ days, which served as the basis for creating randomized groups according to the severity of the condition. The difference is significant ($p < 0.05$).

*Table 1.*

*Characteristics of SCTBI patients admitted before the age of 3 years*

| Groups | Num. of days in ICU | Num. of patients | Gender male | Age | RTA | Catatrauma | Traum. shock of the 2nd deg. | Operated on admission | Number of days in hospital |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 5,9±1,3 | 10 | 4. | 20,8±7,8 | 71% (5) | 29% (2) | 71% (5) | 71% (5) | 15,2±7 |
| 2 | 14±1,7 | 5 | 4 | 23,1±4,7 | 50% (3) | 50% (3) | 83% (5) | 66% (4) | 20±4 |
| 3 | 31,2±5,3 | 5 | 3 | 18,2±4,6 | 80% (4) | 20% (1) | 100% (5) | 100% (5) | 37,4±5,3 |

In group 1, the number of children with closed traumatic brain injury (CTBI) (71%), concussion (28%) prevailed, the number of operations on the first day after injury was 71%. In the 2nd more severe group, the number of open traumatic brain injury (OTBI) was 66%, the frequency of severe brain contusion (SBC) was 50%, the fracture of the parietotemporal bone with the transition to the base of the skull was 48%, severe traumatic shock was observed in all patients. In the most severe group 3, 100% of the severity of the condition at admission was due to CTBI, SBC, subarachnoid hemorrhage (SAH), traumatic shock. In group 1, out of $5.9 \pm 1.3$ days spent in the ICU, only 1 patient out of 7 was on ALV for 4 days in CMV mode, followed by extubation to restore spontaneous breathing (tab. 2). In group 2, all patients were transferred to ALV upon admission according to indications, prolonged for 7 days. Subsequently, out of $14.6 \pm 1.7$ days spent in the ICU, the average ALV in the CMV mode in group 2 was carried out for $6.8 \pm 2.2$ days, SIMV $1.75 \pm 0.8$, CPAP in 1 patient - 1 day. In group 3, ALV in the CMV mode was performed for 3 patients for $17 \pm 3$ days, SIMV for 2 patients for 2 days, in the following days for one child for 12 days, CPAP for $2.5 \pm 1.5$ days, spontaneous breathing for $34 \pm 9.5$ days. For a differentiated assessment of the effectiveness of hardware respiratory support, the number of patients who underwent one or another ventilation mode (CMV, SIMV, CPAP) was noted as a percentage. The number of patients of the 1st group who passed without a mechanical apparatus respiratory ALV/SALV was 70% (7) on day 1, 80% (8) on days 2-5. In group 2, all patients from 1 to 7 days were on ALV in CMV mode, followed by a transition for three days through simv and cpap modes to spontaneous breathing. In group 3, on the first day, 1 patient was on CMV, the other was on SIMV. From 2 to 23 days, two were on ALV, one was on SIMV with a transition to CPAP on days 24-27 and a complete cessation of external respiration support on days 28.

**Results and its discussion**

The largest volume of infusion therapy (fig. 1) on the first day is associated with the need to stabilize hemodynamics, disturbed by severe shock, blood loss, pain syndrome, which represented a high degree of life-threatening condition in injured infants.
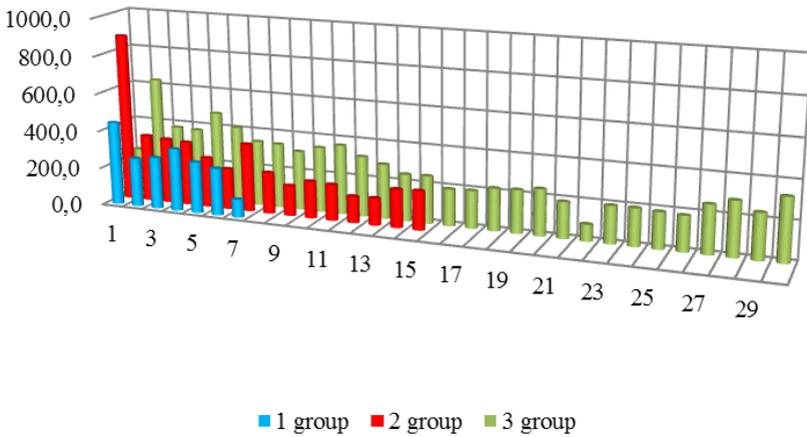
*Figure 1. Infusion volume in the acute period of SCTBI up to 3 years*

In the following days of the acute period of stabilization of the water balance, timely correction of current losses, deviations under the control of clinical and biochemical parameters of homeostasis, with the leading value of enteral compensation for energy losses, contributed.
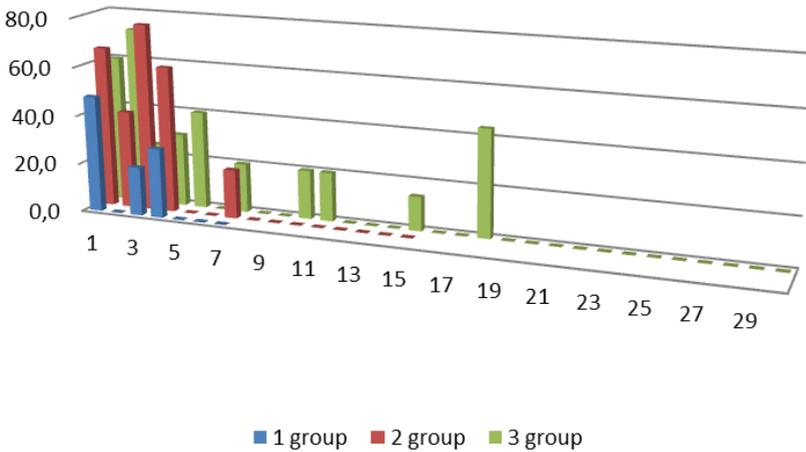


*Figure 2. Introduction of protein preparations in children under 3 years old, ml/ day*

In the first days (5 days) after the removal of patients from shock, the provision of specialized surgical care, the correction of posthemorrhagic anemia, hypodys-proteinemia was carried out most intensively (fig. 2). It is noteworthy that in the 3rd group on the 15th and 17th days, the need for parenteral correction of protein metabolism deviations remained.
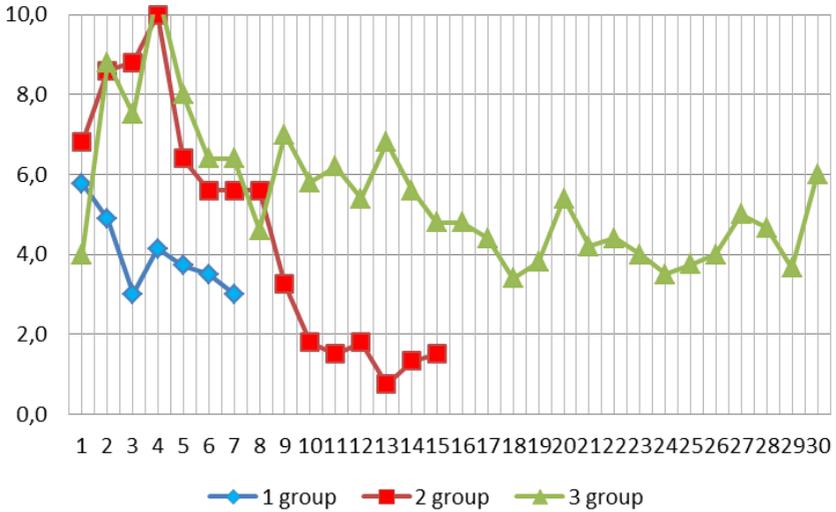


*Figure 3. The frequency of administration of painkillers, sedatives per day*

In the multifaceted drug correction, the main value was given to analgesic, sedative therapy, the intensity of which in groups 2 and 3 increased to a maxi-mum level on days 3-4, while in children of group 1 there was a decrease in the introduction of sedatives, hypnotics (fig. 3). As the general condition improved in group 2, consciousness, reflexes, and motor activity were restored on day 8.9, causing a limitation of drug anesthesia. In group 3, prolonged ALV was performed against the background of conservative corrective sedative therapy.
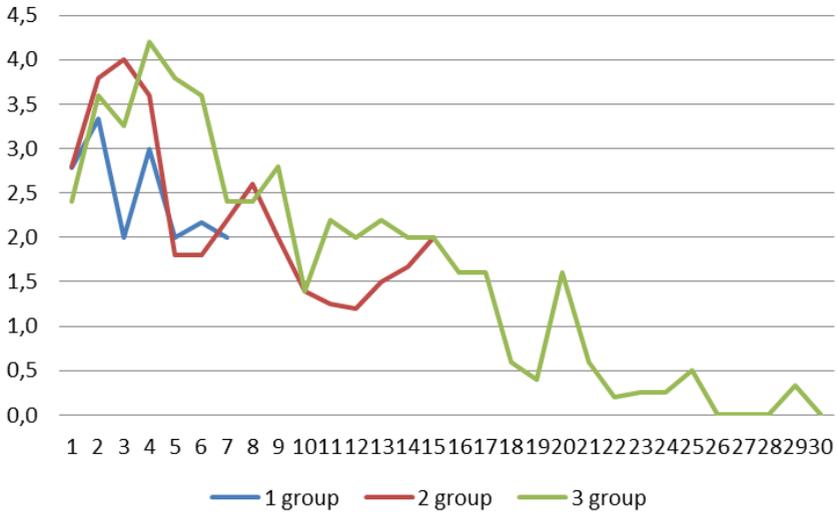
*Figure 4. Anti-inflammatory therapy*

In groups 2.3, a relatively large and prolonged anti-inflammatory therapy corresponded to the severity of traumatic injuries (fig. 4).
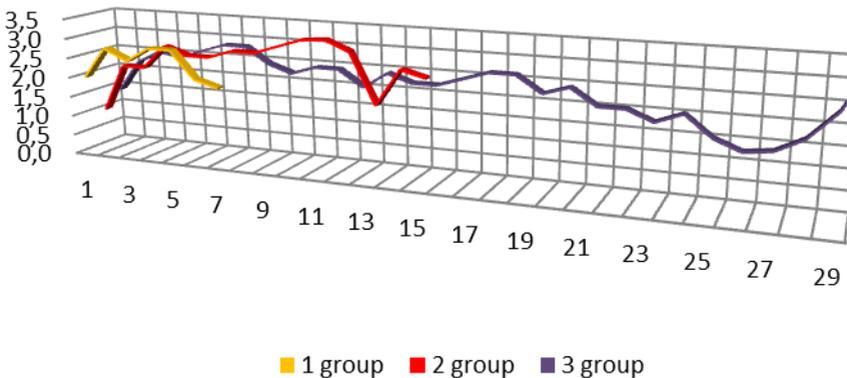


*Figure 5. Antibiotic therapy in the acute period of SCTP up to 3 years*

In groups 2 and 3, antibiotic therapy was longer. There were no significant differences in antibiotic therapy according to the severity of the condition (fig. 5).
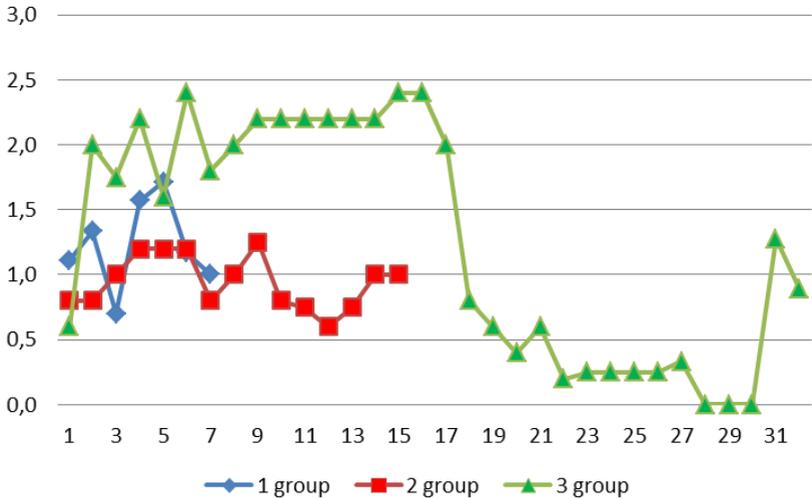
***Figure 6.*** *The frequency of administration of vasodilators*

More active vasodilator therapy in the most severe children of group 3 draws attention (fig. 6), which is due to the need for more prolonged mechanical respiratory support due to the severity of damage to the brain, respiratory system, a more severe inflammatory reaction of the children's body for 17 days. The decrease in the need for vasodilation on days 18-22 is due to the restoration of the function of the respiratory system with the cessation of ALV/SALV.
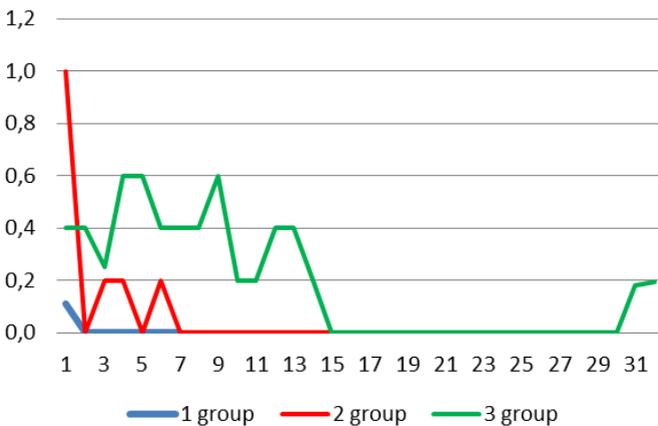


***Figure 7.*** *The introduction of dopamine*

The longest administration of the vasopressor was found in group 3 for 15 days, in group 2 for 7 days, and in group 1 only for 1 day (fig. 7).

*Table 2.*

*Correlations between the volume of infusion therapy and hemodynamic parameters in SCTBI in children under 3 years of age*

|  | **Group 1** | **Group 2** | **Group 3** |
|---|---|---|---|
| i/v infus./RR | -0,73 | -0,59 | 0,10 |
| i/v infus./ox. sat. | -0,92 | 0,01 | 0,22 |
| i/v infus./HR | 0,42 | 0,79 | 0,77 |
| i/v infus./AVT | 0,62 | 0,69 | 0,42 |
| i/v infus./MVP | 0,70 | 0,67 | 0,58 |
| i/v infus./GPVR | -0,33 | -0,60 | -0,06 |
| i/v infus./CO | 0,50 | 0,44 | 0,29 |
| i/v infus./SV | 0,35 | 0,46 | -0,17 |
| i/v infus./temp. | 0,47 | 0,26 | 0,66 |
| i/v infus./MBP | -0,19 | -0,29 | 0,24 |
| i/v infus./SBP | -0,13 | -0,30 | 0,17 |
| i/v infus./DBP | -0,28 | -0,34 | 0,30 |
| i/v infus./PBP | 0,14 | 0,40 | -0,11 |
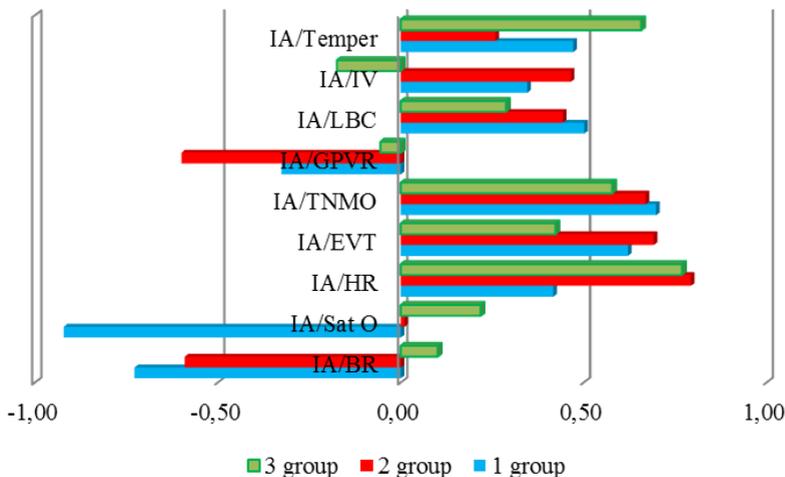


**Figure 8.** *Correlations of infusion therapy with hemodynamic parameters up to 3 years*

In group 1, there is a high probability of a decrease in oxygen saturation with an increase in infusion therapy (-0.92), respiratory rate (-0.73). In group 2, the tendency to decrease GPVR with an increase in intravenous administration (-0.6). Attention is drawn to the increase in the tendency to tachycardia during infusion therapy in 1 (0.42), in 2 and 3 groups (0.79; 0.77, respectively).

Noteworthy are the correlations between the frequency of administration of vasodilators and the studied parameters, the most significant in group 3, causing a tendency to increase oxygen saturation (0.6), increase temperature (0.7), and increase breathing (0.5).

*Table 3.*
*Correlations of vasodilating therapy*

|  | Group 1 | Group 2 | Group 3 |
|---|---|---|---|
| vasodilating/RR | 0,3 | -0,3 | 0,5 |
| vasodilating/ox. sat. | -0,3 | -0,4 | 0,6 |
| vasodilating/HR | 0,0 | -0,1 | 0,4 |
| vasodilating/AVT | 0,1 | -0,2 | -0,1 |
| vasodilating/MVP | -0,1 | 0,0 | 0,2 |
| vasodilating/GPVR | 0,0 | 0,3 | 0,2 |
| vasodilating/CO | -0,2 | -0,5 | 0,0 |
| vasodilating/SV | 0,1 | -0,4 | -0,4 |
| vasodilating/temp. | 0,0 | 0,4 | 0,7 |
| vasodilating/MBP | 0,0 | 0,3 | 0,0 |
| vasodilating/SBP | 0,1 | 0,3 | -0,1 |
| vasodilating/DBP | 0,0 | 0,5 | 0,2 |
| vasodilating/PBP | 0,0 | -0,3 | -0,5 |
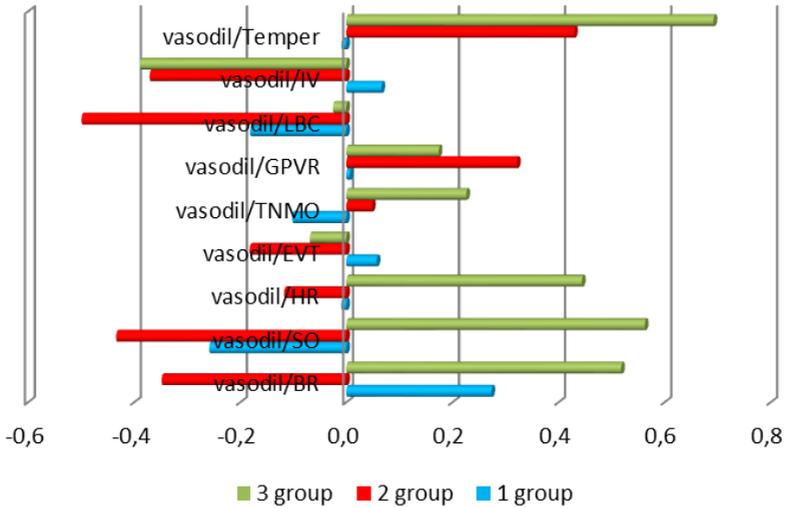
*Figure 9. Correlations of vasodilating therapy*

<div align="right">

*Table 4.*

</div>

*Correlations of dopamine administration.*

|                  | Group 1 | Group 2 | Group 3 |
|------------------|---------|---------|---------|
| dopamine/RR      | -0,5    | -0,4    | 0,4     |
| dopamine/ox. sat.| -0,6    | 0,0     | 0,4     |
| dopamine/HR      | 0,4     | 0,7     | 0,7     |
| dopamine/AVT     | 0,3     | 0,6     | 0,2     |
| dopamine/MVP     | 0,5     | 0,5     | 0,5     |
| dopamine/GPVR    | -0,3    | -0,5    | -0,1    |
| dopamine/CO      | 0,3     | 0,4     | 0,2     |
| dopamine/SV      | 0,0     | 0,4     | -0,2    |
| dopamine/temp.   | 0,4     | 0,1     | 0,8     |
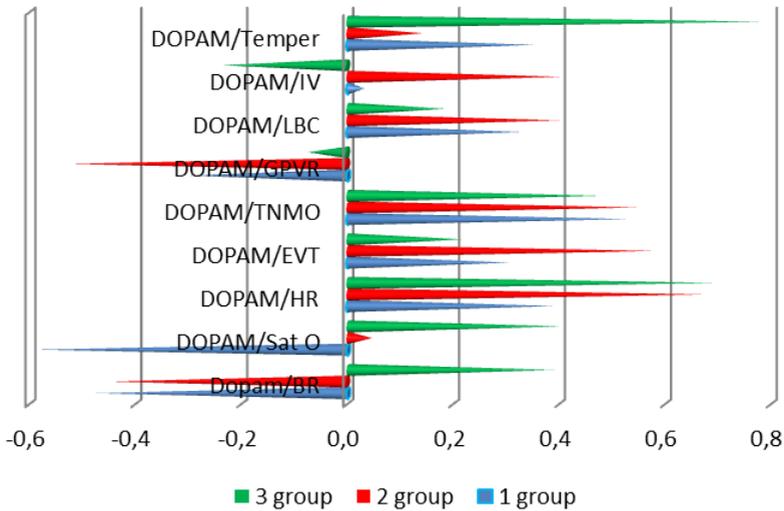
*Figure 10. Dopamine correlations*

A direct correlation was found between the introduction of a vasopressor and an increase in temperature (0.8), a less significant increase in MVP (0.5) in group 3, a tendency to tachycardia (0.7) in groups 2 and 3, a decrease in oxygen saturation (0.6) in group 1.

**Conclusion**

The largest volume of infusion therapy on the first day is associated with the need to stabilize hemodynamics, disturbed by severe shock, blood loss, pain syndrome, which represented a high degree of life-threatening condition in injured infants. In the following days, the enteral method of compensating for energy losses played a leading role. In 2.3 groups, relatively large and prolonged analgesic, anti-inflammatory therapy corresponded to the severity of traumatic injuries. More active vasodilating therapy was carried out in the heaviest children of the 3rd group. The longest administration of the vasopressor was found in group 3 for 15 days, in group 2 for 7 days, and in group 1 only for 1 day.

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为附加教育系统的学生组织夏季创造性转变中的合理营养
# RATIONAL NUTRITION IN THE ORGANIZATION OF SUMMER CREATIVE SHIFTS FOR STUDENTS OF THE SYSTEM OF ADDITIONAL EDUCATION

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抽象的。 这篇文章讨论了在组织暑期创意和娱乐转变中基础教育和附加教育系统中学生和学生的合理营养问题。
关键词：合理营养、组织儿童和青少年娱乐活动、夏季创意协会活动。
*Abstract. The article deals with the issue of rational nutrition of students and pupils of the system of basic and additional education in the organization of summer creative and recreational shifts.*
*Keywords: rational nutrition, organization of recreation for children and adolescents, activities of summer creative associations.*

Today, the quality of life is of great value to humanity. Recent years are characterized by the manifestation of a stable trend towards the deterioration of children's health, an increase in the number of children who during the school year have huge loads both when studying in the system of basic general education and additional pre-professional education, who need a good summer vacation. This problem is very well solved by summer creative shifts.

Children's health is formed under the influence of the external environment. One of these factors is alimentary, while food, when it enters the child's body, serves as a material for nourishing and building organs and tissues, and becomes an internal factor.

In connection with the development of telecommunication systems, many children spend all their free time with phones and tablets, playing computer games.

Every day the number of children communicating with each other on the Internet increases and, thus, in their unformed body, changes occur in the development of motor functions, psycho-emotional state, children do not receive "live" positive emotions. In this regard, the tasks of summer creative associations created on the basis of various institutions of additional education are becoming more and more relevant.

When organizing such creative shifts, it is necessary to take into account many factors for the comfort and safety of the child with the help of pedagogical, social, legal, psychological, medical mechanisms, as well as a very important condition for the formation of a positive social environment during summer holidays.

In recent years, visiting profile shifts have gained immense popularity, where the leading role in organizing children's recreation belongs to children's and youth public associations. The activity of such creative shifts contributes to the continuity of the educational process, has a positive effect on creative development, the exchange of professional experience with students from other creative organizations of the additional education system.

In this regard, the problem arises of finding one's own approach to the realization of the goal of the educational process in specific working conditions. The solution to this problem is through:
 - improving the content of the programs of traveling creative associations, adapting existing programs of additional education.
 - creation of author's methodological approaches and the use of modern pedagogical technologies in the process of organizing recreation and leisure.
 - compliance with the balance, nutritional value and usefulness of the diet in the annexes to SanPiN 2.3/2.4.3590-20.

On the part of the regulatory authorities, there is a tendency to reduce the impact on the activities of such organizations: coordination and preliminary examination of the compiled menus are not mandatory, which leads to violations and errors.

Every year, an increase in the number of chronic diseases and functional dysfunctions in children in all nosologies is recorded. A significant proportion of diseases are caused by malnutrition. At the same time, the proportion of diseases of the gastrointestinal tract has increased several times in recent years. The right diet contributes to the development of neural networks and connections, which increases the potential of intellectual abilities, as well as the level of adaptation to external influences.

Age periods have distinctive features, both in physiology and in the metabolism of a young organism. There are several critical periods when the body is de-

stabilized and forced to adapt to changing environmental conditions. Examples of such changes are admission to kindergarten, school, section, summer camp. At this time, children are more prone to stress, physical and mental overload, increased energy consumption. Good nutrition has a positive effect, helps to maintain health, and sometimes restore it, prepare it for the loads that exist in the school year.

An unbalanced diet in field creative shifts can form a deficiency of a number of micro- and macronutrients, leading to a deterioration in physical performance, a slowdown in the rate of biological maturation, predisposes to the development of chronic diseases, and reduced fertility. This socially significant problem requires special attention.

To solve the problem, it is necessary to understand the causes of deviations in the physical and mental state of schoolchildren.

According to hygienic analyzes in preschool organizations and schools, attention is often paid to the quality of food products, but not their nutritional value. In the North-Western, Central, Southern, Volga, Ural, Siberian, Far Eastern federal districts, as a result of research, it was revealed that the nutrition of children is unbalanced: there is a lack of proteins, meat, fish, fruits, vegetables, dairy and sour-milk products, as well as vitamins, microelements, polyunsaturated fatty acids, replaced to a greater extent by carbohydrates cereals, sugar, pasta, bakery, sausages [9,10].

According to the Institute of Nutrition of the Russian Academy of Medical Sciences, there is also an irrational menu with a deficiency of proteins, vitamins, dietary fiber and calcium. A violation of the balance of nutrients for sufficient growth and development of each child was revealed [5, 15].

The daily requirement for nutrients and energy of children differs depending on age. For children 7-10 years old, it is necessary to consume 77 g of proteins, 79 g of fat and 308 g of carbohydrates per day (up to 355 g due to fruits), the energy value should be 2251 kcal (up to 2359 kcal, with an increase in carbohydrates). For children over 11 years old, the daily requirement is 90g of protein, 92g of fat and 360g of carbohydrates (up to 383g due to fruits), the energy value should be 2628 kcal (up to 2820 kcal, with an increase in carbohydrates). Also, sets of recommended products have been developed that can help in compiling a balanced and rational menu for children and adolescents.

According to the reports of Rospotrebnadzor, not all students and pupils in the territory of the Russian Federation are provided with hot meals, but the percentage of coverage is increasing annually.

Outside the Russian Federation, studies show comparable data on eating disorders.

The search for solutions to this problem is being implemented to a greater extent: programs of summer creative associations are being introduced, the purpose

of which is not only creative, but also preventive to maximize the coverage of the younger generation with a balanced diet, and these methods are bearing fruit.

The eating behavior of society needs to be corrected by medicine and administrative bodies in order to form the correct scientific preventive measures to improve the health of new generations.

Selective in-depth studies of the SRI HHC "NTsZD" of the RAMS in the city of Moscow revealed only half of healthy children among preschoolers, and the older the children, the lower this percentage. By school, this is already a third of the total mass; by graduation from an educational institution, less than 25% of children remain without health problems [3].

In the structure of pathologies arising from alimentary disorders, anemia, gastroenterological and endocrine diseases occupy leading positions. The most obvious problem is obesity and overweight, which, without timely correction, will immediately begin to affect all organs and systems of the body, especially the cardiovascular one [2, 3, 7].

The deceleration of the growth and development of the modern generation is also an important problem that needs to be addressed as soon as possible. And this decision should be comprehensive, focused on children's groups.

Obviously, the main reason for the considered deviations in the digestive system of children is the imbalance of nutrition. To direct society towards a healthy and physically fulfilling life, it is necessary to competently manage modifiable risk factors for the development of diseases. A properly formed digestive system, together with oral tolerance to food antigens, helps to strengthen immunity, improve metabolic processes, detoxify and protect the body. A meager, monotonous diet leads to a lack of desire in children to eat a full portion of the dish, the child does not receive the required nutrients. Flavoring additives, enticing packaging, intrusive advertising promoting unhealthy nutrition, very quickly won the love of schoolchildren. Not only health professionals and cooks need to be aware of the nutrient norms for a balanced diet, but also educators, parents and children themselves. Changing preferences in food choices is largely determined by society: family, friends, organized groups. For the physical and cognitive development of the future of our society, to increase academic performance, endurance, concentration, psycho-emotional stability and to prevent the occurrence of diseases of the gastrointestinal tract in children, it is necessary to provide them with a rational and balanced diet not only in health-improving creative shifts, but also in the school year [14].

Focusing on health-saving technologies is one of the most important tasks of summer creative shifts today, where favorable conditions are created for self-improvement and self-realization of a creative personality, where each pupil is given a choice of the direction and pace of development and ways to meet his new actu-

alizing needs. It is during childhood and growing up that the main eating habits are formed, which is why it is so important to control the children's diet and help the younger generation to form a healthy lifestyle. Moreover, nutrition in organized creative shifts is quite convenient to control and it is quite possible to form rational menus to preserve and strengthen the health of children.

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使用内冠修复受损牙齿的可能性
# THE POSSIBILITIES OF USING ENDOCROWNS FOR RESTORING OF DESTROYED TEETH

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抽象的
在牙科修复体结构的粘合剂固定发展之后，使用牙髓腔壁作为保留资源，使用间接嵌体和覆盖物来补偿脱髓臼齿的牙冠部分变得可以接受。
该研究的目的是分析使用内冠修复受损侧牙的长期结果。
材料与方法。 本文介绍了对脱浆咀嚼牙、通过压制和研磨从二硅酸锂修复内胚层进行三年观察的结果。
获得的结果使我们得出结论，可以有效地恢复受损牙齿的美观和功能。
***Abstract***
*After the development of adhesive fixation of prosthetic structures in dentistry, it becomes acceptable to compensate for the crown part of depulpated molars using indirect inlays and overlays, using the walls of the pulp chamber as a retention resource.*
***The aim*** *of the study is to analyze the long–term results of the use of endocrowns for the restoration of destroyed lateral teeth.*
***Material and methods.*** *This paper presents the results of a three-year observation of depulpated chewing teeth, restored endocorns from lithium disilicate by pressing and milling.*
*The results obtained allow us to conclude that it is possible to effectively*

*restore the aesthetics and function of destroyed teeth.*

**Introduction**

The earliest and most common diseases of the maxillofacial system are defects of the hard tissues of teeth [1,2].

As a rule, for the aesthetic and functional restoration of endodontically treated teeth with a destroyed crown part, dentists use metal pinlays, followed by covering them with artificial crowns [3].

However, despite the prevalence, this technique is not without drawbacks. Firstly, to fix a cast stump tab, it is necessary to endodontically prepare the tooth for a pin structure, which can often be extremely difficult, and sometimes impossible due to the atypical anatomy of the roots and canals in the chewing group of teeth, sclerosis of the root canals [4]. Secondly, according to recent studies, the pinlay tab exerts a significant deformation stress on the tooth tissue, especially under angular load [5]. Thirdly, in the manufacture of metal pinlay tab with its subsequent coating with an artificial crown with a low clinical crown of the tooth, the cementation of this design is in 35-50% of cases [6].

And, finally, the production of a cast pin tab with an artificial crown requires additional clinical stages of taking impressions, fitting the frame of the future crown, followed by packing the finished product and fixing it, which causes discomfort to the patient in physiological and psychological terms.

Today, taking into account the development of adhesive technology in dentistry, it has become possible to compensate for the loss of the crown part of depulpated molars using indirect inlays and overlays, not using intra-root pins, but using the walls of the pulp chamber as a retention resource [7].

**The aim of this study** is to analyze the long-term results of the use of endocorns for dental prosthetics with complete destruction of the crown part.

**Material and methods**

The study was conducted on the basis of the Department of Orthopedic Dentistry of Samara State Medical University. In the course of the study, orthopedic treatment was performed on 15 patients who had 22 endocorns made. The inclusion criteria were the total destruction of the crown part of the tooth (IROPZ by Milikevich > 0.8), the absence of pathological changes in the periapical tissues, the presence of a preserved ferrule of at least 1 mm in thickness and 1 mm in height.

Prosthetics of patients was carried out according to the author's method. The essence of the methodology was as follows. When treating a patient with a destroyed crown part of the tooth (Fig. 1), the removal of untenable restorations and softened dentin was performed, and the restoration of the tooth stump using Core-composite (LuxaCore material was used in this study) to the level of ferrule.

**Figure 1.** *The patient's oral cavity before prosthetic treatment*

After that, the dentist performs dissection of the created stump under the endocrown. The difference between our proposed method is to create a rounded tooth cavity and a guide furrow (Fig. 2).



**Figure 2.** *The cavity of a tooth prepared for the endocrown*

The rounded shape of the cavity allows you to reduce the stress that occurs in the walls of the tooth with vertical, and especially with lateral loads. And the presence of an additional guide furrow allows you to avoid problems when fixing the manufactured endocorns.

After that, the impressions are removed using silicone material, the plaster model is cast and the endocorns are made using the pressing or milling technique. The manufacture of this structure is carried out from lithium disilicate (Fig. 3). The color of the resulting structure is individualized using various dyes.
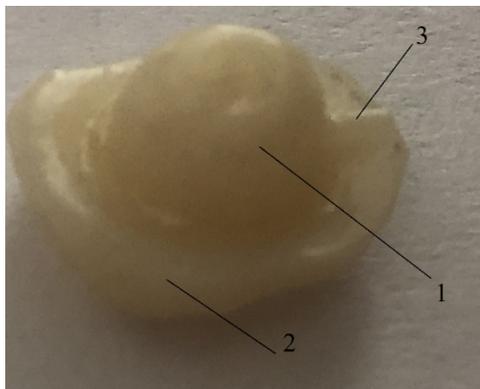
***Figure 3.*** *Device for restoring the destroyed crown of the lateral teeth (photo-enlarged): 1 – holding part; 2 – restoring part; 3 – guide*

Next, the finished device is packed first on the model of the jaw, and then on the tooth in the oral cavity. Check the density and uniformity of contacts in the areas of contact with the hard tissues of the tooth and the filling material, and then proceed to fixation. Fixation is carried out according to the standard adhesive protocol.

The results of the treatment were evaluated after 36 months. In the course of it, criteria such as surface gloss, staining, color matching, anatomical shape, violation of the integrity of the material or tissues of the tooth, marginal fit, approximate anatomical shape, recurrence of caries, marginal periodontal condition were evaluated.

**Results**

In the long-term follow-up, according to the criterion of "surface gloss", 100% of cases received good treatment results.

According to the "staining" criterion, good treatment results were obtained in 100% of cases.

According to the criterion of "violation of the integrity of the restoration or tooth" in the long–term terms of treatment, in patients treated with the help of endocorns, a good result of treatment was noted in 91.4% of cases; in 7.6% of cases, a threadlike crack along the tooth wall, the result was assessed as satisfactory, treatment was not required; 0.5% of cases, chipping of the material; 0.5% of cases – tooth tissue cleavage.

In the long–term terms of treatment, 98.5% of cases noted a good result of treatment according to the criterion of "marginal fit"; in 1.5% of cases, a violation of the marginal fit in the area of the border of the endocortex, which was corrected by polishing, the result was assessed as satisfactory.

According to the criterion "marginal periodontal reaction", in 57.6% of cases, a good result of treatment was noted; in 42.4% of cases, plaque accumulation and minor inflammation of the marginal periodontal were detected, which required professional hygiene. The result was assessed as satisfactory.

**Conclusion**

The obtained results suggest the possibility of effective restoration of the aesthetics and function of the tooth of the destroyed depulpated teeth of the lateral group using the endocorns of the author's design.

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搅拌摩擦焊的数值模拟
# NUMERICAL SIMULATION OF FRICTION STIR WELDING

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抽象的。 考虑了搅拌摩擦焊（FSW）过程的三维数学模型。 该模型包括确定塑料介质的三维流动和焊缝中的三维温度分布的方程。 塑料介质运动过程中的外摩擦和内摩擦都考虑了热量释放。 分析了铝合金FSW问题的解决方法。
关键词：搅拌摩擦焊； 塑性流动； 传播热量； 数值模拟。

***Abstract.*** *A three-dimensional mathematical model of the process of friction stir welding (FSW) is considered. The model includes equations that determine the three-dimensional flow of the plastic medium and the three-dimensional temperature distribution in the weld. Heat release is taken into account both from external friction and from internal friction during the movement of a plastic medium. An analysis of the solution of the problem at FSW of an aluminum alloy is given.*

***Keywords:*** *friction stir welding; plastic flow; heat transfer; numerical simulation.*

Friction Stir Welding (FSW) is a new technology. The basis of this technology is the friction of a rotating cylindrical tool between two metal plates connected by the ends (fig. 1.).
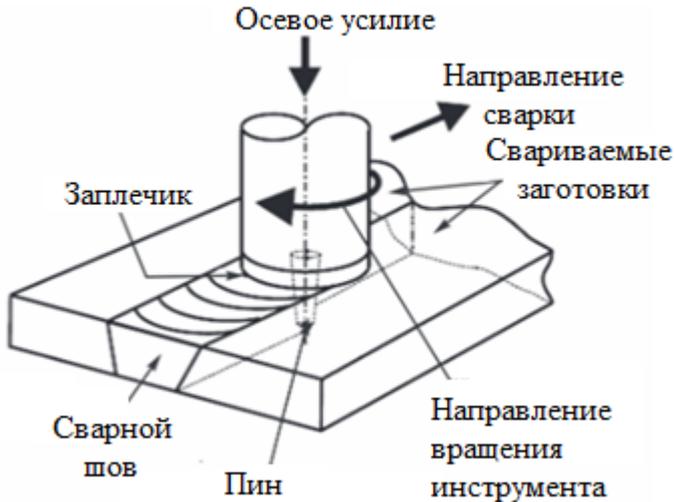
*Figure 1.* *Schematic diagram of the friction stir welding process*

Mathematical modeling of the process of friction stir welding was considered in a number of works. In [1], a nonlinear theoretical model is presented that describes the process of heat propagation during FSW. The results of temperature calculation at FSW for aluminum alloy AMg6 are presented.

The works [2, 3] present a mathematical model of the FSW process. As a rheological model of welded workpieces in a heated state, a model of a viscoplastic medium was used.

The boundary condition for the mathematical model of the FSW process should include the condition that determines the rate of plastic flow of the surfaces of the plastic medium. This velocity depends on the surface shear stresses in the plastic medium and the external shear stresses applied to these surfaces.

When the surface of the workpiece enters the contact area, shear stresses begin to act on it due to sliding friction. If these shear stresses are below the surface shear stresses of the workpiece, then the surface of the workpiece remains stationary. Due to the heating of the workpiece due to friction, its surface shear stresses fall, and when they become lower than the applied shear stresses, the surface of the workpiece begins to move. As a result of this movement, additional heating of the workpieces begins due to internal friction. In this case, the heat flux from the contact areas decreases due to friction, since the relative velocity of the surfaces in the contact area decreases.

Further, two options are possible. The speed of the surfaces of a viscoplastic medium can reach the speeds of movement of the contacting surfaces. In this case, there will be no friction, there will be no heat release from friction, but the heat released in the plastic medium due to internal motion will be sufficient for the surface shear stresses in the medium to remain below the applied external shear stresses. Such a case was considered in [2]. In this work, there is no friction in the contact area, and the speeds of the contacting surfaces are equal.

A second, more probable, option is also possible. When the equality of the surface shear stresses in a plastic medium and the shear stresses applied to these surfaces due to friction is established. In this case, the speed of movement of the surfaces of the workpieces in the contact area is lower than the speed of the surfaces of the shoulder and pin, and friction is present.

This mode of operation of the FSW was considered in [3]. In this case, the speed of the surfaces of the plastic medium was not determined when solving the problem, but was set using the results of experiments.

In the mathematical model of the FSW process given below, the workpiece in the plastic state is modeled by an ideal isotropic rigid-plastic Saint-Venant medium [4]. The rate of plastic flow of surfaces in the contact area is determined when solving the problem.

Consider the steady state of the welding process. We introduce a cylindrical coordinate system $Or\varphi z$, whose origins are placed on the pin axes. In this coordinate system, in the steady state, the plastic flow region is stationary, and the bodies being welded move at a speed $V$ in the direction opposite to the direction of the $Or$ axis. The equations of steady motion in the region of plastic flow have the form

$$V\rho\left(\cos\varphi\frac{\partial u_r}{\partial r}-\frac{\sin\varphi}{r}\frac{\partial u_r}{\partial\varphi}\right)+\rho\left(u_r\frac{\partial u_r}{\partial r}+\frac{u_\varphi}{r}\frac{\partial u_r}{\partial\varphi}+u_z\frac{\partial u_r}{\partial z}-\frac{u_\varphi^2}{r}\right)=$$

$$=\frac{1}{r}\frac{\partial}{\partial r}\left(r\sigma_{rr}\right)+\frac{1}{r}\frac{\partial\sigma_{r\varphi}}{\partial\varphi}+\frac{\partial\sigma_{rz}}{\partial z}-\frac{\sigma_{\varphi\varphi}}{r}$$

$$V\rho\left(\cos\varphi\frac{\partial u_\varphi}{\partial r}-\frac{\sin\varphi}{r}\frac{\partial u_\varphi}{\partial\varphi}\right)+\rho\left(u_r\frac{\partial u_\varphi}{\partial r}+\frac{u_\varphi}{r}\frac{\partial u_\varphi}{\partial\varphi}+u_z\frac{\partial u_\varphi}{\partial z}+\frac{u_r u_\varphi}{r}\right)=$$

$$=\frac{1}{r^2}\frac{\partial}{\partial r}\left(r^2\sigma_{r\varphi}\right)+\frac{1}{r}\frac{\partial\sigma_{\varphi\varphi}}{\partial\varphi}+\frac{\partial\sigma_{\varphi z}}{\partial z}$$

$$V\rho\left(\cos\varphi\frac{\partial u_z}{\partial r}-\frac{\sin\varphi}{r}\frac{\partial u_z}{\partial\varphi}\right)+\rho\left(u_r\frac{\partial u_z}{\partial r}+\frac{u_\varphi}{r}\frac{\partial u_z}{\partial\varphi}+u_z\frac{\partial u_z}{\partial z}\right)=\frac{1}{r}\frac{\partial}{\partial r}\left(r\sigma_{rz}\right)+\frac{1}{r}\frac{\partial\sigma_{\varphi z}}{\partial\varphi}+\frac{\partial\sigma_{zz}}{\partial z}$$

In an ideal isotropic rigid-plastic Saint-Venant medium, the components of the stress tensor are related to the components of the strain rate tensor by the relations [4]

$$\sigma_{rr} = \sigma + \frac{2\sigma_s}{3u}u_{rr}, \ \sigma_{r\varphi} = \frac{2\sigma_s}{3u}u_{r\varphi}, \ \sigma_{rz} = \frac{2\sigma_s}{3u}u_{rz}, \ \sigma_{\varphi\varphi} =$$

$$= \sigma + \frac{2\sigma_s}{3u}u_{\varphi\varphi}, \ \sigma_{zz} = \sigma + \frac{2\sigma_s}{3u}u_{zz}, \ \sigma_{\varphi z} = \frac{2\sigma_s}{3u}u_{\varphi z}$$

where $\sigma = \frac{1}{3}\left(\sigma_{rr} + \sigma_{\varphi\varphi} + \sigma_{zz}\right)$, $\sigma_s$ - material constant, called tensile yield strength, $u$ - strain rate tensor intensity

$$u = \sqrt{\frac{2}{3}}\tilde{u}, \ \tilde{u} = \frac{1}{\sqrt{3}}\sqrt{\left(u_{rr} - u_{\varphi\varphi}\right)^2 + \left(u_{\varphi\varphi} - u_{zz}\right)^2 + \left(u_{rr} - u_{zz}\right)^2 + 6\left(u_{r\varphi}{}^2 + u_{\varphi z}{}^2 + u_{rz}{}^2\right)}$$

The yield strength $\sigma_s$ is temperature dependent. The value of $\sigma_s$ for steels at normal temperatures (up to +300° C) varies with carbon content and alloying elements from $2 \cdot 10^8$ *Па* to $2 \cdot 10^9$ *Па*. As the temperature rises, $\sigma_s$ decreases. At a temperature of about 1000° C $\sigma_s$ is about 10 times smaller.

The region in which there is no plastic flow is determined by the condition

$$\sigma_u < \sigma_s$$

where $\sigma_u$ - stress tensor intensity, determined by the formula

$$\sigma_u = \sqrt{\frac{2}{3}}\tilde{\sigma}_u, \ \tilde{\sigma}_u = \frac{1}{\sqrt{3}}\sqrt{\left(\sigma_{rr} - \sigma_{\varphi\varphi}\right)^2 + \left(\sigma_{\varphi\varphi} - \sigma_{zz}\right)^2 + \left(\sigma_{rr} - \sigma_{zz}\right)^2 + 6\left(\sigma_{r\varphi}{}^2 + \sigma_{\varphi z}{}^2 + \sigma_{rz}{}^2\right)}$$

If condition $\sigma_u < \sigma_s$ is satisfied, then the body remains rigid, deformations are equal to zero, and stresses are not determined. If this condition is not met, then plastic flow takes place.

The components of the strain rate tensor are related to the components of the velocity of the medium by the relations

$$u_{rr} = \frac{\partial u_r}{\partial r}, \ u_{\varphi\varphi} = \frac{1}{r}\frac{\partial u_\varphi}{\partial \varphi} + \frac{u_r}{r}, \ u_{zz} = \frac{\partial u_z}{\partial z}$$

$$u_{r\varphi} = \frac{1}{2}\left(\frac{1}{r}\frac{\partial u_r}{\partial \varphi} + \frac{\partial u_\varphi}{\partial r} - \frac{u_\varphi}{r}\right), \ u_{\varphi z} = \frac{1}{2}\left(\frac{\partial u_\varphi}{\partial z} + \frac{1}{r}\frac{\partial u_z}{\partial \varphi}\right), \ u_{rz} = \frac{1}{2}\left(\frac{\partial u_z}{\partial r} + \frac{\partial u_r}{\partial z}\right)$$

It is necessary to add the equation of continuity to the given equations. Assuming that the medium is incompressible, we write the continuity equation in the form

$$\frac{\partial u_r}{\partial r} + \frac{1}{r}\frac{\partial u_\varphi}{\partial \varphi} + \frac{\partial u_z}{\partial z} + \frac{u_r}{r} = 0$$

The variable $\sigma_s$ is a known function of the temperature $T$ and to determine it, it is necessary to have the function $T(r, \varphi, z)$. This function is found by solving the energy equation, which for the steady state we write in the form

$$V\rho C\left(\cos\varphi\frac{\partial T}{\partial r}-\frac{\sin\varphi}{r}\frac{\partial T}{\partial\varphi}\right)+\rho C\left(u_r\frac{\partial T}{\partial r}+\frac{u_\varphi}{r}\frac{\partial T}{\partial\varphi}+u_z\frac{\partial T}{\partial z}\right)=$$

$$=\lambda\left(\frac{1}{r}\frac{\partial}{\partial r}\left(r\frac{\partial T}{\partial r}\right)+\frac{1}{r^2}\frac{\partial^2 T}{\partial\varphi^2}+\frac{\partial^2 T}{\partial z^2}\right)+\sigma_s u$$

The last term on the right side of the equation takes into account heat release due to plastic deformations.

Boundary conditions must be added to the above equations. At the interface between the plastic flow region and the rigid body region in a fixed coordinate system, rigid bodies move with a velocity $V$. In the $Or\varphi z$, coordinate system, in which the plastic flow region is motionless, the conditions take the form

$$u_r\left(R_s,\varphi,z\right)\big|=-V\cos\varphi,\ \ u_\varphi\left(R_s,\varphi,z\right)=V\sin\varphi,\ u_z\left(R_s,\varphi,z\right)=0$$

At the boundary $z=0$ we assume that there is no motion of the plastic medium. This condition is used in [2, 3]. In the $Or\varphi z$ coordinate system, the conditions have the form

$$u_r\left(r,\varphi,0\right)=-V\cos\varphi,\ \ u_\varphi\left(r,\varphi,0\right)=V\sin\varphi,\ u_z\left(r,\varphi,0\right)=0$$

On the boundary $z=L$ for the velocities $u_r$ and $u_s$ we accept similar conditions, i.e.

$$u_r\left(r,\varphi,L\right)=-V\cos\varphi,\ \ u_z\left(r,\varphi,L\right)=0$$

For the speed $u_\varphi$ the condition on the boundaries $z=L$ and $r=R_p$ we use the conditions, taking into account the above, we take in the form

$$\sigma_{\varphi z}\left(r,\varphi,L\right)=f_t p_0$$

where $f_t$ - coefficient of friction $p_0$ - applied pressure in the contact area of the shoulder and workpieces.

On the surface $r=R_p$ the velocity $u_\varphi\left(R_p,\ \varphi,\ z\right)$ is determined from the condition

$$\sigma_{r\varphi}\left(R_p,\varphi,z\right)=f_t\sigma_{rr}\left(R_p,\varphi,z\right)$$

The remaining velocities on this surface are assumed to be zero.

For the energy equation, we accept the following boundary conditions. On free surfaces, heat transfer occurs with a heat transfer coefficient $\alpha$ and thermal radiation according to the Stefan-Boltzmann law, i.e., on the upper free boundary, the condition has the form

$$-\lambda\frac{\partial T}{\partial z}\bigg|_{\substack{r>R_z\\z=L}}=\alpha\left(T-T_o\right)+\sigma_b\left(T^4-T_o^4\right)$$

where $\sigma_b$ - Stefan-Boltzmann constant, $\sigma_b=5.67\cdot10^{-8}\frac{Bm}{M^2\cdot K^4}$, $\lambda$ - coefficient of thermal conductivity, $T_0$ - ambient temperature.

In the area of contact between the blanks and the shoulder, heat is released due to friction. In this case, part of the generated heat goes into the shoulder, and the other part goes into the blanks. To determine these parts, it is necessary to solve the jointly reduced system of equations with the heat equation for the shoulder. By analogy with how it was done in [3], we introduce the distribution coefficient $k$ and write the boundary condition in the form

$$\lambda \frac{\partial T}{\partial z}\Big|_{\substack{R_p \leq r \leq R_z \\ z=L}} = kf_t p_0 \left(\omega r - u_\varphi\left(r, \varphi, L\right)\right)$$

where $\omega$ - shoulder angular velocity. On the boundary between the pin and the plastic medium, we write similarly

$$\lambda \frac{\partial T}{\partial r}\Big|_{r=R_p} = kf_t p_0 \left(\omega R_p - u_\varphi\left(R_p, \varphi, z\right)\right)$$

On the lower free surface, we take into account heat transfer to the lining. Assuming that the thickness of the lining is $H$, the temperature varies linearly along the thickness of the lining, and the lower surface of the lining has room temperature, we obtain the condition on the lower surface of the parts to be welded

$$\lambda \frac{\partial T}{\partial z}\Big|_{z=0} = \lambda_p \frac{T\left(r, \varphi, 0\right) - T_0}{H}$$

The given system of equations and conditions is solved numerically. To do this, differential equations are replaced by finite-difference equations and the resulting system of nonlinear algebraic equations is solved by the Newton-Raphson method.

Modeling according to the above model was carried out for an aluminum alloy with the following parameter values:

Density $\rho = 2640 \frac{\kappa\varepsilon}{\text{м}^3}$; Thermal conductivity $\lambda = 122 \frac{Bm}{\text{м} \cdot \text{град}}$; Heat capacity $c = 922 \frac{\text{Дж}}{\kappa\varepsilon \cdot \text{град}}$; Heat transfer coefficient $\alpha = 12 \frac{Bm}{\text{м}^2 \cdot \text{град}}$;

Shoulder pressure on work pieces $p_0 = 40 M\Pi a$;

Friction coefficient $f_t$ = 0.35; Shoulder radius $R_z$ = 9.5мм; Pin radius $R_p$ = 3.95мм;

Thickness of the parts to be welded $L = 6.35$мм; Speed $V = 1\frac{\text{мм}}{\text{сек}}$; Angular speed $\omega = 50\frac{\text{рад}}{\text{сек}}$; The value of the heat distribution coefficient k = 0.7.

The dependence of the yield strength on temperature is shown in fig. 1.
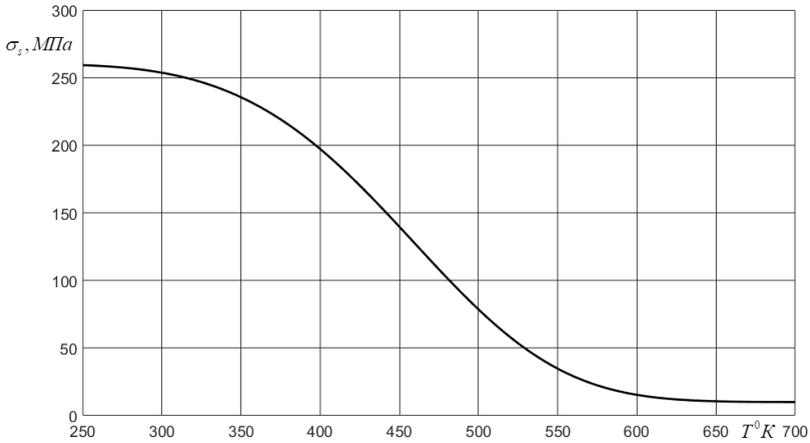
**Figure 1.** *Yield strength versus temperature*

Fig. 2 shows the temperature distribution along the radial coordinate at different depths for the angular coordinate $\varphi = \pi$. Curve 1 was obtained on the surface adjacent to the shoulder, curve 2 - at a depth of $z = 5.4мм$, 3 – on the surface adjacent to the substrate. The above calculation results show that the temperature of the surfaces of the shoulder and workpieces in the area of their contact rapidly decreases with increasing coordinate $r$ at r > 9мм values. This is due to the fact that intense thermal radiation comes from the free surface of the workpieces according to the Stefan-Boltzmann law. As a result, the temperature increases with distance from the surface deep into the workpiece at values of $r > 9мм$. At values of $r > 8.5мм$ the temperature of the workpieces is lower than 550 °$K$. In this case, the parameter $\sigma_s$ has a high value and plastic flow becomes difficult.
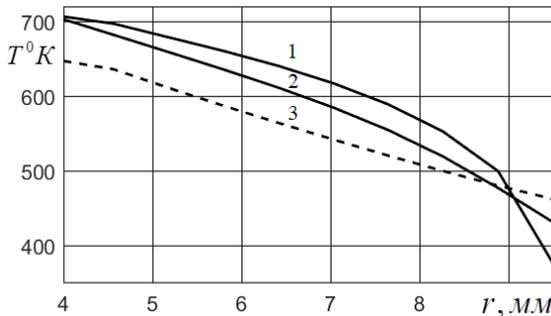


**Figure 2.** *Temperature change along the radius at different depths of workpieces.*

Fig. 3 shows the plastic flow rate of the material as a function of the z coordinate for various values of the *r* coordinate.
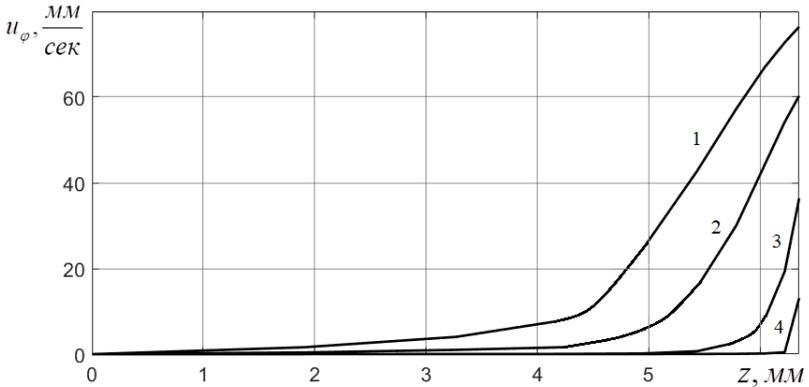


**Figure 3.** *Distribution of the plastic flow rate over the thickness of workpieces at the angular coordinate φ = 0 and at various values of the radial coordinate 1- r = 4.57мм, 2- r = 5.19мм, 3 - r = 5.8мм, 4 - r = 8.26мм.*

It follows from the above calculation results that an intense plastic flow, which ensures the mixing of the material of the workpieces to be welded, takes place in the surface layer of the workpieces with a thickness of the order of 3 *мм*. At small values of *z* mixing of the material of the workpieces to be welded is carried out only in a small vicinity of the pin.

Fig. 4 shows the distribution of the plastic flow velocity along the angular coordinate at *r = 4.57мм* and at *z = 6.22мм*
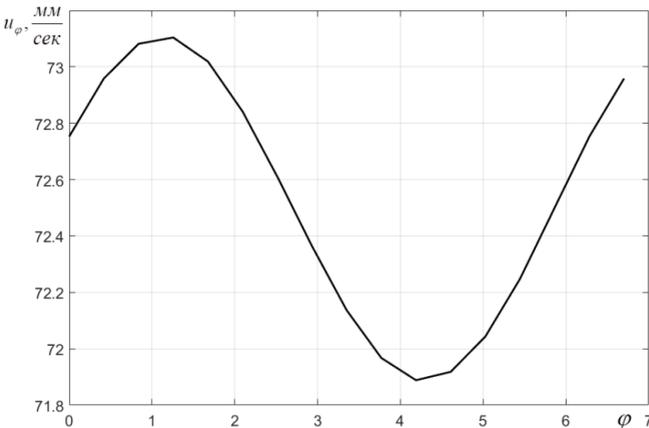


**Figure 4.** *Change in the rate of plastic flow along the angular coordinate*

The results show that after entering the contact region, the plastic flow rate first increases and then decreases.

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纳米添加剂对润滑油摩擦学特性的影响
# INFLUENCE OF NANO-ADDITIVES ON THE TRIBOLOGICAL CHARACTERISTICS OF LUBRICANTS

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抽象的。 介绍了含有纳米添加剂的机油摩擦学特性的实验研究。 所进行的测试可以确定富勒烯和基于次石墨的纳米添加剂的浓度对流体动力摩擦模式下的摩擦系数和润滑层温度的影响。
关键词：富勒烯，次石墨，机油，基础油，摩擦系数，纳米添加剂，润滑层温度。
***Abstract.*** *Experimental studies of the tribological characteristics of motor oils with nanoadditives are presented. The tests carried out made it possible to determine the effect of the concentration of fullerenes and nanoadditives based on shungite on the friction coefficient and the temperature of the lubricating layer in the hydrodynamic mode of friction.*

***Keywords:*** *fullerenes, shungite, motor oil, base oil, coefficient of friction, nanoadditive, lubricating layer temperature.*

**Introduction**

To increase the durability in various fields of technology, a number of additives and additives for a specific purpose are widely used. Currently, the use of nanoadditives is of great interest.

The research was carried out on a friction machine with rotational movements in the laboratory of friction under extreme conditions IMASH RAN. The addition of nanosized particles to the semi-synthetic motor oil Mobil Ultra 10W–40 was investigated. These materials were used as lubricant compositions.

Fullerene powder $C_{60}$ (99.9%) manufactured by Merck KGaA (Darmstadt, Germany) was used. The maximum content of fullerenes in engine oil did not exceed 2%. The lubricant composition was obtained by repeated processing of the oil-fullerene system on an ultrasonic disperser (fig. 1).

The purpose of this work is to study the effect of fullerene powder and nanoadditives based on shungite as an additive to motor oil.

**Research methods.** The study of lubricants was carried out in the hydrodynamic mode of friction on a universal friction machine UMT-1 [6, 7] according to 2 variants of methods that differ in the speed and load of the friction unit. The "ring-to-ring" test scheme is shown in fig. 2. For measurements and recording of results, a data acquisition system from National Instruments with Labview software was used.
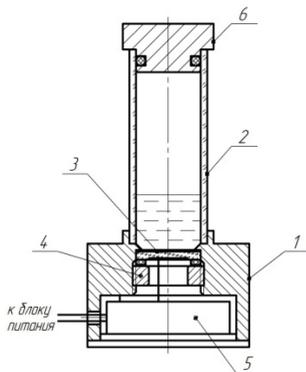


**Figure 1.** *Ultrasonic disperser:*
*1 – base, 2 – glass cylinder, 3 – piezo element,*
*4 – clamping nut, 5 – generator board, 6 – plug*
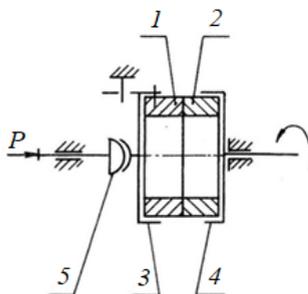
**Figure 2.** *"Ring-to-ring" test scheme: 1 – non-rotating sample-ring; 2 – rotating sample-ring; 3 – sample holder 1, allowing self-installation; 4 – rotating sample holder; 5 – spherical hinge*

According to option I, steel 20 according to GOST 1050–88 was used as the material for friction pairs for testing. During friction, the rotating sample was pressed against a stationary sample with a constant load of 80 N. The linear velocity was 1.5 m/s. The duration of one test was 10 min. During the tests, the readings of the friction torque and the temperature of the lubricating layer were recorded.

Option II was used to determine the coefficient of friction during the test and the temperature of the lubricating layer under a step change in load. Steel, cast iron and bronze were used as friction pairs in comparative tests. The rotation frequency was 50, 100, 300 rpm at a normal load corresponding to 150, 450 N. The duration of one test was 15 minutes.

Thus, these variants of test procedures make it possible to conduct comparative studies of the tribological properties of various additives. Each test was carried out three times, after which the arithmetic mean values of the measured values were calculated.

The volume of metals heated during contact during one revolution:

$$V_1 = 1,73A\sqrt{\frac{\lambda_1}{c_1\rho_1}t},$$
$$V_2 = 1,73A\sqrt{\frac{\lambda_2}{c_2\rho_2}t}.$$

(1)

Using the law of conservation of energy, we equate the specific power of friction with lubricant to the specific heat generated in the lubricating layer in one revolution:

$$\tau vt = \frac{Q_1 + Q_2}{A}.$$

(2)

The amount of heat is found by the formula:

$$Q_1 = 1,73A\theta\sqrt{\lambda_1 c_1 \rho_1 t},$$
$$Q_2 = 1,73A\theta\sqrt{\lambda_2 c_2 \rho_2 t}.$$

(3)

Substituting dependences (3) into (2), we obtain a formula for estimating the temperature of the metal surface

$$\theta = \frac{\tau v\sqrt{t}}{1,73\left(\sqrt{\lambda_1 c_1 \rho_1} + \sqrt{\lambda_2 c_2 \rho_2}\right)} = \frac{fNv\sqrt{t}}{1,73A\left(\sqrt{\lambda_1 c_1 \rho_1} + \sqrt{\lambda_2 c_2 \rho_2}\right)}.$$

(4)

### Research results and discussion

The results of experimental studies (method I) of measuring the moment of friction and the temperature of the lubricating layer for the tribosystem at a constant load of 80 N and an angular velocity of 1.5 m/s are presented in tab. 1.

Experimental studies (tab. 1) made it possible to establish that an increase in the concentration of the fullerene additive in the base oil makes it possible to reduce the friction moment and the temperature of the lubricating layer. As can be seen from Table 1, a comparison of the temperature of the lubricating layer shows good agreement between the calculated and experimental data. The discrepancy was ~5%, which is acceptable.

*Table 1.*

*Test results on the UMT-1 friction machine (method I)*

| Lubricating composition in friction pair | Friction moment, Nm | Friction coefficient | Lubrication layer temperature, °C | Estimated temperature of the lubricating layer, °C |
|---|---|---|---|---|
| Engine oil | 0,22 | 0,23 | 60 | 55,142 |
| Motor oil + 0.2% fullerenes | 0,14 | 0,15 | 53 | 50,552 |
| Motor oil + 2% fullerenes | 0,09 | 0,09 | 47 | 45,577 |

*Table 2.*

*Results of tests on a UMT-1 friction machine at a constant load of 150 N (method II)*

| Friction pair | Rota-tion fre-quency, rpm | Friction coefficient | | Lubrication layer temperature, °C | | Estimated tempera-ture of the lubricat-ing layer, °C | |
|---|---|---|---|---|---|---|---|
| | | Engine oil | Motor oil + additive based on shungite | En-gine oil | Motor oil + additive based on shungite | Engine oil | Motor oil + additive based on shungite |
| Bronze – cast iron | 50 | 0,057 | 0,052 | 20,4 | 20 | 18,9 | 21,3 |
| | 100 | 0,048 | 0,046 | 21,4 | 20,8 | 22,45 | 21,8 |
| | 300 | 0,056 | 0,057 | 23,8 | 24,5 | 25,43 | 23,57 |
| Steel – cast iron | 50 | 0,06 | 0,055 | 22 | 21,8 | 20,406 | 21,21 |
| | 100 | 0,083 | 0,072 | 23,4 | 23 | 22,47 | 21,423 |
| | 300 | 0,09 | 0,089 | 25,6 | 24,6 | 21,577 | 23,516 |
| Steel – bronze | 50 | 0,073 | 0,067 | 22,8 | 22 | 23,386 | 24,807 |
| | 100 | 0,053 | 0,049 | 23 | 22,8 | 22,787 | 21,068 |
| | 300 | 0,07 | 0,065 | 28,6 | 27 | 30,097 | 27,947 |

From tab. 2 (method II) for friction pairs bronze - cast iron, steel - cast iron and steel - bronze at a constant load of 150 N, it can be seen that the introduction of an additive based on shungite into engine oil reduces the friction coefficient and the temperature of the lubricating layer. From the results of testing lubricants (tab.

3) at a normal load of 450 N, it can be seen that the introduction of an additive with shungite increases the value of the friction coefficient, however, in a steel-bronze friction pair at a speed of 300 rpm, the friction coefficient decreases. For a steel-iron friction pair at a load of 450 N, the decrease in the temperature of the lubricating layer is ~ 5.5%.

*Table 3.*

*Results of tests on a UMT-1 friction machine with a constant load of 450 N (method II)*

| Fric-tion pair | Rotation frequen-cy, rpm | Friction coefficient | | Lubrication layer temperature, °C | | Estimated tempera-ture of the lubricat-ing layer, °C | |
|---|---|---|---|---|---|---|---|
| | | Engine oil | Motor oil + additive based on shungite | Engine oil | Motor oil + additive based on shungite | Engine oil | Motor oil + additive based on shungite |
| Bronze – cast iron | 50 | 0,05 | 0,058 | 20,5 | 23,3 | 21,498 | 24,937 |
| | 100 | 0,046 | 0,06 | 23,8 | 26,3 | 19,778 | 25,797 |
| | 300 | 0,057 | 0,063 | 26,3 | 27,646 | 24,507 | 27,087 |
| Steel – cast iron | 50 | 0,056 | 0,059 | 22,3 | 21 | 22,424 | 20,1 |
| | 100 | 0,05 | 0,057 | 24,3 | 23,8 | 25 | 24,1 |
| | 300 | 0,057 | 0,059 | 26 | 27 | 26,338 | 27,749 |
| Steel – bronze | 50 | 0,054 | 0,053 | 21,8 | 22,8 | 23,217 | 22,787 |
| | 100 | 0,051 | 0,057 | 24,8 | 25,5 | 21,928 | 24,507 |
| | 300 | 0,063 | 0,052 | 29 | 32,2 | 27,087 | 30,357 |

It has been established that the discrepancy between the calculated and experimental values of the lubricant layer temperature is ~ 7% (tab. 2 and 3).

**Conclusion**

A mathematical model has been obtained that describes the temperature of the lubricating layer between metal surfaces.

The test results showed that the fullerene additive in the lubricating composition leads to a decrease in the friction coefficient and the temperature of the lubricating layer. The additive based on shungite showed itself most effectively at a normal load of 150 N. In a loaded mode at 450 N, the introduction of a nano-additive based on shungite into engine oil increases the friction coefficient and temperature, however, in a steel-bronze friction pair, a decrease in the temperature of the lubricating layer is observed.

Natural experiments proved the adequacy of the developed mathematical model; the results of computational and natural experiments differ by an average of 7%.

Thus, as a result of the studies carried out, significantly better tribological properties of lubricant compositions with nano-additives were shown in comparison with the base oil.

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中国–俄罗斯北部地区铁路项目实施的相关性（在"上合组织国家科学研究：协同与一体化"会议框架内

# THE RELEVANCE OF THE IMPLEMENTATION OF THE CHINA – NORTHERN REGIONS OF RUSSIA RAILWAY PROJECT (WITHIN THE FRAMEWORK OF THE CONFERENCE "SCIENTIFIC RESEARCH OF THE SCO COUNTRIES: SYNERGY AND INTEGRATION")

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抽象的。在全球政治形势背景下，经济发展面临的现代挑战要求俄罗斯采取适当的适当行动，以促进乌拉尔和西伯利亚地区以及整个俄罗斯的经济潜力。在这方面，对于上合组织国家（尤其是俄罗斯、中国和印度）来说，除了缩短货物到欧洲国家的交货时间外，别无选择。为此，到2024年俄罗斯主要基础设施现代化和扩建的国家综合计划包括计划中的私有高速公路MERIDIAN，穿过俄罗斯领土，连接中国和欧洲。

计划中的私人高速公路"子午线"的实施，穿过俄罗斯领土，旨在连接中国与欧洲，将大大缩短世界这些地区之间的货物交付时间。然而，对于北欧国家来说，这个问题仍然没有得到解决。此外，如果我们考虑汽车运输的环境方面，那么由于已知的负面环境特征（气体污染、对苔原土壤的影响等），后者不能成为俄罗斯北部地区的灵丹妙药。

实施拟议的从铁轨工作表面清除冰层的创新技术解决方案将改善货运机车车辆运营期间的环境状况，并将提高铁路地区机车在北方气候条件下的牵引能力通过北极地区。

关键词：上海–汉堡经络高速公路、铁路结冰、全年陆路交通、机车牵引能力、"无沙"除冰系统。

***Abstract.*** *Modern challenges of economic development against the backdrop of the global political situation require Russia to take appropriate adequate actions that contribute to building up the economic potential of the Ural and Siberian regions and Russia as a whole. In this regard, for the SCO countries (in particular, Russia, China, and India) there can be no other alternative than reducing the delivery time of goods to European countries. To this end, the state comprehensive plan for the modernization and expansion of the main infrastructure in Russia until 2024 includes the planned private **highway** MERIDIAN, passing through the territory of Russia, which should connect China and Europe.*

*The implementation of the planned private highway **"Meridian"**, passing through the territory of Russia, designed to connect China with Europe, will significantly reduce the time of delivery of goods between these parts of the world. However, for the northern European countries, this problem remains unresolved. In addition, if we consider the environmental aspects of motor transport, then the latter cannot be a panacea for the northern regions of Russia due to the known negative environmental characteristics (gas pollution, impact on the soil in the tundra, etc.).*

*The implementation of the proposed innovative technical solutions for the removal of ice deposits from the working surfaces of rail tracks will improve the environmental situation during the operation of freight rolling stock and will increase the traction capabilities of locomotives in northern climatic conditions in the area of railway passage in the Arctic region.*

***Keywords:*** *motorway MERIDIAN Shanghai – Hamburg, icing of railway rails, all-the-year-round overland traffic, traction capacity of a locomotive, "sandless" system for removing ice deposits.*

**Introduction**

Modern challenges of economic development against the backdrop of the global political situation require Russia to take appropriate adequate actions that contribute to building up the economic potential of the Ural and Siberian regions and Russia as a whole. In this regard, for the SCO countries (in particular, Russia, China, as well as other SCO countries, including India), there can be no other alternative than reducing the delivery time of goods to European countries. To this end, the state comprehensive plan for the modernization and expansion of the main infrastructure in Russia until 2024 includes the planned private **highway** MERIDIAN, passing through the territory of Russia, which should connect China and Europe. In Russia, the route should pass through the Orenburg, Saratov, Tambov, Lipetsk, Bryansk, Oryol and Smolensk Oblasts. The total length of the **Shanghai — Hamburg route** will be almost 8.5 thousand km, the length of the Russian section will be about 1982 km (fig. 1).

***Figure 1.*** *Highway Shanghai – Hamburg*

In December 2021, at the EDB (Eurasian Development Bank, Russia-Kazakhstan founders) forum, a memorandum was signed on organizing project financing.

If the solution of logistical problems in the delivery of goods to the countries of Central Europe will be resolved through the implementation of the MERIDIAN project, then for the northern European countries this problem remains unresolved. In addition, if we consider the environmental aspects of motor transport, then the latter cannot be a panacea for the northern regions of Russia due to the known negative environmental characteristics (gas pollution, impact on the soil in the tundra, etc.).

The economic development of any region requires, within the framework of scientific and technological progress, to increase the efficiency of the operated fleet of industrial transport equipment, taking into account the fulfillment of environmental safety requirements dictated by the climatic conditions of the region. The practice of logistics activities shows that the most environmentally friendly is the use of rail transport for almost any region, and, moreover, for the northern regions of Russia.

To solve logistical problems when moving a large volume of goods, the fastest, economical and safe delivery of goods to consumers, a well-known movement transmission mechanism is used on rail transport, which is based on the principle of rolling friction. In particular, this principle is implemented by transferring the load from the transported goods and the mass of the rolling stock through the wheel to the rail, as a result of which the forces necessary for the movement of the train are created. The magnitude of the allowable forces transmitted from the wheel to the rail is influenced by the design features and technical capabilities of the rolling stock and the rail track, the train driving mode, as well as the impact of the environment typical for the northern regions of Russia and the growing consumer requirements for the operation of railway transport.

**Materials and methods and research**

The traction capacity of railway transport determines its efficiency, which is characterized by many factors and, first of all, by the coefficient of adhesion of the tires of wheelsets of locomotives to the rails, which in turn depends on various characteristics, including climatic operating conditions.

The Information and Analytical Agency of the Russian North, (IA "Echo of the North", Arkhangelsk Oblast http://www.echosevera.ru/) reports that the Government of the Russian Federation plans to implement a comprehensive project for the industrial and infrastructural development of the north of the Russian Federation and the Urals, the basis of which is construction of the railway line Solikamsk-Syktyvkar-Arkhangelsk with a length of 1161 km, which will shorten the route from the Urals to the ports of Arkhangelsk by 800 km. Its total cost was estimated at 180 billion rubles, and the throughput will be up to 35 million tons of cargo per year. The project implementation period is 2030 - 2035.

In addition to "SUEK" JSC, Uralkali PJSC, EuroChem JSC and others, VEB, the China Development Bank, the Ministry of Railways of the People's Republic of China, the Chinese Civil Engineering and Construction Corporation in Russia, and the Center for Economic and Investment Cooperation between Russia and China also showed interest in the project. In 2015, the Belkomur interregional company (**White Sea** - **Komi** - **Ural**) and **Poly Technologies**, **Inc (China)** signed an agreement on the construction of the Arkhangelsk - Syktyvkar - Solikamsk railway line [1], (fig. 2).



***Figure 2.*** *Scheme of the railway line Arkhangelsk — Syktyvkar— Solikamsk, here: Архангельск – Arkhangelsk, Карпогоры – Karpogory, Вендинга – Vendinga, Микунь - Mikun, Сыктывкар – Syktyvkar, Гаймы – Gajmy, Соликамск – Solikamsk, Пермь – Perm, Екатеринбург – Yekaterinburg*

A significant part of the road shown in the diagram is located in a region with prevailing **negative** temperatures. However, it should be noted that the problems of chip formation and removal of ice deposits on rails in the winter climatic conditions of Siberia and the Arctic region have not been practically studied and solved so far [2].

The implementation of innovative ways to increase the traction capacity of locomotives in conditions of icing of the working surfaces of rails (during the operation of rolling stock in the regions of the Arctic and the continental shelf of the Russian Federation) will have, in addition to economic, also strategic importance for the Russian Federation and China, since the goal of this program should also be implementation of comprehensive studies of the problems outlined above, and its task is to create rational technical solutions that ensure the efficient operation of railway transport in the northern regions of the Russian Federation.

This can contribute to the creation of a year-round overland communication between the countries of Europe and the PRC. In the future, other SCO countries (for example, India) may also join the project. In addition, the created railway will provide the basis for the industrial and infrastructural development of the North of the Russian Federation and the Urals.

**Research results and discussion**

Today, logistics from China to Europe is carried out along two routes: the Northern Sea Route (through the Sea of Okhotsk) and the Southern Sea Route (through the Suez Canal) (fig. 3)
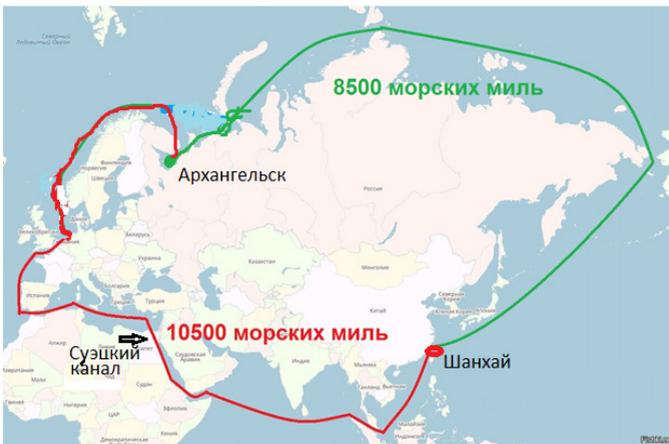


*Figure 3. The modern route of cargo from China to Europe, here: морских миль - nautical miles, Архангельск – Arkhangelsk, Суэцкий канал - Suez Canal, Шанхай – Shanghai*

Comparing these two routes, it can be found that the delivery of goods from China to northern European countries will be more rational and economically feasible with the implementation of the Northern Sea Route (NSR) option. However, the implementation of the project proposed by the Belkomur company will significantly reduce the time for delivery of goods from China to Europe by rail along the route Shanghai – Yekaterinburg – Solikamsk – Syktyvkar – Arkhangelsk (fig. 4).



*Figure 4. Scheme of the railway route Shanghai - Arkhangelsk, here: Мурманск – Murmansk, Северный морской путь - Northern Sea Route, Архангельск – Arkhangelsk, Москва – Moscow, Россия – Russia, Соликамск – Solikamsk, Екатеринбург – Yekaterinburg, Казахстан – Kazakhstan, Китай – China, Корея – Korea, Япония – Japan, Транскитайская ЖД - Trans-Chinese Railway*

The table shows comparative data on the labor costs of delivering goods to the northern countries of Europe along three routes.

**Table.**

*Comparative data on the delivery of goods by sea and rail along the route Shanghai - Arkhangelsk*

| Kind of transport | Unit of measurement | Nautical (NovSea-Way) | Nautical (SouthSea-Way, through the Suez Canal) | Railway | Note |
|---|---|---|---|---|---|
| Distance | km / miles* | 13685 / 8500 | 16905 /10500 | **8550** /5310 | Arkhangelsk Solikamsk – **1161km** Solikamsk Shanghai –7389 km Total: **8550** km (railways) |
| Delivery time | days | 26 | 32 | 10 | *) 1 mile= =1,61 km |

The analysis of the research results given in the table showed that the implementation of the project for the transportation of goods by rail from Shanghai to Arkhangelsk will reduce the distance of transportation by 1.6 times, and reduce the time of transportation of goods by more than 2.5 times. However, along with the obvious positive factors, the operation of railway transport in the northern regions of Russia may have a number of problematic parameters, such as the formation of ice on the rails and the chip formation.

A number of studies are devoted to the issues of removing ice plaque from rails, which are given in the relevant works [3,4]. The paper [3] provides a technical solution for the method of removing ice plaque, which consists in supplying heated sand to the contact zone of the wheel – rail system (fig. 5).
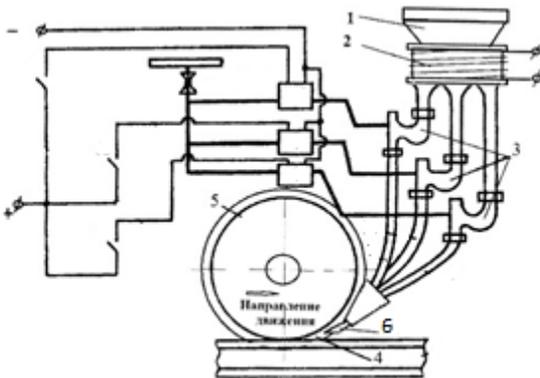


*Figure 5. Scheme of the implementation of the method for removing ice deposits from the surface of the rail. 1 – hopper, 2 – inductor, 3 - sand supply nozzles, 4 – wheel-rail contact zone, 5 – wheel, 6 – heated sand supply nozzle*

Modernization of the existing fleet of locomotives with the implementation of the implementation of the proposed invention will increase the friction coefficient and, therefore, will increase the tractive effort of locomotives by reducing the slippage of wheelsets. As a result, the wear of wheelset tires and working profiles of rails will be reduced, which will eliminate additional energy losses associated with slippage of wheel sets.

The use of sand to increase the adhesion of wheels to rails, in addition to a positive effect, has certain disadvantages. In his research, Yu.M. Luzhnov found that: "... the sand left on the rails after the passage of the locomotive creates additional resistance to the movement of the train, reaching 12%, and the sand that gets on the rubbing parts of the track and rolling stock leads to their more intense abrasive wear"[4]. The sand supplied from the sand system of the locomotive pollutes the ballast prism, worsens the condition of the railway track and thus creates the need to allocate significant financial resources to restore the environmental characteristics of the surrounding space of the rail track.

In this regard, it is of interest to study and create the so-called "sandless" systems for removing ice deposits. The most realistic of the known "sandless" methods of removing the ice crust from the surface of the rails is the method of influencing the working surfaces of the rails using a microwave controlled electromagnetic field (MW)[5]. The heat flux supplied to the working surfaces of wheels and rails affects surface contamination and improves the frictional characteristics of the working surfaces of the wheel-rail system. The results of tests carried out under the guidance and with the direct participation of prof. Luzhnova Yu.M., showed "... the possibility of increasing the coefficient of adhesion to 0.5" [4,6].

In addition to the considered methods for cleaning railroad tracks, one can note the methods used in France. For example, there is a known method of cleaning from an electric locomotive with chemical compounds that decompose substances that pollute the working surfaces of rails. This method proved to be useful at speeds up to 15 - 20 km / h. Another way is mechanical cleaning with rubber rollers driven by a servomotor, which can be effective up to 20 km/h. In France, until recently, experiments were carried out using the method of cleaning the working surfaces of rails using electrospark treatment of them with high-frequency currents. With clean contact surfaces, the adhesion coefficient increased to 0.4 - 1.5. However, at the same time, wear increased by 1.5 times [7].

The authors consider it necessary to note, that we are currently carrying out research to solve the problem of removing ice deposits from the working surface of rails by other "sandless" methods, eliminating the need for traditional sand, to improve the environmental situation during the operation of freight rolling stock and increase the traction capabilities of locomotives in northern climatic conditions.

**Conclusions**

1. The implementation of the planned private highway "**Meridian**", passing through the territory of Russia, designed to connect China with Europe, will significantly reduce the time of delivery of goods between these parts of the world. However, for the northern European countries, this problem remains unresolved. In addition, if we consider the environmental aspects of motor transport, then the latter cannot be a panacea for the northern regions of Russia due to the known negative environmental characteristics (gas pollution, impact on the soil in the tundra, etc.).

2. The implementation of innovative ways to increase the traction capacity of locomotives in conditions of icing of the working surfaces of rails during the operation of rolling stock in the regions of the Arctic and the continental shelf of the Russian Federation will, in addition to economic, also be of strategic importance for the Russian Federation and may contribute to the creation of a year-round overland communication between the countries of Europe and China. In addition, the created railway will provide the basis for the industrial and infrastructural development of the North of the Russian Federation and the Urals.

3. Research and creation of so-called "sandless" technological solutions for removing ice deposits from the working surface of the rails will contribute to the implementation of the construction project and the efficient operation of the Solikamsk-Syktyvkar-Arkhangelsk railway line. In addition, the PRC will have the opportunity to build the Shanghai-Arkhangelsk railway line, which will reduce the delivery time of goods from PRC to Europe by more than 2 times.

4. The implementation of the proposed innovative technical solutions for the removal of ice deposits from the working surfaces of rail tracks will improve the environmental situation during the operation of freight rolling stock and will increase the traction capabilities of locomotives in northern climatic conditions in the area of railway passage in the Arctic region.

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考虑地层酸处理过程中的热加热
# ACCOUNTING FOR THERMAL HEATING DURING ACID TREATMENT OF THE FORMATION

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抽象的。 解决降低已开发油田井底带滤阻问题，是油气工程提高采收率的一项紧迫任务。 本文介绍了碳酸盐岩储层井底带酸处理过程的数学建模结果，考虑了开发对象的所有特征、酸成分、与多孔基质的相互作用以及相关的温度效应。
关键词：酸处理，碳酸盐岩储层，化学反应，温度效应，数学建模。

***Abstract.*** *Solving the problem of reducing the filtration resistance of the bottomhole zone of developed oil fields is an urgent task of oil and gas engineering in terms of increasing oil recovery. The paper presents the results of mathematical modeling of the process of acid treatment of the bottomhole zone of a carbonate reservoir well, taking into account all the features of the development object, acid compositions, interaction with the porous matrix and associated temperature effects.*

***Keyword:*** *acid treatment, carbonate reservoir, chemical reaction, temperature effects, mathematical modeling.*

### Introduction

Pollution (colmatation) of the bottomhole formation zone (BFZ) significantly affects well productivity and formation permeability. At the same time, clogging is understood as the contamination of the bottomhole zone with drilling fluid dur-

ing the opening of a productive formation, the deterioration of the properties of the bottomhole zone during cementing, perforation of the productive interval, repair and insulation works, during well operation, etc. The use of methods to increase inflow at the later stages of field development can lead to "natural" clogging. So, for example, there is a decrease in temperature during the injection of cold displacing agents, leading to the precipitation of heavy fractions of hydrocarbons, or a "technogenic" reason is possible, due to the injection of thickeners, diverters, gels (for example, during HF).

In order to restore/improve the filtration characteristics of BFZ, chemical treatment methods are applied at various stages of development using various acid compositions. The specific composition is selected taking into account the structure and composition of the reservoir, the stage of development, the degree of contamination of the BFZ [1-3].

The most widely used stimulation method in carbonate reservoirs is hydrochloric acid treatment. However, as practice shows, its success is about 50%. The main problem with standard acid treatment of carbonate reservoirs is the low depth of penetration of the solution into the formation, or the escape of acid through natural or man-made fractures. When acidizing the formation again, the situation can even be aggravated due to the formation of excessive vugginess in the near-wellbore zone or the loss of the active composition due to the outflow through the channels of increased conductivity formed at the previous stage of treatment.

Currently, the bulk of oil is mainly produced from terrigenous deposits. However, since most of the fields under development are at a late stage of development, tight reserves concentrated in carbonate reservoirs are of greater interest. Such deposits are characterized by a sharp heterogeneity of reservoir properties (fracturing, vugginess). In addition, in the carbonate reservoir, the pores are not always connected to each other; in part, the reservoir has almost impermeable inclusions. The success of stimulation methods depends on how correctly the technological scheme of treatment and the acid composition are selected.

The purpose of this work is to evaluate and predict the effectiveness of the traditionally used technology of stimulation from carbonate reservoirs. For the analysis, the method of mathematical modeling of the process of thermal acid treatment is used, taking into account the heterogeneity of the reservoir, the composition of the rock, the chemical interaction of the active chemical composition with the porous matrix, and all the features of the real development object.

**Math modeling**

The general principle of acid treatments is based on the dissolution of the carbonate part of the rock to increase the throughput of the reservoir in the treatment zone by increasing the volumetric porosity and pore connectivity, which increases the permeability of the BFZ and reduces the overall filtration resistance of the

reservoir. The considered method of stimulation of fluid inflow to the well is quite often used today. However, it is important not only to take into account the PVT properties of the fluid, but also to take into account the real physical and thermal properties of the porous matrix and its facies composition. There are several factors to consider when evaluating the effectiveness of an acidizing process. First, the stoichiometry of the chemical reaction of the acid with the carbonate part of the rock, the exothermicity of the reaction, the rate of the reaction, the volume of gases released, and the effect of the reaction products on the formation fluid. Secondly, of course, that the thermal factor will work not only during the processing process, but also have a significant prolonged effect due to the thermal conductivity of the matrix. And the third is the possibility of changing the porous porosity itself and the connectivity of the channels. All these factors can have a significant impact on the effectiveness of the impact.

The release of carbon dioxide hot gas as a reaction product and its good solubility in oil leads to an increase in the fluid compressibility coefficient and a significant decrease in viscosity. The amount of gas released in comparison with other reaction products is small, which ensures its complete dissolution in oil. It should be noted that in the course of field experiments on the injection of hydrochloric acid in *many deposits, a significant increase in temperature is recorded by sensors at the bottom of wells* [2, 3]. The use of acidic solutions can also be used to trigger other heat release reactions when using methods of thermal-gas-chemical treatment of collectors [4].

This paper presents the results of numerical simulation of the process of thermal acid treatment of a carbonate deposit in the Republic of Bashkortostan. The influence of thermal effects of the studied chemical reaction on the properties of a saturated pore reservoir has been studied. To estimate the magnitude of heat release, the difference between the enthalpies of the reaction components was calculated: taking into account the number of moles of the substances participating in the reaction. In accordance with the reaction equation (1), the result of the thermal effect was 15.2 kJ per 1 mol of hydrochloric acid and 208.45 kJ per 1 kg.

$$CaCO_3 + 2\ HCl = CaCl_2 + H_2O + CO_2. \tag{1}$$
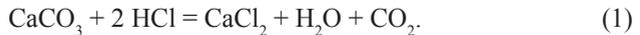
The authors of the work considered the problem of pumping a 15% aqueous solution of hydrochloric acid, which is described in the framework of multicomponent nonisothermal two-phase filtration of incompressible liquids in a cylindrical setting [5,6]. To describe the mass transfer of all substances that saturate the porous medium and injected into it, taking into account the chemical reaction of the acid with the carbonate matrix, the mass conservation equations for reservoir fluids (oil and aqueous solution), the continuity equation for acid in an aqueous solution, the equation for changing the mass of the porous skeleton with taking into account the ongoing chemical reactions of dissolution of its carbonate part.

The mass inflow at the well is taken into account for the aqueous solution. For all mobile phases, we write the generalized linear Darcy filtration equations, neglecting the diffusion rates of the acid component relative to the aqueous phase. The energy conservation equation for a saturated reservoir is written under the condition of thermodynamic equilibrium in the mixture as a whole, taking into account the exothermic chemical reaction of dissolution of the carbonate part of the rock. The convective heat transfer is neglected. The reaction products, calcium salt and carbon dioxide, in the model under consideration are completely dissolved in the liquid phases of the system, which is taken into account in the equations of state of liquid phases by changing the compressibility coefficient.

An important part of the acid treatment models is taking into account changes in reservoir properties. There are many principles and ideas to describe this part of the process model. Among the most classical is the Kozeny–Karman scheme, in which a porous medium is modeled by a "package" of unidirectional capillaries. The application of this scheme is based on the similarity of Poiseuille's laws for fluid flow in a cylindrical channel and Darcy's law for the filtration process, and the dependence of permeability on porosity is reduced to a power function. A more accurate and complicated approach is based on the hydropercolation approach, when the change in the pore size distribution function with an increase in porosity after chemical reactions of dissolution and sorption processes is considered [5, 7]. This paper presents calculations using the classical approach with a change in effective porosity and permeability due to the dissolution of the carbonate part of the rock depending on the concentration of the acid solution and the injection rate [6].

Another fundamental part of the acid solution filtration model in a carbonate reservoir is the description of the kinetics of the chemical reaction of their interaction. In general, the reaction rate depends on the concentration of the acid solution and also on the temperature. Most isothermal models of the kinetics of the described process contain a linear dependence of the mass consumption of acid on concentration, sometimes a power law. For each specific field impact, the kinetic parameters of the reaction must be refined experimentally. In this work, the change in the mass of the acid depends linearly on its concentration. In this case, to recalculate the change in the mass of other substances (rock matrix, water), proportionality coefficients are used, containing the stoichiometric coefficients of the reaction equation (1), taking into account the molar volumes of all components of the mixture before and after the reaction.

**Calculation results**

The formulated mathematical model was numerically solved in two settings:
• for a homogeneous isotropic reservoir characterized by average porosity and permeability determined from the results of hydrodynamic well studies (HWS),

• for zonal inhomogeneity of the distribution of porosity and porosity characteristics of the BFZ, taking into account its clogging.

Figures 1 and 2 show the results of these formulations for comparison. Fig. 1 (a) reflects the change in porosity from the initial $m_{in}$ to the resulting $m_{res}$ values in a homogeneous reservoir. Fig. 2(a) illustrates a BFZ with a linear initial increase in resistivity near the well up to the average formation porosity. In both options, a standard volume of 15% hydrochloric acid solution in a volume of 7 $m^3$ is pumped through the well into the formation. The subsequent displacement fluid volume is 14 $m^3$. Injection is carried out under the condition of supplying reagents at a constant pressure at the bottom of the well; at the remote supply circuit, the reservoir pressure is also considered unchanged at the stage of stimulation. The average porosity according to HWS data before treatment was $m_{in}$ =0.18, the carbonate content of the formation was taken to be 13.4%, which, under the condition of complete dissolution of the carbonate part of the matrix, corresponds to the limiting increase in porosity in the treated formation zone to $m_{max}$ =0.29.

In the course of calculations in dynamics, the distribution profiles in the BFZ zone of all hydrodynamic and porosity reservoir parameters, such as temperature, pressure, water saturation, acid solution concentration, porosity, permeability, phase filtration rates, were obtained. Fig. 1 (b) and 2 (b) show the profiles of the temperature distribution of the saturated reservoir in the near-wellbore zone for different observation time intervals, respectively, in homogeneous and "colmated" formations. Temperature distribution data are given: at the end of the solution supply (T0) and at three subsequent time points (T1, T2, T3). According to the distribution profiles of parameters, one can draw a conclusion about the depth of the zone and the degree of BFZ treatment, as well as the intensity of heating of the bottomhole zone due to the exothermic reaction of the acid with the carbonate part of the porous matrix skeleton.
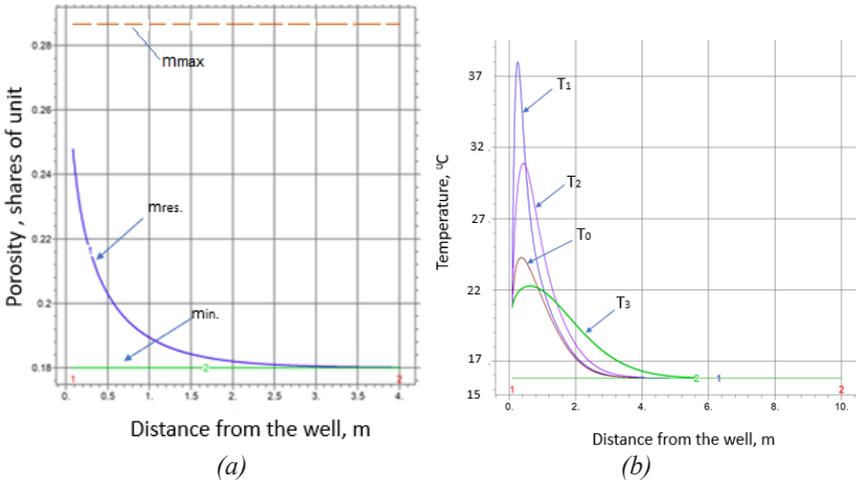
*Figure 1.* Distribution of porosity (a) and formation temperature (b) after injection of hydrochloric acid solution into a homogeneous formation at the time points: $T_0$ – completion of acid injection into the reservoir, $T_1$ – 5 hours after the entire volume of acid was injected into the formation, $T_2$ – one day after supplying the entire volume of acid into the reservoir, $T_3$ – 8 days after the entire volume of acid was supplied to the reservoir
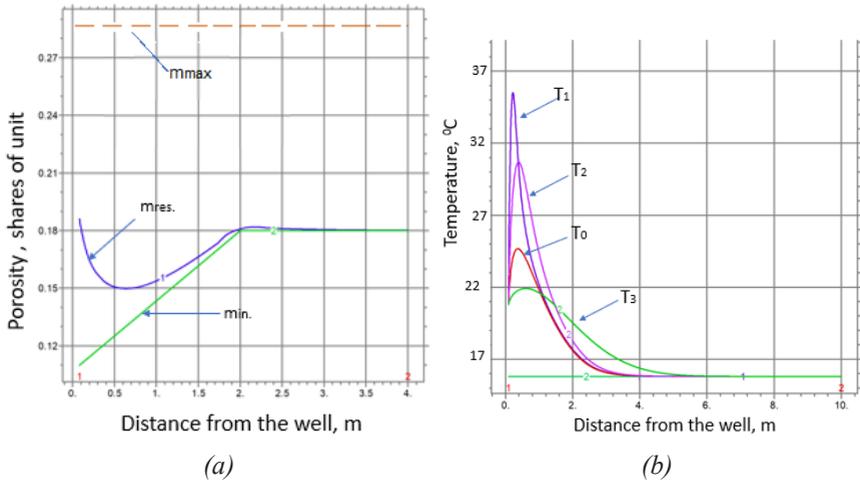


*Figure 2.* Distribution of porosity (a) and reservoir temperature (b) after injection of hydrochloric acid solution into a heterogeneous reservoir at time points: $T_0$ – completion of acid injection into the reservoir, $T_1$ – 5 hours after

*the entire volume of acid was injected into the formation, $T_2$ – one day after supplying the entire volume of acid into the reservoir, $T_3$ – 8 days after the entire volume of acid was injected into the reservoir*

For additional analysis of the treatment efficiency for the considered options, the values of the initial (before treatment) and final (after treatment) current flow rate of the well and monthly production were calculated. The results are shown in table 1.

*Table 1.*

*Comparison of flow rate and production volume before and after treatment for a month*

| | Homogeneous formation | | Reservoir with polluted zone | |
|---|---|---|---|---|
| | before treatment | after treatment | before treatment | after treatment |
| Maximum current oil production rate, t/day | 0,563 | 0,889 | 0,309 | 0,609 |
| Monthly oil production, m³ | 18 | 34 | 10 | 24 |

According to the table, an increase in production rate after treatment with a solution of hydrochloric acid in a homogeneous reservoir is 1.6 times, and in a heterogeneous reservoir - almost 2 times. At the same time, production for 30 days for a homogeneous reservoir increases almost 2 times, and in a heterogeneous one - more than 2 times.

**Conclusion**

Comparison of the results of the distribution of parameters with the same characteristics of the acid composition and injection volumes reveals a weaker effect in terms of the sweep depth for the reservoir treatment option with a contaminated bottomhole zone. Namely, when 7 m³ of an acid solution is injected and then pure water is injected in a volume of 14 m³, a treated zone with increased porosity and permeability is formed about 2 m wide in a homogeneous reservoir and only 1 m in a heterogeneous one, which does not correspond to the task of completely restoring the filtration properties of BFZ to the mid-layer level. BFZ contamination is also reflected in the temperature profiles: for a contaminated formation due to matrix heating during an exothermic reaction, a lower average level of temperature rise in the BFZ is observed, which may be relevant if the task is to dissolve settled heavy hydrocarbons (paraffins, etc.). For both options, it is worth noting a prolonged thermal effect, consisting in a long time of maintaining an elevated

temperature in the reservoir after treatment (over a week) with small volumes of reagent injection, and leading to a decrease in resistance, including due to a decrease in the viscosity of the reservoir fluid in the BFZ zone.

According to the data obtained, it can be said that the considered volume of the acid solution, which is standard for a homogeneous reservoir, provides incomplete cleaning of the bottomhole zone in the event of even a slight contamination in it (using the considered option as an example). However, a comparison of the obtained flow rates shows the effectiveness of the use of acid treatment to intensify the operation of the well by reducing the filtration resistance in the BFZ zone.

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商船的运营能源效率
# OPERATIONAL ENERGY EFFICIENCY OF A MERCHANT VESSEL

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抽象的。自 2020 年 1 月起，高硫船用燃料禁令要求船东放弃部分利润，转而满足对海上船舶能效的限制。从 2023 年开始，船舶必须按照既定的降低值每年降低其碳强度，即每单位运输工作向大气排放的温室气体量。空气污染的减少直接取决于船舶能效的运行指标。文章从航速变化对能效运行系数的影响以及船体结垢减速的角度分析了一艘海上商船运输船在海上航道的运输作业。本文确定了可以通过控制船舶速度和有效规划过渡来提高海上运输船的能源效率并减少海上通道二氧化碳排放的操作措施，而无需建设性干预和设备改造。船用柴油机燃料消耗对船速的依赖性已被识别和分析
关键词：船舶，能效，航速，$CO_2$ 排放，船体污垢，能效运行指标，能效设计指标，燃料消耗。

*Abstract. The ban on high-sulfur marine fuel, from January 2020, requires shipowners to abandon part of the profit in favor of satisfying the restrictions on the energy efficiency of the sea vessel. Starting from 2023, ships will have to annually reduce their carbon intensity, namely the amount of greenhouse gas emissions into the atmosphere per unit of transport work, in accordance with the established lowering values. The reduction of air pollution is directly dependent on the operational indicators of the ship's energy efficiency. The paper analyzes the transport operation of a marine merchant car carrier at the sea passage, from the point of view of the impact of speed changes on the operational coefficient of energy efficiency and speed reduction owing to hull fouling. The article identifies operational measures that can increase the energy efficiency of a marine transport vessel and reduce carbon dioxide emissions at a sea passage without constructive intervention and modification of equipment by controlling the speed of the vessel and effective planning of the transition. The dependence of fuel consumption by marine diesel engines on the speed of the vessel has been identified and analyzed*

*Keywords: ship, energy efficiency, speed, $CO_2$ emissions, hull fouling, energy efficiency operational index, energy efficiency design index, fuel consumption.*

**Introduction**

With the adoption of the Paris Climate Agreement on December 12, 2015, all parties agreed on a common set of goals to address global warming. These goals include the long-term goal of keeping global mean temperature increases below $2x°C$ above pre-industrial levels and continued efforts to limit temperature increases to $1.5°C$ above pre-industrial levels [1].

Another important goal is the ability of countries to adapt to the negative impacts of climate change. Of course, both climate change itself and the proposed energy policy in the near future will impose significant restrictions on global economic growth and foreign trade.

Global socio-economic trends, population growth, rising incomes and increased urbanization inevitably lead to an increase in demand for electricity, transport and other energy-intensive services. The unprecedented growth of the world economy over the past century has led to an increase in the use of commodities and their associated greenhouse gas emissions. Higher greenhouse gas emissions, in turn, have accelerated climate change, which has had a negative impact on the production of goods itself.

**Air emissions**

Today, there is a well-established opinion in the scientific community that global warming, as well as extreme and adverse climate changes, are caused by an increase in the concentration of greenhouse gases in the Earth's atmosphere. In particular, the concentration of $CO_2$ in the atmosphere has increased by 31 percent since the beginning of industrialization (i.e. since the second half of the twentieth century), and $CO_2$ emissions account for the largest share of greenhouse gas emissions. At the same time, the largest emissions come from the combustion of oil, natural gas and their derivatives.

The discussion of climate change is connected with the search for ways to reduce $CO_2$ emissions associated with human activities. Under these conditions, it is estimated that the coronavirus pandemic could save many lives by improving air quality in cities [2]. A large number of enterprises are forced to change their supply logistics due to the pandemic, which in the short term is associated with a decrease in foreign trade volumes in global markets. However, since 1990 the total radiative forcing causing global warming has increased by 43 percent, with $CO_2$ accounting for about 80 percent of the increase [3].

Maritime transport underpins global supply chains and economic interdependence with shipping and ports, which are estimated to account for over 80 percent of global merchandise trade by volume and over 70 percent by total commodity value. According to IMO estimates, greenhouse gas emissions from ships accounted for about 2.2 percent of anthropogenic carbon dioxide emissions in the world in 2012 [4]. Today, emissions from international shipping are already about

4 percent, and by 2050 their volume may reach (according to forecasts) more than 50 percent [4], see fig. 1.
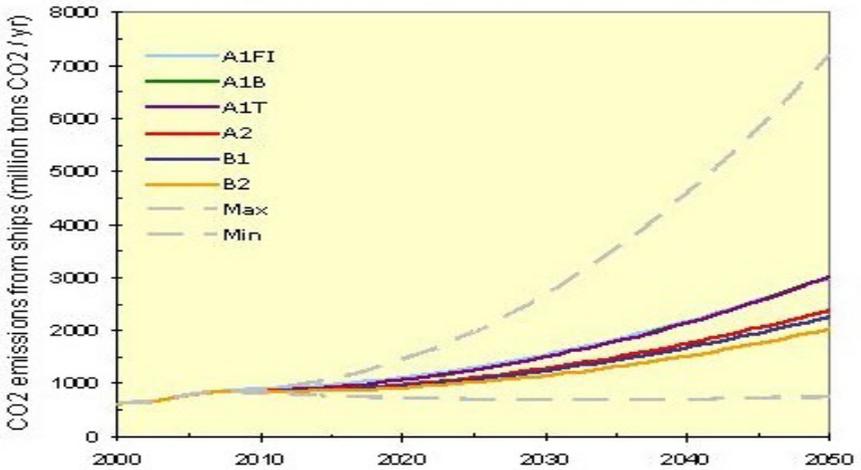


*Figure 1. Emission forecast up to 2050 [4]*

Experts estimate that the implementation of a number of technical and operational measures can improve the energy efficiency of ships and reduce greenhouse gas emissions by 75 per cent. An assessment of the potential to reduce emissions from ships is presented in table 1.

*Table 1.*
*Assessing the potential to reduce emissions from ships*

| Design (New vessels) | $CO_2$ savings/ tons per mile | Joint | Joint |
|---|---|---|---|
| Concept, speed and power | 2–50% | 10–50% | 25–75% |
| Hull and superstructure | 2–50% | | |
| Power and propulsion systems | 5–5% | | |
| Low carbon fuel | 5–5% | | |
| Renewable energy source | 1–10% | | |
| Reduction of $CO_2$ in exhaust gases | 0% | | |
| Operation (All Vessels) | | | |
| Fleet Management, Logistics and Incentives | 5–50% | 10–50% | |
| Cruise optimization | 1–10% | | |

Starting in 2023, ships will be required to annually reduce their carbon intensity, namely the amount of greenhouse gas emissions into the atmosphere per unit of transport work, in accordance with the established reduction values. From January 1, 2023, new requirements are also introduced for sea cargo and passenger ships operating outside national waters. Such ships will need to meet a set value for the ship's "energy efficiency factor" and be certified accordingly.

Maritime administrations will assign an annual carbon intensity rating of A, B, C, D, or E, depending on the performance achieved. If the ratings are low, the ship will need to develop and implement a corrective action plan to improve carbon intensity.

Every ship of 400 gross tonnage and above must have an Energy Efficiency Management Plan (SEEMP), which may be part of the ship's safety management system or an ISO 14001 environmental management system. This plan must aim to reduce $CO_2$a emissions through better fuel management and cruise planning. To do this, the EEOI operating energy efficiency index is calculated and compared with the EEDI design energy efficiency index for new ships. The indices have the same physical meaning - the ratio of $CO_2$ produced per voyage (voyages) to the value of the ship's transport work for a certain period:

$$EEOI = (MTER_f \times CF) / A_f \qquad (1)$$

where: $MTER_f$ – actual fuel consumption in operation by all consumers, t; $A_f$ – the actual transport work of the vessel in t. miles; CF – dimensionless conversion factor of fuel consumption to $CO_2$ emissions.

Of course, the greatest interest for shipping is the question of determining the factors influencing the change in the operational energy efficiency index.

To determine the main operational parameters affecting the operational energy efficiency index, I conducted full-scale experiments on trans-Pacific crossings on several RO-RO ships of the same type, namely "GALAXY ACE" and "EUPHONY ACE" with a gross tonnage of 59.583 and 58.631 reg. t. respectively. Operational measures have been identified that can improve the ship's energy efficiency by reducing sea crossing $CO_2$ emissions without equipment modifications (see fig. 2) by managing the ship's traffic and speed with efficient voyage planning.

The volume of fuel consumption at the crossing was quite accurately described by the formula:

$$Q = Q_\text{T}(V/V_\text{T})^3 \qquad (2)$$

where: Q – actual fuel consumption in t/day.; V – operating speed, knots (see fig. 2); $Q_\text{T}$ – fuel consumption corresponding to the technical speed in t/day.; $V_\text{T}$ – technical speed, knots.

It can be seen from formula (2) that for marine diesel engines the level of fuel consumption depends significantly on speed. For example, reducing the operating

speed from 16 to 11 knots results in a 2/3 saving in fuel consumption per day. When reducing the speed of the vessel, one should take into account the fact that incomplete combustion of fuel and an increase in the toxicity of exhaust gases may occur. With an increase in the load on the main engine and the speed of the vessel, the concentration of harmful substances in the exhaust gases decreases. Therefore, the specific amount of exhaust gases, related to power, mainly depends on the operating mode of the engine and its type and has the character of a hyperbolic dependence.

Calculations of the operating coefficient of the ship's energy efficiency using formula (1) showed quite good results (see fig. 2).

For the purposes of analyzing the significant factors affecting the operational efficiency of a sea vessel, we transform formula (1) using the concept of material flow – Mp (tons of cargo per day), we obtain the following expression:

$$EEOI = CF \times [(Q \times V) / (M_p \times T)] \qquad (3)$$

where: T – cruise time days.

Our studies of speed loss by RO-RO ships in operation show that the determining factor can be

Total Fuel consumption and $CO_2$ emissions

| Parameter | Value |
|---|---|
| Total fuel consumption | 2322.65 m tonnes |
| Fuel consumptions assigned to on laden | 2269.30 m tonnes |
| Total $CO_2$ emissions | 7291.9579 m tonnes |
| $CO_2$ emissions from all voyages between ports under a MS jurisdiction | 1940.88 m tonnes |
| $CO_2$ emissions from all voyages which departed from ports under a MS jurisdiction | 3000.12 m tonnes |
| $CO_2$ emissions from all voyages to ports under a MS jurisdiction | 2179.92 m tonnes |
| $CO_2$ emissions which occurred within ports under a MS jurisdiction at berth | 171.04 m tonnes |
| $CO_2$ emissions assigned to on laden | 7120.9178 m tonnes |

DISTANCE TRAVELLED, TIME SPENT AT SEA AND TRANSPORT WORK

| Parameter | Value |
|---|---|
| Total distance travelled | 23177 n miles |
| Regular navigation | 23177 n miles |
| Total time spent at sea | 1554.82 hours |
| Regular navigation | 1554.82 hours |
| At anchorage | 0 hours |
| Total transport work (mass) | 96553994 m tonnes · n miles |

ENERGY EFFICIENCY

| Parameter | Value |
|---|---|
| Fuel consumption per distance | 100.2136 kg / n mile |
| Fuel consumption per transport work (mass) | 24.0555 g / m tonnes · n miles |
| Fuel consumption per distance on laden voyages | Missing source values! kg / n mile |
| Fuel consumption per transport work (mass) on laden voyages | 23.5029 g / m tonnes · n miles |
| $CO_2$ emissions per distance | 314.6204 kg $CO_2$ / n mile |
| $CO_2$ emissions per transport work (mass) | 75.5221 g $CO_2$ / m tonnes · n miles |
| $CO_2$ emissions per distance on laden voyages | Missing source values! kg $CO_2$ / n mile |
| $CO_2$ emissions per transport work (mass) on laden voyages | 73.7506 g $CO_2$ / m tonnes · n miles |

**Figure 2.** *Transport work and vessel energy efficiency*

loss of speed due to intensive fouling of the hull and propeller(s) when ships are parked under cargo operations in warm latitudes. The actual results of speed measurements 12 months after docking the vessel are losses of the order of 1.35. The volume of fuel consumption at the crossing was quite accurately described by the formula:

$$Q = Q_T (V/V_T)^3 \qquad (4)$$

where: Q – actual fuel consumption in t/day.; V – operating speed, knots (see fig. 2); $Q_T$ – fuel consumption corresponding to the technical speed in t/day.; $V_T$ – technical speed, knots. 1.5 knots at the trans-Pacific crossings. The results of fouling depend on the types of foulers and, if measures are not taken for timely underwater cleaning of the flat parts of the bottom at the ends and the PVL belt, they can be so significant that they no longer perceive the shearing forces during underwater cleaning of the ship's hull (the ship can only be cleaned in the dock), see fig. 4. Our field experiments made it possible to obtain a universal empirical coefficient

of velocity loss from fouling in the form:

$$\mu = [V_T - (1{,}35 \times V_T) \times (0{,}07T/365)] / V \qquad (5)$$
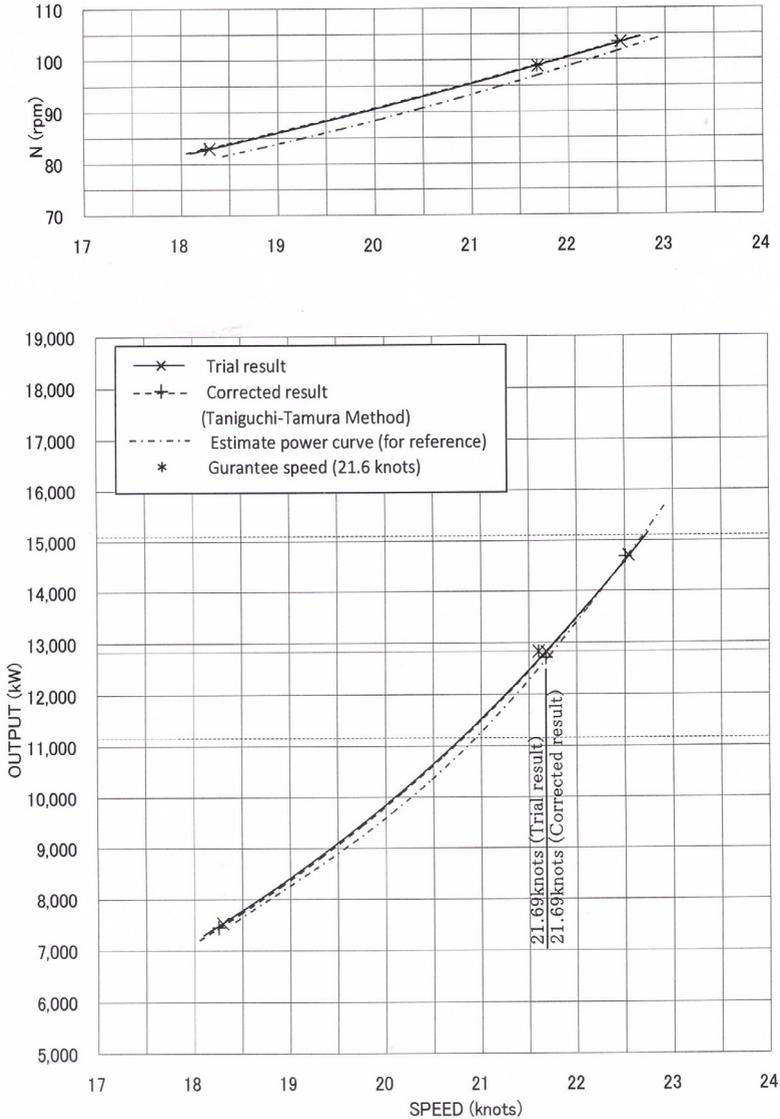


**Figure 3.** *Vessel performance characteristics*
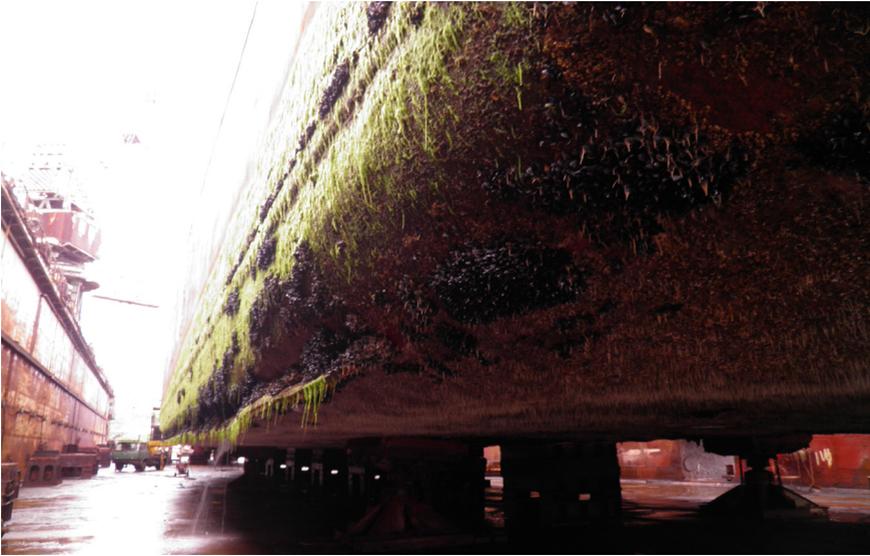
***Figure 4.*** *Fouling of the hull with various types of foulers*

Therefore, for the purposes of determining the operational energy efficiency factor in (3), instead of V, the corrected speed in the form - ($\mu$ x V) should be substituted. During inter-trip underwater cleaning of the ship's hull and propeller(s), in (3) should be substituted for the operating speed V - ($\frac{1}{2}$ $\mu$ x Vt).

**Conclusion**

The resulting formulas can be used to calculate the operational energy efficiency factor of RO-RO type ships in preparation for a voyage. As can be seen from (3), with an increase in the cruise range and a decrease in the operating speed, the energy efficiency of the vessel will increase. Therefore, market mechanisms are the most efficient and cost effective in terms of optimizing energy efficiency in the commercial operation of a ship. However, there is significant potential to reduce $CO_2$ emissions in operation based on technical measures, in relation to the hull, engine and propulsion, ship cleaning and painting operations, trimming and ballast management.

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重力不影响时间的流逝
# GRAVITY DOES NOT AFFECT THE PASSAGE OF TIME

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抽象的。在经典物理学中，时间被认为是绝对的。相信所有过程，无论其复杂性如何，都不会影响时间的流动

相对论确定物体的时间流动取决于物体的运动速度和引力势的大小。人们认为，由于航天器的高速，空间轨道上的时间过得更慢，而由于重力势比地球表面的低，空间轨道上的时间过得更快。目前，全球定位系统考虑了时间对引力势和速度（相对论效应）大小的依赖性。

然而，在研究相对论效应时，科学家们对轨道卫星的时钟频率与地球表面的时钟频率之间的差异做出了错误的解释。所有进一步解释相对论效应的研究都是根据类似的情况进行的，即只研究了不同引力势条件下时钟频率的差异。

在进行理论研究时，我发现由于地球重力的影响，信号的频率在从卫星到接收器的过程中会发生变化。结果发现

位于不同高度的两个高精度时钟的读数在任何一段时间后都不会出现差异，即表明时间的流动不依赖于引力势。建议进行全面实验，期间将一些高精度时钟发送到空间站上，而另一些则留在地球表面的实验室中。预计卫星时钟的读数将与地球实验室的时钟读数完全相同。

关键词：时间流，相对论效应，频率发生器，引力势。

***Abstract.*** *In classical physics, time is considered absolute. It is believed that all processes, regardless of their complexity, do not affect the flow of time*

*The theory of relativity determines that the flow of time for bodies depends both on the speed of movement of bodies and on the magnitude of the gravitational potential. It is believed that time in space orbit passes slower due to the high speed of the spacecraft, and faster due to the lower gravitational potential than on the surface of the Earth. Currently, the dependence of time on the magnitude of the gravitational potential and velocity (relativistic effect) is taken into account in global positioning systems.*

*However, studying the relativistic effect, scientists have made a wrong interpretation of the difference between the clock frequency of an orbiting satellite and the clock frequency on the Earth's surface. All further studies to explain the*

*relativistic effect were carried out according to a similar scenario, that is, only the difference in clock frequencies under conditions of different gravitational potentials was investigated.*

*While conducting theoretical research, I found that the frequency of the signal changes along the way from the satellite to the receiver due to the influence of Earth's gravity. It was found that the readings of two high-precision clocks located at different heights will not differ after any period of time, that is, it is shown that the flow of time does not depend on the gravitational potential. It is proposed to conduct full-scale experiments, during which some high-precision clocks are sent aboard the space station, while others remain in the laboratory on the surface of the earth. It is expected that the readings of the satellite clock will be absolutely identical to the readings of the clock in the Earth laboratory.*

*__Keywords:__ time flow, relativistic effect, frequency generator, gravitational potential.*

### Introduction

For the first time, the magnitude of the relativistic effect was experimentally determined in the USA in experiments on the NTS-2 space satellite [1]. The idea of using a spacecraft to navigate mobile objects in the United States began to develop after the launch of the first artificial Earth satellite in the USSR in 1957. In 1964, the first-generation Transit satellite radio navigation system (SRNS) was created to provide navigation support for launching Polaris ballistic missiles from submarines [2]. For commercial use, this system was introduced in 1967. The coordinates of the consumer were calculated based on the reception and extraction of the Doppler frequency change of the transmitter of one of the 7 spacecraft.

With the development of atomic clocks in 1960, it became possible to use a network of precisely synchronized transmitters transmitting coded messages for navigation purposes. The measurement of the corresponding time delays by the receiver made it possible to calculate the coordinates of the receiver. For the first time this principle was implemented on the US Navy satellite TIMANTION-I (05/31/1967). Work in this direction was continued and marked by the launch of the TIMANTION-II-82B satellite (30.09.1969). Both satellites were initially equipped with onboard time and frequency standards based on a quartz oscillator to develop common principles [3].

In 1973, the navigation programs of the US Air Force and Navy were combined into a common navigation technology program, which later turned into the NAVSTAR-GPS program. The TIMANTION-III satellite was converted into a general spacecraft NTS-1, launched on July 14, 1974 with a frequency standard based on quartz and rubidium generators.

This was followed by the creation of NTS-2 and NTS-3 devices, respectively,

with caesium and hydrogen standards. During this period, the synchronization accuracy increased from $10^{-11}$ to $10^{-12}...10^{-13}$ and higher. The height of the satellites' orbits increased (from 925 km to 13,000 km, and then 20,000 km), the carrier frequency of the transmitters changed (from 400 MHz to 1227 and 1575 MHz).

On the eve of the launch of NTS-2, there were numerous discussions among the developers of the NAVSTAR-GPS system about the limits of which values the relativistic effect would be observed. It was decided to measure the accumulated error over a long time relative to terrestrial standards.

200 days after the launch of the two standards on the satellite, the comparison showed that the clock on the satellite "went ahead" by 0.0076 seconds. Consequently, the time on the clock of the NTS-2 satellite increased by 38 microseconds during the day compared to the Earth clock.

Therefore, NTS-2 is considered as the first NAVSTAR-GPS SRNS satellite.

The results of the analysis of the NTS-2 laid an exhaustive foundation for further efforts aimed at creating SRNS NAVSTAR-GPS. Thanks to NTS-2, there was no need to manufacture and launch NTS-3 and NTS-4 satellites. The success of the launch of the NTS-2 satellite brought the era of SRNS NAVSTAR-GPS closer [4]

**Results**

In [4], it is reported about the difference between the readings of the satellite clock and the ground clock for the day and for the time period under study, however, I clarify that the readings of the satellite clock were obtained by calculating on the ground based on the received signals.

The NRL report [5, 6] emphasized the paramount importance of NTS-2 in solving the problem of relativistic effects when creating GPS. It seems that everything is precisely and unambiguously defined – the flow of time in space orbit is different from the flow of time on the surface of the earth. At the same time, they reported a difference in the readings of the clocks in space orbit compared to the readings of the clocks on the surface of the earth, however, provided that the readings of the orbital clocks were calculated in a laboratory on the surface of the earth.

The source [7] reports that if two identical molecular generators are synchronized, and then one of them is placed on an artificial satellite of the Earth, and the other is left on Earth, then the frequency of the first of them, measured on the satellite, will be equal to the frequency of the second, measured on Earth. However, the frequency of the molecular generator placed on the satellite, measured by an observer on Earth, will be changed due to the Doppler effect of the 1st and 2nd orders and the effect of gravitational frequency shift.

Therefore, to measure the gravitational frequency shift, it is necessary to exclude, first of all, the influence of the Doppler effect of the 1st order.

In the source [8], for this purpose, a method is proposed for accurately measuring large periods of time on the Earth's surface and on a satellite, followed by comparing them with each other using radio communication. The essence of the method is as follows. The satellite has a highly stable generator of the set frequency (for example, a molecular generator), which produces short electrical pulses following one after another through a strictly defined number of oscillation periods of the generator. These pulses are transmitted to Earth and recorded simultaneously with the same pulses of a similar installation available on Earth. It is shown that with long-term fixation of pulses (not necessarily continuous), it is possible to notice a difference in the duration of large periods of time elapsed on Earth and on the satellite between two pairs of corresponding pulses received from the Earth's surface and from the satellite. According to the theory of relativity, this time difference is caused by the gravitational field and the 2nd order Doppler effect.

In general, the article [8] is devoted to an overview of all existing at that time and, accordingly, used in practice, including in the USA, methods for comparing the frequencies of two time variables of periodic signals spaced in space. And first of all, comparing the signals coming from the satellite to the earth with the signals emitted by the ground device. Considering that the devices are synchronized in frequency.

The latest materials on measuring the frequency difference with a small difference in the height of the clock are shown in [9 and 10}.

In a new study [9], physicist Jun Ye of GIL in Boulder, Colorado, and his colleagues used a clock consisting of approximately 100,000 ultracold strontium atoms. These atoms were arranged in a lattice pattern, which meant that the atoms were positioned at different heights, as if they were standing on the steps of a ladder. Displaying how the frequency changed at these heights revealed a shift. After adjusting for non-gravitational effects that can change the frequency, the clock frequency changed by about one hundredth of a quadrillionth of a percent per millimeter, just the amount expected according to general relativity.

In the source [10], Shimon Kolkovits from the University of Wisconsin-Madison and his colleagues measured the relative ticking speed of two clocks separated by about six millimeters, with an accuracy of 8.9 millionth of a trillion percent. Thanks to this sensitivity, scientists were able to detect the difference between two clocks that tick at a speed so slightly different that they will diverge by just one second in about 300 billion years.

**Discussion**

In all experiments, in all theoretical studies shown above, the relative ticking speed of two clocks separated by height in a gravitational field is compared.

At the same time, the difference in frequencies is indeed detected. Because of this difference, it is concluded that the oscillation frequency of the clocks located

above is greater than the oscillation frequency of the clocks located below. Therefore, in order to align the frequency of the orbital clock with the frequency of the ground clock, it is proposed to reduce the frequency of the orbital clock. In the course of further operation, GPS and GLONASS really began to delay the orbital clocks before launching satellites into orbit.

Neither in the experimental results nor in theoretical studies could I find a physical comparison of the readings of the satellite's onboard clock with the readings of the ground-based laboratory clock. For example, we will ask an astronaut on the radio what the clock on his atomic clock shows, and we will see that the Earth clock shows the same time. Or we send the clock into orbit, and after a certain period we remove the clock from orbit. We compare the readings of the orbital clock and the readings of the Earth clock. We will see that the readings of the ground and orbital clocks will be identical.

This means that since the experiments on NTS-2, the readings of the orbital clocks have never been compared with the readings of the ground clocks. This means that no one has ever compared the readings of clocks spaced by height in a gravitational field.

However, what about the Hefele-Keating experiment (1971) [11], which is considered as a test of relativity theory? According to the authors, this experiment directly shows the reality of the time delay of moving objects predicted by the theory of relativity. It should be noted that some publications indicate the fallacy of the Hefele-Keating experiment due to the discrepancy between the accuracy of measuring instruments and the measured parameter.

It follows from the article [12] that the frequency of the clock on the satellite differs from the frequency of the Earth clock, and, accordingly, the readings of the clock, which will not slow down before launching into space orbit, will be increased compared to the readings of the Earth clock. If you reduce the speed of the satellite clock (in fact, this is done in GPS and GLONASS), then the numerical values of the satellite clock and the clock on earth will coincide.

Similar conclusions are also made in the article [13], where it is stated that in the case of atomic clocks, when they rise in a gravitational field, the distance between the energy levels of an electron in an atom increases, and in the case of nuclear clocks, the distance between the energy levels of the nucleus increases. With an increase in the energy difference between the levels in the atom (nucleus), the frequency of radiation increases, and the oscillation period decreases. This means that such atomic (nuclear) clocks will go faster.

Thus, assuming that the last two articles [12, 13] were released after (1999 and 2012) in relation to article [7] (1961), we can say that today it is recognized in science that the readings of satellite clocks will differ after a certain period from the readings of terrestrial clocks (naturally, the clocks must be synchronized before

sending a satellite into space orbit).

I believe that in order to verify the correctness of the current conclusions of science, it is necessary to check the correspondence of the readings of the satellite clock and the readings of the Earth clock, which should be done with the help of the space station.

I will also say a forecast - the readings of the space station clock and the ground clock will absolutely coincide at any time.

I claim that the passage of time does not depend on either the gravitational potential or the speed of motion of bodies. In this case, the difference in the frequency of the received signal from the frequency of the satellite transmitter occurs due to an increase in the speed of the signal on the way from the satellite to the ground receiver.

**Methods**

We will consider how the flow of time changes under conditions of different gravitational potential, assuming that the speed of photons changes under the influence of a gravitational field.

Consider, for example, the GLONASS satellite (H = 19,100 km), which constantly sends radio signals to receivers on earth.

By calculation, it was determined that the radio signal on the way from orbit receives a velocity increment of 0.16 m/s in the gravitational field of the Earth.

The signal from the GLONASS satellite is sent with a frequency of $f_o$ = 1609 MHz, received in a receiver on earth with a frequency of $f'$ = $f_o$ / (1 + z) = 1 609.00000084 MHz. At the same time, there is a shift in the signal spectrum to the purple side:

$$z = (f_o - f') / f' = (C - C') / C' = (299792458 - 299792458.16)/299792458.16 = -5.25 * 10^{-10}$$

Where: C = 299,792,458 m/s, C' = 299,792,458.16 m/s.

It should be noted that to compensate for presumably relativistic effects, the frequency generated by the onboard frequency generator from the point of view of the observer located on the GLONASS satellite changes when the satellite is launched into orbit relative to the base frequency by the amount:

$\Delta f/f_o$ = -4.36 $*10^{-10}$ (almost coincides with - 5.25 $*10^{-10}$),

Next, we will look at the difference between the expected arrival time of a signal from orbit to Earth and its actual arrival time (relative to the travel time from orbit to Earth). The signal arrives on earth from the GLONASS satellite after a while:

$t_1$ = 19100000/299792458.16 = 0.0673710742149 s.

An observer on the Ground calculated that the signal should arrive within time $t_2$ = 19100000/299792458 = 0.0673710742183 s.

The relative difference in signal travel time is:

$(t1 - t2) / t2 = - 5.25 * 10^{-10}$ times.

Thus, the estimated difference in the passage of time in space orbit due to the difference in gravitational potentials is exactly equal to the difference between the expected arrival time of a signal from orbit to Earth and its actual arrival time relative to the time spent on the path. In this case, it is important for the observer not to change the time of arrival of the radio signal, but to change the frequency of the radio signal at the receiver in comparison with the frequency of the satellite radio signal in accordance with the expression f' = fo/(1+z).

**Conclusions**

Proper consideration of the relationship between the speed and frequency of the radio signal wave allows us to talk about the independence of the flow of time from the gravitational potential.

Given that the speed of a photon changes in a gravitational field, there is no room in further reasoning for the difference in the flow of time in regions of space with different gravitational potentials.

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科学出版物

上合组织国家的科学研究：协同和一体化

国际科学大会的材料

2022年6月28日，中国北京

编辑A.A.Siliverstova
校正A.I.尼古拉耶夫