SCIENTIFIC RESEARCH OF THE SCO COUNTRIES: SYNERGY AND INTEGRATION

上合组织国家的科学研究：协同和一体化

Materials of the International Conference

Date: May 14

Beijing, China 2020

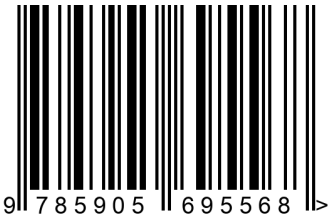
上合组织国家的科学研究：协同和一体化国际会议

参与者的英文报告

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

Part 1: Participants’ reports in English

2020年5月14日。中国北京
May 14, 2020. Beijing, PRC



Materials of the International Conference
“Scientific research of the SCO countries: synergy and integration” - Reports in English

(May 14, 2020. Beijing, PRC)

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这些会议文集结合了会议的材料 – 研究论文和科学工作者的论文报告。 它考察了职业化人格的技术和社会学问题。一些文章涉及人格职业化研究问题的理论和方法论方法和原则。
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These Conference Proceedings combine materials of the conference – research papers and thesis reports of scientific workers. They examines tecnical and sociological issues of research issues. Some articles deal with theoretical and methodological approaches and principles of research questions of personality professionalization.

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

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Foreword

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

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

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

Fan Fukuan,
Chairman of the organizing committee of the conference
"Scientific research of the SCO countries: synergy and integration"
Full Professor, Doctor of Economic Sciences

前言

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

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

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

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

开发针对COVID-19流行病的具有成本效益的隔离措施的综合数字模型

DEVELOPMENT OF A COMPREHENSIVE DIGITAL MODEL OF COST-EFFECTIVE QUARANTINE MEASURES AGAINST THE COVID-19 EPIDEMIC[1]

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抽象。 COVID-19冠状病毒流行病的全球发展特点是，几乎在所有国家中，对严格检疫措施的决策都被延迟了。不难假设采取从医学角度来看最佳的过于严厉的措施会给经济带来灾难性的后果，从而恶化社会状况。因此，有必要快速开发一种综合的经济和流行病学模型，该模型可以将发达的流行病管理模型与发达的经济增长管理模型相结合，这是这项工作的目标和结果。改良的SIR模型用作基本的流行模型。作为经济增长的模型，我们使用了我们开发的混合经济系统的概率模型。已将这些模型以极其简化的形式集成到单个离散方程系统中，可以用作综合的经济和流行病学模型。

关键词：冠状病毒流行COVID-19，改进的SIR模型，混合经济系统的概率模型，综合经济和流行病学模型，最佳隔离措施。

Abstract. *The worldwide development of the COVID-19 coronavirus epidemic is characterized by delayed decision-making on harsh quarantine measures in almost all countries. It is not difficult to assume that the adoption of too harsh measures that are optimal from a medical point of view can lead to disastrous consequences for the economy, and hence worsening social situation. Hence, the need arises to quickly develop a comprehensive economic and epidemiological model that could combine well-developed epidemic management models with well-developed models of economic growth management, which is the goal and result of this work. A modified SIR model was used as the basic epidemic model. As a model of*

[1]This work was financially supported by the Russian Foundation for Basic Research, project № 20-010-00140a, "Methodological Aspects of Modeling the Russian Economy under Digitalization: Sectoral Cross Section".

economic growth, we used the probabilistic model of mixed economic systems that we developed. The integration of these models in an extremely simplified version into a single system of discrete equations has been performed, which can be used as a comprehensive economic and epidemiological model.

Keywords: *coronavirus epidemic COVID-19, modified SIR model, probabilistic model of mixed economic systems, comprehensive economic and epidemiological model, optimal quarantine measures.*

Introduction

In the near future, all resources, including scientific developments, will be involved in the fight against the epidemic of the coronavirus COVID-19. The experience of China, Italy and many other countries shows that the catastrophic slowdown in the adoption of strict quarantine anti-epidemic restrictions is caused by the fear that they will entail even more catastrophic socio-economic consequences. Along with this, large amounts of data are collected on the course of the epidemic in different countries with a different set of anti-epidemic measures. With their proper digital processing, you can get reasonable recommendations on the introduction of an economically feasible level of anti-epidemic measures and the use of effective algorithms for their phased tightening of the adaptive situation.

Research results

Due to the fact that these recommendations should be used by specialists of a different profile, they should be based on simple and understandable ideas and brought to the level of visual images. In the present work, the first combined digital model satisfying these requirements is presented, combining the probabilistic theory of mixed economic systems that we developed [1, 2] and the standard SiR epidemic development model [3], which in the most ideally simple version has the form:

$$\frac{dS(t)}{dt} = -\beta \times \frac{S(t) \times I(t)}{N}, \quad (1)$$

$$\frac{dI(t)}{dt} = +\beta \times \frac{S(t) \times I(t)}{N} - \gamma \times I(t), \quad (2)$$

$$\frac{dR(t)}{dt} = +\gamma \times I(t), \quad (3)$$

where $S(t)$ – individuals predisposed to the disease; $S(0) = N \approx 50 \times 10^6$;

$I(t)$ – individuals infected and capable of transmitting infection;

$R(t)$ – Individuals "retired" to recover or die;

β – indicator proportional to the average number of contacts of one individual per day;

γ – usually considered inversely proportional to the average time of infection by an infected individual $\left(\gamma = \frac{1}{t}\right)$.

In the first digital experiments, we take $N = 50 \times 10^6$, that is, a third of the population of the Russian Federation, taking into account the potential immunity of part of the population and distributed living over a very large territory.

β – corresponding to the global rate of daily growth of patients and short Russian exponential series can be in the range (0.2÷0.25). There is no reliable information on the average time of death and recovery. Therefore, parameter γ can be selected as shorter than the recommended quarantine time of 14 days (i.e., in the range of 5-14 days).

We also need to add to the standard SiR model a correction for the registered return of a part of the retired R to the category of potentially infected S. In the calculations, we took the share of such recovered individuals as 10%.

Equations (1)-(3) specify a simple, transparent and well-tested model for epidemics, for which there are databases on individual coronaviruses.

From the point of view of suppressing the epidemic in the absence of drugs and vaccines, the only significant controlling parameter is β, which can vary from 0.2 - corresponding to the current minimum restrictions to ~ 0 with full military quarantine.

According to the experience of China R (0)=0; *I*(0)=1000.

The results of digital modeling according to (1)-(3), modified for the reinfection of survivors, are presented in Figures 1, 2 and 3.

Figure 1 shows a three-dimensional growth chart of the number of infected by days (x-axis) depending on β (y-axis), where β varies from 0 (0) to 0.2 (360).

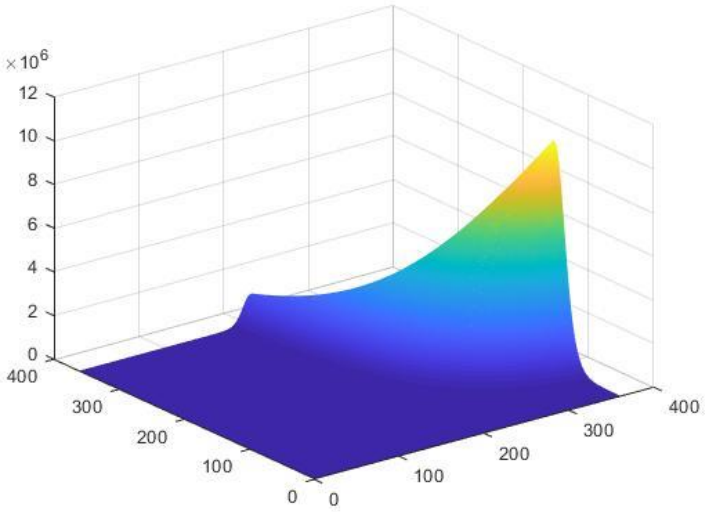

Fig. 1. *The dependence of the number of infected I (t, β) on time (t – left horizontal axis) and the intensity of contacts (β - right horizontal axis on a scale of 0.2/360).*

Figure 2 shows the dynamics of infected by day for β=0.2, which corresponds to Russian realities at the current time.

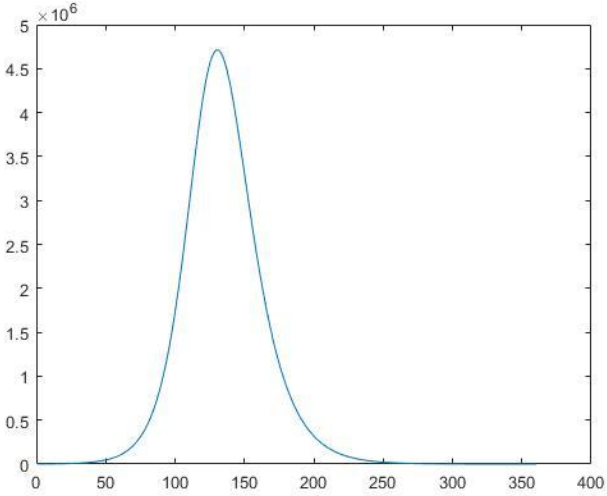

Fig. 2. *The dependence of the number of infected I(t) on time (t – horizontal axis x) for β=0.2.*

Figure 3 shows the dynamics of those infected at β=0.1, which corresponds to approximately twice blocking the current average level of contacts of one individual.

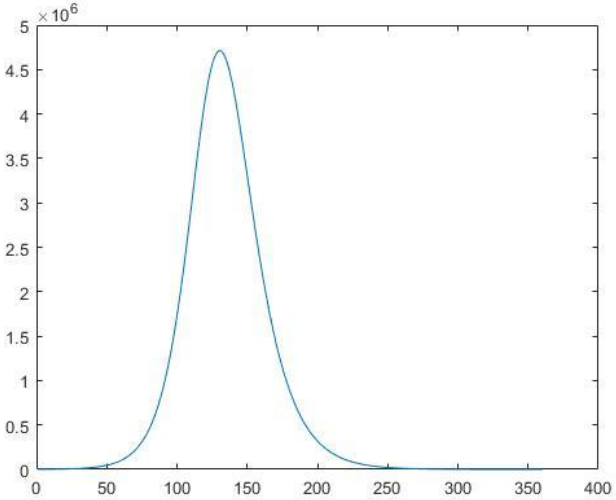

Fig. 3. *The dependence of the number of infected I (t) on time (t – horizontal axis x) for β=0,1.*

That is, purely from an epidemiological point of view, it is necessary to immediately halve the number of contacts by quarantine.

However, to make an informed management decision, a solid assessment of the economic consequences of this quarantine measure is not enough.

To this end, we add to equations (1)-(3) the simplest version of the economic growth model from [1, 2]:

$$\bar{A}_{i+1} = \bar{A}_i + diag\left(\bar{\xi}_i\right)\times\bar{A}_i - \langle\bar{\xi}_i, P\rangle\times\bar{A}_i \ , \quad (4)$$

where $\bar{A}_i$ – vector of gross production (capitalization) of agents of the economic system;

$\bar{\xi}_i$ – vector of agent cost-effectiveness;

$\langle\bar{\xi}_i, P\rangle$ – average value of the efficiency of the economic system, taking into account (P)-available natural resources, tax and other exemptions.

Assuming completely identical agents and infinite resources, as well as to a first approximation, assuming uniform quarantine suppression of all agents, which can be written as:

$$a_{i+1} = a_i + \alpha \times a_i - \alpha_0 \times a_i \quad (5)$$

where a_i in this expression can be interpreted as the country's GDP;

a_0 – inevitable GDP depreciation;

$\alpha_0 < \alpha$ – growth rate.

Given the ratio of tax press to GDP, assuming 3% annual growth without the coronavirus epidemic and with a daily sampling interval of $a_0 \sim 0{,}0002$; $a \sim 0{,}0003$;

To combine (5) with (1)-(3), it is necessary to add to (5) the dependence of daily growth on factor β and costs for each patient. That is (5) → (6):

$$a_{i+1} = a_i + \alpha(\beta) \times a_i - \alpha_0 \times a_i - z \times I(i) \quad (6)$$

where z – costs per patient per day, which we varied in the range from 10 to 100 thousand rubles.

In turn, we assumed a linear dependence $\alpha(\beta)$ under the condition $\alpha(0{,}2)=0{,}0003$;

The simplest scheme (6) was combined into a system with discretization (1)-(3). The calculation results for t = 11 are presented in Figures 4 and 5.

Figure 4 shows a model of economic recession $Q = \frac{a_0 - a_t}{\alpha_0}$ depending on time and parameter $\beta(0\div0{,}2)$ at a cost per patient of 10 thousand rubles per day.

Figure 5 shows the integral values of the economic downturn for the year, depending on the parameter β at a cost per patient of 100 thousand rubles per day.

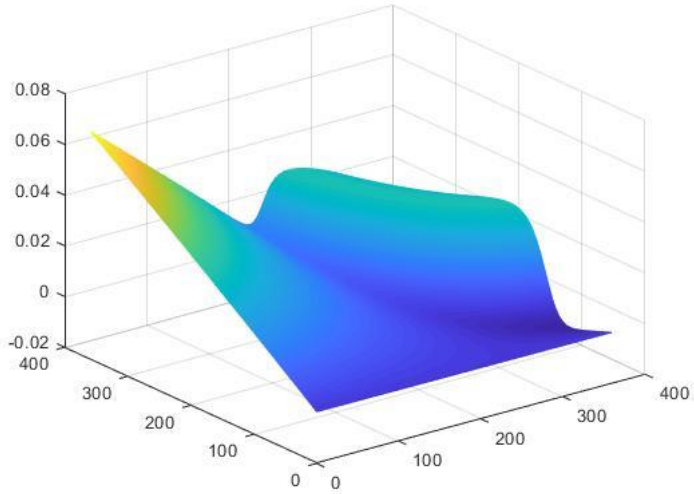

Fig. 4. *The dependence of the economic downturn Q(t, β) on time t and intensity of contacts β.*

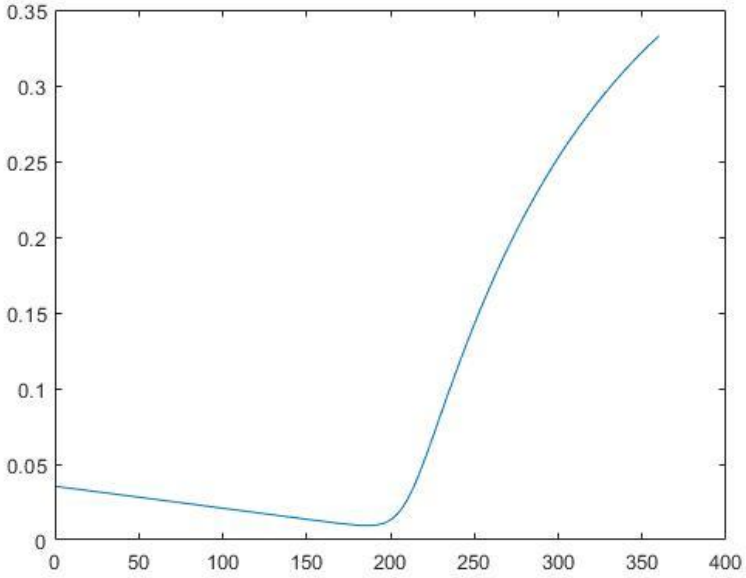

Fig. 5. *The dependence of the annual decline of 2020 of the Russian Federation on the intensity of contacts β.*

Conclusion

The presented digital model using the parameters corresponding to the current epidemic databases allows us to quite definitely state that the Russian Federation does not yet need total quarantine. It is necessary to reduce the average number of contacts of an individual by 2 times urgently and firmly to achieve acceptable socially and economically optimal results.

Using well-developed variants of the SIR model and the probabilistic model of mixed economic systems, a unified digital economic and epidemiological model of the socio-economic consequences of the epidemics of the coronavirus COVID-19 in the Russian Federation was built depending on the rigidity of quarantine measures. The model uses approximate parameters of contact intensity, economic growth and other indicators borrowed from databases around the world and our country.

Digital experiments have demonstrated the stability of recommendations for toughening quarantine measures for various variations of the model parameters.

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基于人员管理能力和专业能力发展的企业人力资本形成
THE FORMATION OF HUMAN CAPITAL OF ENTERPRISES BASED ON THE DEVELOPMENT OF MANAGERIAL AND PROFESSIONAL COMPETENCIES OF PERSONNEL

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抽象。本文以中层管理者的管理能力研究为例，证实了人员的管理能力和专业能力对企业人力资本形成的重要性。经济信息化领域（数字经济产品的开发，引进和实施）的企业之一被选为研究对象。该研究的主题是中层管理者的管理和专业能力。提出了一种评估许多关键能力的现有水平的新方法。根据获得的结果，进行了简要分析并提出了有关转变关键管理人员能力结构的建议，以便确定中层管理人员能力的优势和发展方向，并建立个人培训计划。企业人力资本形成的基础。

关键词：企业，人员，管理和专业能力，人力资本，形成。

Abstract. *The article substantiates the importance of the managerial and professional competencies of personnel for the formation of the human capital of an enterprise on the example of a study of the managerial competencies of middle managers. One of the enterprises in the field of informatization of the economy (development, introduction and implementation of digital economy products) was chosen as the object of research. The subject of the study was the managerial and professional competencies of middle managers. A new approach to assessing the existing level of a number of key competencies is proposed. Based on the results obtained, a brief analysis was carried out and recommendations were developed on transforming the structure of key managerial competencies in order to determine the strengths and directions of development of the competencies of middle managers, as well as building individual training programs as the basis for the formation of the human capital of an enterprise.*

Keywords: *enterprise, personnel, managerial and professional competencies, human capital, formation.*

Introduction

Today, many Russian enterprises in their daily activities are forced to experience negative consequences from the impact of sanctions restrictions. Under such conditions, promising directions and opportunities for their progressive development largely depend on the availability and level of development of human capital and its main components, such as managerial and professional competencies, intangible assets and the results of intellectual activity. Depending on the industry, type of production activity, organizational and legal structure and a number of other factors, the human capital of each enterprise is individual in itself, and its structural components are more or less important in its formation. However, paying due attention to the main structural components of the human capital of the enterprise, it seems to us that, first of all, it is necessary to dwell on the analysis of the current level of managerial and professional competencies of the enterprise personnel. The presence of a developed level of managerial and professional competencies suggests that the enterprise is capable of structural transformation and the development of its production and economic activities. For this reason, today it seems obvious to everyone that, in order to successfully counter sanctions, in addition to attracting and targeted use of financial, material, information technology and other types of resources necessary for organizing production, the harmonious development of human capital of enterprises becomes more relevant than ever. It involves achieving optimal compliance with the levels of development of managerial competencies of enterprise management and middle managers, as well as professional competencies of specialists directly involved in production. This circumstance is especially evident on the example of medium and small modern enterprises engaged in the development, production and sale of digital economy products. Increasing the level of managerial and professional competencies that the personnel of these and other enterprises possess, in fact, have a decisive influence on the formation of their human capital.

Purpose of the study

The main goal of this study is to justify the importance of the managerial and professional competencies of personnel in the formation of human capital using an example of one of the enterprises in the field of informatization of the economy (development, introduction and implementation of digital economy products). To achieve it, the priority tasks of forming the human capital of the enterprise through the transformation of the structure of managerial and professional competencies based on the application of a dynamic approach, identifying the strengths and promising areas of development of the competencies of middle managers of the enterprise under study were identified.

Materials and research methods

The novelty of the proposed approach to the formation of human capital on the example of one of the enterprises in the information sphere of the economy does not lie in the presence of a certain level of managerial competencies among middle-level managers, but in the ability to develop them (an internal determinant of the formation of human capital of an enterprise). At the same time, the enterprise management must create all the necessary conditions for the development of managerial competencies (the external determinant of the formation of the human capital of an enterprise). Thus, the essence of the proposed approach is determined through the combination of these determinants and the use of a dynamic approach to the continuous development and improvement of managerial competencies, as the most important factor in the formation of the human capital of an enterprise.

As criteria for assessing the managerial competencies of middle-level managers of our enterprise, the most significant ones from the point of view of their influence on the performance of each manager and the enterprise as a whole were selected from the standard list of competencies. The following were included in the composition of such managerial competencies.

1. Orientation to the result – is the desire and ability of the manager to focus his attention and resource support of achieving the set goals (including through quantitatively and qualitatively measurable indicators of the implementation of business processes).

2. Leadership – is the ability to lead other people along, inspire and motivate them to achieve their goals in such a way that they can show the desired result, while demonstrating standards and quality of work above their usual level.

3. Execution management – is the ability to effectively delegate authority and organize its management cycle: setting goals, monitoring execution, feedback and correction.

4. The ability to work in a team – is a respectful attitude of a leader to colleagues at work, the desire to contribute to the achievement of common goals, the ability to create a comfortable working atmosphere in a team.

5. Stress resistance – is the ability to keep emotions under control, to remain calm in pressure situations, to cope with long loads or a large amount of information, work effectively in a stressful situation, and also recover quickly after its completion, while maintaining high performance.

6. Self-organization – is the ability to plan your actions in time, rationally prioritize, use time efficiently and achieve your goals on time.

As the main method for conducting empirical research, the tools of the Assessment Center (AC) were selected. The advantages and disadvantages of this method are well studied and described in fundamental works [3, 5]. Analysis of the practice of using AC in our country and abroad allows us to consider that

the competent organization and consideration of relevant standards and principles when using this method helps to obtain the most comprehensive and objective information about the managerial and professional competencies of the enterprise personnel [2, p. 51-52].

In Russia, the AC method has been used for over 30 years. During this time, it established itself as one of the most popular methods for assessing the managerial and professional competencies of personnel of various enterprises. According to the Federation of Personnel Assessment, among the 150 largest companies in the Russian market over the past decade, most of them used the AC method [7]. Standards have been adopted that prescribe the principles and procedures for conducting AC, there are practical guidelines that detail the methodology, technology and other issues of using this method [4, 6].

To assess the managerial competencies of mid-level managers, a three-point scale was selected with a step equal to "0.25" points, where:

- the rating of "3 points" corresponds to the level of skill and implies a particularly high degree of development of this competency;

Mid-level managers who have reached this level are able to apply their managerial competencies in non-standard situations or situations of increased complexity; they can come up with initiatives related to the scope of this competency.

- he rating of "2 points" corresponds to the level of experience and suggests that the mid-level manager of the enterprise has fully mastered this competency;

This means that in standard situations he makes no mistakes, and the manifestation of skills in a specific competency occurs automatically.

- the rating of "1 point" corresponds to the level of development and means that the mid-level manager of the enterprise understands the importance of this competency and is in the process of mastering it;

This means that the skills of possession of a specific competence are unstable, errors are possible in standard situations.

- the rating of "0 points" corresponds to the level of incompetence and means that the mid-level manager of the enterprise does not have competence, does not understand its importance, does not try to apply and develop it.

The study sample consisted of 12 middle managers of the enterprise (department heads), whose age was in the range from 22 to 49 years. Among them were 9 men and 3 women. To conduct an empirical study using the AC method, all mid-level managers of the enterprise were randomly divided into 3 mini-groups, for each of which competency assessment was carried out on a separate day.

The AC toolkit was selected based on the principle that each competency should be assessed using at least two independent tools [1, p. 31]. In total, 6 assessment tools were involved in the study, namely: 1) a group simulation case "Additional

opportunity"; 2) group simulation case "Preparation for an exhibition"; 3) an individual simulation case with the role-playing game "Zeitnot"; 4) individual imitation written case "Probationary period"; 5) written testing; 6) interview [1, p. 141].

All imitation cases were united by one "legend". This approach (a single legend) in AC is used so that each manager can immerse himself in imitated situations as much as possible and behave in them as naturally as possible (just as he behaves in real life).

In AC case "Additional opportunity", all managers acted as managers of one of the divisions of a fictitious enterprise. They were faced with the task of promoting their unit and convincing others of this decision. Moreover, the common goal facing all participants (in the context of this case - the heads of divisions of a fictitious enterprise) was to select a finite number of promoted divisions, which would be deliberately smaller (in our case, 2). Thus, in this case there was a certain conflict between the personal interests of each manager and the common interests of the enterprise management, as well as between the interests of individual managers. In this case, such competencies were observed as: result orientation, leadership, teamwork, stress resistance and self-organization.

In the individual case "Probationary period", the participant was asked to solve the problem associated with the adaptation of a new employee at the workplace. To do this, the manager had to study the information about the position that the employee entered, his biographies and write for him: goals and a work plan, ways to control him and his motivation, as well as prepare a welcome letter for the employee. This case was used to assess competencies: leadership, performance management, self-organization.

Case "Preparation for an exhibition" is also a group task. It has been used repeatedly in various variations of AC.

The individual case "Zeitnot" was a task where the manager had to sort out the to-do list and draw up a written plan of the day, and then talk with one of his subordinates (an observer acted as a subordinate) in order to delegate part of his authority to work. Using the case, the following competencies were evaluated: result orientation, leadership, performance management, stress tolerance and self-organization.

The essence of the Competency Interview method is that the interviewee is asked questions about his past with a request to give an example of his actions in some situation (it is set by the interviewer) and describe his behavior in it. For instance, "Give an example when you needed to complete a task that you had not encountered before." This method is based on this connection: as competence manifested itself in a person in the past, so it is highly likely to appear in the future. Thus, the method "Interviews on competencies" allows you to complement the idea of the competencies of the manager by analyzing his behavior in a situation that can actually arise in practice.

Results and discussion

A summary table with the final assessment scores for each competency and the assessments for the set of competencies for each of the 12 middle managers is given below (see Table).

Table

Summary table with total scores for each competitor's competencies

№	Evaluation criterion (competence)	Members											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Result orientation	1,25	2,25	2,0	1,75	2,0	1,75	2,0	2,0	1,5	1,75	0,5	2,0
2	Leadership	0,75	1,5	1,5	2,0	1,5	1,5	1,5	1,75	1,0	1,25	1,0	1,25
3	Performance management	1,0	2,0	1,25	1,75	1,5	1,75	1,5	2,0	1,5	1,25	1,75	1,25
4	Teamwork skills	1,5	1,0	1,75	1,75	1,5	1,25	1,75	1,75	1,5	2,0	2,25	1,75
5	Stress resistance	1,75	1,5	1,75	2,0	1,75	1,75	1,5	1,5	1,5	2,0	1,0	2,0
6	Self-organization	1,5	1,5	1,5	2,0	1,5	1,5	1,5	2,0	2,0	1,75	1,75	1,75
Competency summary score		1,3	1,6	1,6	1,9	1,6	1,6	1,6	1,8	1,5	1,6	1,4	1,7

On the whole, the absence of the highest values for all competencies (3 points) is noteworthy for the sample, which indicates the degree of availability of competencies at the level of experience when they appear in standard situations. The manifestation of competencies in non-standard, creative situations requiring initiative is not typical for managers of this sample.

For each AC member, the following are personally developed:

1) individual report on all competencies indicating strengths and development areas;

2) detailed recommendations for training and competency development.

Conclusions

Based on the results obtained during the research, the following conclusions can be formulated.

1. From the point of view of the enterprise management, the following key competencies were determined for middle management managers: result orientation; leadership; performance management; teamwork skills; stress resistance; self-organization. To solve the tasks, the Assessment Center tools were chosen as the main method for conducting empirical research.

2. In the summary table there are no assessments of competencies above 2.25 points for any of the studied competencies, which indicates the degree of experience in manifesting competencies in standard situations. The manifestation of competencies in non-standard, creative situations that require initiative is uncharacteristic for mid-level managers of a given enterprise.

3. Among the priority tasks facing the enterprise management in the field of managing the formation of its human capital, the training of mid-level managers of the enterprise's management, as well as the development and improvement of their managerial competencies, are identified.

4. The structure of managerial competencies of mid-level managers of the enterprise was revealed. Based on the joint use of a dynamic approach to competencies and the AC method, strengths, growth areas and competency development areas are identified. The results can be used in designing individual development programs for the competencies of mid-level managers and the formation on this basis of the human capital of an enterprise.

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金融-能源平衡
FINANCE – ENERGY BALANCE

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抽象。这项研究探讨了当代社会经济系统运作的法律和规则。重点放在能源作为系统存在和发展的主要组成部分上。在哲学上给出了更精确的商品和货币概念。已经提出并证实了一个国家，一个联盟，一个系统的财力平衡计划。该研究分析了货币流通规律。引入了以下新概念：基于众所周知的能源预算（EB）概念的食品能源预算（FEB），以及以EB + FEB的总和表示的发展能源。

能源单位被提议为标准货币单位，货币流通规律被表示为以下等式：

$$\begin{cases} \Delta M = \Delta E \\ M = E_m \end{cases}$$ 或微分：$\partial M/\partial E = 1$

其中ΔM是货币单位，ΔE是能源单位，M是货币数量，E_m是发展能源(E_m = EB + FEB)。 。

关键词：能源预算，粮食平衡，法律和货币标准，经济计算机模型，金融—能源平衡

Abstract. *This study addresses the laws and rules of the functioning of contemporary socio-economic systems. Major emphasis is placed on energy as the main component of the existence and development of systems. More accurate notions of commodity and money are given in terms of philosophy. A scheme of the finance-energy balance of a country, a union, a system has been proposed and substantiated. The study analyzes the laws of monetary circulation. The following new notions are introduced: the food-energy budget (FEB), based on the well-known notion of energy budget (EB), and the energy for development, E_m, as a sum of EB + FEB. The energy unit is proposed as a standard monetary unit, and the law of monetary circulation is expressed as the following system of equalities:*

$$\begin{cases} \Delta M = \Delta E \\ M = E_m \end{cases}$$ *or differentially:* $\partial M/\partial E = 1$

where ΔM is a monetary unit, ΔE is an energy unit, M is the quantity of money, E_m is the energy for development (E_m = EB + FEB).

Keywords: *energy budget, food balance, laws, and monetary standards, Computer model of economy, finance-energy balance*

Over the past century, energy and economic crises have occurred several times, either in turn or simultaneously, complementing each other. They start in different countries, subsequently spreading throughout continents and involving the world community. Having gone through a phase of some stabilization, crises occur again and again, with increasing frequency. Representatives of the international economic and political community gather at top-level forums to put forward and discuss various ideas of stabilizing the global economic system, but no effective solutions have been found yet. Unfortunately, contemporary economics has abstracted itself from the material world, and the financial world has abstracted itself to an even greater extent.

For the past three years, the idea of stabilizing the economy through the recovery of the lost monetary standard, including the use of an energy unit, has been several times proposed at world summits, but has not been developed or supported. Economists and politicians have ignored physicists. The world, however, is primarily based on the laws of nature and only then on the rules invented by Homo sapiens for the human community.

This study is another attempt to address economic processes in terms of natural science and propose a constructive solution.

Energy as the basis of life

The main and, actually, the only source of energy in the Solar System for the Earth's ecosystem, Homo sapience, and human community is the Sun. For millions of years, solar energy, via photosynthesis, has accumulated on the Earth as energy stocks. The constant inflow of solar energy keeps the planet ecosystem functioning, which ultimately supports the life of Homo sapiens and human community.

In the economic activity, Homo sapiens use various energy sources to attain the end result. The result usually has the form of commodities: food or other goods, or services such as transportation etc., which are ultimately aimed at supporting and improving the life of Homo sapiens.

The intellectual product occupies a special position. At the present time, it cannot be physically measured and the energy expended on its production cannot be accurately determined. The intellectual product can be treated as an amplifier, programmer, catalyst or, even, detonator of different processes in the community economic activity.

The original source of any kind of energy on the Earth is the sun. Photosynthesis, which is one of the basic processes on the Earth, initiates cycles of carbon, oxygen, and other elements, providing material and energy basis for life on the planet. Photosynthesis forms plants, and then plants and solar energy enable the formation of fauna and Homo sapiens. Photosynthesis is based on the transformation of light electromagnetic energy into chemical energy. This energy ultimately enables conversion of carbon dioxide into carbohydrates and other organic compounds, accompanied by oxygen release. Photosynthesis is a source of nutrients for all living organisms, also providing humans with fuel (wood, coal, and oil), fiber (cellulose), and innumerable useful chemical compounds. Carbon dioxide and water bound during photosynthesis are responsible for the formation of about 90-95% of the economic part of the harvest. The remaining 5-10% is formed by mineral salts and nitrogen taken up from the soil.

Carbon bound in organic substances due to photosynthesis annually amounts to $8 \cdot 10^{10}$ t and the annual production of cellulose reaches 10^{11} t. Owing to photosynthesis, land plants annually produce about $1.8 \cdot 10^{11}$ t of dry biomass, and, although one cannot measure exactly the yield of plants growing in the Global Ocean, it can amount to about the same mass. The contribution of tropical forest reaches 29% of the total production of terrestrial photosynthesis and that of forests of all types amounts to 68%. Photosynthesis of higher plants and algae is the only source of atmospheric oxygen – O_2.

The emergence of the mechanism of water oxidation followed by formation of O_2, which took place on the Earth about 2.8 billion years ago, was the most important event in biological evolution: sunlight became the main source of free energy of the biosphere and water turned into a virtually unlimited source of hydrogen for the synthesis of substances in living organisms.

The annual increase in the solar energy stock in the form of products of photosynthesis amounts to about $1.6 \cdot 10^{21}$ kJ, and current energy consumption by humankind is about 10 times lower. Yet, photosynthesis uses not more than 0.1% of the total physiologically active energy of the radiation incident on the Earth's surface.

Fossil fuel (coal, oil, gas, etc.) is also a product of photosynthesis, but this product has been stored for an extended period of time, and annual consumption of fossil fuel at the end of the 20th century was almost equal to the biomass increment. Thus, **humankind has approached the negative carbon balance on the Earth.**

Other types of energy used in human activity, such as water power, energy of wind, tides, geysers, and other natural forces, are also formed due to transformation of solar energy and the Earth's thermal resources.

A special position is occupied by nuclear energy, but even in this case one can assume that nuclear fission of heavy elements was preceded by nuclear synthesis caused by the sun or a similar source of highly concentrated energy.

These arguments lead to the logical conclusion that energy is needed for anything to occur in the world, especially for transformations performed by Homo sapiens. There is no doubt that all material objects either contain energy or energy has been used to create them. Thus, **"energy component"** can be regarded as the main property of any commodity, product, or service. The energy component is a sum of the energy contained in the commodity – **"energy content"** and the energy expended to produce it – **"energy inputs"**. Depending on the type of the commodity, the energy component can consist of energy content only, for example, in the case of carbon, firewood, electric power, certain food products, etc. On the other hand, it can consist of energy inputs only in the case of primary metal, inert materials, etc. The ratio of the components can vary too, for instance, for goods made of wood, fabrics, plastics, etc., i.e. anything that can burn or be oxidized and release energy. Based on these notions, one can easily determine the minimum life-support value of any commodity as its energy content.

These arguments lead to a definite conclusion: ENERGY is the main and, sometimes, the only property of the commodities supporting life of Homo sapiens on the Earth and, thus, the basis of economy.

Material-informational dualism in the financial system

The contemporary economic system is based on the financial system, which is in turn based on money. The essence of money has not been determined unambiguously so far.

The definition of commodity-money relations was first given by Adam Smith and then by Karl Marx, and many other scholars subsequently used the following definition of money: "Money is some commodity that serves as the general equivalent for all other commodities". This is the definition of the commodity money. Hence, the theory of money, which defines money as some commodity, has been termed the commodity money theory.

This idea, however, has long been opposed by another one, suggesting that money is some information. The first to express this idea was Montesquieu, and then it was modified to the quantity, nominalistic, state and various other theories of money. These are all different variants of the information theory of money, which is based on regarding money as some information rather than commodity.

In contemporary history the situation with the theory of money is as follows.

In the USSR and other socialist countries, the official ideology was based on the commodity money theory, but it was virtually the information system. The Western doctrine was wholly based on the quantity (information) money theory, but it was actually the commodity system. In both cases, the declared theoretical basis was different from practice.

In the West, the monetary-banking system has always been based on the commodity money theory.

Originally, a market is the place where sellers and buyers meet, trade, and come to terms. However, since the time when stock exchanges were established, "market" terminology has defined the market as a play area, and sellers and buyers have become players. The goal of any game is to outsmart and deceive the adversary. An essential negative factor in this market play is the presence of numerous money substitutes in the form of securities. Thus, the main reason for the contemporary economic crises is most certainly the disproportion between the play money supply and the quantity of actual goods in circulation.

The socialist administrative monetary-banking system was actually based on the informational character of money. Special calculations determined what and how much a Soviet human needed for his/her life support, the content of his/her basket of goods was priced, and salaries were fixed accordingly, their range being very narrow for different groups of society or rather wide for the select few.

In the monetary sphere, there was a fundamental discrepancy between theory and practice both in the capitalist (Western) world and in the socialist society.

Under current conditions, the issue of resolving the material-informational dualism in commodity-money relations is becoming increasingly urgent for both philosophical and practical purposes, but no understandable and practicable solutions have been proposed yet.

Based on the conclusion about the interrelationship between the commodity and energy, one can logically derive a notion of commodity:

Commodity is an object or an aggregate of objects necessary for Homo sapiens to develop, or an object plus information.

Thus, the notion of commodity now unites and determines the interactions between the matter, energy, information, and Homo sapiens. The definition of commodity unites two notions: object and information. The components matter and energy define it as an object. The informational component, as a property of the object, determines the degree to which it is necessary for Homo sapiens.

In order to exchange goods, to allow the property rights to be transferred from one human to another, to produce new goods, to create new objects and living conditions, and, generally speaking, to let humankind develop, Homo sapiens in different parts of the world invented an equivalent for commodities – money.

Based on the fact that both commodities and money are derivatives of the activity of Homo sapiens and are necessary for Homo sapiens only, within the framework of the above arguments, I propose the following definition of money:

Money is a universal property of the commodity, which corresponds to the degree of its being necessary for Homo sapiens. It cannot exist without commodity or Homo sapiens.

The development of the above argument that the main and, sometimes, the only property of the commodities circulated by Homo sapiens is energy, suggests

an equally indisputable conclusion that **the two properties of commodity – energy as a physical property and money as an informational one – are UNITED.**

Thus, under current conditions, material-informational dualism in commodity-money relations can be regarded as an anachronism. As for the financial systems based on either commodity or information doctrine, they are doomed to degradation, which has been confirmed by the contemporary history of financial crises occurring in countries with different state and political systems.

Money theories, laws, and monetary standards

To develop these arguments, it would be reasonable to consider and briefly analyze the basic theories of money, which were put forward as early as 16-18 centuries, during the genesis of classical political economy.

Money theories

The metallistic money doctrine was developed in the early period of contemporary history and played a progressive role in the struggle to prevent debasing of coins (a reduction in the precious metal weight). The most significant part in its advancement belongs to mercantilists, who developed the doctrine of metal coins of full value as national wealth. Metallists' mistake was that they equated money to goods and did not understand the difference between circulation of money and commodity exchange. Representatives of the metallistic theory denied the possibility of substitution of the token money for metal money of full value in the domestic circulation.

The nominalistic money doctrine was developed by critics of mercantilism, who negated the commodity nature of money. Its representatives argued that money is just a token, which has nothing to do with the goods. Nominalists focused on the analysis of the functions of money, as a means of circulation and an instrument of payment, allowing a replacement of metallic money by paper money. The main mistake of advocates of the nominalistic theory was that they negated the commodity nature of money. Whereas suggestions based on the metallistic theory hindered the introduction of paper money, nominalists' proposals could cause inflation buildup.

The quantity theory of money stated that the quantity of money should influence the level of commodity prices. Its early representatives were C. Montesquieu in France and D. Hume in England. In the 20th century it was developed by J.M. Keynes in Great Britain, I. Fisher in the USA, G. Cassel in Sweden, M. Friedman in the USA, and other economists. The quantity theory of money establishes a direct relationship between the increase in the quantity of money in circulation and a rise in commodity prices. M. Friedman, the leader of monetarism, one of the main lines in the contemporary neoclassical economic theory, argued that any government intervention in the circulation of money is fruitless and harmful. Hence, the main suggestion against government intervention in economy is to keep the

quantity of money increasing at a steady rate (about 3% a year), irrespective of economic conditions.

Laws of monetary circulation

The functioning of money is supposed to obey certain objective principles. The basic ones have been formulated as K. Marx's law, the Copernicus law (Gresham's law), the Fisher equation, and the Cambridge equation.

K. Marx's law of monetary circulation is expressed by a basic equation, determining the main parameter, **M** – quantity of money.

MV=PT

The Copernicus law – Gresham's law was formulated in the 16th century almost simultaneously and independently by Nicolaus Copernicus, a Polish thinker, and Thomas Gresham, an English financier. The law states that if there are two forms of money in circulation, "bad" money drives "good" money out of circulation. People will use more stable ("good") money as a means of hoarding and, thus, take it out of circulation. Money that has unstable value, debased ("bad") money will be used in transactions and for payment.

The Fisher equation is named after Irving Fisher, an American economist. This equation describes the factors determining the quantity of money necessary for normal functioning of market economy. The equation has the following form: $\mathbf{M} \times \mathbf{V} = \mathbf{P} \times \mathbf{Q}$.

The Cambridge equation was formulated in the 20th century by Arthur Pigou, an English economist. It has the following form:

$\mathbf{M} = \mathbf{k} \times \mathbf{P} \times \mathbf{Q}$,

where **k** is the portion of the product ($\mathbf{P} \times \mathbf{Q}$) that will be held as liquid assets, **V** is the velocity of money, **P** is the price level, and **Q** is the quantity of goods sold.

Similarly to the Fisher equation, the right-hand part of the Cambridge equation shows money demand and the left-hand one – money supply.

K. Marx's law, the Fisher formula, and the Cambridge equation only provide guidelines for the answer to the most important question of the market system: How much money should be issued to ensure normal economic development? All of them, however, have two drawbacks: there is no monetary standard and their statistical data are subjective.

Regulation of money circulation. Monetary policy is the regulation of money supply to curb inflation, to reduce unemployment, and to stimulate economic growth. It is based on the ability of the monetary and credit system to exert significant influence on the solutions to problems of macroeconomic instability.

The policy of "expensive money" is conducted to control inflation. A reduction in money supply causes a rise in the loan interest rate. This can lead to a decrease in the inflation rate, at the same time, reducing investments and increasing unemployment.

The aim of the policy of "cheap" money is to stimulate economic growth. Money supply is increased and the loan interest rate decreased. The loan becomes more affordable, investments and employment increase. However, the disadvantage of this policy is higher inflation rates. The main regulator of money circulation is the central bank of a country. To increase the quantity of non-cash assets, more loans should be given, without having to print more money.

The central bank uses three main approaches to monetary regulation:

1. Discount policy – a change in the discount rate.

2.Open market operations.

3. Changing legal reserve requirements.

These instruments are used to reduce or increase the quantity of money. This is how the central bank regulates the investment flow, the inflation rate, national currency rates, and, ultimately, the growth rate of gross domestic product and the employment level.

Monetary standards. Gold and silver proved to be the most suitable materials to function as money.

In 1944, the United Nations Monetary and Financial Conference held in Bretton Woods (USA) established the international monetary system. The Bretton Woods system was based on an interstate financial gold standard currency.

The Bretton Woods system had the same set of elements as the gold standard, but that was a transitional system. Gold was still a standard of value, but US dollars were used as the world's new reserve currency. Until 1952 gold had been almost solely used as bank reserves. Gold backed the US dollar, deficits in the current accounts, and intervention.

The Bretton Woods system was followed by the Jamaica monetary system, agreed upon by IMF countries at a meeting in Kingston (Jamaica) in 1976.

In April 1978, after the IMF countries had ratified this agreement, the IMF statute was altered. As the USA position in the external market became weaker as a result of reduction in gold reserves of the country, in 1971 – 1973 the international monetary system based on the US dollar's fixed value against gold collapsed. The US dollar was no longer the only reserve currency. The FRG mark, the Japanese yen, the British and Swiss pounds, and, more recently, SDR, ECU, and Euro also acquired the function of reserve currencies. ***On August 1, 1971, dollar's convertibility into gold was suspended*** and the fixed dollar price of gold was cancelled officially.

ECU became a basket of currencies for the European Monetary System (EMS) member states in March 1979. ECU was a paperless unit used in accounts of central banks of the EMS member states. ECU was later replaced by Euro, also without an exact standard.

In order to alleviate the problems of international liquidity, the International Monetary Fund created a ***Special Drawing Right*** (SDR). The SDR value was initially determined by the price of gold in US dollars (US$ 35 per ounce at that time). In 1976 it was defined on the basis of the currency basket of 16 countries. In 1981, the SDR unit was defined as a weighted sum of contributions of five major currencies: the US dollar, the German mark, the French franc, the pound, and the Japanese yen.

The contemporary monetary system of Russia functions in accordance with the Federal Law on the Central Bank of the Russian Federation of April 12, 1995. The basic monetary unit (currency) is the ruble. There is no legally fixed price of gold in rubles.

It is evident that AT THE PRESENT TIME THERE IS NO MONETARY STANDARD IN ANY COUNTRY OF THE WORLD!

In the analysis of the history of theoretical foundations for the contemporary monetary system, one cannot ignore the practical conclusions made by the most prominent historical figures.

The significance of monetary policy was emphasized by J.M. Keynes, an English economist: "There is no surer means of overturning the existing basis of society than to debauch the currency." (1883-1946)

"All the perplexities, confusions, and distresses in America arise, not from defects in their constitution or confederation, not from a want of honor or virtue, so much as from downright ignorance of the nature of coin, credit, and circulation." said John Adams, the second President and the author of the Constitution of the USA (1797-1801).

M.A. Rothschild, a banker, expressed it in an even more definite way: "Give me control over a nation's currency and I care not who makes its laws." (1743-1812)

Careful analysis shows that the parameters constituting the laws considered above are based on subjective statistical data, and their main parameter – the quantity of money – is purely subjective. As the quantity of money is determined by the government or the ruler, the laws of monetary circulation depend on the person signing the document that starts money emission or on the interested party.

Hence, we arrive at Aristotle's conclusion: MONEY CAME ABOUT THROUGH AGREEMENT, NOT BY NATURE, BUT BY LAW.

The analysis described above suggests the following conclusions:

1. Money is a universal property of the commodity, which corresponds to the degree of its being necessary for Homo sapiens.

1. There is no monetary standard in any of the states of the contemporary world.

2. The two properties of commodity – energy as a physical property and money as an informational one – are UNITED.

These conclusions logically give rise to the idea of the FINANCE-ENERGY BALANCE.

Finance-energy balance

The idea is based on three fundamental principles:

1. The law of conservation and transformation of energy: *"The total amount of energy in an isolated system, whatever the processes occurring in the system, remains constant over time. Energy can only be transformed from one state to another and be redistributed among different parts of the system."*

2. The law of the equivalence of mass and energy: ($E = mc^2$ A. Einstein)

3. The main instrument of economy is MONEY

THE MAIN PURPOSE OF THIS IDEA is to achieve sustainable, crisis-free development of the economic system (of a country and the world) by employing the principle of strict correspondence between the quantity of circulating commodities and the quantity of money in the system.

The balance between energy and money in a country, a system, or the world can be addressed in terms of a more general science – ecology.

Further arguments require a definition of ecology, and E. Haeckel's seems to be the most appropriate, although it was written at the time when biology was a purely biological science.

"By ecology we mean the body of knowledge concerning the economy of nature—the total relations of the animal to both its inorganic and organic environment. In short, ecology is the study of all those complex interactions referred to by Darwin as the conditions of the struggle for existence."

To show the main idea, I propose presenting the major interrelationships as a scheme of the finance-energy balance of a country, a union, a system.

The economic potential of any country, union, or system comprises the following principal components:

- the territory receiving solar energy, which has stored energy resources and renewable energy sources;
- economically active population – human resources;
- active portion of the national wealth – production facility;
- national wealth – created and accumulated components of the sphere of human activity;
- intellectual (scientific, administrative) population, capable of advancing all the components listed above.

In what follows we will use the following terms:

The energy for development, $\mathbf{E_m}$ – the energy transformed and utilized by the economy of a country, a union, or the world.

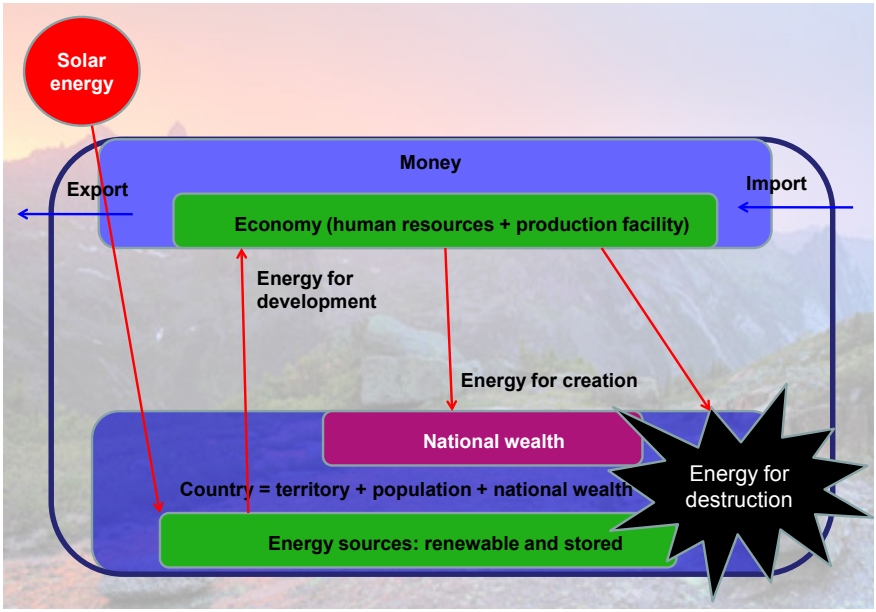

Fig. 1 *A scheme of the finance-energy balance of a country, a union, a system*

The energy for creation, $\mathbf{E_C}$ – the energy used to increase national wealth and improve the conditions of human activity.

The energy for destruction, $\mathbf{E_d}$ – the energy used to destroy the sphere of human activity (war, destruction of the ecosystem, etc.).

The contemporary system cannot exist and develop without energy for development and its two components: the energy for Homo sapiens (food) and the energy for economy and production (fuel, electric power, etc.). The energy for economy and production is usually measured in tons of equivalent fuel or terajoules. The conversion to equivalent fuel (EF) is conducted by multiplying the amount of certain fuel by a so-called heat ratio. Electric power generated by hydroelectric and nuclear power plants is converted to EF based on the following estimate: 1 TEF = 2000-3000 kWh (depending on the efficiency of the power plant). The annual consumption of electric power by the country's economy is usually calculated as energy budget (EB).

As food balance will be calculated in the same units as **EB**, it seems reasonable to introduce the notion of food-energy budget (**FEB**). Thus, the energy for development can be presented as a sum of the two values: $\mathbf{E_m = EB + FEB}$

The scheme in Figure 4 is an illustration of the following:

1. The main source of the inflowing and stored energy is the Sun.

2. The energy for development is the energy involved in economy: $\mathbf{E_m = EB + FEB}$.

3. The energy for creation is the energy used to create the conditions for human activity and develop its constituents. This is the difference between the energy for development and the energy for destruction: $\mathbf{E_C = E_m - E_d}$.

4. The energy for destruction, $\mathbf{E_d}$, is the portion of the energy for development with destructive functions: deterioration of the territory, war and any other activities that destroy energy sources, national wealth, population, etc. Importantly, the energy used to destroy another system also destroys its own system.

5. The export-import energy balance determines the degree to which the system depends on external systems.

6. The development, stability, and security of the system of a country or a union are determined by the reserve, amount of transformed energy and the export-import balance.

As, in this case, money is defined as a universal instrument of commodity circulation and, hence, energy circulation, interactions between the major components of the system can be presented as occurring via monetary circulation, but the contemporary monetary system has two drawbacks that do not allow one to do this:

The first drawback is that there is no monetary standard.

The second is that the laws of monetary circulation are subjective.

Computer model of economy

At the present time, the functions of modern supercomputers enable accurate and detailed simulation of almost any natural process. Economic processes can even be modeled in real time and space, on a global scale. The question arises: Why has not it been done yet?

Numerous attempts to construct accurate mathematical models of the economy of a country, a union, or the world have not been quite successful due to the lack of a pivot (a reference point), because of the drawbacks mentioned above.

In contemporary ecology and economy, energy can serve as a pivot and any mechanism of its transformation, including money, can be a lever.

A real-time computer model of energy fluxes inside the system would enable very accurate control of the economy of the system as a whole.

The proposed solution

Based on the above arguments and the conclusion that the two properties of the commodity – energy as a physical property and money as an informational one – are united to make a universal instrument of commodity circulation and, hence, energy circulation, expressing the monetary unit $\Delta\mathbf{M}$ as an exact physical quantity,

in the general form $\Delta\mathbf{M} = \Delta\mathbf{E}$ (e.g., **1 Ruble = 1 kWh**), and expressing the energy of development, $\mathbf{E_m}$, as a sum of the annual energy and food-energy budgets (**EB** and **FEB**), $\mathbf{E_m = EB + FEB}$, **I suggest expressing the law of monetary circulation as the following system of equalities:**

$$\begin{cases} \Delta\mathbf{M} = \Delta\mathbf{E} \\ \mathbf{M} = \mathbf{E_m} \end{cases} \qquad \textbf{or differentially:} \quad \partial\mathbf{M}/\partial\mathbf{E}=1$$

where $\Delta\mathbf{M}$ is a monetary unit, $\Delta\mathbf{E}$ is an energy unit, **M** is the quantity of money, $\mathbf{E_m}$ is the energy for development $\mathbf{(E_m = EB + FEB)}$.

The monetary unit can be compared to the standard at any point of payment, for example, for the standard **1 Ruble = 1 kWh** – at the point where the electricity meter is installed. The cost of any commodity acquires a standard value as its own energy content and the energy expended to produce the commodity.

The equalities $\Delta\mathbf{M} = \Delta\mathbf{E}$ and $\mathbf{M} = \mathbf{E_m}$, as an absolute prerogative of the government of a country, a union, or a system, are established and controlled exclusively by the state.

The mission of the proposed solution is:

1. Construction of an extremely accurate real-time computer model of the economy of a country, a union, the world.

2. Control of the stability of the economic system in a country, a union, the world.

3. The world leadership of the country initiating modernization of the global monetary system (creation of new universal international currency).

4. Stability of social guarantees such as 1 kWh = 1 Ruble; 1 liter of petrol = 8 Rubles; 1 loaf of bread = 10 Rubles; stable municipal rates; etc.

5. Accurate implementation of the national budget in internal and external payments.

6. Development of the positive aspects of the system: environmentally friendly energy, ecological balance, rational economy, comfortable conditions for human activity, humane policy.

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土耳其和哈萨克斯坦执法法规的比较法分析
COMPARATIVE LAW ANALYSIS OF LEGISLATIVE REGULATION OF LAW ENFORCEMENT TURKEY AND KAZAKHSTAN

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抽象。 这篇科学分析文章是对土耳其执法服务法律框架的研究的逻辑延续，其中对土耳其和哈萨克斯坦的执法系统进行了比较法分析。 作者试图详细研究当前研究课题的法律规制问题，以便对管理土耳其共和国和哈萨克斯坦共和国执法机构活动的立法的主要方面和可能的遗漏之处进行比较分析。

在对土耳其法律在执法领域的法律规定的积极方面进行了比较分析和审查的基础上，作者提出了旨在改进立法的建议，这些建议可以在哈萨克斯坦的立法过程中予以考虑 和土耳其。

关键字：立法法规法律法规分析执法

Abstract. *This scientific and analytical article is a logical continuation of the study about the legal framework for law enforcement services of Turkey, in which a comparative law analysis between the law enforcement systems in Turkey and Kazakhstan was carried out. The author tried to examine in detail the current issues of legal regulation of research topic, to conduct the comparative analysis of the main aspects and possible omissions in the legislation governing the activities of law enforcement bodies of the Turkish Republic and the Republic of Kazakhstan.*

Based on the conducted comparative analysis and review of the positive aspects of the legal regulation of the Turkish legislation in the field of law enforcement, the author worked out proposals aimed at improving the legislation and which can be taken into account in the legislative process of Kazakhstan and Turkey.

Keywords: *legislation, regulations, analysis of legal regulation, law enforcement*

In previous articles it was suggested that in Turkey there is no comprehensive normative legal act, such as the Law of the Republic of Kazakhstan «On law enforcement service» in Kazakhstan that would define general principles and rules of regulation in the field of law enforcement. However, in the course of the thorough analysis of the legislation in the field of law enforcement it was found that the current Law of the Republic of Turkey № 3201 «On security organizations», which was adopted in 1937, has an amazing resemblance to the Law of the Republic of Kazakhstan «On the Law enforcement service» adopted in 2011.

In the table number 1 the author tried to make the comparative analysis of the structure of the Law of the Republic of Kazakhstan «On law enforcement service» with the content of legal rules and articles of the Law of Turkey number 3201 «On security organizations».

As the analysis showed, the structural parts and sections of both laws have almost identical wordings and contain substantially similar legal provisions. Of course, the Law of the Republic of Turkey № 3201 has undergone numerous changes and additions, and today is one of the major laws in the regulation of law enforcement service in Turkey.

One important aspect of the Law № 3201 is that in Article 3 the division of the security bodies into the public and private (special) was enshrined in law. Common law enforcement bodies include the armed forces of the police and gendarmerie, the special include other law enforcement bodies, which perform their functions in accordance with the legislation (customs, forest protection, traffic police, etc.).

It should be noted that this legal provision is similar to Article 3 of the Law of the Republic of Kazakhstan «On law enforcement service», according to which legislators have determined that *the prosecutor's agencies, internal affairs bodies, financial police, state fire service, the customs bodies of the Republic of Kazakhstan, carrying out their activities in accordance with the laws of the Republic of Kazakhstan, refer to the law enforcement bodies* (Law #380-IV, Art. 3). This allowed to delineate legal powers of law enforcement structures, as well as an understanding of law enforcement in general, that was not quite legitimate before and significantly affected various aspects of legal regulation related to social, material and legal support of law enforcement officers.

In Kazakhstan, the adoption of the Law «On law enforcement service» was the fact that in the legislation there were norms that contributed to duplication of legal provisions, moreover, the law expected to merge several regulations, which was also one of the mechanisms for improving the legislation. Of course during the development of the bill, along with positive aspects, there was much critic from the scientific community, international experts, as well as law enforcement structures themselves. However, immediately after the adoption the law has proved the effectiveness of its actions.

Table № 1

Law of the Republic of Kazakhstan «On law enforcement service» 06.01.2011. № 380-IV	**Law of the Republic of Turkey «On security organization» 12.06.1937 № 3201**
The Chapter №1. General provisions (articles 1-5)	General provisions (articles 1-12)
The Chapter №2 The admission to law enforcement service (articles 6-13)	The procedure for admission to the service after the special educational institutions (police academy and colleges), as well as civil servants under the contract (articles 26-54)
The Chapter №3. The legal status of employees (articles 14-21)	The functional responsibilities of security officers (articles 16-22)
The Chapter №4 The special ranks or class ranks (articles 22-28)	The class ranks and ranks of security officers (articles 13, 15)
The Chapter №5 Appointment to office, transfer and promotion in law enforcement (articles 29-46)	The procedure and conditions of appointment and promotion (articles 55)
The Chapter №6. The validation (articles 47-53)	The assessment of efficiency of staff work (article 85)
The Chapter №7 The service discipline in law enforcement (articles 54-58)	The procedure for disciplinary and penalties (articles 68-84)
The Chapter №8 The use of firearms and other weapons, special means and physical force by employees (articles 59-62)	*It is regulated by the Law Republic of Turkey «On authorities and duties of the police» 14.07.1934. № 2559*
The Chapter №9. The social security (articles 63-70)	The material and financial support for security officers (articles 86-96)
The Chapter №10. Holidays (articles 71-78)	
The Chapter №11 The termination of service in law enforcement (articles 79-82)	The procedure and conditions of termination, resignation or dismissal from service (articles 56-67)
The Chapter №12. The final provisions (articles 83-85)	The additional articles 1-31 (the separate numbering of the main articles); The preliminary articles 1-23 (the separate numbering of the main articles); The final provisions (articles 97, 98)

As a result, in 2011, Kazakhstan was the first CIS country who adopted the Law «On law enforcement service», which *regulates the social relations associated with admission to law enforcement service to the Republic of Kazakhstan, its passage and termination, as well as determines the legal status, economic security and social protection of law enforcement officers of the Republic of Kazakhstan* (Law #380-IV).

The next important legal instrument in the field of law enforcement is the Law of Turkey № 2559 «On authorities and duties of the police», which, despite the fact that was adopted in 1934, has legal force to the present day, as well as some of the positive aspects of the legal regulation of police. This law in its structure, as well as the previous law, has no sections, chapters, parts, includes a little more than 35 articles.

The modern police of Turkey and internal affairs bodies in general believe that the effective legal mechanism in their activities is precisely this law, as he laid the foundation of the regulation of legal relations in the field of public order and public safety, thus fixing the powers and duties of the police in carrying out its functions and responsibilities (Bilgiç ve Karakaya, 2002: 180).

I consider the nature and content of the Law № 2559 «On authorities and duties of the police», pay attention to its main legal aspects. So according to Article 1 of the Law № 2559 *police duties in ensuring public safety and public order include compliance with laws and other legal acts in accordance with government policy, along with mandatory compliance with the rules of criminal procedure legislation* (Law #2559, Art. 1). In general, this law contains the legal rules and regulations that govern the activities of the police *(apply to all bodies of internal affairs, including the gendarmerie, traffic police, coast guard, and others)*, connected in particular with their following powers and duties:

- to conduct fingerprinting and photographing of criminals and offenders;
- to conduct investigation in public entertainment places, to inform the municipal bodies on conducted activities;
- to identify persons who have not reached the appropriate age to visit entertainment places, as well as to carry out the arrest of those who violate the public order and in a state of alcohol/drug intoxication;
- to use firearms or other special means;
- to apply security measures for vehicles;
- to apply measures to eliminate fire, flood and other natural disasters;
- to take appropriate measures to prevent from the abuse of authority by the police officers.

Of course, this is only one part of the duties and tasks of the internal affairs bodies, which are regulated in detail in the Law, and other laws, which will be discussed later. The analysis of the rules of the Law № 2559 allows us to formulate a conclusion that the internal affairs bodies in their activities are guided by the principles, established by the legislation: to ensure and protect public order, security of persons and their property; to work towards the prevention of crimes and offenses; to detect, to arrest and transfer the offenders and the evidence to the appropriate legal authorities; to exercise other powers prescribed by laws and other normative legal acts.

The Law of Turkey № 3152 «On organization, duties and authorities of the Ministry of Internal Affairs» adopted in 1985 was criticized during the study. As a matter of fact the Law regulates the mission, tasks, functions and structure of the Ministry of Internal Affairs (hereinafter – the MIA) and its structural units and subordinate organizations, which is not acceptable for the legislative activity of any state. For example, in Kazakhstan the same provisions are regulated at the level of the decision of the Government (Decision #607). If it is necessary, the faster way to change the legislation will be making changes and additions in the decision of the Government, rather than in the law.

The Government of Turkey for several years has discussed the issues of reform of the law enforcement system, improvement of legislation, bringing it into accordance with modern conditions of legal, economic and social situation. During the great legislative work on the development of a package of bills *(Law № 2559 «On authorities and duties of the police», Law № 3201 «On security organizations», Law № 2803 «On authorities and duties of gendarmerie», Law on amendments to certain laws)* aimed at the modernization of internal security systems the experience of law enforcement bodies of Turkey and foreign countries, as well as the results of the research work of educational institutions of law enforcement bodies have been used. As a result, MIA of Turkey in November of 2014 introduced to parliament four bills providing for the amendment of the legislation in the area of law enforcement (yeniasya.com.tr, 2014; taraf.com.tr, 2014).

Analysis of the Law on MIA of Turkey showed that more resembles it has with the Regulation on MIA of the Republic of Kazakhstan. Moreover, I believe, that a comparative analysis of this part of the study can be carried out with the Law of the Republic of Kazakhstan «On the Internal affairs bodies of the Republic of Kazakhstan» (Law #199-V). Thus, in accordance with Article 3 of the Law of the Republic of Kazakhstan «On law enforcement service» one of the major law enforcement structures in Kazakhstan are the internal affairs bodies, whose activities are regulated by the Law of the Republic of Kazakhstan № 199-V. Internal affairs bodies of the Republic of Kazakhstan are the law enforcement body intended to protect the life, health, rights and freedom of man and citizen, interests of society and the state from illegal encroachments, protection of public order and public safety. In turn, the internal affairs bodies, designed to serve the people of Kazakhstan, as well as to ensure public safety, carry out the following tasks:

- the crime prevention;
- the protection of public order;
- the combating delinquency ;
- the execution of criminal penalties and administrative sanctions;
- the prevention and liquidation of the emergency situations, fire safety, the organization of civil defense.

Based on the tasks established by the legislation, the internal affairs bodies in accordance with Articles 5 and 6 of the Law «On the Internal affairs bodies of the Republic of Kazakhstan» exercise the rights and duties within their competence. It should be noted that the competence and powers of the internal affairs bodies meant in these articles are regulated clearly and in great detail.

In accordance with Article 8 of the Law № 3152, the structure of MIA includes six major service units: General directorate of regional administration; General directorate of population and citizenship affairs; General directorate of local authorities; Department of data collecting on smuggling and exploration; Department of associations; Department of external relations with the European Union. In this regard, based on the provisions of the Laws «On unions of local governments» (Law #5355), «On the provincial administrations» (Law #5442), it can be concluded that MIA is involved in the activities of local authorities, moreover, the ministry oversees the activities of local government. For example, the affirmation of new administrative-territorial units and provincial governors is accepted after the mandatory approval and consent of the Minister of MIA.

In Kazakhstan legislation the competence of local executive bodies (Law #199-V, Art. 12) is carried out similarly, local executive bodies are competent to joint functions with the international affairs bodies, besides, MIA doesn't have any control and supervisory powers in relation to the local executive bodies (Law #199-V, Art. 11).

In accordance with Article 29 of the Law № 3152 «On organization, duties and authorities of the Ministry of Internal Affairs» the system of MIA includes such subordinated organizations as the General directorate of security *(general police)*, General command of gendarmerie, Coast guard command, the Agency of public order and safety, as well as the General directorate on migration issues.

In the structure of the General directorate of security there are intelligence units, units for combating terrorism, contraband and organized crime, crime labs, traffic police officers, as well as special units *(departments of President, Prime Minister and members of parliament protection,)* (egm.gov.tr, 2014).

The structure of the General command of gendarmerie includes criminal department, units of national security, the environment protection, services for combating terrorism and drugs, ensuring traffic rules, search and rescue services, border guards, as well as the control system of correctional institutions (jandarma.gov.tr, 2014).

Areas of the police and the gendarmerie activities are carried out exclusively within their competence, if the legislation does not contain provisions when law enforcement bodies are entitled to exercise joint operations and actions (Law #2803, Art. 10). According to Article 4 of the Law № 2803 «On authorities and duties of gendarmerie», General command of gendarmerie is the part of the Turkish Armed Forces, which reports to MIA. Moreover, according to Article 8 of this

Law with the introduction of martial law, the entire block of gendarmerie is transferred to the subordination of the General headquarter of the Ministry of Defense. Thus, it is the hallmark between gendarmerie and police, despite the fact that these law enforcement bodies have similar functions.

In general, the law № 2803 regulates only the certain part of the legal relationships related to the duties and powers of the gendarmerie officers, as well as organizational procedures of their activities *(assignment/release on service, material, financial provision, etc.).*

Another distinctive feature between the gendarmerie and police is fact, that the last one acts according to the civil administrative system and performs its duties, obeying to the civil authorities (municipalities), i.e., the police work takes place under the supervision of the heads of cities and districts (Law #3152, Art. 28).

To some extent, the analog of the Turkish gendarmerie in Kazakhstan is the Internal Troops of the Ministry of Internal Affairs, which operate on the basis of the Law of the Republic of Kazakhstan «On the Internal Troops of the Ministry of Internal Affairs of the Republic of Kazakhstan».

During comparative analysis of the systems of internal affairs of Kazakhstan and Turkey it has been identified a lot of the similar components. I think that for the Turkish audience the next part of the article will be more informative. In accordance with Article 7 of the Law «On the Internal affairs bodies of the Republic of Kazakhstan», *the police, correctional system, military investigative bodies, the National Guard of the Republic of Kazakhstan, civil protection bodies form the unified system of law-enforcement bodies* (Law #199-V, Art. 7).

Kazakhstan's police consist of the criminal police, administrative police departments of investigation, inquiry, and others.

Criminal police consists of units for combating organized crime, extremism, illicit trafficking of drugs, psychotropic substances and precursors, and other units engaged in operational investigative activity.

Administrative police consists of police inspectors units, juvenile affairs units, units to protect women from violence, to control in the sphere of circulation of civil and service weapons, traffic police, migration, environmental police, specialized agencies and other units engaged in the protection of public order.

With the naked eye the similarity of structural units of law enforcement bodies of both countries can be traced, however, for more detailed analysis I will try to make the comparison of the structural units of internal affairs bodies of Kazakhstan and Turkey.

In Turkey, the units for combating drugs are part of the General command of the gendarmerie, which, in accordance with the Law № 2313 «On the control of drugs» exercise the functions of detection of illegal manufacture, distribution, as well as suppression of drug smuggling in cooperation with the Customs and the Coast Guard (Law #2313).

Department of drug trafficking combating of MIA of the Republic of Kazakhstan, as well as the territorial bodies of internal affairs in accordance with the Regulation on MIA, the Law of the Republic of Kazakhstan «On drugs, psychotropic substances, precursors and measures to combat illicit trafficking and abuse by them» ensure the implementation of the state policy in the sphere of trafficking of drugs, psychotropic substances and precursors, combating of illicit trafficking and abuse by them, as well as other regulations (Law #279).

According to the Article 5 of the Law № 2918 «On road traffic» Department of transport services of General directorate of security of the Republic of Turkey performs the functions of the traffic police ensuring the organization and traffic safety. In addition, Article 6 of the Law provides that in cases when there is no traffic police or when its power is not enough, the police or gendarmerie officers, who have received special education of road-patrol officers, have the right to perform the functions of the organization of traffic safety within their powers (Law #2918).

In Kazakhstan, the MIA has the Committee of administrative police, which includes structural units operating in the field of traffic safety. The traffic police of Kazakhstan operate in accordance with the Law «On road traffic» (Law #194-V), Traffic Regulations of the Republic of Kazakhstan (Decision #1196) and other legal acts and regulations.

The criminal executive system in Turkey is based on the General directorate of prisons and penitentiaries of the Ministry of Justice and regulated by the Law № 5275 «On the execution of sentences and security measures» and other legal acts (Laws #4301, #4675, #4681, #4769). Gendarmerie bodies according Article 7 of the Law № 2803 carry out the external protection of prisons and penitentiaries, transportation and escorting convicts, as well as other powers provided by the legislation.

Bodies of the criminal executive system of Kazakhstan are subordinate to the Committee of the criminal executive system of MIA of the Republic of Kazakhstan, which accordingly has territorial departments and agencies, executing punishments, as well as other subordinate organizations (Law #199-V, Art. 7). In accordance with the Regulation of MIA (Decision #607), the Criminal executive code (Law #234-V) and other regulations of the Republic of Kazakhstan (Decision #900), the bodies of the criminal executive system operate on the protection of the bodies and institutions of the criminal executive system, on the control of the operational situation in them, as well as ensure the safety of stuff, suspects, accused and convicted.

The system of civil defense bodies of Turkey is headed by the General directorate of civil defense, which in its turn is accountable to MIA. According to the Law № 7126 «On civil defense» civil defense bodies provide activities for dealing with liquidation of emergencies, natural disasters, fires, rehabilitation of wreck

public and private facilities, providing life-saving measures and other measures of civil defense (Law #7126).

In Kazakhstan, in MIA there is the Committee of emergency situations, which heads and coordinates the system of civil protection bodies. In accordance with the Law «On civil protection» civil protection bodies exercise the functions of prevention and liquidation of emergency situations of natural and man-made disasters, emergent medical and psychological assistance to the population, fire safety and civil defense organization (Law #188-V).

Next, we consider the subordinate units of MIA of Turkey, which in the past were in the structures of the police and gendarmerie, and for various reasons, were withdrawn as separate law enforcement bodies.

Coast guard command is under the jurisdiction of MIA and carries out its tasks in the territorial and internal waters of Turkey, the exclusive coastal economic and other areas in accordance with the Law of Turkey № 2692 «On the Coast guard command» and international legislation. The main functions of department include ensuring the safety of life and property at sea, prevention and suppression of smuggling, search and rescue operations, as well as the prevention of marine pollution (Law #2692).

Despite the fact that the law № 2692 was adopted in 1982, the Coast guard service was the part of the General command of gendarmerie until 1985. This necessitated the establishment of the appropriate material and technical basis for the efficient functioning of the Coast guard bodies.

Kazakhstan's analogue of the Coast guard service is Maritime border guard service established in 1994, which is located in Aktau city *(coastal region of the Caspian Sea).* In 2008, the Service was reorganized into the regional management of the Coast guard of Border guard service of the Republic of Kazakhstan, which included the border units, divisions of ships and boats. The activity of the coast guard and border protection in the whole is regulated by Chapter 9 of the Law of the Republic of Kazakhstan «On the State border of the Republic of Kazakhstan». It is necessary to clarify that the border service of Kazakhstan is the structure being under the jurisdiction of the National security committee, the activity of which is regulated by the Law «On national security bodies of the Republic of Kazakhstan».

Due to the increasing problems associated with illegal migration and people trafficking, as well as international migration flows in 2013, the Turkish government introduced new rules for the implementation of effective policy on migration affairs. Thus, on the basis of Article 103 of the Law № 6458 «On foreign citizens and international protection», the independent state body was created- the General directorate of migration affairs, accountable to MIA. The law regulates legal relations in the field of migration, in particular getting visa to enter the territory of

Turkey, residence permits for foreigners, deportation, international protection, as well as in the field of organization of activity for the authorized bodies on migration affairs (Law #6458, Art. 103).

In Kazakhstan, the competence of the international affairs bodies is regulated by Article 9 of the Law «On population migration», according to which the migration police carries out activities related to the registration of citizens, foreigners and stateless persons, granting them permission for temporary and permanent residence in Kazakhstan, prevention of illegal migration as well as other functions within its competence (Law #477-IV, Art. 9). As the analysis showed, the difference of migration services of Kazakhstan and Turkey is that the Kazakh migration police on the organizational structure is subordinate to the central and regional departments of internal affairs bodies, and in Turkey as it was noted before, the migration service exists as the separate agency.

The Agency of public order and security was established in 2010 as the subordinate division of MIA, the main purpose of which is to prevent from terrorist acts. According to articles 3 and 8 of the Law № 5952 «On organization, duties and authorities of the Agency of public safety» the agency is the competent body for coordination in the combating terrorism, and operates in conjunction with the intelligence structural units of the police, gendarmerie and other law enforcement bodies. Moreover, the analysis of Articles 6, 9 of the law led to the conclusion that the Agency also performs the functions of collection, analysis and evaluation of strategic information relating to the security of society and the state (Law #5952, Art. 3-9).

Kazakhstan's law enforcement body on the coordination in the field of combating terrorism is the National security committee, which is in accordance with Article 4 of the Law «On combating terrorism» is included in the national system of combating-terrorism and conducts its activities in cooperation with public authorities and within the framework of permanent anti-terrorist center (Decree #588). Analysis showed that the Antiterrorism centre of the Republic of Kazakhstan as well as the Counterterrorism coordination committee of Turkey (Law #5952, Art. 4), are permanent advisory bodies in the coordination of counterterrorism, including all units of law enforcement bodies.

As it was previously reported, in November 2014 the Ministry of Internal Affairs introduced to Parliament the bill providing for the improvement of legislation in the field of law enforcement, thus the following changes are assumed to be:

- separation of powers of MIA and governors of local executive bodies in relation to the activities of the gendarmerie and the coast guard;
- the procedure for promotion and retirement of law enforcement officers is revised;
- the closing of the police academy and colleges, transfer of students and teachers of these institutions to civilian institutions of higher education and colleges;

- law enforcement bodies powers for the use of firearms and other special equipment are expanded;
- the procedure of registration of the population, providing of identity cards and passports is revised.

These innovations, as well as other changes in the legislation will allow law enforcement bodies to reach more qualitative level of their professional activities.

In the annual Letter to the nation the President of Kazakhstan N.A. Nazarbayev provides necessarily reforms in law enforcement. For the past few years a number of important reforms was held, that allowed reaching the qualitatively new level of law enforcement in the country. So the results of the examination of law enforcement officers, which was held according to the Decree of the President of the Republic of Kazakhstan (Decree #292) during 2012, the qualitative composition of the law enforcement bodies was much improved. From the more than 100,000 employees 12.5 thousand people have not been certified and were dismissed from the bodies (akorda.kz, 2014).

The work in this point continues in the framework of the Concept of personnel policy of law enforcement bodies of the Republic of Kazakhstan and the State Program of further modernization of the law enforcement system of the Republic of Kazakhstan for 2014-2020, which were approved by the Decree of the President of the Republic of Kazakhstan (Decree #720).

Within the State program of further modernization of the law enforcement system of the Republic of Kazakhstan for 2014-2020 specific tasks were set: conducting of the next phase of modernization of the national legal system, building of the legal state, in which law enforcement bodies have an important mission to protect and promote the rights and freedoms of citizens.

Moreover, one of the main points of the program is efficiency increase of international collaboration.

Within the realization of this point, it is necessary to settle the following tasks:
- concluding of international contracts about providing of legal assistance, extradition and rendition of convicts and other contracts in the sphere of struggle with delinquency;
- concluding of trilateral treaty with the states-members of the EvrasEU about formation of Evrazpol;
- development and strengthening of collaboration within SCO, SIC, CSTO, Customs Union;
- increasing of cooperation with law enforcement bodies of foreign countries for exchange of experience, training of specialists and their professional development;
- further implementation of international contracts clauses to the national legislation in the sphere of struggle with delinquency and protection of rights of people, ratified by the Republic of Kazakhstan.

The level of tasks implementation will be measured by the following indexes:

- image of the Republic of Kazakhstan in the area of struggle with delinquency and protection of rights of people on international level will rise;
- methods of information swapping in international collaboration of law enforcement bodies are improved;
- international contract base is expanded;
- Republic of Kazakhstan will join authoritative international organizations, executing their activity in the sphere of struggle with delinquency and protection of rights of people;
- National legislation will progress taking into account accepted international obligations.

Thus, it should be noted that long-term program of modernization of the law enforcement system of Kazakhstan is due on the one hand, by the necessity of improvement of law enforcement authorities' activity taking into account real circumstances and legal and economical processes in the Republic of Kazakhstan, on the other hand, by the necessity of usage of managerial paradigm at state administration, so called organizational-legal approach, and creation of corresponding mechanism of involving of society to the process of law enforcement service improvement.

Turkey is the important regional Eurasian country, politics of which has great potential and can have a significant influence on the development of the situation in the Middle East, the Caucasus and Central Asia. At the same time, Turkey and Kazakhstan share a common approach to the major issues of world development in the XXI century and are in favor of democratization of international relations aimed at building of the equitable international order that should be based on respect for international law, equality and mutual respect, cooperation and safety. In Astana and Ankara they agree with the fact that the main role in achieving this goal must be cooperation within international organizations such as the CICA, NATO, the SCO, the main objectives and activities of which is to strengthen the cooperation by elaborating multilateral approaches towards promoting peace, security and stability in the states-members of international organizations. One of the results of the dialogue in the framework of international cooperation was the opening of the military-technical representation of the General Staff of the Turkish Armed Forces in Kazakhstan in August of 2001. The task of the new structure is to coordinate military cooperation between the defense agencies of Kazakhstan and Turkey.

From the period of independence of the Republic of Kazakhstan the Governments of Kazakhstan and Turkey signed a number of bilateral agreements in the field of national security, law enforcement, administrative and criminal offenses (Laws #143-V, #367, #180; Decision #191), which allow at present both countries

to provide mutual assistance in addressing issues related to the combating terrorism, drug trafficking, smuggling and other crimes. One example of effective mutual cooperation is issuance of Kazakh citizen R. Aliyev to law enforcement bodies of Kazakhstan to be held criminally responsible for the most serious crimes. R. Aliyev committed murder with special cruelty, coupled with the robbery, escaped from the prosecuting agencies. After his arrest by Interpol of Turkey, the Supreme Court of Antalya granted the petition of Prosecutor General's Office of the Republic of Kazakhstan on extradition of the criminal (prokuror.gov.kz, 2014).

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数字经济时代的青少年公民身份
CIVIC IDENTITY OF ADOLESCENTS IN THE AGE OF DIGITAL ECONOMY[1]

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抽象。 本文证实了这样一种假设，即在数字经济时代和劳动力市场变化的时代，大规模移民，气候变化以及全球对人力资本和投资的竞争加剧了青少年的公民身份形成问题。 研究表明，公民身份的研究需要谨慎的多学科方法，包括对本体论，道德，环境，社会政治，主观和个人成分的分析。 讨论了与社会责任意识，青春期学生的公民自我认同相关的风险。

关键词：公民身份，少年，边疆，跨学科研究。

Abstract. *The article substantiates the assumption that in the era of digital economy and changing labor market, mass migration, climate change, and global competition for human capital and investment exacerbated the problem of civil identity formation of adolescents. It is shown that the study of civic identity requires careful multidisciplinary approach, including analysis of the ontological, moral, environmental, socio-political, subjective and personal components. The risks are discussed associated with the awareness of social responsibility, civic self-identification of students of adolescence.*

Keywords: *civil identity, teenager, Borderlands, interdisciplinary approach*.

The current geopolitical situation is characterized by strengthening of falsification tragic for the Russian people the history of the great Patriotic war. For some of the younger generation acquire popularity values of Western democracy, despite the fact that "the West is beginning to consider post-Communist Russia as something alien internally, requires the development of special policy" [4, p. 145].

[1]*The study was performed with the financial support of the Council for research and innovation activities of the "ZabGU", project No. 297 GR "Subjective approach in the development of professional identity of the student in the University."*

In addition, special emphasis on the territory of Siberia and the Far East in connection with the effects of the epidemic of the coronavirus, a slowdown in industrial production, rising unemployment, Exodus of young people, which makes it difficult as geo-economic and social situation of the state.

The study of civic identity requires careful multidisciplinary approach, including analysis of the ontological (ordering chaos unit of life, defining the position of man in the world), moral (moral values, life meanings – material values), environmental (living – dead, "life-sustaining manifestations" – the irreversibility of the changes), socio-political (peaceful cooperation – crisis, poverty), subjective-personal (identification, solidarity of the subject with social norms, attitudes and standards – alienation) components. Interdisciplinary analysis will help to identify the causes, the determinants, the risks of formation of this multifactorial phenomenon.

The study of the civil identity of the youth due to the need to assess how the dynamics of the innovative potential of the state and strategic resources for its development, since the phenomenon serves as an indicator of socio-political processes [13, 14].

The development of civil society, the era of digital economy and changing labor market, mass migration, climate change, global competition for human capital and investments, showing the problem of producing a meaningful and socially responsible participation of the individual in the life of the school, society, country, commitment to spiritual and moral values of Russian society, observance of civil rights and duties in society, respect for a large and a small country [3; 5; 8].

Civic identity is based on national, state and ethnic identity that correlates with them. Jean Rousseau underlined that "...for the State it is important that each citizen has a religion that would make him love his duties but the tenets of this religion .... relate to morals and duties" [7]. Man, being a citizen, identifies himself with the political society to which it belongs, and promotes stability and unity [12, 242 - 244]. Civic identity implies a positive unit relation to each other, social groups and movements, state. Fukuyama warned that the success not only of social relations but also the efficiency of an economy is directly proportional to the "radius of trust" [10]. Civil identity means experience and personal awareness of the value of belonging to social communities on cultural basis [11, 158 – 179; 2], identification with state-territorial space of the country, a sense of solidarity, of responsibility for the situation in the country, "the way we are" [1, 213-244].

The study was carried out from 2019 to 2020 in Municipal secondary school № 49 with profound study of the English language of the city of Chita, Chita College of railway transport, branch of Irkutsk state University of railway messages. In the study 128 students, 10 teachers were involved. In-depth interviews and test "Who am I?" (M. Kun, T. Macpartland; modification of T. V. Rumyantseva) were used to define civic identity.

The results of the study show that 51% of respondents show social infantilism in relation to their own citizenship, which indicates the violation of the mechanisms of social adaptation and socialization. 15% of respondents find the rejection of social policy, since education and health are based on values characteristic of a market economy. The instability of the social status of the parents makes the teenagers to think about the future in terms of social insecurity (39%). 13 % of respondents do not believe in the existence of positive life prospects. 7 % of teenagers believe that they have no reason to be proud of their country.

Multiethnic Zabaikalie is represented mainly by two ethnic groups: Russians (89,9 %) and Buryats (6,8 %), characterized by the belonging to different language groups (respectively to Slavic and Mongolian), differences in religion (Christianity and Buddhism). The application of methods in-depth interviews showed that religious identity cannot be considered an integral element of civil identity and self-determination. However, since Christianity and Buddhism are aimed at increasing the spiritual potential and strengthening the moral foundations of society, then perhaps they could serve as the basis for the formation of a civil position.

Respondents' basic categories, which include social and role ("student", "sister", "brother", "daughter", etc.), gender ("girl", "guy", "girl", etc.), generic-species ("human", "Homo sapiens") identity, are 67% in the set of all descriptions. Ethnic identity is represented in 5,9 % of respondents. According to the results of surveys of civic identity is expressed vividly: 78 % of students who participated in the study, called themselves Russians or citizens of Russia. Russian identity of adolescents of multinational Zabaykalsky Krai is expressed more intensively than ethnic one. However, 72% of respondents stated that "respect for the dignity of my people" is extremely important for a comfortable psychological well-being. The study also found local identity, manifested in the identification with homeland ("Siberian", "the inhabitant of Chita").

So, adolescents are socio-age group, which are characterized by the search for his "I as a citizen" and their place in the life of the country. We agree with the position of S. V. Patrushev, who believes that the basis of formation of civil identity is involvement in political life, "the potential and confidence of citizens in the ability to influence the political decision-making", the opportunity and ability of citizens to determine their own destiny as the "equal and worthy of respect human beings". It is encouraging that for the overwhelming majority of adolescents in Zabaykalsky Krai, despite the change in cultural and civilizational map of the world, is characterized by Russian civil identity and sense of social responsibility for the prosperity of the region.

The recognition of civil identity of a teenager would allow him to act as a worthy representative of the society and have a meaningful impact on the development of civil society. Otherwise, his activity is a threat of adverse social impacts.

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反腐败潜能发展的决定因素
DETERMINANTS OF THE DEVELOPMENT OF ANTI-CORRUPTION POTENTIAL

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注解。本文探讨了反腐败潜力的来源，因素和指标。该研究的目的是确定发展个人反腐败潜能的个人决定因素。本文介绍了反腐败潜力发展问题的现状分析，证实了这一概念的解释，突出了反腐败教育领域的关键问题。还提供了一项实证研究的结果。受访者是Transbaikal State University的68名一年级学生，年龄在19至25岁之间。汇总数据的因素分析使我们能够找到6个重要因素（方差的76.8%）。因子1（31.6%）包含生活的积极方面：对自我实现和取得的成就的满意，做出决定的能力以及采取行动形式的选择自由，对未来的渴望被视为具有吸引力。整合和控制各种活动以及足够有效地进行，管理和控制情绪的能力；根据灵性的标准，内在世界的丰富性的自我价值感；对生活的兴趣，高度乐观；内部与成就，家庭关系有关。因子2（16.4%）包括以下因素：虚幻的选择自由，对根据自己的想法建立生活的能力缺乏信心，对控制自己的生活方式的能力的怀疑；自责，内部冲突，害怕进入您的世界；外部控制源。因子3（6.8%）涵盖了人们对非独立性格的看法；对自己的能力不满意，情绪紧张程度高；准备接受生活中的失败；否认问题，封闭。研究结果可用于制定反腐败教育计划。

关键词：反腐败潜力，来源，因素，指标，威胁，偏差，反腐败活动。

Annotation. *The article touches upon the sources, factors, and indicators of anti-corruption potential. The purpose of the study is to identify the personal determinants of the development of anti-corruption potential of the individual. The article introduces the analysis of the current state of the problem of the development of anti-corruption potential, substantiates the interpretation of this concept, highlights the key problems in the field of anti-corruption education. The results of an empirical study are also presented. The respondents were 68 first-year students of the Transbaikal State University aged from 19 to 25 years. The factor analysis of aggregated data allowed us to find out 6 significant factors (76.8 % of the variance). Factor 1 (31.6 %) contains the positive aspects of life: satisfaction with self-realization and achieved results, the ability to make decisions, and freedom of choice in the form of an action, the aspiration for the future perceived as something attractive; the ability to integrate and control different activities*

and conduct, manage and control the emotions effectively enough; a sense of self-worth according to the criteria of spirituality, the richness of the inner world; the interest in life, a high level of optimism; internality connected with achievements, family relations. Factor 2 (16.4 %) includes such parameters as illusory freedom of choice, lack of confidence in the ability to build your life according to your ideas, disbelief in your ability to control the way of your living; self-blame, internal conflict, fear of entering your world; an external locus of control. Factor 3 (6,8 %) covers the perceptions of people as of non-independent personalities; characterized by dissatisfaction with their abilities, a high level of emotional tension; preparedness to accept their life's failures; denying of problems, closedness. The results of the research can be used for the development of anti-corruption education programs.

Keywords: *anti-corruption potential, sources, factors, indicators, threat, deviation, anti-corruption activities.*

The spread of various forms of corruption in the transitive area of a dynamically developing world requires a systematic analysis of its causes and factors. According to the Transparency International research in 2018 Russia took the 138th position of 180 participants due to the Corruption Perception Index, or CPI. The etymology of the term "corruption" discloses its meaning. In Latin, corruption means "the seduction, bribe", "spoiled", "to spoil, to seduce, to entice, to pervert, to lure". The consequences of corruption connected with the national threat, justice, welfare, trust, require close attention not only to the structure and way of organization of corruption, the causes and social conditions of its origin, but also to the circumstances, factors, indicators of the development of anti-corruption potential [18].

The international anti-corruption approach has led to understanding that corruption is a real problem and it requires the establishment of a uniform, consistent, and effective international anti-corruption regime. The elimination of corruption is a difficult task, and none of the ways of preventing it is perfect. Despite strict legislative requirements, the direct anti-corruption measures don't bring the desired results. The UN Convention is against several acts of corruption, but now there is no decent system for ensuring law enforcement [23, pp. 249–270.].

Anti-corruption activities according to the National anti-corruption plan include both law enforcement, educational and other measures aimed at forming anti-corruption behavior and developing legal awareness of the society [17].

Corruption can never be eradicated, but it can be reduced by monitoring the structure and dynamics of the development of anti-corruption potential, implementing some innovative projects of anti-corruption education, including civil control, social modeling of public opinion connected with corruption crimes, in-

creasing anti-corruption awareness about legal ways of getting social guarantees and services, and promoting anti-corruption behavior.

Being a social phenomenon [7, pp. 187-193.] corruption is considered as a derivative of the human factor, an element of social reality, an objectified result of the subjective activity of factors, a kind of marker of the state of uncertainty, disorganization of society. In this research, we will review the anti-corruption potential, which occurs in a variety of forms and functions. The purpose of the research was determined by the significance of this problem. We are going to study the sources, factors, and indicators of the development of anti-corruption potential in the transitive society.

According to World Bank experts, the indicators of anti-corruption potential are the efficiency of public administration, political stability, and transparency of political processes.

The sociological analysis allowed to A. Pinchuk to consider corruption in the conditions of diverse social realities such as a social concept, an innovative type of deviant behavior, a special type of latent social activities, including sensory perception and the inner imagery itself [12, pp. 80-95].

Based on the theory of anomie, the source of the corruption potential development is weakening of social connections, "disorders of organic solidarity" [4, p. 361-403], mismatch of cultural goals and institutionalized activities of their achievement, implicit paradigms of the estimation of culture [10].

According to the interactionist theory of deviance [1, p. 202] introduced by Gary Stanley Becker, the development of anti-corruption potential is based on the social interaction of the subjects and their reaction to each other.

S. Karepova and S. Klimovitsky introduced a theoretical model that includes "external" factors, or environmental factors that are internalized by the individual and determine the social context, and "internal" factors of social behavior, or factors of social self-regulation (systems of values, social attitudes and dispositions of individuals) [5, pp. 73-78].

The complex dynamic interaction of the factors of social self-regulation with institutional, material and socio-cultural conditions or environmental factors, creates the motivation for a sensible choice of a social behavior model.

One of the most important studies of pedagogical knowledge, the subject of which is the research of the anti-corruption education of students from the position of creating of anti-corruption ideology, proper citizenship, and personal and education values, is the identification of structural elements of the source of the corruption potential.

According to the general definition of "corruption potential" it is the latent opportunity of a subject to implement some corruptive activities, due to the personal, moral, professional deformation; the ability to exchange or use the managerial resources [7; 3, pp. 134-135; 8, pp. 20-32].

Based on the previous content, economic, political, socio-cultural, psychological, pedagogical, and situational conditions can be identified as the basic sources of the corruption potential development.

The flexibility, uncertainty, multiplicity, and variability of a transitive society give a new understanding of sociocultural activities. On the one hand, transitivity uncovers the adaptive potential of a person, on the other hand, it influences the content of the value-semantic space of the subject [22, pp. 55-68].

In the meta-scientific area, the study of the determinants of anti-corruption potential is promising because of the perspectives of a subjective approach. Subjectivity as a systemic quality of a free individual allows you to be the creator of your life, build yourself and the world around you, change your spiritual image.

Under the extreme conditions of social anomie, subjectivity implies the maturity of a value-semantic system, in which a person's ideas about the world and himself, psychological and subjective well-being of the individual, the ability to use self-regulation and reflection methods are shown [19]. Subjectivity is characterized as the "implantation" of a person in the social reality of a certain space-time continuum and appears in the process of conscious deployment of its potential. Pierre Teilhard de Chardin [8, pp. 51-61, 191-203] postulated that the symbol of the human way of living is reflection. Reflection is a special competence connected with the willingness to analyze and correlate your actions with the social situation. The development of the subjectivity of personalities who can resist the pressure of corruption is a continuous systematic process associated with the formation of the so-called “super adaptive” way of functioning in the conditions of social anomie focusing on the spiritual and moral development.

The formation of a negative attitude to corruptive behavior involves studying the image of a corruptive person [13, pp. 12-27]. At the level of common attitude of people, there is rather a tolerant attitude to corruption, which reflects the mentality of the Russian society and shows it as a complex system of political views, attitudes, stereotypes, value-semantic components due to cultural, historical and socio-psychological realities, religious, ethnic, and social preferences that determine the behavioral patterns of an individual, or a social and ethnic group [21; pp. 55-64.].

O. Vanovskaya examines the internal determinants of the corruptive behavior of the individual at the following levels: value-semantic, cognitive-moral, emotional, regulative and behavioral [2, pp. 323-328].

The descriptor of the most important meaning of life which is full of corruptive behavior is the desire to get some false self-assertion with the help of having wealth, power, and fame. At the cognitive and moral level, low anti-corruption stability is indicated by the undifferentiated structure of attitudes and lack of awareness of the motivation for proper moral behavior. At the same time, the lack of direct access to cognitive processes and the significance of subjective interpreta-

tion processes are evidenced by the research of L. Ross and R. Nisbett [15, pp. 149-153]. The emotional process can be determined by the situation. However, as we know, there is a congenital tendency to get a certain kind of experience. At the emotional level, high anti-corruption stability is indicated by the satisfaction with life, profession and social status, adequate self-esteem, and positive self-attitude.

Defining the personal determinants of the tendency to corruptive behavior, O. Vanovskaya pays her attention to the location of the personal control, which determines the specifics of the regulatory level, and the type of response that dictates the behavior of an individual.

The study is based on the REC "Interdisciplinary research of human development in the educational environment". The purpose of the research is to identify the personal determinants of the development of anti-corruption potential of the individual. The respondents were 68 first-year students of the Transbaikal State University aged from 19 to 25 years.

The study of meaningful-for-life orientations as the complex socio-psychological formations that determine the boundaries and vector of self-realization of the individual was made with the help of the method of "Testing of Meaningful-for-Life Orientations" by D. A. Leontiev, an adapted version of the "Purpose-in-Life Test" by J. Crumbaugh and L. Maholic. To study self-relation, the method of self-relation research was used by S. Panteleeva. The indicators of satisfaction of life were studied with the help of the questionnaire "Life Satisfaction Index" created by B. Neugarten (Russian adaptation of N. Panina). The locus of control was studied with the help of the questionnaire "The Level of Subjective Control" made by E. Bazhina, E. Golynkin, and A. Etkind.

The factor analysis of the aggregated data (processing was carried out in SPSS 23.0) found out 6 significant factors (76.8% of the variance). Factor 1 (31.6 %) contains positive aspects of life: satisfaction with self-realization and achieved results; awareness of the ability to make decisions; a sense of freedom of choice; aspiration for the future perceived as something attractive; the ability to integrate and control activities and conduct, manage emotions and monitor them effectively; a sense of self-worth according to the criteria of spirituality, the richness of the inner world; the interest in life, a high level of optimism; internality connected with achievements, family relations.

Factor 2 (16.4 %) includes such parameters as illusory freedom of choice, lack of confidence in the ability to build your life according to your ideas, disbelief in your ability to control the way of your living; self-blame, internal conflict, fear of entering your world; an external locus of control.

Factor 3 covers (6,8 %) the perceptions of people as of non-independent personalities; characterized by dissatisfaction with their abilities, a high level of emotional tension; preparedness to accept their life's failures; denying of problems, closedness.

As the other factors reflect the values of individual scales, a detailed analysis of this phenomenon is necessary in the context of our research. In the future, we plan to study the features of the style of self-regulation of behavior, the degree of development of reflexivity.

Hence, the anti-corruption potential of the individual means the integral unity of latent capabilities of the subject to resist anti-corruption pressure through emotional and moral strength, the development of the ability to predict and assess corruptive situations appropriately.

Conclusion

The process of developing the anti-corruption potential of an individual in a transitive society is associated with the formation of its subjectivity, the ability to reflect in a situation of corruptive pressure. The results of the research suggest the need to analyze the personal determinants of anti-corruption potential, which are manifested at the cognitive level in satisfaction with self-realization and the achieved results, self-management, the ability to make decisions, a high degree of freedom of choice, and a positive aspiration for the future; at the behavioral level - in the ability to integrate and control activities and conduct; at the emotional level - in the effectiveness of managing emotions and the ability to monitor them properly; a sense of self-worth according to the criteria of spirituality; in a high level of common internality.

Internal conflict, low levels of self-esteem and self-acceptance, increased self-blame, lack of self-confidence, externality do not allow the respondents to represent themselves as subjects who can resist corruption pressure.

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在医学生的志愿活动中促进社会行为的培养
PRO-SOCIAL BEHAVIOR UPBRINGING IN THE CONTEXT OF VOLUNTEERING ACTIVITIES OF MEDICAL STUDENTS

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抽象。 该论文强调了志愿服务活动对医学生的教育和养育的影响。 志愿服务的亲社会方面。 作者分析了学生社会活动的方向以及参加志愿活动的医学生的年龄，性别和动机。

关键词：养育，志愿活动，亲社会行为，社会责任，价值取向。

Abstract. *The paper highlights the impact of volunteering activities on medical students' education and upbringing. Pro-social aspect of volunteering is characterized. The authors analyze directions of students' social activities as well as age, gender and motivation of medical students participating in volunteering activities.*

Keywords: *upbringing, volunteering activities, pro-social behavior, social responsibility, value orientations.*

Pro-social behavior may be manifested by volunteering activities. There exist numerous definitions of the concept "pro-social behavior". Taking into consideration this great diversity of definitions, we can define the essence of human pro-social behavior as an activity aimed at the good for other people and the whole society, a socially useful behavior which has no other benefits for the person helping except moral reward. Besides, there's an opinion of evolutionists concerning pro-social behavior. They believe that pro-social behavior evolving with the mankind is aimed only at human genotype preserving and maintaining, at mankind survival anyway, despite the disasters of the surrounding world.

Education as a social cultural mechanism determines stabilization of the society and a holistic development of individuals by means of their mastering of social cultural values, thus being a stable basis of formation of their pro-social behavior. The key personality factors of pro-social behavior are empathy, predisposition to altruism, focusing on cooperation as a value, social responsibility, internal locus of control, low egocentricity level. Giving help, sharing, donation, collaboration, and volunteering activities are considered to be pro-social behavior manifestations.

Volunteering as a socially significant activity has an important educational potential. According to Anton Makarenko, the principle of mutual support and assistance must be one of the leading principles in educating and upbringing the collective of pupils. The founder of Russian scientific pedagogy, Konstantin Ushinsky believed that upbringing "must vigilantly care how to enable the individual to find some useful for the mankind labor, on the one hand, and to inspire him to work tirelessly, on the other" [1]. In terms of pedagogy volunteering activity is considered to be an instrument of development and implementation of social upbringing, value orientations, social responsibility, social experience and pro-social behavior being the source of good for people and the society in general.

Pro-social behavior should be considered as an important constituent of a general psychological culture. According to the modern progressive demands of both state educational standards and labor market, medical graduates must possess a wide range of common cultural and professional competences, knowledge, skills and habits including psychological culture, psychological literacy, flexible intelligence, openness to new experience, the ability to overcome difficulty communicating, readiness to improve their own performance, capability of working successfully with new psychological risks initiated by the modern society. Psychological culture as an important component of the general culture of a doctor can be brought up in the educational environment of any educational institution.

Upbringing of students is a vitally important part of the educational environment of the Chita state medical academy. There exists the youth volunteer movement "You're not alone!" within the framework of the Academy educational activities. Volunteering activities are arranged according to the following directions: assistance to the medical institutions in caring after the patients, work in perinatal care centers, and in children's and social shelters, constant sanitary education work aimed at raising medical literacy among the population, religious education work, promotion of healthy lifestyle, planning and implementation of socially significant projects, arrangement and hosting of various educational and entertainment activities for various population groups: other students, children, the disabled, the aged, etc., environmental protection activities, arranging and collecting donations for those in need, charitable handiwork for pre-term infants, career guidance for schools, encouragement of voluntary blood donation, work as animal shelter volunteers. Students of the Chita state medical academy participate in the activities of 17 volunteer squads, the oldest of which is "The endorphins" founded in 1999, the newest are "The heart of surgery" and "The youth of the all-Russian people's front", both founded in 2019.

The survey was conducted to reveal the volunteers' age, gender, preferences and motivation. There were 101 respondents. All of them were medical students, participants of volunteer squads. According to the data obtained, there were

88.7% female volunteers and 11.3 % male volunteers. They were divided into the following age groups: 24.5% volunteers aged 17-18 years; 46.2% - aged 19-20; 24.5% - aged 21-22; 4.8% - aged 23-24. The respondents were students of the 3 faculties: Medical, Pediatric, and Dental. 41% respondents were future pediatricians. The distribution of the volunteers into squads was the following: 23.8% respondents were members of the squad "Give a smile", 14.5% - "Buyan", 11.3% - "The youth of the all-Russian people's front", 9.7% - "Young dentists association", 9.5% - "Atlant", 8.2% - "Together with Nature", 6.4% - "Volunteer doctors", 4.6% - "Panacea", 3.8% - "Happiness on the palm", 7% - members of 7 other volunteer squads. Motivation was also analyzed. The possibility to help other people (43.4% respondents) was the key reason for participating in volunteering. 22.6% respondents were attracted by the possibility to get new social experience. 16% volunteers got new interests and hobbies. Meeting new people attracted 9.4% volunteers. 8.6% volunteers were active supporters of environmental protection. Based on the findings, we can draw a conclusion that the need for helping other people was the main value orientation for medical students, determining pro-social behavior of volunteers.

Currently, during the coronavirus pandemic, 70 students of the Chita state medical academy have been participating for 7 weeks as volunteers in the activities of the regional department of the all-Russian volunteer movement "We're together", helping the aged and all those in need staying home due to the self-isolation regimen and quarantine. Volunteers have to accept and register over the phone the requests for food products or medications, and then to supply delivery of these items to those in need. Moreover, 316 medical students and 138 medical residents work as nurses and junior medical personnel in the hospitals. Thus we can say that all these efforts and social activity of volunteers and other medical students is aimed at survival and preserving of mankind despite this greatest life-threatening disaster defined as "coronavirus pandemic".

Within the framework of axiological approach, participation of medical students in socially significant activities is considered to be a value, developing future doctors' personality and psychological culture, encouraging their altruism, empathy, social intelligence, stable pro-social behavior, endeavor at responsibility not only for their own lives and well-being but for the lives and well-being of other people and the whole society.

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集体智慧，“智能人群”和科学行动
COLLECTIVE INTELLIGENCE, "SMART CROWDS" AND THE ACTIONS OF SCIENCE

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“In insects with social lifestyle, there is division of labor. Scientists have long used the concept of “superorganism,” in which each individual is only part of something larger. In the forest, typical representatives of this phenomenon are red wood ants ”[1]

In 1911, Wheeler's article, “The ant-colony as an organism”, was published.

In it, the author first formulated and defended the idea, which later became known as the concept of superorganism. According to this concept, a colony of social insects is a real organism, quite comparable in composition, organization and basic life functions with an ordinary organism. Communication mechanisms bind all parts of a superorganism into a single whole, and make it possible to maintain the stability of their basic properties. The superorganism is capable of responding to external influences quite reasonably and behaving as a whole. [2]

Kevin Kelly sees the origins of theories regarding suddenly-occurring properties in the teachings of William Morton Wheeler, an expert on the behavior of ants. Wheeler called insect colonies superorganisms and determined the ability of the swarm to perform tasks that separate individuals cannot perform as “suddenly arising properties” (emergent).

A superorganism, like an organism, is a unit of natural selection. Families, colonies, which more successfully than others provide themselves with food and withstand adverse external influences, grow faster and spawn more descendants.

At the stage of development of superfamily structures of ants, associations of colonies arise. Such associations are most clearly manifested in the northern forest ant, which has become due to this one of the most numerous species of our forests. The system of interconnected colonies - *federation* - arises precisely in conditions of overpopulation and lack of hunting grounds.

In a federation, each colony retains its structure with the dominance of the mother ant hill. The most important thing here is the principle of unification of the colonies. Unification should be such that it does not affect the internal structure of constituent units, does not destroy the principle of colonialism. Otherwise, instead of several colonies, one will appear, consisting of many anthills. And the more nests in the colony, the more ephemeral it is. [3]

Biological and artificial systems exhibit the same properties of what might be called a “swarm system”:

1) lack of centralized control;

2) independence of elements;

3) high connectivity of elements;

4) spider nonlinear conditionality of their influence on each other.

Steven Johnson's 2001 book "Emergence: The Connected Lives of Ants, Brains, Cities, and Software", shows that the patterns Kelly transferred from biological networks to technology networks apply to cities and to Amazon.com’s recommendation system.

The movement from elementary rules to sophistication is what the emergence is.

As for cities, the emerging mind here is like an ant, although every single person, at least, has a potential consciousness.

Bernardo Huberman, deputy director for science at the HP Laboratory of Information Dynamics, conducted a study on the emergence of the beginnings of a collective mind. Huberman presented computer networks in the form of ecologies, markets in the form of public computers, and interactive communities as a public mind. Huberman considers fruitful the idea of representing the emerging / emergent mind / intellect as a public computer. The mind manifests itself in collectives, like insect colonies, in social and economic behavior within society, scientific and professional communities. Where a large number of individuals capable of solving local problems, which can be interpreted as calculations, participate in collective behavior, a number of problems that are beyond the power of any individual representative are successfully solved. When a huge number of individuals process symbolic information and interact with each other, new patterns appear in their general behavior. These are the laws of quantitative order. They are subject to trial verification.

Smart crowds — an unpredictable, but partially descriptive emergent property of the present world, which manifests itself as more people start using mobile phones, more and more microchips - communicate, more and more computers - determine their location, more and more technology - integrate into our clothes, more and more people - use new information tools to create new social practices. Human social networks and communities, in fact, have existed

for many millennia before their online counterparts appeared. Both of them have established themselves as reliable and stable social structures that have passed all the tests of time. They appeared again and again, despite collapse or peak of civilizations. People by their nature definitely gravitate to this type of interaction. Human social networks have one interesting feature - they are all absolutely unique. [4]

And no matter what the champions of hierarchies say, social networks are invincible. Today they form the basis of the so-called *civil science*, that is, the union of professionals and amateurs to solve a specific problem.

People tend to represent science as a sphere where "lone geniuses" or "cabinet scientists" work. Current researchers and especially experimenters are constantly working in large groups. A classic example was the discovery in 1994 of the "*true quark*", it was attributed to 450 physicists.

The more productive and famous a scientist is, the more inclined he is to collaborate with colleagues.

Scientists collaborating with each other are more productive and more often achieve. If two groups of scientists make the same discovery, the most famous is attributed to his honor. You can call it the effect of Matthew. **For whoever has will be given more, and they will have an abundance. Whoever does not have, even what they have will be taken from them** (Matthew, 25:29). In short, luck invites luck. The Matthew effect can be considered as a heuristic device, a way, a filter, with which scientists can sift the flow of daily information. Since much effort is wasted in science, the Matthew effect provides attention to works that might go unnoticed. Universal explanatory schemes are hard knowledge, which is a collective social product of thinking.

Strictly speaking, it is incorrect to state that an individual thinks. It is much more correct to insist that he moves further in thinking than people who thought before him. He finds himself in an inherited situation with patterns of thinking adapted to this situation, and tries to develop further inherited methods of reaction or replace some of them in order to work more adequately with new challenges that arise as a result of shifts and changes in his situation. An extremely important issue is to find out how universal explanatory schemes are formed.

In this we see the mutual penetration of philosophy, the sociology of knowledge, knowledge management and the theory of artificial intelligence.

Artificial intelligence - practical philosophy.

To find the key to solving the most complex puzzles of our time - quantum gravity, dark energy and dark matter - we may need a different type of intelligence than human. In fact, perhaps we will need to invent an intermediate intellect that will help in the formation of a more complex mind, which man cannot create on his own. **We need ways to think differently.**

Today, many scientific discoveries require the unification of the intellectual efforts of hundreds of people. In the near future, we may encounter classes of problems so deep that solving them will require the combination of hundreds of *different types* of intellects.

Already today, the mathematical evidence offered by the computer is perceived by many with great reluctance. Human intelligence is not able to understand them, so it has to rely on the sequence of algorithms, and this requires new understanding skills when they can be trusted.

This will let us down from the cultural line, since it will be psychologically difficult for a person to accept answers from *foreign intelligence*. Interaction with artificial intelligence will require similar skills from us, as well as expanding the boundaries of our perceptions.

Built-in artificial intelligence will change the way we do science. The scientific method is a way of knowing, but it is based on the existing mechanisms characteristic of man. After adding a new type of intellect to this method, science will have to build and develop in accordance with the criteria of a new intellect. [5]

From that moment, everything will change.

Therefore, we should start now: learn to understand the intelligence of other living beings and other ways of thinking. This is the goal of cognitive science.

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修辞格作为有效的语言人格言语思维活动方法
RHETORICAL FIGURES AS METHODS OF EFFECTIVE SPEECH-THINKING ACTIVITY OF LINGUISTIC PERSONALITY.

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抽象。 本文以修辞格为重点，通过这种重要的言语交际质量（如表达力）来达到修辞理想的重要机制之一。 本文考虑了为有效的跨文化交流和修辞人物准备未来的专家的问题，这必须有针对性地并在系统的分类基础上引入到他的语音思考活动的日常实践中

关键字：修辞格，修辞格，言语思维活动，交际效果，交际，认知模型，语言人格。

Abstract. *The paper is devoted to the rhetorical figures one of the important mechanisms for achieving this speech ideal in terms of such an important communicative quality of speech as its expressiveness. The paper considers the issue of preparing a future specialist for the effective intercultural communication and rhetorical figures, which must be purposefully and on a systematic, classification basis introduced into the daily practice of his speech-thinking activity*

Keywords: *figure of speech, rhetorical figures, speech-thinking activity, communicative effect, communication, cognitive model, linguistic personality.*

The communicative effect of the act of the intercultural communication is directly determined by the ability of the language personality to optimal speech-thinking activity. According to the requirements of the rhetorical theory, effec-

tive speech is recognized as "expedient, influencing, harmonizing" [Mikhalskaya, 1996]. Rhetorical figures are the important mechanisms for achieving this speech ideal in terms of such an important communicative quality of speech as its expressiveness.

As V. N. Toporov notes, there is no exhaustively accurate and generally accepted definition of speech figures in linguistics. The term itself is used in various senses, most often approximate, but there is a tendency to attach this term and identify its linguistic meaning. This ambiguity is rooted both in the history of the term " figures of speech "(and, more broadly," figures"), and in the desire of linguistics to assimilate a concept that existed outside of its framework. The term "figure" is associated by ancient tradition with Anaximenes of Lampsacus (4th century BC). Figures were considered as the main object of the section of rhetoric dealing with "poetic" semantics, and were understood as means of changing the meaning, evading the norm. The connection with the language was characteristic of the entire ideological and cultural context in which the concept of figures emerged. Already representatives of the elite school of philosophy (6-5 centuries BC), who questioned the thesis about the natural and necessary connection between a name (word) and a thing, put forward the concept of conditionality of such a connection, which assumed the fundamental possibility of building its new forms, different from the existing ones, interpreted as stylistically neutral. Recognition of the possibility of different forms of verbal expression of the same content led to the idea of choosing stylistically marked forms and using them to convince the listener, guide his soul. Thus, the language itself has become a means of psychic influence on the listener through its own characteristics. It is not surprising that Gorgias (5th-4th centuries BC), whose name is associated with the birth of rhetoric, is, according to ancient sources, the "inventor" of verbal figures. The origin of the doctrine of figures of speech is Aristotle, who used the term "figure" in relation to the structure of speech. The definitions of figures were operational and therefore allowed them to be reformulated in a strictly linguistic sense. For Aristotle and his followers, figures of speech became the object of research for the first time. Thus, Theophrastus emphasized the contrast between practical and artistic speech and the number of elements that make speech majestic, along with the choice of words and their combination, as well as the figures that these combinations lead to [Toporov, 1990]. Next, we present two definitions from the dictionary of foreign sources in the publication "Theoretical poetics: concepts and definitions. Anthology for students of philological faculties / N. D. Tamarchenko (Moscow: RSHU, 1999):

The rhetorical figure (type of speech) is one of the typical means of language expression that uses the sound, semantic and emotional qualities of expressions and their combinations in order to achieve the desired impression. From an unlimited number of ways of expression within the framework of classical rhetoric and poetics, those that are recognized as more effective and recommended are marked and

repeated in speeches and literary works, they are divided into groups depending on the mechanism of formation and application, and they are given names. There are usually figures of thought that consist in changing the meanings and figurative use of expressions (tropes); verbal, in which the effect is achieved through appropriate sound comparisons of expressions; figures of passion, which convey and evoke emotions; grammatical, introducing changes to the usual syntactic structures, and so on. rhetorical turns. These distinctions are not very precise and the sections overlap, since the same shape can perform different functions simultaneously. The introduction of figures is also associated with the normative recommendations for the processing of speech and so on. common places, i.e. repeated decorations in its schemes and alternately used ways to enliven the style and convince, to move the reader. Although figures appear in all varieties of language and in everyday speech, they are of particular importance in a poetic style formed specifically for artistic purposes (Sierotwiski S. Słownik terminów literackich. S. 89-90).

Rhetorical figures – in style and rhetoric, all those forms of language material, deliberate and unintentional, deviate from the normal use of language or are consonant with it, but emphasize it with special purposes, which are aimed at increasing speech, accentuating individual parts or embellishing statements and-with the help of their differentiation, naming and special processing-are extracted by rhetoric from natural languages. behaviors and became stamped stencils of the expression of certain patterns of thought. Distinguish: 1. Verbal figures that relate either to the meaning of the word – as figurative and metaphorical tropes, to grammatical irregularities-as grammatical figures, to sound effects - as sound figures; or to the placement of words - as stylistic figures or sentence figures, and 2. Semantic or semantic figures that reflect the content, formation and division of thought without direct connection with the sound of the word and that are not affected by changes in the placement of words (Wilpert G. von. Sachwörterbuch der Literatur. S. 775).

Figures of speech as expressive " speech gestures "[Toporov, 1990, p. 542] are traditionally considered in the rhetorical section "Elokution". Along with the usual grammatical, stylistically neutral figures, they are included in the broader concept of "figures of speech". Thus, in terms of terminological differentiation, it should be emphasized that if in the broad sense the concept of a figure of speech includes both visual language means (tropes) and expressive (figures themselves), then when applied to the analysis of a specific language material, the term "figure of speech" is usually used in the second, narrow sense.

In the educational process, it is advisable to use the following traditional definition as a working tool for students: a figure of speech is a speech turnover, a special combination of words, a syntactic structure used to enhance the expressiveness of an utterance. In other words, these are special forms of syntactic constructions that enhance the impact of speech on the recipient.

The most well-known and frequent syntactic features are the antithesis-a figure of speech that represents an opposition ("I am the king – I am the slave, I am the worm – I am the God"). G. R. Derzhavin); anaphora-repetition of the initial word in each parallel element of speech ("I Swear by the first day of creation, I Swear by its last day..." M. Yu. Lermontov); epiphora – repetition of a word or sound combination at the end of several phrases; repeat (re-prize) - repetition of sounds, words or expressions in a certain sequence; antimetabola – repetition of the same words, but with changes in their syntactic functions and connections in the immediate context (eat to live, not live to eat).

In the course of teaching effective speech activity, students of Philology can be offered the following fairly convenient classification, according to which three groups of figures are distinguished:

- figures based on the ratio of word meanings: antithesis (a turn in which the meanings of words are sharply contrasted: "Where the table was food, there was a coffin" (G. Derzhavin), gradation (the location of words, in which each subsequent contains an increase or decrease of values: I do not regret, do not call, do not cry. (S. Yesenin), inversion (the location of words that violate the usual order: our Amazing people (I. Ehrenburg), ellipsis (omitting any implied member: Men are for axes (A. Tolstoy).

- figures based on the repetition of identical elements: anaphora (the repetition of identical words at the beginning of a sentence), epiphora (the repetition of separate words or turns at the end of a sentence), parallelism (the same syntactic construction of neighboring sentences), period (rhythmic construction, thought and intonation in which gradually grow, reach the top, the theme gets its resolution, and then reduces the intonation tension).

- figures based on the expression of rhetorical address to the reader or listener: address, question, exclamation [Vvedenskaya L. A., 2000].

Based on this classification, in the course of analyzing publicistic discourse, we called the figures of the first group, based on the ratio of the meanings of words – concepts in them (antithesis, gradation, inversion, ellipsis), semantical and syntactic.

Figures of the second group, based on the repetition of identical elements and having the property of facilitating listening, understanding and memorizing speech (repetition, anaphora, epiphora, parallelism, period), we qualified as syntactic and regulatory.

The figures of the third group, based on the expression of rhetorical address to the reader or listener, i.e. the techniques of dialogization of monologue speech that attract the attention of the recipient (appeal, rhetorical question, question-and-answer move, exclamation, etc.), we called communicative and dialogic.

In conclusion, we emphasize that in the course of preparing a future specialist for effective intercultural communication, rhetorical figures should be purposefully and on a systematic, classification basis introduced into the daily practice of their speech-thinking activities. This lingo-didactic process should be carried out in a coordinated manner, i.e. on the material of both native and foreign languages, accompanied by reflection of students-with the fixation of general and ethnospecific moments

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能源安全领域的信息战
INFORMATION WAR IN THE FIELD OF ENERGY SECURITY

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摘要本文揭示了信息战争的内容，即信息和信息流对民意的影响，从而取得了一定的成果。 作者认为，能源资源出口国和进口国能源安全的主要方面是不同的。 在这种情况下，媒体在能源安全领域的信息战中起着主导作用，并充当实现政治和经济目标，形成和建立必要的社会变革的手段。

关键词：信息战，能源安全，媒体，国家利益，竞争，油气资源，俄罗斯，美国。

Abstract. *The article reveals the content of the information war as an impact of information and information flows on public opinion in order to achieve certain results. The author argues that the main aspects of the energy security for exporters and importers countries of energy resources are different. In these conditions, the media play a leading role in the implementation of information wars in the field of energy security, and act as a means to achieve political and economic goals, to form and establish the necessary social change.*

Key words: *information wars, energy security, media, national interests, competition, hydrocarbon resources, Russia, USA.*

The information war is one of the innovations of the recent decades, the main concept of which - the "new" war with bloodless methods. In the course of this war, it is possible to obtain significant results, without attracting special attention, without destroying the manpower and infrastructure of the enemy to defeat without fighting.

The first person who used the term "information war" was an American expert Thomas Ron in a report he prepared for Boeing in 1976, entitled "Weapon Systems and the Information War". T. Rona argued that information infrastructure was becoming a key component of the American economy. At the same time, it has become a vulnerable target, both in wartime and in peacetime. This report can be considered the first mention of the term "information war".

Information impact has always existed. In ancient times, for example, myths were used as the first information attacks. So, the troops of Genghis Khan followed the stories of their incredible cruelty, which greatly undermined the morale of the opponents. The psychological attitude towards resistance, defense of the fatherland and victory was also supported by the corresponding ideology and education.

Information warfare is information management that can be open and secret in order to achieve certain results [1]. There is another definition of information warfare is nothing like explicit and implicit targeted information impact of systems on each other with the purpose of obtaining a certain gain in material field [2]. There is also a broader definition of information warfare as actions are taken to achieve information superiority by damage to information, processes, based on information systems of the enemy while protecting own information, processes, based on information and information systems [3]. The general definition for information warfare today does not exist but from all existing definitions it is possible to allocate a common feature: information warfare is any impact on the flow of information with the purpose of obtaining a predetermined benefit.

It is believed that the concept of information warfare in its modern sense was first used in “Desert Storm operation" conducted by the United States in 1991 against Iraq. the Concept used by the Americans, involved the violation of the decision cycle of the enemy and was based on five elements: psychological operations, electronic combat, deception and the physical destruction of command structures and communication lines of the enemy.

The concept of energy security was formulated after the oil crisis of 1973-1974 . The International energy Agency (IEA) and interprets it as "adequate supplies at reasonable price" According to the IEA, energy security in its entirety has three components:1) affordable and competitive supply; 2) reliable and stable supply; 3) easily accessible and available sources of supply [4].

In the Russian Federation the definition of energy security presented in the Energy Strategy of Russia for the period up to 2030 as "the state of security of the country, its citizens, society, state and economy from threats to reliable fuel and energy supply. These threats are determined by external (geopolitical, macroeconomic, market) factors and the condition and functioning of the energy sector of the country" [5]. It also indicates that energy security is a critical component of national security. Resource sufficiency determines the physical possibility of deficit-free energy supply of the national economy and the population, economic accessibility – profitability of such security at the respective prices, environmental and technological validity – the possibility of extraction, production and consumption of energy in existing at each stage of the technology and environmental constraints that determine the safety of operation of energy facilities" [5].

Since April of 2015 all articles on energy subjects in the foreign press were devoted to the antitrust case of the European Union against Russian state energy giant “Gazprom”.

In 2015, the European Commissioner for Competition Margrethe Vestager announced that the five member countries of the European Union (Bulgaria, Estonia, Latvia, Lithuania and Poland) Gazprom is carrying out unjustified the high pricing policy (gas prices in these countries are 40% higher than in other member countries of the European Union). Gazprom was also accused of conducting "cruel policy" in Czech Republic, Slovakia and Hungary [6]. It also highlighted the "unfair policy" of Gazprom concerning restrictions of free sale of gas between the European countries.

Almost every article on the subject pointed to the fact that “Gazprom” is a company owned by Moscow, and is a tool of Putin's policies in Europe. However, no one article has no references to the third energy package adopted by the European Union and aimed at liberalizing the European electricity and gas market. "It includes six legislative acts providing for restrictions for vertically integrated companies in the ownership and management of energy transportation networks from the outside. Thus, the European Commission is trying to divide the business of selling energy recourses and their transportation. According to the EC, this will increase competition, allow new players to enter the market and reduce energy prices ”[7]. The reasons for filing a European Union lawsuit against “Gazprom” are clear enough. For several years , the European Union has been trying to diversify its own imports and reduce its “dependence” on Russian gas. This intention is confirmed by the fact that the European Commission approved the creation of the Energy Union, which should ensure the energy security of the European Union. The main task of this agency is the diversification of energy resources: reducing imports (now the European Union imports about 53% of all energy resources consumed), developing new energy production technologies - the main emphasis is on the so-called clean and green fuel (which stands out as a positive thing for the goals of this agency).

The articles of the news Agency "Bloomberg" stressed that at the moment the European Union has no possibility of diversification of its gas supplies [8].

At the same time, Russia has the opportunity to diversify its own exports to the Asia-Pacific region, and to reduce its dependence on Europe. This was reaffirmed at the fourth summit of the Conference on Interaction and Confidence building measures in Asia (CICA), after which the press began actively discuss the contract between “Gazprom” and CNPC. Unfortunately, the text of the agreement was not represented by any of the Contracting party. If we consider the foreign press, the signing of this contract not covered.

The International Energy Agency has published a forecast on natural gas, according to which for China there is a "Golden age", while Europe can't refuse Russian supplies, despite the desire to do so in connection with the situation in Ukraine. Russian news traced the mass media opinion that this contract would negatively affect the relations between Russia and Europe and the United States.

At this stage you can see how the methods of information warfare are widely used in the foreign press. First, given the "clean and dry" information, consisting only of facts, then, there are the opinions of experts in this field. And in this case, a positive impact that professionals, as a rule, are Russian. All information regarding energy and related policies is given only to specific news agencies. From here it is possible to judge that any discussion of the topic is suppressed, or experts and news agencies do not see the point in discussing this topic (articles in the Russian press regarding the above issues between the EU and Russia is three times less than in foreign press).

Information warfare in the field of energy security are mainly based on economic aspects associated with the desire of key players to establish control over the most a large number of markets. On the other hand, the purpose of these wars is to prevent the enemy to do the same. The most aggressive position in the information war for the capture of the European market are taking the US media which, being formally independent and objective, actively pushing the position to limiting the influence of Russian companies in the energy market of the EU.

At the same time in the Asia-Pacific region's energy companies of the Russian Federation, by contrast, moved to the active expansion of its market. The success of Russian companies in China are positioned in Russian press as the tremendous achievements of the Russian Federation, which in turn is the inner element of information warfare aimed at maintaining the current government.

Thus, in the present economic and political aspects of information warfare in the field of energy security is actually integrated into a single entity that can be described as national security and national interests, both on domestic and global levels

Information war in its conceptual development has largely expanded its "theater of war", spreading from the level of actual support to the real local conflicts om inter-state level to the levels of politics, business and even individuals. Now information warfare has become a tool that is used in almost all spheres of human activity and interaction.

Analysis of the tactics and methods of information warfare shows that much more attention is paid to information and psychological operations whose primary purpose is the impact on the public mental consciousness to disorient society of the state of the enemy, the destruction of existing patterns of behavior (stereotypes) and imposing preferred settings.

We have been witnessing the birth of a new powerful “information-energy” weapon, which has already been successfully used in the geopolitical confrontation on the fronts of the info war.

The information and energy wars are directly related to the industrial development processes of any society. Energy today is a determining factor in the existence of states, peoples and civilizations. Not only the financial well-being, but also political stability in the country depends on the planned and stable production and supply of energy. Anyone who controls energy and can exclusively control it receives powerful levers of political influence.

The understanding of the essence of energy wars is embedded in the political economy of the state and is directly related to the extraction and supply of all types of energy carriers, as well as control over the main deposits of major fossil sources, such as gas and oil. Today, the issue of having direct access to energy resources leads to real military conflicts, since oil and gas are still fundamental resources for the economies of developed countries.

Information and energy conflicts are accompanied by stuffing information about certain actions taken by the parties to the conflict. Information and psychological operations found their application in mass media. Media is widely used at the state level and at the level of private lobbyists for the formation of the "right" opinions on the domestic and international levels.

In the field of energy security, information wars have intensified in recent years, the most active phase of which takes place precisely in mass media. In fact, the media are used in this area as a means of combating competing states on energy exports (for example, against transport and pipeline projects with “Gazprom” participation - “Nord Stream 2”, “Turkish Stream”), and also as a means of lobbying the interests of importers and transit countries. Energy prices, as well as stock indicators of energy companies, have become quite susceptible in recent years as an information tool.

The comparative analysis of foreign and domestic media shows that foreign media have a stronger influence and more actively use information warfare methods. Ultimately, the goal of informational impact is to form the right opinion on a certain problem. The foreign media are global players by their universal worldwide recognition and authority. Domestic media, forming an opinion within the country, are actually engaged in information protection. Thus, we can conclude that the media play a leading role in the implementation of information wars in the field of energy security.

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适应性瑜伽课对自闭症谱系障碍儿童心身特征的影响
THE EFFECT OF ADAPTIVE YOGA CLASSES ON THE PSYCHOSOMATIC CHARACTERISTICS OF CHILDREN WITH AUTISM SPECTRUM DISORDER

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注解。 文章考虑了适应性瑜伽课程对自闭症谱系障碍青少年儿童神经代谢水平和神经系统适应性反应的影响。 自适应瑜伽练习的目标是帮助处于任何初始状态的孩子获得最大可能和完整的发育。 定期练习瑜伽对有特殊需要的儿童的心身状态有有益的影响。 在实践中，重点主要放在大脑半球和半球之间的连接的发展，注意力的集中，运动协调和人体感觉的发展。

关键词：适应性瑜伽，矫正，自闭症谱系障碍，青少年儿童，神经代谢，自闭症谱系障碍儿童的适应能力。

Annotation. *the article considers the influence of adaptive yoga course on the level of neurometabolism and adaptive reactions of the nervous system of adolescent children with autism spectrum disorder. The goal of adaptive yoga practice is to help the child in any initial state achieve the maximum possible and complete development. Regular practice of yoga has a beneficial effect on the psychosomatic state of children with special needs. The main emphasis in practice is placed on the development of cerebral hemispheres and interhemispheric connections, concentration of attention, development of coordination of movement and feeling of one's body.*

Keywords: *adaptive yoga, correction, autism spectrum disorder, adolescent children, neurometabolism, adaptive capabilities of children with autism spectrum disorder.*

Autism spectrum disorder (ASD) is a complex disorder that includes a number of cognitive, behavioral, and sensory problems. In addition, disorders of the autonomic nervous system, digestion, and metabolic processes are often characteristic

of people with ASD. However, the features of metabolic processes and adaptive reactions of the brain of adolescent children with autism spectrum disorder are still poorly understood. It is known that yoga favorably affects the psycho-emotional background, helps to improve self-regulation and behavior in children with cognitive impairment.

Adaptive neuroyoga is an effective and at the same time quite simple method of rehabilitation of children with developmental disorders. This technique allows not only to significantly improve the physical and mental state of children with autism spectrum disorder, but also to see the potential of their body, hidden behind numerous diagnoses. Yoga is a practice consisting of physical and breathing exercises that help "unite" the body and mind. Adaptive yoga is based on the principles of classical yoga [1]. The sequence of exercises is made according to the needs of the child at this particular moment.

Therapeutic yoga contributes to the development of sensory integration skills. Yoga poses affect the joints and muscles around the joints, as well as the vestibular apparatus. Natural stimulation during exercise and twisting can alert and calm the nervous system of a child with sensory disorder [2]. A correctly selected sequence of asanas provides vestibular stimulation in different positions of the body (in inverted poses, lateral sprains, sitting, lying, etc.). Twisting the back and leaning forward improve the quality of movement, while at the same time stimulating spinal stretching.

Adaptive yoga is kinesthetic and tactile - it is doubly useful. Deep stimulation, pressure with strengthening postures can help rid the nervous system of its constant excessive stimulation.

Yoga therapy includes many approaches to each part of the body, all physical systems are stimulated. Compliance with the sequence of yoga therapy guarantees complete stimulation of the whole body [3].

The purpose of adaptive yoga classes is to relax the nervous system, correct and develop the existing psychophysical and sensorimotor spheres of children, optimize mental development by selecting an individual program and creating optimal conditions for the development of motor activity, taking into account age, physique, and individual characteristics.

Adaptive Yoga helps:

- development of joint mobility;
- improving the elasticity of tendons and muscles;
- relieve tension in the muscles;
- improving the sensation of one's own body, its perception and self-awareness in space;
- improving blood supply to the brain, memory;
- normalization of digestion;

- relaxation of the nervous system;
- normalization of sleep;
- reduction of anxiety and depressive states;
- improving concentration and control of emotions;
- improving the general condition of the body.

In this regard, **the aim of our study** was to determine the level of neurometabolism and adaptive reactions of the nervous system in adolescent children with ASD on physical activity, as well as the effect of the adaptive yoga course on these indicators.

Methods. In the study, with the consent of the parents, took part 10 teenage children with an autism spectrum disorder: 5 boys and 5 girls aged 11-15. The background level of stable potential was recorded in 5 standard EEG leads (Fz, Cz, Oz, Td, Ts). After 5 minutes, a breathing test was performed (diaphragmatic breathing for 3 minutes), the procedure was repeated after a course of 10 yoga classes.

Children with autism have a well-developed visual ability to perceive the environment. The neuro-yoga trainer first demonstrated each exercise himself, and also showed children with ASD a card with the image of this exercise. At the beginning of the lesson, an emotional connection was created between the children and the trainer, then physical and breathing exercises were introduced gradually, which helped the children get out of their “shell”.

The results of the study. In all examined adolescent children with autism spectrum disorder, were detected metabolic disturbances in the cerebral cortex: a diffuse increase in stable potentials in comparison with standard values by 1.5-2 times. Significant differences ($p < 0.001$) with the norm were observed in the frontal, central and occipital zone, which indicates chronic hypoxia of brain tissue. On the respiratory load in most of the subjects, the indicators changed on average by 35% towards normal. After a course of yoga, all children showed improvement in behavior, emotional self-control and motor functions. According to re-registration, the values of stable potentials in the frontal and central zone in 8 out of 10 children were within normal values, which confirms the positive effect on metabolic processes in the brain.

Findings. Improvement of neurometabolism after short-term breathing exercises and yoga shows that their use in the correction process favorably affects not only behavioral manifestations, but also the general level of brain activity, increasing the adaptive capabilities of teenage children with autism spectrum disorder.

Neuroyoga helps these children easier to find a common language with people. A set of physical and breathing exercises, as well as deep relaxation exercises strengthen the nervous system, improve the general condition and develop body perception and concentration. As a result, the overall quality of life of children and their parents increases.

Thus, yoga improves many areas of a child with an autism spectrum disorder. As a rule, social skills are an area in which progress is observed. The ability to respect oneself is the basis for respect for others. The ability to move, listen, observe changes in the body, as well as kindness and reciprocity during yoga, also contribute to the successful social interaction of these children.

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二十一世纪初俄中科技创新合作的主要方向
THE MAIN DIRECTIONS OF RUSSIAN-CHINESE SCIENTIFIC AND INNOVATIVE COOPERATION AT THE BEGINNING OF THE XXI CENTURY

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注解。 科学技术合作仍然是俄中关系整体中最重要的要素之一。 本文考虑了国家创新和科学互动的主要方向，确定了国家的前景。 作者指出，发达的双边关系法律框架使我们寄希望于更加有效的合作，并得出结论，俄中之间的这一互动领域将对两国的经济发展产生重大影响，增加中俄两国的竞争力。 俄罗斯产品销往世界市场，并提高了人们的生活质量和生活水平。

关键词：科学合作，俄罗斯，中国，创新政策，技术园区。

Annotation. *scientific and technical cooperation remains one of the most important elements of the entire complex of relations between Russia and China. The article considers the main directions of innovative and scientific interaction of States, defines their prospects. The author notes that the developed legal framework of bilateral relations allows us to hope for even more effective cooperation and concludes that this sphere of interaction between Russia and China will have a significant impact on the economic development of both countries, increase the competitiveness of Chinese and Russian products on world markets, and improve the quality and standard of living of the population.*

Keywords: *scientific cooperation, Russia, China, innovation policy, technology parks.*

Currently, international scientific, technical and innovative cooperation is the basis of the world economy. General Secretary of the Chinese Communist party stressed the importance of scientific, technical and innovative cooperation with Russia, noting that it is a decisive factor in the final victory over the international financial crisis, contributes to the globalization of the economy, and allows us to achieve lasting peace and prosperity for all.[1]

[1]Gusevskaya N. Y. Prospects for internationalization of higher education: experience of universities in Asia, Europe, and North America // Baltic humanitarian journal. 2015. № 3. P. 39..

By the beginning of the XXI century, a new trend has emerged in the creation of Russian-Chinese centers and technoparks, which should become the main points of implementation of the results of high-tech and innovative research into production. Thus, in 2005, the Center for the study and development of science and technology was opened.it was created by the Shenyang industrial Institute, on the Russian side - Tomsk Polytechnic University and the Siberian branch of the Russian Academy of Sciences. The main task of the Center is development in the field of space and aviation technologies, bioengineering and energy.[2]

One of the priority scientific and technical areas of cooperation between Russia and China is the aircraft industry. Both sides actively cooperate in the framework of joint projects. So in 2004, the Russian side took part in an air show in Zhuhai, during which a meeting of the Commission on scientific and technical cooperation was held. At that time, Rosaviakosmos proposals to deepen cooperation between Russia and China in the development of aviation technology, conduct joint fundamental research, and produce onboard integrated REO systems and civil aircraft and helicopters were considered. Later, the Association of technical universities of Russia and China was created, which included 15 universities from each side. On our side, it is headed by the Moscow state technical University. Bauman (MSTU), and its rector A. Alexandrov was elected co-Chairman of the Association.

The main task of the Association is to unite the efforts of elite technical universities of the Russian Federation and China in training highly qualified personnel for the innovative economy, to promote academic exchange of students and teachers, and to develop scientific and technical cooperation between Russia and China.[3]

The most important achievement of cooperation at the moment is the signing of a Memorandum of cooperation in the implementation of the project for the construction of high-tech parks "silk road "in October 2014.it was decided to build two parks: on The territory of the SKOLKOVO innovation center in Moscow and in Shaanxi province. Construction of the Chinese facility, called "Zhongxing shenlan", started in 2016. Leading specialists from Russia and China will jointly implement projects on the development of information and communication technologies, robotics, and start-up incubators.

In accordance with the agreements, it is planned that Russia will allocate equipment and technology as its share, while China will allocate funds for joint development and production. Cooperation between our countries in the field of high technologies was confirmed at the seventh international innovation forum "Pujiang", which was held on October 25-26, 2014 in Shanghai (China). Therefore, it is not surprising that by now Russia and China are implementing joint projects in

[2]Larin V. L. Russian-Chinese relations in regional dimensions in the 80th years of the XX century-the beginning of the XXI century. – M., 2005. P. 227.

[3]Syryamkin V. I., Vaganova E. V., Yani B. Overview of Russian-Chinese cooperation in the field of scientific, technical and innovative activities // innovative Russia. - 2011. - №6 (152). — P. 24.

more than 40 areas, the total amount of investment in which exceeds 20 billion dollars.[4] More than 70 joint projects of fundamental and applied research are under implementation: geological exploration in both Russia and China, research in the field of optics, Metalworking, hydraulics, aerodynamics, solid fuel cells.

Industrial and medical lasers, computer technologies, energy (including nuclear, wind, solar, etc.), ecology, Geochemistry, catalytic processes, etc. are also priorities in the field of scientific cooperation.

The innovative development of our countries requires long-term programs, large financial expenditures, training and attracting highly qualified specialists in various fields of knowledge, and creating the necessary infrastructure. This is especially important when implementing expensive and large-scale projects related to aviation and space, such as the GLONASS and Beidou space systems».[5]

Thus, it is necessary to consider that the innovation system is a process contributing to the development not only of economy and science, it covers areas of state-building, education, culture, where an important role is played by the international scientific and technical cooperation, and regional integration.

One of the most important areas of cooperation in the field of science is the development and production of scientific equipment and high-tech products by RAS institutes commissioned by Chinese organizations. Thus, SB RAS institutes supply industrial accelerators and devices for high-energy physics, equipment for cold gas-dynamic deposition of powder materials, unique high-voltage equipment, installations for hardening metal surfaces, and equipment for thermal power plants to China.

Another promising area of scientific cooperation between Russia and China is the Chinese-Russian technology parks in the Chinese cities of Harbin (Heilongjiang province), Changchun (Jilin province), and Yantai (Shandong province). For example, the centers for scientific and technical cooperation in Shandong and Heilongjiang provinces are planning to produce civil and military aircraft, military equipment, space aircraft, gas turbines and other large-scale civil equipment using advanced Russian innovations.

With Russian participation, the first stage of the Tianwan nuclear power plant was built, which is recognized as the safest in China. Since 2011, China has been operating an experimental fast neutron reactor, which was prepared with the help of Russian specialists. Thus, China became the fourth country in the world, after Russia, Japan and France, with such technology.

[4]Russia and China are expanding cooperation in the high-tech sector. (Electronic resource). Mode of access: http://www. rg.ru/2014/09/23/sotrudnichestvo.html

[5]Russia and China have agreed on the mutual operation of GLONASS and Beidou satellite navigation systems. Electronic resource. Access mode: http://space-team.com/ pressa/detail/glonass_i_beidou_transgranichnyy_proekt/.

Moreover, the Chinese-Russian Technopark in Changchun is a kind of cultural transfer of high knowledge and technology from Russia to China. To date, complex incubators have already been built, two standard plants, the "Chinese-Russian joint laboratory of fungi", "Chinese-Russian joint laboratory of rare earth functional materials", "Chinese-Russian joint laboratory of clean energy and related technologies" and three joint international laboratories, two foreign technology transfer centers have been built.

In the state scientific and technical Park in Changchun, it is planned to introduce Russian technologies of RAS institutes into mass production. Among the joint projects proposed for implementation are the development of new compositions of pigments for coloring plastics and polymers and the creation of a joint technology for their production, the development and creation of fiber-optic laser systems for technological use, etc. Currently, there are several Russian-Chinese technology parks operating in China - in the cities of Harbin, Yantai and Changchun. It should be noted that on the territory of the Yantai Technopark, there is also a Russian-Chinese base for the industrial use of scientific developments, the purpose of which is to promote innovative products to the Chinese market.

One of the most important events in the field of scientific, technical and innovative cooperation between Russia and China this year was the IV Russian-Chinese EXPO "Russia and China: new growth points of trade and economic cooperation, development of innovations", which was held in Harbin from June 15 to 19, 2017.[6] Both the Chinese and Russian sides have high hopes for the future of EXPO. It should be noted that a similar event held in Yekaterinburg in 2016 attracted more than 250 companies, over 45 thousand visitors, and the total amount for which contracts were signed was 54 billion rubles.[7]

At the same time, Russia and China are stepping up their scientific cooperation on Arctic issues. On August 19, 2016, the first joint Russian-Chinese Arctic expedition was completed, during which Chinese scientists entered the Russian exclusive economic zone in the Arctic ocean for the first time, which was a breakthrough in joint research by scientists of the two countries in the polar region.

In December 2016, Saint Petersburg state Maritime technical University and the Chinese shipbuilding research center signed an agreement to jointly develop new Arctic ocean research technologies, ice load modeling, and ship strength analysis.

[6]IV Russian-Chinese EXPO [Electronic resource]. Mode of access: http://www.china-rus-expo.ru/ru/

[7]Pavlova V. S. Problems and prospects of international advertising as an intercultural communication // Russia-China: development of regional cooperation in the XXI century: materials of the XIII international conference. scientific-practical Conf. Chita: Zabgu, 2015. P. 145.

Despite the significant intensification of Russian-Chinese scientific and technical cooperation in the Arctic in recent years, there are also difficulties and contradictions in the interaction between the two countries. Projects to develop the Arctic involve a long development cycle and require large-scale investments, but the dividends from them are unstable and unpredictable. In this regard, priority projects in the region are implemented by state-owned enterprises of the two countries or by experienced Russian private companies. In this regard, the partnership between the two countries in the region, with the exception of the Yamal LNG project, is often called fruitless in the media.

Artificial intelligence (AI) may become an important area of scientific and technological partnership between Russia and China in the coming years. AI today is one of the absolute priorities of China's technological development. In June 2016, the state Council of China adopted an ambitious plan for the development of this sphere, designed to make China a leader in a new and fast-growing sector of the economy by 2030. At the same time, Beijing already has a serious groundwork. According To the Association for the development of artificial intelligence, in 2016 China accounted for 23% of the total number of scientific articles published in the world on the relevant topic, while the United States accounted for 34% (in 2012, the ratio was 10% against 41% in favor of the United States) 143. In at least one area of AI — deep learning — the Chinese surpassed the Americans in the number of published scientific articles back in 2013. on July 8, 2016, the state Council of the people's Republic of China published a statement of approval in June 2016. A plan for the development of a new generation of artificial intelligence. The plan is a strategy for developing artificial intelligence technologies and industries. The document, which establishes the division into three stages (until 2020, 2025 and 2030), aims to win China's global leadership in the field of AI and achieve the position of the world's main center for the development of AI-based industries. At the end of 2017, a plan for the first three years (2018-2020) was published, defining actions at the initial stage.[8]

It is expected to achieve ambitious goals by using the "advantages of socialism with Chinese characteristics", namely, by significantly concentrating the country's financial, technical and human resources on priority tasks. As in other similar scientific and technical programs of the PRC, special emphasis is placed on military-civil integration, technology exchange between economic sectors, as well as rapid commercialization of the results obtained.

For the execution of the Plan involved 15 state government departments and agencies, including the Ministry of science and technology, State Committee for development and reform, Ministry of education, Ministry of industry and Informa-

[8]China has unveiled an action plan to boost the development of the artificial intelligence industry // Xinhua. (Electronic resource). Mode of access: https://www.russian.people.com.cn/n3/2017/1215/c31517-9305144.html

tization, Academy of Sciences, Academy of engineering Sciences, Scientific and technical Committee of the Central military Commission, Chinese Association of science and technology and others.

By 2025, it is expected to reach the leading positions in the world in at least some areas of AI with the volume of production of the corresponding industries of 400 billion yuan, and related — 5 trillion yuan. By 2030, China should become the main center for the development of artificial technologies in the world, acquire a leading position in all areas of development of relevant technologies and have an AI industry with a production volume of 1 trillion yuan, and in related industries — 10 trillion yuan.

The most important features of the national plan are:

- Focus on technological leadership: it is intended to analyze in depth the trends of AI development in the world and achieve rapid results by concentrating huge resources on a limited number of priority areas to achieve a breakthrough;

- Systematic approach: in implementing the Plan, considerable attention will be paid to ensuring a close relationship between institutions of fundamental science, as well as companies and institutions working in the field of applied science and production, taking into account the characteristics of various enterprises involved in the work on AI;

- Market support: special attention will be paid to commercializing the scientific and technical results obtained, as well as attracting commercial companies, including private companies, to implement the plan;

- Openness and exchange of technologies between industries and enterprises of various forms of ownership.

In General, the Chinese leadership relies on achieving leadership in the field of AI, hoping that in this way the state will be able to turn the industry into one of the engines of economic growth in an environment where traditional factors of competitiveness of Chinese industry, such as low labor costs, are close to exhaustion.

In 2016 Russia also announced its intention to step up efforts in the field of AI technology development. In September 2017, Vladimir Putin said that whoever achieves leadership in the field of AI will become the "ruler of the world", noting that Moscow will make efforts to progress in this area.[9]

It is not yet known about the existence of a large-scale national AI development program in Russia, similar to the Chinese one. At the same time, AI has long been one of the priorities of the Russian Foundation for advanced research — a state-owned structure designed to Finance promising research and development in areas related to national defense and security.[10]

[9]Putin: the leader in creating artificial intelligence will become the ruler of the world / / TASS. 01.09.2017. (Electronic resource). Mode of access: https://www.tass.ru/obschestvo/4524746

[10]Foundation for advanced research. Directions. (Electronic resource). Mode of access: https://www.fpi.gov.ru/about/areas

The synchronous interest of the two countries in the development of this promising area of technology is largely related to their interest in preventing lagging behind the United States, where the long-term vision for the development of AI technologies was published back in 2016. At the same time, if the US relies on a wide network of technology partners, including Japan, EU countries and other States, then Russian and Chinese efforts may become more isolated amid deteriorating relations with the US and increasing restrictions on technology transfer. In this regard, AI can be a promising area of Russian-Chinese partnership.

However, there are also some problems that significantly hinder the development of scientific and innovative cooperation between Russia and China. Among them we note the following:

1) due to the fact that a number of projects invested by the Chinese side affect the development and transportation of natural resources, there are growing fears among Russian representatives that the role of a raw material appendage is being imposed on Russia. The latest striking example is the negative reaction of the Russian public to the construction of a plant for the production of drinking water on lake Baikal with the participation of Chinese investments. Despite the results of the research (summary: the creation of a plant for the production of drinking water will not have any negative impact on the ecosystem of lake Baikal), an impressive amount of investment (more than 16 billion dollars), as well as the creation of several hundred jobs for Russian citizens, irrational fears of the Russian public prevailed over common sense;

2) the problem of importing equipment from Russia that was not created for military purposes.

Despite the interest of China, Russian enterprises are mostly negative about this, mostly due to fears of loss of technology, as well as low awareness of the needs of companies from China.

These problems can be solved by developing a joint dialogue, involving experts and professional consultants, and providing adequate information to the General public. As a result, scientific and innovative cooperation between Russia and China will have a significant impact on the economic development of both countries, increase the competitiveness of Chinese and Russian products on world markets, and improve the quality and standard of living of the population. In addition to creating joint hi-tech parks, it is also necessary to conduct other events based on the principles of openness, mutually beneficial cooperation, efficiency and flexibility.

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苏联风格的绘画
THE SOVIET PAINTING OF «SERVERE STYLE»

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抽象。在过去30年中，从赫鲁晓夫的“解冻”到后苏联的“衰落”，对苏联美术中艰难的文化和艺术现象的判断已经走了很长一段路。研究人员提出了极端的观点，从通俗地确定六十年代苏联艺术的普遍现象到通过在七十年代通过具体工作固定其艺术价值，并在八十年代末至九十年代结束激烈的争论，提出了极端的观点。 。在1980–90–x年间，有相当多的出版物将“严重风格”现象视为“显微镜下的”现象，显然，与前十年相比，它对苏联艺术的这种现象进行了深入而认真的分析。在涵盖创造力的“严重”时期，对70年代的男性进行了有趣的搜索。对二十世纪苏联美术60–70–x的持久兴趣目前是文化范式变化的自然结果，并且在现代美术的多样性和多样性面前表现出混乱。因此，首先，“严峻风格”的思想和艺术计划必须成为从早期的宣传形式发展到宗教哲学的运动载体，以判断未来几十年的生活问题。认真的艺术批评研究。

关键词：苏联艺术，社会主义现实主义，严肃的作风，六十年代的男人，肖像画，浪漫主义

Abstract. Judgment of the difficult cultural and art phenomena of the Soviet fine arts from Khruschev's "thaw" to Post-Soviet "decadence" went a long way for the last 30 years. Researchers stated extreme views, from banal ascertaining of the single phenomenon in the general context of the Soviet art of the sixtieth years, by fixing of its art value through concrete works in the seventieth and, finishing

hot polemic in the late eighties - the ninetieth years. Quite considerable number of publications 1980 - 90 - x years in which the phenomenon of "severe style" is considered "under a microscope", obviously speaks about the deep and serious analysis of this phenomenon of the Soviet art in comparison with the previous decade of interesting searches of men of the seventies, for the period of "severe" which covered creativity. Persistent interest in the Soviet fine arts 60 – 70 - x for of the XX century is presently a natural consequence of change of cultural paradigms and shows confusion before diversity and diversity of the modern fine arts. Therefore, first of all, the ideological and art programs of "severe style" setting a vector of the movement from a publicistic expression in its early period to religious philosophically art judgment of problems of life in the next decades have to become a subject of a serious art criticism research.

Keywords: *soviet art, socialist realism, severe style, men of the sixties, iconography, romanticism*

Introduction

In particular, to the fine arts of the Soviet period, very many publications, both in the second half of the XX century, and during the late Post-Soviet period are devoted to the great Soviet culture of the 20th century. The era of socialist enthusiasm of "a storm and an impact" attracted and involves to itself many art critics with brightness power, passionarity of the proceeding cultural and art processes defining new quality of the Soviet bytiyny space. Post-war development of the Soviet (Russian) culture, in particular painting, had rough splash and laid the foundation of further cultural growth of our country. Heritage, baggage of this period the USSR and Post-Soviet Russia lived and lives all next decades. Judgment of the difficult cultural and art phenomena proceeding in development of the Soviet fine arts from Khruschev's "thaw" to Post-Soviet "decadence" went a long way for the last decades. Researchers stated very extreme views, from banal ascertaining of the single phenomenon in the general context of the Soviet art of the sixtieth years, by fixing of its art value through concrete works in the seventieth and, finishing hot polemic in the late eighties - the ninetieth years. Quite considerable number of publications 1980 - 90 - x years in which the phenomenon of "severe style" is considered "under a microscope", obviously speaks about the deep and serious analysis of this phenomenon of the Soviet art in comparison with the previous decade of interesting searches of men of the seventies, for the period of "severe" which covered creativity. The new surge in great interest in the Soviet heritage in graphic creativity 60 – 70 - x of the XX century during our postmodern period obviously demonstrates the serious crisis which arose owing to change of cultural paradigms which shows lostness of society before loudly "shouting" diversity of modern graphic language and art. [1.]

Research objective

Today need of identification of ideological and art reference points of the creative positions of "severe" artists which had an impact on addition becomes more and more relevant. This relevance is caused, first of all, by critical accent which was present earlier at a research of domestic culture of the XX century where the main emphasis was placed on insufficiently studied or very contradictory problems. Though, gradually there is a positive trend of more objective, "out of political" judgments of many already known processes. Proceeding from the aforesaid, special importance is gained by use of the system approach synthesizing together achievements of early domestic art of 1910 - the 1930th and all world cultural and art fund. Original synthetic creative thinking of representatives of "severe style" managed to transform harmoniously art practicians of various traditional styles and the directions which were divided centuries from each other. Many artworks of masters of "severe style" bear in themselves not only some peculiar features of author's originality. Often they create own cultural and art space filled with original innovative experiments. In our opinion, "severe" as if would stretch ropes with which pulled together practice of pre-revolutionary and post-revolutionary art of the 20th century and heritage of Old Russian and European creativity of old masters. For this reason, it is necessary to study attentively rich cultural and art heritage of the late Soviet period (especially 60 – 70 - x of the 20th century), having separated, so to speak, "grains from a ryegrass", selecting everything the most valuable to preservation of general historical cultural space of a uniform Russian civilization.

Results of a research and their discussion

The Soviet art creativity of the 60-80th years, including, generated the strong, outstanding works relating to so-called "severe style". The art phenomenon of masters of "severe style" personified the most interesting cultural and religious movement of the Soviet fine arts of the second half of the 20th century which marked the beginning of new development of domestic painting and had significant effect on its further development. For the fiftieth anniversary at assessment of "severe style" as any large art phenomenon, various judgments express. At the end of August, 1956 the Russian artist V.A. Serov published the program article in which especially allocated national roots of the Russian and Soviet art in the Pravda newspaper. Article made deafening success, at least on the fact that loud polemic on pages of various newspapers and magazines/, in the course which, a number of art critics, painters and writers even accused Serov of "a chernosotenstvo and anti-Semitism" was its result. Nevertheless it was the attempt of reconsideration of estimated categories of the pre-Soviet and Soviet period of development of domestic culture. In many respects, exactly this stremeleniye also generated the unique phenomenon of "severe" style in the USSR. This direction gave rise earlier

and generates the mass of contradictory opinions today. At the same time, fixed attention enthusiastic recognition of its special role in the history of the Soviet art - denial or underestimation of its importance was replaced by oblivion, and. Today the next round of interest concerning painting of "severe style" during which articles and monographs are written is noted, catalogs of works are published, and cloths are exhibited at structure of the largest exhibitions and at Russia and around the world. Especially It should be noted the interest shown by the famous private collectors and auction houses to painting of masters of "severe style" that emphasizes once again timeless a continuum of this genre. As designers (architects-artists), we can draw a rough analogy: severe style in painting, it is kind of modernism (not to confuse with a modernist style) in design and architecture. Vulgar simplification should be considered that the severe style, having left socialist realism, became its logical continuation. By no means, the severe style is turned to Deyneki's creativity antagonistic to both vanguard and a formalism more likely. In this sense the severe style should be considered original Russian painting, originally the "secular iconography" though which fell on the Soviet period. Speaking about execution, we would allocate the following receptions in this style: dabs are large, but at the same time the having clear boundary, because many works remind a panel, monumental painting. Original painting "severe" most often monochrome, a palette of works is intentionally limited, in works quite often use three - four primary colors. Special "rublennost" of forms is inherent in style, and even the easy floating clouds in pictures have concrete outlines and can remind geometrical objects. Compositions of pictures, as a rule, intentionally gruzna, kind of, "ordinary", and silhouettes deliberately angular, as if executed from a stone. To put it briefly, severe style - masterly executed "rough" professional painting. The severe style formally comes to an end approximately in the late seventies (having given an impetus to the subsequent artists), however its influence is big even today. It is worth looking at Yu.I. Bosko, N.P. Eryshev, E.A. Kazantsev, P.P. Kozorezenko, N.N. Krapivin, V.F. Samarin's works to be convinced that the severe style became the special Russian picturesque direction. The first shy attempts to somehow define new art the direction arisen in painting of the 1960th years were made in parallel with the birth of this movement. So it was bright and unexpected. However, even before emergence of the first large "proto-severe" works, in the art criticism environment and in periodicals the issue of modern style of the Soviet painting was very violently discussed. The discussion lifted by the art critic of H.A. In 1958 [2., page 190] found Dmitriyeva the continuation during the round table organized by the Tvorchestvo magazine. This heated debate was directed to understanding of the processes happening in the late fifties in art of the USSR. Discussion revealed a number of formal criteria of modern style which distinctive features considered lapidarity, monumental generality, a picturesque grafichnost

and an expression of an art form. These quite exact trends shown in painting of the younger generation of artists were called by Alexander Kamensky terms: "severity", "courageous simplicity", "severe truth". [3.] Definitions were at once picked up by art criticism and began to appear in various publications. Finally the phrase "severe style" was practically fixed in terminology of art critics at once after issue of Article A. Kamensk "Reality of the metaphor" published in the Tvorchestvo magazine for 1969. [4] It should be noted that the term "severe style", as well as any term in the history of arts, it is necessary to understand very conditionally as it covers too wide range of names and quite considerable historical piece. There was this term, most likely, on a wave of penetration into the sphere of art criticism of fashion for lessons of the French "formal school" in philosophy and an esthetics, for representatives which the category of style already was fundamental. For example, the world history of art seriously was understood by representatives "formal school" as history of styles. A.M. The cantor quite fairly noted the fact that the term "severe style" initially was given too "broad sense" owing to what began to call this term practically any art of 1950 - the 1960th years which though in something differed from the established formal "canons" of socialist realism. "It is clear that in this case it is impossible to speak about any uniform style, and the Soviet art, having hardly left from under guardianship, began to break into at once numerous streamlets" [5.], - the Cantor notes. Art critic of B.C. Manin also emphasizes, ambiguity and vagueness of outlines of "severe style" as the defining criteria of the "new" direction. "Certain masters left aside, but neither the right step, nor a left step led to death of all direction... it is also difficult to establish chronological limits of "severe style" which some representatives remained are faithful to themselves until the end of the 20th century, and others changed creative addictions", [6., page 10] - V.S. Manin writes. From here it is necessary to assume that "the severe style" is the certain certain "system of coordinates" describing esthetic, moral and style features of art phenomena. In other words, characteristic "severe" can express the certain semantic intonation arising from the aspiration to oppose naive and cheerful art of socialist realism and "special art" of young artists of an era of "thaw". To speak about "severe style" in its finished form (as about a concept) it is very problematic as in this art direction masters very diverse on the style preferences coexisted. Especially, according to authoritative opinion of B.R. Vipper one of essential signs of addition of new art style, disclosure of new style in different types of art always acts. And first of all, B.R. Vipper - in architecture considered: "when signs of style appear in architecture, it means that the style is formed". [7., page 12] In other cases, Vipper considered, it is possible to speak rather only about formation of the direction or certain general stylistic trends of this period of time. Proceeding from the aforesaid "the severe style" can be understood doubly, as in its narrow semantic value (mainly Moscow school), and in

wide, including similar art manifestations in other regions and the Soviet republics. The scientific and popular scientific literature devoted to severe style published at a boundary of the 1990th - the 2000th years, dazzles with a variety, though includes serious researches. So on pages of the Tvorchestvo magazines [8.], "Art" [9.], "Decorative art", "Artist" - the questions connected with consideration of characteristics of the direction and definition of sign works were designated. [8.] In parallel with the critical works devoted to "severe style" appear as well the generalizing scientific research which is basic when studying dynamics of all direction in general. Approximately in the 1980th years when there was a certain historical distance, became possible to generalize the saved-up graphic material. A.A. Kamensky in the book "Romantic Installation" (1989) analyzes historical conditions, ideological and graphic features, the evolution which happened in creativity "severe" for 1950 - the 1970th [10., page 190] Kamensk also especially focuses attention on the underestimated aspects of "severe style", in particular on aspiration to metaphoricalness and width which the criticism did not notice even in "rather favorable responses". [10.] The serious and sound analysis of painting of "severe style" can be found in A.I. Morozov's works of the 1980th years. One of such important works book "Generations of young people. Painting of the Soviet artists of the 1960-1980th years", published in 1989. [11., page 17] the Author of this book investigates art of "severe style" from various parties, outlining a circle of the interests consideration of questions of continuity of works of painters of "severe style", revealing value of artistic touches of new artists, "severe" for the subsequent generations. Frosts in the book "The artist and the world of the personality. Creative problems of modern portrait painting" fixing the attention on features of a portrait genre of "severe", allocates a factor of enthusiasm for a certain "chamber form" and naive "pravdoiskatelstvo" which appears in works by men of the seventies, taking sources in painting of "severe style". [12., page 59] Over time series of albums devoted to works and authors of "severe style" are born. From which, for example, especially It is necessary to distinguish work "Nikolay Andronov: Painting. Monumental art" Sarabyanova D.V., and publication B.C. Manina who is devoted to Victor Popkov's painting. [13.] In addition, it is very useful to address a research of the Soviet phenomenon of "severe style" in numerous works of the western colleagues. So in the interesting monograph "The Soviet art: painting, a sculpture and architecture in the one-party state, 1917 - 1992", is devoted to a subject of art of "severe" Suzan Read's article "Memory art": retrospectivism in the Soviet painting of an era of Brezhnev" ("The "art of memory": retrospectivism in Soviet painting of the Brezhnev era"). [14.] The author of article in particular notes the fact that artists of "severe style" in the creative search processed usual subjects of socialist realism consciously to emphasize still big "severity" of real life. [14., river 165] Mathew Baum in the book "Art at Stalin"

investigates the Soviet art at a boundary of 1950 - the 1960th years and already in the epilog "Art after Stalin, 1956-1990" ("Art after Stalin, 1956-1990") notes special "inevitability" of emergence of "severe style". [15., river 230] Baum, in particular tells about the subsequent influence of this style and its further wide circulation in art of the 1960th at what, in very disputable opinion of the researcher, characteristic of this decade is more logical to consider this direction as special style of socialist realism. We are represented very disputable to consider art of "severe style" any branch of socialist realism as works by "severe" artists differed from the most characteristic cloths of the forthcoming period, both on formal, and on the ideological orientation markedly. In the most part of the researches published after "disintegration" by the USSR in the 2000th years in the Russian magazines on art, for example such as: "Academy", Artkhronika, "Dialogue of arts", "The Russian art", Tretyakov gallery, "The art magazine", a terminology problem of "severe style", a problem of its chronology and further distribution, remains debatable (however, as well as semantic contents of the term). So, for example, the researcher A. Bobrikov in article "Severe style: mobilization and the cultural revolution" [16., page 30] quite safely calls the direction of "severe style" - the peculiar "Soviet Reformation". And, the author treats ideological and art programs of "severe" artists as "… individual experience of the main values of Bolshevist religion (including a historical mystery of Revolution and Civil war) - instead of collective execution of ceremonies". [16., page 30] Having made such bold statement, Bobrikov notes that over time in works by masters of "severe style" not attendees by it "seclusion and intimacy" therefore in their late works some works in the spirit of "peculiar silent "Biedermeier" appeared began to be shown earlier. [16., page 30] Youthful "severity", according to Bobrikov, was gradually transformed to certain "depressiveness", and slightly later in painting there was a natural drift to coast of "gloomy romanticism" or even certain "philosophy of despair". It can be observed in the so-called "Ferapontovo cycle" of artists of Nikolay Andronov and brothers Smolin. There are also more rigid opinions. In 2004 A. Kovalyov in the monograph "Introduction to art political economy of an era of "stagnation" stated the offer to mean by the term "severe style" in general two separate options of style which corresponded to eras of "thaw" and "stagnation". And, "severe" A. Kovalyov sees presence of intonations of a certain neglect and condemnation in the assessment of creativity. Thus, Kovalyov kind of at all rejects all importance of experience and heritage of men of the sixties, is groundless criticizing "severe realism" as the phenomenon of art culture. Such radical statement quite keeps within modern tendentious statements of young art critics that the quality of painting in general is not so important that just and lays down on modern fashionable concepts of vision of the fine arts. However, nevertheless recently even more often there are serious works which authors consider the various thematic directions in

creativity of masters of "severe style". So, for example, dissertation work of L.K. Bondarenko "A village subject in works of the Soviet painters of the 1960-1970th years" is devoted to the detailed analysis "rural" subject in works of "severe" painters. In a number of the modern researches devoted to creativity of masters of "severe style" it is constantly allocated special impact which the Russian vanguard, in particular, painting of community "Jack of Diamonds" had on creativity of "severe". Pyotr Konchalovsky, Aristarkh Lentulov, Alexander Kuprin, Alexander Osmyorkin, Ilya Mashkov and Robert Falk's creativity in their surprising variety of plots and color scale. The fact that influence it had character of original independent experiences is especially noted and was not simple imitation or blind loan of art "quotes" on own cloths "severe".

Conclusions

A significant amount of publications of the very different authors who appeared in 1990 - 2000 - x the years which are fixedly investigating a phenomenon of emergence and development of "severe style" obviously confirm the attentive serious analysis of this original phenomenon of the Soviet art in comparison with the previous decade of "accidental" searches of men of the seventies - the eight-foremen who covered creativity "severe". Each researcher introduces the idea of the "severe" direction. Everyone states individual estimates, enriching at the same time, a common understanding of substantial and formal features of the phenomenon. Despite external diversity of "severe", it is possible to mark out the certain general signs uniting creativity of various masters and relatives on mood of a cloth, perceiving them as the uniform direction. Undoubtedly, first of all, the ideological and art programs of "severe style" setting a vector of the movement from a publicistic expression in its early period to religious philosophically art judgment of problems of life in the next decades have to become a subject of a separate serious art criticism research.

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横向扁平足患者手术治疗结果的评定量表
RATING SCALE OF THE RESULTS OF SURGICAL TREATMENT OF PATIENTS WITH TRANSVERSE FLATFEET

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注解。本文考虑了评估前足病理患者手术治疗的长期效果的问题。提出了一种用于评估治疗结果的改进量表，与AOFAS和Groulier量表的临床实践中普遍接受和最常用的对照，该量表考虑了患者和医生的主观评估。进行了一项涉及128位患者的比较研究。所有患者均接受了三种量表的访谈，以评估治疗效果。在分析结果时，医生和患者给出的积极评价的百分比实际上是一致的（分别为91.4%和89.8%）。但是，进一步的分析表明，患者给予的良好分数百分比（76.5%）比医生（64.8%）高得多。所有这些表明，今天的医生比患者对手术治疗的要求更高，也更挑剔。建议将改进的量表用于评估治疗结果的临床实践，以进一步改善针对脚的前部变形的各种类型和程度的手术治疗的选择。

关键词：扁平足，拇外翻，第一脚趾偏斜，足部畸形，治疗效果。

Annotation. *The article considers the problem of assessing the long-term results of surgical treatment of patients with pathology of the anterior foot. An improved scale for assessing the results of treatment is proposed, which, in contrast to the generally accepted and most commonly used in clinical practice of AOFAS and Groulier scales, takes into account the subjective assessment by the patient and the doctor. A comparative study was conducted involving 128 patients. All patients were interviewed on three scales for evaluating treatment outcomes. When analyzing the results, the percentage of positive ratings given by the doctor and the patient practically coincides (91.4% and 89.8%, respectively). However, a further analysis shows that the percentage of good marks given by patients is much higher (76.5%) than by doctors (64.8%). All this suggests that today doctors are more demanding and picky about the results of surgical treatment than patients. The introduction into clinical practice of an improved scale for assessing treatment results is advisable for further improving the choice of surgical treatment for various types and degrees of deformation of the anterior part of the feet.*

Keywords: *flatfeet, hallux valgus, deviation of the first toe, foot deformity, treatment results.*

Relevance. The foot is an organ with late development in the process of phylogenesis. Performing the unique function of supporting and moving a person, the foot is more than any other component of the musculoskeletal system of a person subject to pathological changes in shape associated with external and internal causes and leading to a violation of the static-dynamic function of the entire lower limb.

Currently, effective reconstructive operations have been developed to treat various degrees of transverse flatfoot and hallux valgus deviation of the first toe, but the percentage of various complications and technical shortcomings remains rather high. All this limits the possibilities of optimal restoration of the feet function.

Despite the successes of traumatology and orthopedics in the field of forefoot surgery, many unresolved and controversial issues remain. One of these issues can be considered an assessment of the results of treatment of pathology of the forefoot. In fact, sometimes we see a good cosmetic and radiological result, and a complete dissatisfaction of the patient with the results of treatment. Also sometimes we have the opposite picture.

Purpose of this study was an optimization of the assessment of the results of surgical treatment of anterior foot pathology, taking into account objective data, additional examination data and subjective sensations of the patient.

To achieve this goal, we set the following **tasks**:

1) To conduct a subjective assessment of the results of treatment of patients on a scale: good, satisfactory, unsatisfactory, find it difficult to answer;

2) Conduct a subjective assessment of the results of treatment by a doctor on a scale: good, satisfactory, unsatisfactory;

3) Conduct an objective assessment of treatment results on the wellknown AOFAS and Groulier scales;

4) Based on the data obtained, develop an improved scale for assessing treatment results with its subsequent implementation in practice.

Materials and research methods

We analyzed the results of treatment of 128 patients with pathology of the forefoot, who were treated at the clinic of traumatology, orthopedics and emergency surgery of SamSMU in the period from 2014 to 2015.

The following evaluative techniques were applied:

1) Evaluation of the result on the AOFAS scale. The results of treatment are evaluated as follows: excellent - 95-100 points; good - 75-94 points; satisfactory - 51-74 points; bad - 50 points or less

2) Evaluation of the result on the Groulier scale. We have taken the classic scales. The result of treatment using the Groulier scale is evaluated as follows: excellent - 71-85 points; good - 60-70 points; satisfactory - 29-59 points; bad - 28 points or less

3) Evaluation of the results on a scale improved by us. We evaluated the treatment results as follows: excellent - 95-100 points; good - 75-94 points; satisfactory - 51-74 points; bad - 50 points or less. In assessing the patient's result of treatment within the framework of our improved scale, we used four-degree gradation (good, satisfactory, unsatisfactory, difficult to answer). The assessment was carried out exclusively subjectively. The patient was recommended to consider the presence of pain, swelling, contractures, degree of correction, ease of wearing shoes. When evaluating the result of treatment with the operated surgeon, three-degree gradation was used (good, satisfactory, unsatisfactory). The assessment was carried out taking into account objective data, cosmetic and functional results. In addition, the degree and type of deformation before surgery and the amount of correction achieved were taken into account.

Evaluation of the results of surgical treatment of foot deformities on the AOFAS scale (Kitaoka)

Evaluation of the results of surgical treatment of patients with anterior foot deformities using the AOFAS scale is widely used in many countries of the world [12]. The results of treatment are evaluated as follows: excellent - 95-100 points; good - 75-94 points; satisfactory - 51-74 points; bad - 50 points or less.

Evaluation of the results of surgical treatment of foot deformities on the Groulier scale

The long-term results of surgical treatment of patients with anterior foot deformity using the Groulier scale are evaluated by the following components:

1. The condition of the first ray - correction of deformation (under load), pain and range of motion in the first metatarsophalangeal joint.
2. The condition of the forefoot - metatarsalgia, plantar hyperkeratosis, flattening of the forefoot.
3. Functional activity - difficulties in wearing shoes, restrictions on walking distance, sports and domestic load.

The result of treatment using the Groulier scale is evaluated as follows: excellent - 71-85 points; good - 60-70 points; satisfactory - 29-59 points; bad - 28 points or less

Subjective assessment by the patient

Depending on the functional requirements for the foot and the psychological structure of the patient, the assessment of the results of treatment by him can vary in a very wide range. For many patients, the disappearance of pain and the ability to wear regular shoes are acceptable as a good treatment result. For some, even having the potential to wear model shoes occasionally is more than a good result. For some patients, even a slightly hypertrophic suture or minor swelling that appears at the end of the day is an unsatisfactory result.

For a subjective assessment, a three-degree assessment is traditionally used: good, satisfactory and unsatisfactory. In our opinion, it is advisable to add the option "find it difficult to answer". According to our observations, at the first follow-up examination (3 months after the operation), some patients cannot formulate how satisfied they are with the result of treatment.

We used a number of mandatory, in our opinion, questions asked at the control examination. To facilitate this task, we created a small questionnaire for the patient.

Questions offered by us.

1) Do you experience pain in the feet during normal exercise?
2) Do you experience pain in the feet under a heavy load?
3) Did the pain become weaker after surgery?
4) Did the pain become stronger after surgery?
5) Do you have edema on the operated foot?
6) Can you wear regular shoes easily?
7) Can you wear model shoes easily?
8) Are you satisfied with the aesthetic result?
9) Are you satisfied with the range of motion in the joints of the foot?
10) Are there any other complaints? What kind?
11) How do you generally evaluate the result of treatment (good, satisfactory, unsatisfactory, difficult to answer)?

Questions 1 through 9 may be answered by "yes", "no", "difficult to answer", a patient can answer in a free form to question № 10. When answering question 11, it is proposed to choose one of four options for evaluating treatment results.

This questionnaire, in our opinion, can only be used to help the patient answer the most important, 11th question. Thus, this part of the evaluation of treatment outcomes remains subjective, but does not become unimportant!

Subjective assessment by a doctor

For the doctor, obviously, in assessing the results of treatment of a patient with pathology of the forefoot, the elimination or significant decrease in the degree of deformation, the presence of edema, the amplitude of movements, as well as the pain syndrome upon examination are the most important. It is quite obvious that the assessment given by the patient and given by the doctor is far from always correlating. In some cases, the doctor may be very pleased with the anatomical removal of the deformity and the aesthetic appearance of the operated foot, and the patient will complain of certain pains and dysfunctions, being completely dissatisfied with the results. In fairness, it should be noted that a diametrically opposite situation is also possible, when the absence of a complete correction of the deformation and the presence of any other restrictions objectively (according to the doctor) present in patient do not bother them at all, since they returned to their usual life and don't feel any inconvenience.

For a subjective assessment of the result of treatment by a doctor, we used the traditional three-degree scale: good, satisfactory and unsatisfactory. The "difficult to answer" score is hardly acceptable for a doctor.

Evaluation of the results of surgical treatment of foot deformities on our scale.

As a rule, the assessment of the long-term results of surgical treatment of anterior foot deformities, according to the AOFAS and Groulier scales, is the same, which indicates the equivalence of the methods used for assessing treatment results.

However, they practically do not take into account the subjective assessment of the result of treatment, which often makes conclusions diametrically different from the opinions of the patient himself. The perversity of this situation lies in the fact that the use, in some cases, of any justified treatment methods leads to a large percentage of unsatisfactory results, based on the applied rating scales. This prompted us to reconsider the assessment of the results of surgical treatment of diseases of the forefoot. We have developed, tested and implemented our scale for evaluating the results of treatment (Tab. 1). Based on the well-known AOFAS and Groulier grading scales, which we somewhat reworked, in addition, we added subjective factors for evaluating the results.

We evaluated the treatment results as follows: excellent - 95-100 points; good - 75-94 points; satisfactory - 51-74 points; bad - 50 points or less.

Table 1. *Scale for evaluating the results of the treatment of deformity of the forefoot, proposed by us.*

Pain (30 points)		
Pain in the big toe	No	10
	Moderate, rare	8
	Strong, daily	5
	Very strong, constantly present	0
Metatarsalgia	No	10
	Decreased or is irregular	5
	Constant	0
Hyperkeratoses	No or asymptomatic	10
	Yes, slightly painful	5
	Yes, painful	0
Function (30 points)		
Activity limitation	No daily activity limits	10
	No daily activity limits, only with overload	7
	Daily restrictions, inability to overload	4
	Restrictions excluding any activity	0

Shoe requirements	Fashionable, comfortable, not requiring insoles	10
	Comfortable with orthopedic insoles	5
	Only specially selected or brace	0
Range of motion	Full or small restriction (volume 750 and more)	10
	Moderate restriction (volume 30 - 740)	5
	Significant limitation (volume less than 300)	0
Angular deformities of the forefoot (radiological indicators) (10 points)		
The degree of recovery of angular deformations	Fully restored	10
	There are minor deviations from the norm	5
	Not recovered or significant loss of correction	0
Subjective assessment of treatment outcomes (30 points)		
Assessment of the result of treatment by a patient	Good	20
	Satisfactory	10
	Unsatisfactory	0
	Difficult to answer	10
Assessment of the result of treatment by a doctor	Good	10
	Satisfactory	5
	Unsatisfactory	0

Results and discussion

We analyzed the long-term results of surgical treatment of diseases of the forefoot in 128 patients who were treated at the clinic of traumatology, orthopedics and emergency surgery of SamSMU in 2014-2015.

All patients underwent an evaluation of the results of surgical treatment using all the previously described methods.

As can be seen from table 2, the evaluation of treatment results on the AOFAS and Groulier scales is almost the same, which confirms the literature data.

When analyzing subjective evaluations, paradoxically, the percentage of positive evaluations (good and satisfactory) made by a doctor and a patient practically coincides (91.4% and 89.8%, respectively). However, upon further analysis, we see that the percentage of good marks given by patients is much higher (76.5%) than by doctors (64.8%). All this suggests that today doctors are more demanding and picky about the results of surgical treatment than patients. But still, do not forget that the opinion of the patient cannot be ignored.

After analyzing the results of treatment on a scale proposed by us, we see a significant difference in the results towards a larger number of positive treatment outcomes.

Conclusions

In our opinion, during the follow-up examination of the patient operated on in the forefoot, there should be a certain algorithm of questioning and research, which will make it possible to judge the objective and subjective result of treatment.

It is advisable to write in the consultativeform the subjective result of treatment according to the patient, according to the doctor and using one or all of the treatment assessment scales (AOFAS, Groulier, our scale).

Perhaps this may be a separate form, which is attached to the advisory:

Subjective assessment of the patient: good, satisfactory, unsatisfactory, find it difficult to answer (underline as necessary);

Subjective assessment of the doctor: good, satisfactory, unsatisfactory (underline as necessary);

Result on the AOFAS scale: _____ points - excellent, good, satisfactory, unsatisfactory (underline as necessary);

Result on the Groulier scale: _____ points - excellent, good, satisfactory, unsatisfactory (underline as necessary).

Result on the scale proposed by us: _____ points - excellent, good, satisfactory, unsatisfactory (underline as necessary).

Control examinations should be carried out 3, 6 and 12 months after surgery or more often, if necessary.

Undoubtedly, the introduction into widespread practice of such measures for evaluating treatment results will slightly delay the time of followup examinations and add work, but we consider it necessary to further improve the choice of surgical treatment for various types and degrees of deformation of the anterior foot. In addition, all this will make the results of a particular operation more predictable.

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物理因素在冠状病毒19患者复杂病因治疗中的应用

THE USE OF PHYSICAL FACTORS IN THE COMPLEX ETIOPATHOGENETIC THERAPY OF PATIENTS WITH CORONAVIRUS-19

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抽象。国内外科学家的基础科学研究令人信服地表明，如果不广泛使用现代物理因素来诊断，预防，治疗和康复从新生儿到老年患者的几乎所有疾病学形式的疾病，医学的进步都是不可能的。

每个微生物和大微生物都有与其类型相对应的各自的生物能特征，这是机体正常功能的主要条件。

在出现"外来"生物能特征的情况下，这种生物固有的特定生物过程被破坏，从而导致其死亡[13]。

每个人的生物潜能在规范和病理学上都是严格的个体。生物电势偏离的程度对应于疾病的发展阶段，即身体的中间状态的形成，违反了其超分子结构。

关键词：病因治疗，超分子结构，冠状病毒，COVID-19。

Abstract. *Fundamental scientific research of domestic and foreign scientists convincingly indicates that the progress of medicine is impossible without the widespread use of modern physical factors in the diagnosis, prevention, treatment and rehabilitation of almost all nosological forms of diseases from newborns to old age patients.*

Each micro- and macroorganism has individual bioenergetic characteristics that correspond to its type, which is the main condition for the normal functioning of the body.

In the case of the appearance of "alien" bioenergetic characteristics, specific biological processes inherent in this organism are violated, which leads to its death [13].

The biopotential of each person is strictly individual, both in norm and in pathology. The degree of biopotential deviation corresponds to the stage of development of the disease, i.e. the formation of intermediate states of the body with a violation of its supramolecular structures.

Keywords: *etiopathogenetic therapy, supramolecular structures, coronavirus, COVID-19.*

Natural and preformed physical factors occupy an important place in XXI century medicine, as they are important for the diagnosis, treatment, prevention and medical rehabilitation of patients.

Medicine should be developed according to this concept:

"The level of perfection of medicine determines the progress of conservative treatment of patients of any pathology except traumatology."

Surgery should not be a factor in determining the progress of medicine. It is forced and will be inferior to the conservative method of treatment constantly at different speeds and scales.

Based on the progress of the physical and technical sciences, the concept of "the mechanism of action of the physical factor" should be replaced by "the mechanism of interaction of the physical factor and the whole organism". [1,4,9]

From the moment the physical factor and the body come in contact, intermediate states of both sides are formed with the release of energy (to continue the cyclic process).

In domestic and world literature, we have not found scientific studies of their significance for the diagnosis, effectiveness and correction of treatment, prevention and medical rehabilitation. This is especially important in oncology for monitoring and managing the healing process. [3,5]

For an organism, any external influence is a violation of its integrity, and therefore, a system for quickly getting rid of it instantly turns on.

Even own blood outside the vascular bed is a foreign body for the organism. That is, there is an instant transfer of the work of all organs and systems of the body to the emergency mode. [4,5]

It should be noted that at the moment of the development of medical science there are no methods for determining the temporal level of the cycle of each system at the time of exposure to the body of a medicinal substance, in its transitional states at the supramolecular level and when all systems return to normal functioning.

In this regard, it is difficult to imagine the advantage of a particular medicinal substance, and in particular for a particular patient. The lack of data in the chronological sequence of the drug substance in its path to achieving the goal casts doubt on the benefits of drug therapy over physiotherapy.

It is known that "the interaction of a drug with the body is studied in two aspects: how it affects the body (pharmacodynamics) and what happens to it in the body (pharmacokinetics). Pharmacodynamics studies the localization, mechanism of action and pharmacological effects of drugs. [2]

Pharmacokinetics studies the patterns of absorption, distribution and elimination of drugs in humans and animals. [2]

It should be noted that the speed, scale, content and time of formation of intermediate formations of a pharmacological preparation in the body are strictly individual for each patient.

All drugs, when interacting with the body before they are introduced into medical practice, in accordance with pharmacodynamics, pharmacokinetics, must be investigated by quick, harmless and highly informative methods. [5]

Compliance with this concept helps to ensure a high therapeutic effect, primary and secondary prevention of diseases, the prevention of complications and side effects on the body.

This is not observed in medical and pharmaceutical practice due to the lack of research methods for pharmacological preparations at the supramolecular level. [6]

The biopotential for each person is strictly individual, both in norm and in pathology. In this regard, any nosology in each individual causes a deviation of his biopotential in accordance with the stage of development of the disease, i.e. the formation of intermediate states of the body with certain violations of its supramolecular structures.

This, in turn, determines the clinical picture at the time of examination of the patient and is the leading condition for choosing the right treatment tactics for any specialist physician so that disease regression is accompanied by the restoration of destroyed supramolecular structures, excluding new gross violations at any level of the whole organism [6,7].

This concept is not the main principle for drug therapy, due to the lack of highly informative research methods: frequency, dose, mechanism of action of pharmacological drugs at the supramolecular level.

It is known that the ultimate characteristic of any drug substance at the supramolecular level is "energy", which is difficult to dose and regulate for therapeutic purposes.

The impact of the energy of any physical factor is metered and regulated (physiodynamics) using nanotechnology and its path to every molecule of the whole organism (physiokinetics) is freely traced without disturbance of supramolecular structures, without negative consequences using a nanosensor. (Patents for inventions: Russia № 2675006, Germany № 20 2017 006 896.)

Modern pharmaceutical science does not have such a high level of control over the path of the drug substance in the body.

“The conversion of the energy of photons, particles of light, into electrical energy takes place in several stages,” explains Professor Christoph Well, head of the IFG Institute. First, light is absorbed on the surface of a photosensitive material. [11]

Under the influence of the energy of photons of light, electrons leave their places, leaving in their place electronic holes with which they immediately form quasiparticles called polaritons.

These polaritons exist only for a very short time, moving to the boundaries of the material, where they decay into electrons and holes, which continue to move further on their own.

And the further fate of these charge carriers, in turn, depends on the nature of the photosensitive material used ”[11].

In this regard, any therapeutic effect on the body should be considered a trigger for restoring homeostasis, engagement of its own internal systems.

After studying the drugs officially designed and published by the Russian media intended to combat coronavirus-19, one has to admit not only their inefficiency, but sometimes even harm.

Their original premises appear to be clearly incorrect. In fact, physiotherapeutic methods of treatment seem to be a more suitable approach.

It is based not only on the stated considerations, but also on the half-century experience of use.

Highly effective methods of physiotherapy include:

I. Light therapy device "Bioptron".

Its spectral range - 480-3400 nm - reproduces the dominant types of solar radiation on Earth - visible and infrared radiation, under the influence of which the body absorbs and utilizes radiant energy. Polychromatic visible and infrared polarized (PVAIP) light activates the nicotinamide adenine dinucleotide phosphate oxidase (NADP oxidase) enzymes and the nucleotide containing biopteroflavoprotein NO synthesis, localized in the cell membrane and using the surrounding oxygen, produce its active forms, the hydrogen radical hydroxide, superoxidanion and nitric oxide (NO). [15]

They conduct a light signal from the surface of the irradiated cell to its nucleus, acting on specialized intracellular mechanisms for conducting the activation signal (protein phospholation; state of calcium channels, calcium content in the cell, etc.).

The enzymes responsible for the formation of ROS and NO, like themselves and intermediaries, are found in cells and tissues, in all types of leukocytes, platelets, endothelial and smooth muscle cells of blood vessels. It has been established that nitric oxide - NO, is an essential part of the mechanism of expansion of blood vessels and platelet disaggregation, without which phototherapy could hardly be highly effective. [10,14]

After daily 5-10 exposures, the number of mononuclear leukocytes - monocytes and lymphocytes circulating in the blood - increases by 14-17%.

30 minutes after the first exposure to PVAIP light, proinflammatory cytokines — tumor necrosis factor (TNF-α), interleukins — IL-6, IL-2, IL-12, “disappear” from the circulating blood. So, with an initially elevated content of TNF-α, it drops 30 times, IL-8 - 4-6 times, IL-2 - 4-10 times and IL-12 - 12 times, towards the end of the course. [14, 16]

At the same time, the content of anti-inflammatory cytokines - IL-10 and the transforming growth factor - TGF-β1 in the blood plasma increases. [14]

A feature of phototherapy of PVAIP light is a rapid 6-fold increase in the blood of the most important immunomodulator - interferon-γ (IFN-γ).

The most important function of this cytokine is the activation of cellular immunity (the functional state of monocytes, macrophages, natural killers and cytotoxic T-lymphocytes), which primarily increases the antiviral and antitumor resistance of the body. [13]

Fig. 1 *Light therapy (PVAIP) conducted by the "Bioptron-COMPACT" apparatus - 5 cm.*

Fig. 2 *Light Therapy (PVAIP). The device "Bioptron PRO" - 11cm.*

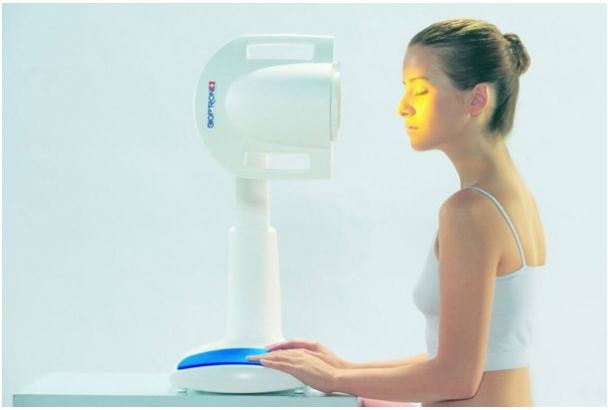

Fig. 3 *Light therapy (PVAIP) conducted by the "Bioptron PRO" apparatus - 11cm.*

II. The use of dry carbon baths "Rebox".

Dry carbon dioxide baths (DCB) - a method of transdermal therapeutic effect of carbon dioxide on a patient whose body is in a specially equipped box to the neck level.

The use of (DCB) "Reabox" provides non-invasive, i.e. the introduction of carbon dioxide that does not violate the integrity of the skin, which distinguishes this method from CO_2 injections.

The immediate (direct) action of carbon dioxide on the respiratory center. The excitation of the respiratory center is not caused by carbonic acid itself, but by an increase in the concentration of hydrogen ions due to an increase in its content in the cells of the respiratory center.

Fig. 4. *Dry carbon baths using the "Reabox" apparatus*

The specificity of carbonic acid as a causative agent of the respiratory center was revealed by the experiments of Frederick and Holden, who found that H^+ and HCO_3^- ions pass poorly through the cell membrane and undissociated carbonic acid passes well: undissociated H_2CO_3 diffuses into the cells of the nerve center, which dissociates already in nerve cells releasing the irritative H^+ ion.

Faster diffusion into the cells compared to other acids is a specific feature of carbonic acid, and a stronger irritating effect on the respiratory center is associated with this. [12,15]

Normal ranges for total blood CO2 should be as follows.

Age range	Conventional units	SI units
18–59	23–29 meq/l	23–29 mmol/l
60–89	23–31 meq/l	23–31 mmol/l
90+	20–29 meq/l	20–29 mmol/l

Hyperventilation for a short time (several tens of minutes) leads to death due to the loss of carbon dioxide by the body.

Humoral regulation of respiration, the role of carbon dioxide, oxygen and blood pH in this process.

The main stimulant of respiration is CO_2. An important role in the regulation of respiration is also played by the pH of the blood.

With a decrease in the pH of arterial blood compared with the normal level (7.4), lung ventilation increases, with an increase in pH above normal, ventilation decreases. An increase in CO_2 in the blood stimulates respiration both by lowering the pH and directly by the action of CO_2 itself. [12,15]

The effect of CO_2 and H^+ ions on respiration is mainly mediated by their effect on special structures of the brain stem that are chemosensitive (central chemoreceptors as part of the blood-brain barrier; low sensitivity threshold).

It was found that a decrease in cerebrospinal fluid pH of only 0.01 is accompanied by an increase in pulmonary ventilation by 4 l/min. [15]

O_2 deficiency can be a respiratory stimulator in the case of the use of barbiturates as narcotic drugs, because in this case, the sensitivity of the respiratory center to CO_2 is suppressed. Breathing pure oxygen (O_2) by patients with a reduced sensitivity to CO_2 is very dangerous, because with an increase in O_2 potential in the arterial blood, the last respiratory stimulant (O_2 deficiency) is eliminated and respiratory arrest can occur. In such cases, it is necessary to use an artificial respiration apparatus.

III. Extremely high-frequency therapy (EHF) is the therapeutic use of millimeter-wave electromagnetic waves.

The experience of more than 30 years has shown high efficiency in the treatment of a wide range of diseases, including cancer patients.

Extremely high frequencies occupy the range of 30-300 GHz (wavelength range - 10-1 mm). A feature of this frequency range is that millimeter-wave radiation of cosmic origin is practically absorbed by the Earth's atmosphere, therefore the biological evolution of all living organisms occurred with a very small natural EHF electromagnetic background. This, apparently, explains the active effect of low-intensity millimeter radiation on a person.

The following wavelengths are most often used in EHF therapy: 4.9 mm (60.12 GHz), 5.6 mm (53.33 GHz) and 7.1 mm (42.19 GHz). [8]

Low-intensity millimeter radiation refers to non-ionizing radiation, i.e. cannot have a damaging harmful effect on the biological tissues of the body, and therefore it is safe.

A specific feature of the EHF effect is its normalizing character, i.e. EHF radiation normalizes only the physiological parameters of a number of body conditions that deviate from it: it increases the values of reduced indicators and decreases the values of overestimated values. The parameters that are normal do not respond to irradiation of the body with a millimeter field.

That is, the features of EHF therapy such as non-invasiveness, the absence of allergy to EHF radiation, and drug-free therapy contribute to the normalization of the intracellular energy of any cell of the whole organism.

IV. Multifunctional device for point infrared exposure and magnetotherapy for effective pain relief (Rayforce).

IR wavelength: 850 nm. Magnet power: 1000 Gauss. Charging: from sunlight and artificial light.

IR therapy. It is proved that waves of various ranges affect the body in different layers and levels. IR radiation has the greatest penetration depth. In physiotherapy, waves ranging from 780 to 1400 nm are used, i.e. short, penetrating into tissues to a depth of 5 cm. The effect of IR radiation is aimed at accelerating physicochemical reactions: tissue repair and regeneration processes are stimulated, the vasculature is expanded, blood flow is accelerated, cell growth is enhanced, biologically active substances are produced, white blood cells are sent to the lesion focus. The reserve functions of the body are awakening.

Constant magnetic field (CMF) improves microcirculation, stimulates healing processes, activates immunological reactions, has anti-inflammatory and sedative effects. [17]

Experimental studies were carried out at the Fiber Optics Research Center (FORC) RAS, Moscow. FORC employees developed new non-toxic, non-hygro-

scopic silver halide optical fibers with low optical loss in a wide spectral range of 3-15 μm, which allowed us to obtain in vivo skin spectra with a good signal-to-noise ratio even on an uncooled standard Bruker DNGS pyrodetector Fourier spectrometer

Fig. 5 IR *spectroscopy of the inner surface of the left elbow joint*

spectrum of the area of the left elbow joint before the treatment

spectrum of the area of the left elbow joint after the therapeutic effect of the RayForce apparatus

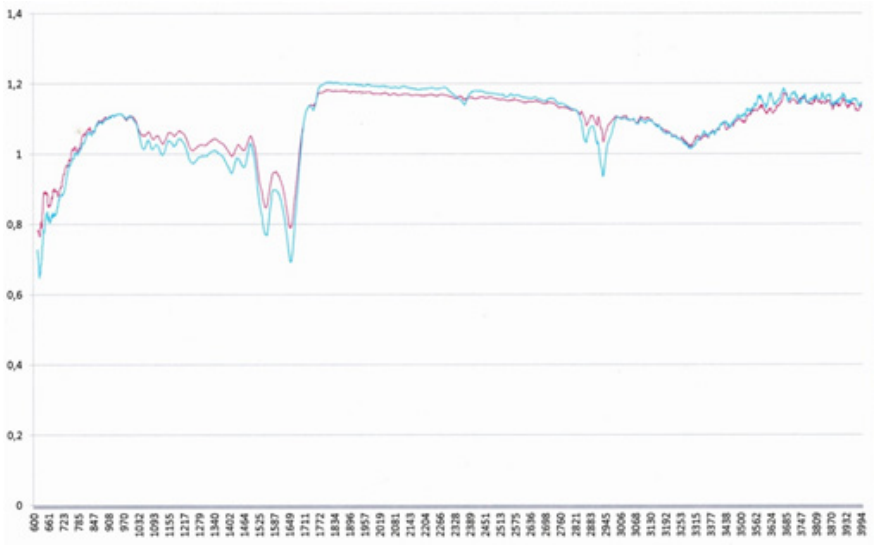

Fig. 6 *IR spectroscopy of the inner surface of the right elbow joint.*
spectrum of the region of the right elbow joint before the treatment
spectrum of the region of the right elbow joint after the therapeutic effect of the RayForce apparatus

The results of the effectiveness of treatment with the RayForce apparatus according to IR spectroscopy.

In this experiment, the high therapeutic effectiveness of the **RayForce** apparatus was confirmed:

In Fig. 5, infrared spectroscopy shows the absence of pain in the left elbow joint after the therapeutic effect of the **RayForce** apparatus in the form of a complete restoration of the spectrum in form and amplitude of light transmission, as well as correction of morphological changes in this area of exposure in the wavelength range of 970 - 1400 nm.

Based on the data in Fig. 6 on IR spectroscopy, there is reason to argue that the right elbow joint in the experiment was healthy and IR spectroscopy of the right elbow joint should be considered a control.

Symptoms of coronavirus, the first signs of COVID-19.

- Fever.
- Dry cough.
- Shortness of breath.
- Chest pressure.
- Runny nose.

- Weakness.
- Tiredness.

Coronavirus effect on lungs

The structure of the human lungs is cellular. They consist of the smallest bubbles saturated with air, - alveoli.

Each such alveolus is surrounded by capillaries, through which, in fact, carbon dioxide is removed from the blood and oxygen is supplied.

Red blood cells - erythrocytes - are responsible for their transportation through tissues and organs.

Alveolar cells that participate in gas exchange are of two types: type I. Thin. Oxygen passes through them;

II type. Surfactant is secreted - a substance that envelops the alveoli and protects it from damage. Coronavirus attacks mainly type II cells.

Spiky proteins on its surface are bound by angiotensin-converting enzyme 2 (ACE2) on their surface.

So the virus “breaks” the defense and penetrates into the cell, starting to replicate its RNA.

The host cell soon dies, and the coronavirus spreads to neighboring cells and thus gradually affects the lungs.

Naturally, our immune system does not sit still and actively produces macrophage cells.

The result of this struggle is the death of the alveoli and a decrease in gas exchange turnover.

This continues until the so-called alveolar collapse occurs and the same acute respiratory distress syndrome begins.

In severe inflammation, a fluid saturated with inflammatory proteins enters the bloodstream and spreads to other organs and tissues.

This is how the systemic inflammatory response syndrome (SIRS) develops, followed by septic shock and multiple organ failure.

The incubation period of COVID-19 is from 2 to 14 days, at which time there are no symptoms. From the moment a coronavirus infection is suspected, preventive physiotherapy should be started.

1. Light therapy with"Bioptron" apparatus:
   - action on the face from 10 cm 5 minutes;
   - on the neck from 10 cm 5 minutes;
   - on the interscapular region from 5 cm 10 minutes;
   - on the plantar surface of the feet from 5 cm for 5 minutes;
   - on palm surfaces from 5 cm for 5 minutes;
   - twice a day, daily, course of 14 days.
2. Dry carbon baths "Rebox":

• CO_2 concentration of 18-20%, 15 minutes, 1 time per day, course of 14 days.
3.EHF-therapy, "Yav" apparatus:
• paravertebral interscapular region, two points on both sides, the distance between points 10 cm;
• epigastric region;
• paravertebrally at the level of the VII cervical vertebra;
• emitters: 4.9 mm (60.12 GHz), 5.6 mm (53.33 GHz) and 7.1 mm (42.19 GHz) for 3 minutes per field 1 time per day, couse 14 days.
4.Therapeutic breathing exercises 5 minutes, 1 time per day, daily, treatment 14 days.

In case of complications, the physiotherapist individually for each patient, according to the state of the clinic, draws up a daily physiotherapy plan with hourly correction.

Physiotherapy is carried out in combination with drug therapy.

The proposed physiotherapy plan provides indications and contraindications at the supramolecular level, as well as for children from two years of age with a 50% reduction in the exposure time of each method, i.e. if an adult is 5 minutes, then children are 2.5-3 minutes.

When establishing the diagnosis of "pneumonitis", inhalation of the oxygen-helium mixture should be carried out according to the developed methodology of academician A.G. Chuchalin from the apparatus AKGS-31 of the design of the Minsk Research Institute of Radio Materials.

Conclusion

Given the characteristics of coronavirus (COVID-19) infection, its differences from other known viruses are:

- suddenness of occurrence;
-high speed, scale and unhindered distribution;
- program selectivity of penetration into the intracellular space;
- consistency of the striking nature at the supramolecular level of chronically weakened organs and systems, taking into account their biological age.

The wave origin of coronavirus-19, that is, based on quantum mechanics (entanglement), should be assumed.

In this regard, it should be argued that a global solution to the problem of neutralizing the damaging insidious actions of the virus (COVID-19) is possible at the level of quantum physics and can only be done by a group of scientific physicists led by professor Lukin Mikhail Dmitrievich of the United States Harvard University.

The physiotherapeutic methods proposed above for the prevention, treatment, and rehabilitation of patients with coronavirus (COVID-19) infection are also consistent with quantum physics, since their mechanism of action on the whole organism is identical to quantum touch, so they should be included in the program for combating coronavirus infection (COVID19).

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纤毛虫履带草履虫和梨形四膜虫对环境物体的生物指示
BIOINDICATION OF ENVIRONMENTAL OBJECTS USING CILIATES PARAMECIUM CAUDATUM AND TETRAHYMENA PYRIFORMIS

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抽象。 提出了在某些栽培条件下重金属盐以及某些有机物对纤毛虫存活的影响的研究结果。 发现尾草履虫和梨形四膜虫对各种浓度的重金属盐，合成表面活性物质（SSAS），苯酚和石油产品的溶液具有不同的敏感性。

关键词：尾草履虫，梨形四膜虫，生物测试，毒性。

Abstract. *The results of a study of the influence of salts of heavy metals, as well as some organic substances on the survival of ciliates under certain cultivation conditions, are presented. It was found that Paramecium caudatum and Tetrahymena pyriformis have different sensitivity to solutions of heavy metal salts of various concentrations, synthetic surface-active substances (SSAS), phenol and oil products.*

Keywords: *Paramecium caudatum, Tetrahymena pyriformis, biotesting, toxicity.*

Many pollutants, when introduced into the environment, undergo various transformations in it, enhancing their toxic effect. For this reason, the most popular methods were integrated assessment of the quality of the ecosystem and its individual components (water, soil, air), including biotesting [1, 2].

Depending on the objectives of the study, bacteria and ciliates can be used as test objects. Among the simplest ciliates are the most commonly used biological models for bioindication studies [3]. When creating a really working test, an important point is the choice of test reactions. The most easily recorded reaction is cell death under the influence of a toxic substance [4, 5].

The purpose of this study was to exaamine the sensitivity of the ciliates Paramecium caudatum and Tetrahymena pyriformis to solutions of heavy metal salts of various concentrations, as well as to solutions of certain organic substances (SSAS, petroleum products, phenol).

Research methodology

The ciliates of Paramecium caudatum were cultured in a double flask on a mineral-yeast medium prepared according to the Lozin-Lozinsky recipe for 2 weeks at room temperature (+25°C). The thickness of the medium layer is not more than 20 mm (for a flask with a bottom diameter of 65 mm, the volume of the medium is 50 ml). A flask with ciliates was shaken daily to aerate the medium. Every two weeks, the ciliates were washed and reseeded on fresh nutrient medium.

Tetrahymena pyriformis culture was grown at a temperature of 25°C in a nutrient medium of the following composition: peptone - 2.0 g, glucose - 0.5 g, sodium chloride - 0.1 g, yeast extract - 0.1 g, distilled water - up to 1 l.

Biotesting was carried out using the automated "BioLaT" toxicity assessment system, which allows automatic counting of mobile test organisms in automatic mode. To process the information received at all stages of the study, the computer program "AutoCiliata" was used. The data obtained were subjected to statistical analysis using Statistica 10.0 and Microsoft Excel. When evaluating the results, the level of differences at $p < 0.05$ was taken as statistically significant.

Results and discussion

The research results showed that the ciliates Paramecium caudatum and Tetrahymena pyriformis are highly sensitive to heavy metals. A significant decrease in the amount of Paramecium caudatum is already observed at a concentration of heavy metal ions of 0.01 mg/l (Fig. 1). It was noted that Paramecium caudatum is more sensitive to the presence of copper, nickel and cadmium ions.

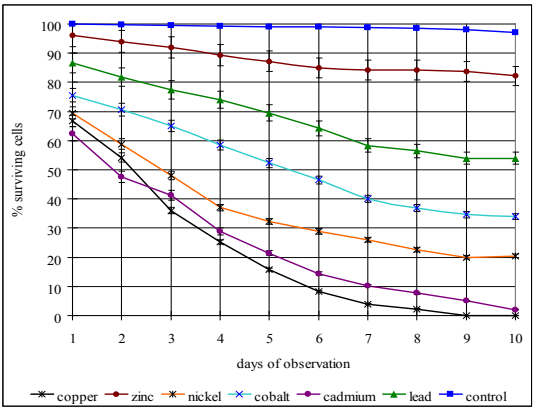

Fig. 1. *The survival rate of Paramecium caudatum when exposed to heavy metal ions with a concentration of 0.01 mg/l.*

Under equal conditions, heavy metal ions have a more pronounced cytotoxic effect on Tetrahymena pyriformis than on Paramecium caudatum. In addition, Tetrahymena pyriformis is more sensitive to nickel, lead, and copper ions (Fig. 2).

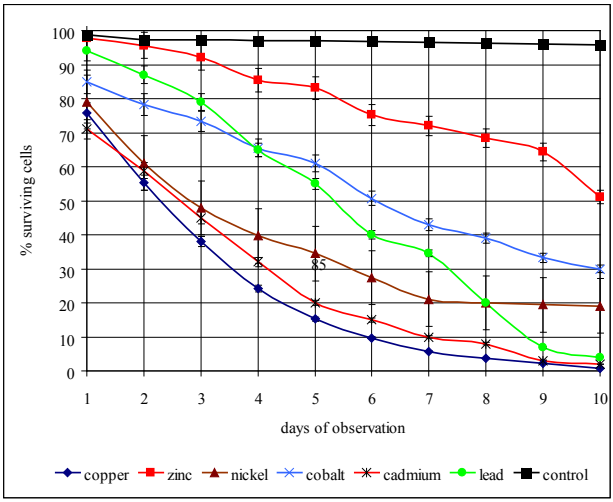

Fig. 2. *The survival rate of Tetrahymena pyriformis when exposed to heavy metal ions with concentration of 0.01 mg/l.*

To assess the information content of the obtained results, we investigated the relationship between the value of the ciliates survival coefficient (K%) and the value of the total soil pollution index (Zc) by heavy metals. The negative nature of the correlation (r = - 0.8916) indicates a decrease in one attribute with an increase in another (Fig. 3).

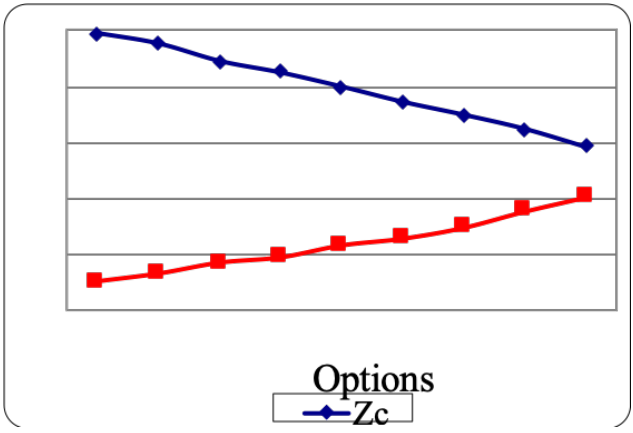

Fig. 3. *The logarithmic relationship between the value of the total indicator of soil pollution with heavy metals (Zc) and the survival rate of ciliates (K%)*

Thus, the results obtained using the "Biolat" automated biotechnological system show that there is a statistically significant relationship between the total soil pollution by heavy metals (Zc) and the survival rate of ciliates (K%).

Further studies revealed that the culture of Paramecium caudatum exhibits lower sensitivity to petroleum products in the studied concentrations than Tetrahymena pyriformis (Figs. 4 and 5). Most clearly, the survival dynamics of Tetrahymena pyriformis is manifested starting at a concentration of 0.05 mg/l. This indicates the possibility of using Tetrahymena pyriformis as an indicator microorganism in case of oil pollution of water.

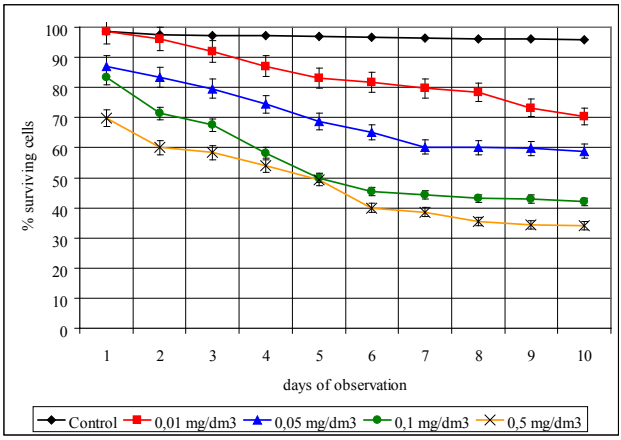

Fig. 4. *Survival of Paramecium caudatum when exposed to petroleum products*

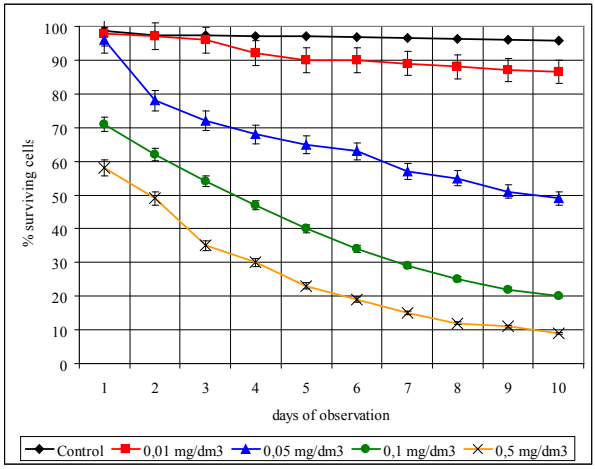

Fig. 5. *Survival of Tetrahymena pyriformis when exposed to petroleum products*

The ciliates Paramecium caudatum and Tetrahymena pyriformis are highly sensitive to SSAS. Moreover, the number of ciliates significantly correlated with SSAS concentration and exposure (Figs. 6 and 7).

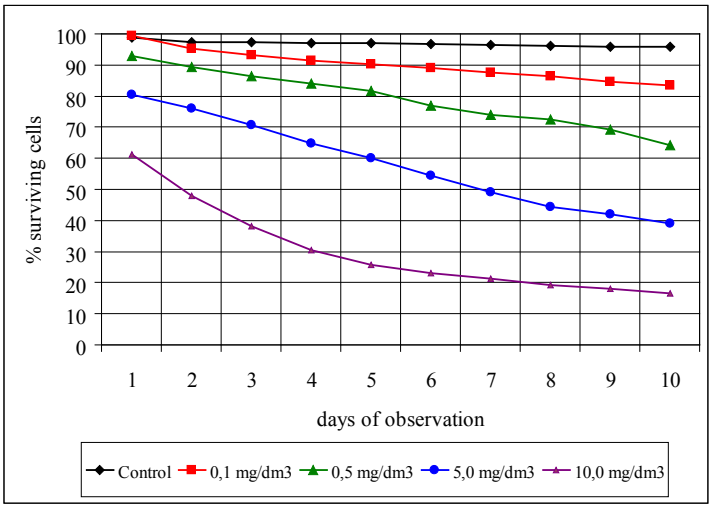

Fig. 6. *Survival of Paramecium caudatum at various concentrations of SSAS*

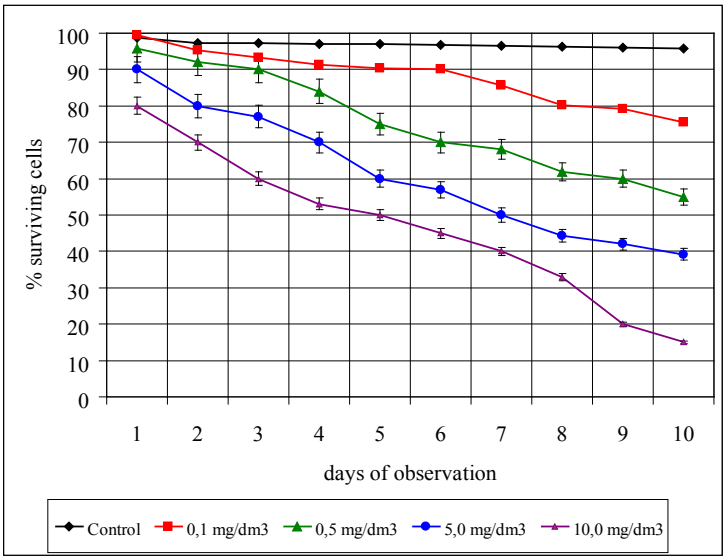

Fig. 7. *Survival of Tetrahymena pyriformis at various concentrations of SSAS*

Phenol has the highest toxicity compared to petroleum products and SSAS. Already on the first day of observation, the number of surviving ciliates significantly decreased (Fig. *8).*

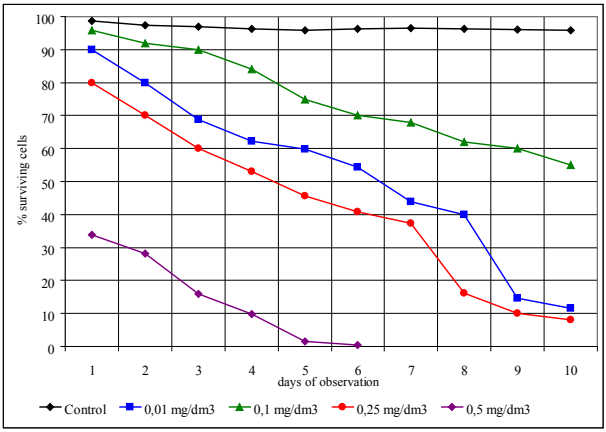

Fig. 8. *Survival of Paramecium caudatum at various concentrations of phenol*

Conclusions

1. The ciliates Tetrahymena pyriformis and Paramecium caudatum can be used for biotesting environmental objects contaminated with heavy metals. Paramecium caudatum is more sensitive to the action of copper, nickel and cadmium ions, and Tetrahymena pyriformis to lead and zinc ions.

2. Cell cultures of Paramecium caudatum and Tetrahymena pyriformis are highly sensitive to organic ecotoxicants and can be used as indicator microorganisms for bioindication assessment of environmental pollution.

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指示和规划的远东景观范例

FAR EASTERN LANDSCAPE PARADIGM OF INDICATION AND PLANNING

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抽象。文章指出，在俄罗斯，由V.T.教授领导的是一所实际的风景学校。远东联邦大学的Starozhilov研究景观领域，其目的是合理利用和利用领土，并最大程度地减少自然和社会变化对全球和区域的影响，以及寻求和实施创新方法以实现可持续发展，远东地区的环境平衡和安全发展。获得了关于有限元安全景观框架和解决俄罗斯联邦总统和政府为远东地区的勘探和开发所赋予的任务的工具的客观信息，以及俄罗斯景观科学的发展战略俄罗斯远东地区。应当指出的是，现有的景观基础和在景观规划中的实际实施及其在领土发展中的相关性方面的经验已经为在俄罗斯太平洋规划和设计自然资源中实际采用景观方法确定了重大机会。在领土密集发展的条件下，科教的实际景观取向对执行发展中地区的任务和培养专业人才具有重要意义。

关键字：景观，发展，结构，形态，映射

Abstract. *The article states, that in Russia, an actual landscape school is formed under the leadership of Professor V.T. Starozhilov in the far Eastern Federal University for the study of landscape sphere, which is aimed at the rational exploitation and use of territories and minimizing the global and regional implications of changes in the nature and society and the search and implementation of innovative approaches to sustainable, environmentally balanced and safe development of the vast far East region. Was given objective information about the level of FE security landscape framework and instruments for the solution of tasks given by the President and the government of the Russian Federation for the exploration and development of the far Eastern region, and the strategy of development of landscape science in the Russian far East. It is noted that the existing landscape foundations and experience in the practical implementation of landscape planning and their relevance in the development of territories already determine significant opportunities for the practical implementation of the landscape approach in planning and designing of natural resources in the Pacific*

Russia. The practical landscape orientation of science and education, in the conditions of intensive development of territories, is significant in the implementation of the tasks of developing regions and creating professional personnel.

Keywords: *landscape, development, structure, morphology, mapping*

Introduction

The Far Eastern landscape paradigm as a fundamental scientific and applied area developed at the FEFU Pacific International Landscape Center is aimed at the rational development and use of territories, minimizing the global and regional consequences of changes in nature and society and the search and implementation of innovative approaches in the sustainable, environmentally balanced and safe development of the vast Far Eastern region is based on the analysis, synthesis and evaluation of not only theoretical results of scientific studies, but also the practical implementation of the landscape approach in various industries of Russian Landscape Pacific belt. The development of the fundamental direction is accompanied by the implementation of the long-term results of landscape studies in the diversified development of the Pacific landscape belt. Moreover, the landscape implies - ***landscape –is a natural body with a high (upper), deep (lower) and horizontal (area) border, with an internal content of interconnected, interdependent and interpenetrating components (foundation, topography, climate, soil, vegetation, biocenoses) with differentiation that obeys altitudinal and latitudinal zonality, and organized by the orogenic, orographic, climatic, and phyto-vegetative factors responsible for them in certain zonal and azonal conditions at every moment of its existence.*** The landscape belt is understood as - ***the azonal belt of the landscape sphere with a genetically uniform structural-tectonic position in the marginal continental dichotomy of the ocean-continent system and the landscape foundations characterized by the accretion nature (in the Russian part of the belt are Sikhotealin, Lower Amur, Priokhotsk, Sakhalin, Kamchatka-Kuril, Chukchi, etc.) areas (structures) with climatic and plant internal contents, subject to altitudinal and latitudinal zonality and evolving under the influence of interacting, in interrelated and interpenetrating orogenic, orographic, climatic and phyto-vegetative factors in certain zonal and azonal conditions at every moment of its existence.***

When developing a scientific and applied field, the methods of landscape component, morphological, areal, multi-scale vector-layer display in the classification units of landscapes (tract, landscape, type, genus, subclass, class, type, district, province, region, belt) are applied. The use of scientifically developed indicator methods allows cartographically, using modern digital computer technologies, to move on to the consideration of scientific and practical tools harmonized with nature, planning and forecasting models of economic, social, environmental and other geosystems. However, analysis, synthesis and evaluation of materials on the

practical phased sequential implementation of the landscape approach in planning the development of the vast Far Eastern region shows that such studies are absent and, given the importance of taking into account natural models in the development, we can talk about the relevance of the studies.

Purpose – consider the Far Eastern landscape paradigm of indication and planning as a fundamental scientific and applied area developed at the Pacific International Landscape Center of FEFU and aimed at the rational development and use of territories.

Task – provide objective information about the level of FE supply with landscape fundamentals and documents for solving the problems of development and enhancement of the Far Eastern region, and the development of landscape science in indication and landscape planning at FE.

Materials and methods

The general methodological scientific basis of the FEFU landscape school is landscape geography and the landscape approach as a whole.

To date, there are already the results of the theory and practice of the landscape approach in the study of geographical space on the basis of multiscale landscape studies. There are the results of many years of scientific and practical research in the field of geological and geographical study and landscape mapping of the regional (Primorye, Sakhalin Island, Chukotka, etc.) links of the marginal-continental landscape belt of Pacific Russia [1-11].

Extensive related information on the internal content of nature has been collected for selected territories of Pacific Russia. To address the issue, there are data on fairly significant data samples, not only on topography, vegetation and soils, but also on bedrock and loose rocks, climate, on the power of loose accumulations, transit of clastic material, moisture, physical and chemical weathering, meso- and microclimatic features. For the geographic systematics of landscapes, especially based on the materials of geological surveying, aerial photographs, and satellite images, material complexes of loose rocks are systematized and identified, the state of erosion-denudation systems, and relief are considered.

Following the results of numerous expeditions to Sakhalin, Kamchatka, Chukotka and other territories of the Pacific landscape belt of Pacific Russia, the following were developed:

1. The foundations of a new direction in geography in Pacific Russia – landscape geography. It is aimed at the practical implementation of the landscape approach in the development of Pacific Russia and the undergraduate training in the program "Landscape Planning".

2. Fundamentals of the practical implementation of the landscape approach using landscape indication: in forest management of Pacific Russia; in the planning and design of environmental management of geosystems.

3. The theory of landscape indication of the transformation of geosystems in Pacific Russia.

4. Landscape and nature management strategy in Pacific Russia.

5. Classification and structural differentiation of landscape geosystems on a scale of: 1: 500,000 Pacific Russia (Sakhalin Oblast, Primorsky Krai); 1: 25 000 - Russky island of the Primorsky Krai; 1: 500 000 - Sakhalin link.

6. The allocation methodology and the internal content of the geosystem districts of the Sakhalin-Primorsky Krai, Muravyevo-Amursky Okrug (including Russky Island) of the Primorsky Krai and the hierarchical structure of the latter.

7. The methodology of vector-layer mapping of landscapes and the identification of okrugs of the Pacific landscape belt of Russia.

8. The method of vector-layer landscape mapping and zoning.

9. The concept of indication of landscapes of Pacific Russia.

10. The concept of nodal landscape structures for the development of the landscape sphere.

11. The concept of a new structuring of mountain landscape and island systems of the Pacific landscape belt.

Established: vector-layered landscape structure of the Muravyevo-Amursky Okrug of Primorsky Krai.

Conducted: analysis, synthesis and assessment of the geoecological state of landscapes in the southern part of the Far Eastern Federal District of Russia.

Conducted: landscape geography of regional districts of the Pacific landscape belt of Russia.

Highlighted: Pacific landscape belt, belt areas.

Considered: the author's concept of the evolution of the foundation of the Pacific landscape belt.

The developed principles are applied in the practical implementation of the landscape approach using landscape display in various areas of nature management: the comprehensive establishment of the landscape status of nature management objects in the existing landscape system of the region; regional identification and assessment of ecological and environmental problems; features of possible technogenic transformations of landscapes during nature management; geo-ecological substantiation of land management of agricultural enterprises; and etc.

Based on the work of the Pacific International Landscape Center SNS FEFU, authored by Professor V.T. Starozhilov, 350 scientific works are published, of which 28 monographs, 25 study guides; 7 cards.

All available material was analyzed, and the following was obtained:

Results

Based on the analysis, synthesis and evaluation of significant field and theoretical material, the fundamental result of these studies is established, which consists

in the fact that, for the implementation of the tasks set, first of all, digitized vector-layer morphological landscape basics (vector-layer medium-scale landscape map), are obtained, which on a digital level provide knowledge of the structure of the geographical space of the object in question. This result allows us to analyze the territory by digitized landscapes. Compare the internal content of taxa such as landscape, type, genus, subclass, class, type, county, province, region. Then solve the problems of nature management, including its planning.

The first results of landscape planning in the Pacific landscape belt of Russia on the basis of component and morphological indications were obtained by us in 1983. government programs for the search and evaluation of mineral deposits. In 1983, for the first time for the Primorsky Krai, a map of landscape typification was compiled on a scale of 1: 500 000 (Starozhilov, Mostovoy, 1983) and a map of physical and geographical zoning on a scale of 1: 1000 000. As a result, a map of search regions was compiled on their basis, within which According to the results of studying materials for indicating landscape situations, data were obtained on the planning of the application of methods for searching for mineral deposits. As a result, the first experience in applying landscape indications and planning in practice was obtained.

The research results, as an example of the practical implementation of the landscape approach in the field of planning, design and management of environmental control, were used as the basic foundations for solving environmental management problems. The materials were transferred to the following organizations: Pacific Institute of Geography, Institute of Biology and Soil, Far Eastern Institute of Geology FEB RAS, Far Eastern Research Institute of Hydrotechnics and Land Reclamation, Far Eastern Research Institute of the State Committee for Hydrometeorology and Environmental Monitoring and other organizations.

In subsequent years, the results of applying the methodology of indication and planning in other areas of environmental management and, in particular, as noted above in the materials section, in ecology, the organization of agricultural enterprises in taiga zones and other areas, were obtained. For example, as a result of the use of indications in the field of ecology of territories of mining centers (for example, Primorsky Krai), the importance of applying landscape planning to establish environmental situations and problems in the development of mining production has been established. The necessity of applying landscape planning in Pacific Russia in the field of organizing agricultural enterprises, forest management, tourism, etc. is also established.

The existing landscape basics and experience in the practical implementation of landscape planning and their relevance in the development of territories already determine the significant opportunities for the practical implementation of the landscape approach in planning, designing nature management in Pacific Russia.

We emphasize that the practical objective implementation of the application of the medium-scale landscape approach at the present stage of the development of geographical and other sciences is possible only with the use of digitized regional landscape maps mentioned above. According to A.G. Isachenko their absence can only lead to "fruitless theorizing" and only "landscape mapping" will provide an opportunity to focus on the development of constructive concepts, including when solving issues of applied landscape geography.

Based on the noted materials, practical experience in indicating and planning industrial environmental management and the above results of practical implementation of the landscape approach in various fields of science and nature management, a generalization of materials on the strategy for the practical implementation of the landscape approach in the field of industrial and environmental management planning is made. The first basic stage is highlighted, it includes:

1) – development of nature-use-landscape models, including assessment and accounting of the nature-use potential of different-ranking landscape systems;

2) – assessment of the degree of possibility of saturation of landscape taxa with natural resources. At the same time:

- landscape models of their placement should be compiled using component-wise and morphological landscape indications:
- estimation of perspective density of objects distribution is given.;
- establishment of natural resource management and economic relations;
- ranking of nature management objects by landscape taxa;

3) – development of a program of landscape and nature-user research based on the use of cartographic landscape materials within the framework of mountain landscape geography with its systematic vision of nature and for the planning of nature-use prospective activities.

Based on the totality of materials, it was also established that before proceeding with planning, it is necessary: to obtain a landscape morphological map of nature - to draw an industry indication of geographical space using a landscape map - to draw up an industry model based on the nature model with the results of an industry indication of the territory drawn on it - to draw up an industry map landscape nodal structures of development - draw up sectoral planning maps.

Conclusion. The Pacific International Landscape Center of the Far Eastern Federal University substantiated and consistently develops in Pacific Russia the landscape paradigm of indication and planning as a fundamental scientific and applied direction aimed at the rational development and use of territories. Using separate examples, a scientific and practical landscape basis has been developed for the use of indications as a method and industry development planning. Today, it is proposed to use computer technology of the vector-layer landscape method, especially computer technology for using landscape materials, as a “platform”

in the practical implementation of territorial development plans. In addition, it is proposed to use computer technology of the vector-layer landscape method, especially computer technology for using landscape materials, as a "platform" in teaching graduate students under the program "Landscape Planning".

Provided that vector-layer mapping is used, landscapes are studied using component, morphological, area, multi-scale vector-layer displays in the classification units of landscapes (landscape, type, genus, subclass, class, type, district, province, region, belt), it will allow cartographically using modern digital computer technologies at the level of the Landscape sphere, go on to consider scientific and practical models of economic planning and forecasting harmonized with nature, with social, environmental, etc. geosystems. "Landscape Geography", Pacific International Landscape Center SNS FEFU will help in solving the practical tasks set by the government to develop the territories of Pacific Russia and in developing the theoretical base of landscape geography of the Landscape sphere. Developed at FEFU by Professor V.T. Starozhilov, a new for Pacific Russia interdisciplinary (includes knowledge of geography, hydrology, geology, climatology, oceanology, geomorphology, etc.) direction "Landscape geography" takes education, science and practice to a new information and creative level. The practical landscape orientation of science and education in the conditions of intensive development of territories is significant in fulfilling the tasks of developing regions and creating professional personnel not only in geography, but also in geology, hydrology, climatology, and oceanology.

In general, it can be stated that to date, the Pacific International Landscape Center SNS FEFU has developed the basics for display and landscape planning. The Center recommends the use of landscape display and landscape planning in the development of Pacific Russia and in the training of professional personnel not only in geography but also in geology, hydrology, climatology, oceanology and other areas of knowledge important for Russia.

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分析过去24个太阳活动周期的气候条件及其在下伏尔加河和里海北部地区在接下来的25和26个周期中最有可能发生的变化

ANALYSIS OF CLIMATIC CONDITIONS DURING THE PAST 24TH CYCLE OF SOLAR ACTIVITY AND THEIR MOST LIKELY CHANGES DURING THE NEXT 25 AND 26TH CYCLES ON THE LOWER VOLGA AND IN THE NORTHERN PART OF THE CASPIAN SEA

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抽象。 使用了当今已知的地球气候及其各个区域对太阳活动周期的主要规律性和依赖性。 描述了先前时期，第24周期的时期和里约热内卢北部的伏尔加河下部和里海北部的水文和热力状况的预期变异性和长期特征。 即将到来的第25和随后的第26个太阳活动周期。

关键字：太阳活动，气候周期，温度，气候预报

Abstract. *The main regularities and dependences of the Earth's climate and its individual regions on the cycles of solar activity known today are used. A description is given of the expected variability and specifics of the long-term characteristics of the hydrological and thermal regimes of the lower Volga and the northern part of the Caspian Sea for the previous periods, the period of the 24th cycle and the conditions of the upcoming 25th and subsequent 26th cycles of solar activity.*

Keywords: *solar activity, climate cycles, temperature, climate forecast*

Solar activity cycles

Solar activity is the regular occurrence of characteristic formations in the solar atmosphere: sunspots, torches in the photosphere, flocculi and flares in the chromosphere, prominences in the corona. The areas where these phenomena are observed together are called centers of solar activity. In solar activity (growth and decline in the number of centers of solar activity, as well as their power), there is an approximately 11-year periodicity (cycles of solar activity, Fig. 1). Solar activity affects many earthly processes.

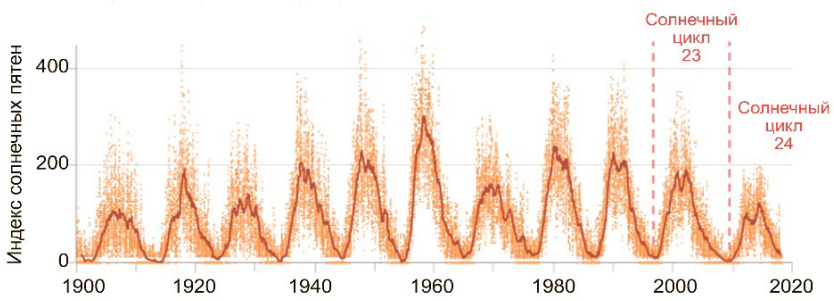


Fig. 1. *Quasi-11-year cycles of solar activity (Schwabe-Wolf cycles).*

The influence of the cyclical processes of solar activity on the Earth's climate was established more than two centuries ago and is now not in dispute by anyone.

Changes in solar activity are cyclical in nature. To date, 11-year, 22-year, 80-year, 190-year solar activity cycles have been identified:

- 11-year cycles (Schwabe-Wolf);
- 22-year cycles (Hoyle);
- "secular" cycles (80-90 years);
- 190-year cycles (indiction).

11-year cycles (Schwabe - Wolf.) To characterize solar activity, in 1849, the director of the Zurich Observatory R. Wolf proposed a conventional unit (Wolf number) - the number of sunspots (Table 1).

The connection of 11-year cycles with hydrometeorological phenomena on Earth was established. So, the most severe floods in St. Petersburg occur at the beginning of the ascending branch of the solar cycles with a delay of one year after the minimum (1824, 1924. 1955).

22-year cycles (Hoyle). Upon transition from one 11-year cycle to another, the polarity of the head and tail sunspots in each hemisphere changes. This allowed Hoyle to distinguish 22-year cycles, each of which consists of even and odd 11-year cycles.

“Secular” cycles. A.P. Ghansky singled out 80-year cycles of solar activity, which were called "centuries ". In 1939, Gleisberg calculated the duration of secular cycles at about 78 years. In 1956 he specified - 78.8 years. The existence of “secular” cycles was confirmed by M.N. Gnevyshev [1].

190-year cycles («indiction»). In 1948 L.L. Predtechensky established a cycle of solar activity lasting 190 years, which was called "indiction" - returning. According to Anderson’s calculations, indiction consists of two half-periods: 88 and 81 years, a total of 169 years. According to the calculations of D.A. Bonov, taking into account the magnetic properties of 11-year cycles, indiction consists of eight 22-year cycles and lasts 176 years. Analysis of the temperature regime in Astrakhan for the period from 1836 to 2016 is in good agreement with the calculations of D.A. Bonov [2].

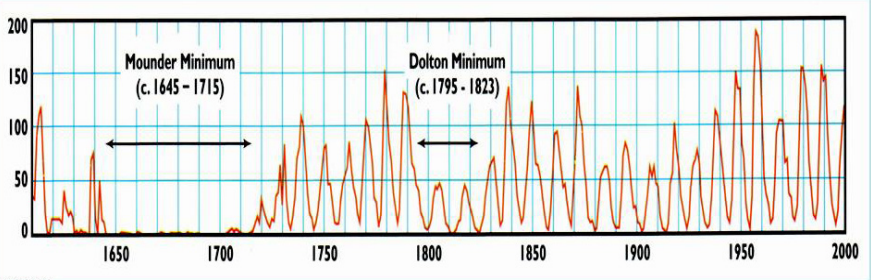


Fig. 2. *In the optical range, the indicator of solar activity is the average number of spots.*

In the second half of the XVI century, a general cooling (Little Ice Age) was observed on Earth (Fig. 2).

The influence of solar activity on climatic characteristics is regional in nature, and is manifested in the strengthening of atmospheric processes in some regions and their weakening in others. Climate change along the coast and the waters of the North Caspian Sea are unidirectional. Thus, the temperature regime according to the data of the Astrakhan, Tyuleniy, Kulaly, Ganyushkino, Atyrau, Peshnoy, Fort-Shevchenko MSs changes simultaneously and in phase in 1938-2003. Periods of sharp changes in air temperature occur simultaneously and have one trend - increase or decrease [3].

Having data on air temperature observations from the Astrakhan MS since 1836, it is possible to identify the features of the temperature regime from the 8th to the 23rd eleven-year solar activity cycle and extend them to the entire North Caspian region (Fig. 3).

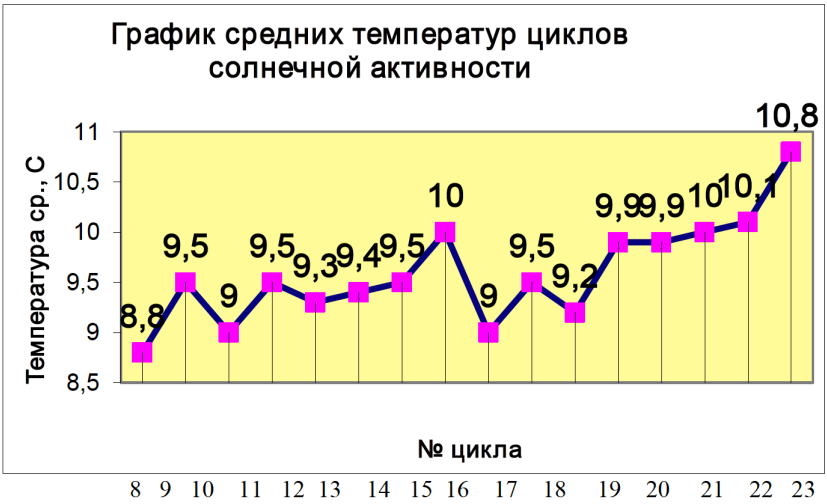


Fig. 3. *Features of the temperature regime from the 8th to the 23rd eleven-year cycle of solar activity.*

The past, 24th even eleven-year cycle of solar activity began in December 2008 and lasted until mid-2019. The total cycle duration was 10.8±0.7 years. The main maximum of solar activity in the first half of 2011. The maximum of 5-6 summer cycles fell at the end of 2009 - beginning of 2010 and the end of 2014 - beginning of 2015.

The decrease in atmospheric pressure in the polar regions, characteristic of even 11-year cycles, during periods of increasing solar activity, as a rule, leads to a shift in the center of the Arctic anticyclone to the northeast. Atlantic cyclones that form in moist sea air and pass north of the usual, which, in general, leads to a decrease in precipitation in the Volga and Kama basins and a decrease in the annual flow of the Volga River in the Caspian Sea.

Sunspots and Earth's climate cycles

On Earth, there are relatively short (approximately 10-year) cycles of climatic fluctuations, which approximately coincide with the cycles of activity of the Sun. Can they affect the weather?

The cycles in temperature changes approximately coincide with the cycles of solar activity. However, the peaks of solar activity account for both the warmest (mostly) and the coldest years (Fig. 4).

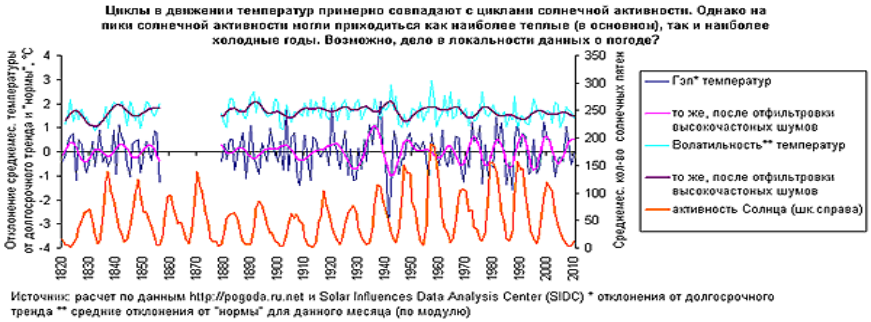


Fig. 4. *The relationship of temperature changes with cycles of solar activity.*

Table 1.

Changes in solar activity (W) from 1755 to 2018 (in the numerator, years, in the denominator of the Wolf number W).

1	1755 10	1756 10	1757 32	1758 48	1759 54	1760 63	1761 86	1762 61	1763 45	1764 36	1765 21	1766 11		
2	1767 38	1768 70	1769 106	1770 82	1771 82	1772 66	1773 35	1774 31	1775 7					
3	1776 20	1777 92	1778 154	1779 126	1780 85	1781 68	1782 38	1783 23	1784 10					
4	1785 24	1786 83	1787 132	1788 131	1789 118	1790 90	1791 67	1792 60	1793 47	1794 41	1795 21	1796 16	1797 6	1798 4
5	1799 9	1800 14	1801 34	1802 44	1803 43	1804 47	1805 42	1806 28	1807 10	1808 8	1809 2	1810 0		
6	1811 1	1812 5	1813 12	1814 14	1815 35	1816 46	1817 41	1818 30	1819 24	1820 16	1821 7	1822 4	1823 2	
7	1824 8	1825 7	1826 36	1827 50	1828 62	1829 67	1830 71	1831 48	1832 27	1833 8				
8	1834 13	1835 57	1836 121	1837 138	1838 103	1839 86	1840 63	1841 37	1842 24	1843 11				
9	1844 15	1845 40	1846 61	1847 98	1848 125	1849 96	1850 66	1851 64	1852 54	1853 39	1854 21	1855 7	1856 4	
10	1857 23	1858 55	1859 94	1860 96	1861 77	1862 59	1863 44	1864 47	1865 30	1866 16	1867 7			
11	1868 37	1869 74	1870 139	1871 111	1872 102	1873 66	1874 45	1875 17	1876 11	1877 12	1878 3			
12	1879 6	1880 32	1881 45	1882 60	1883 64	1884 63	1885 52	1886 25	1887 13	1888 7	1889 6			
13	1890 7	1891 36	1892 73	1893 85	1894 78	1895 64	1896 42	1897 26	1898 27	1899 12	1900 9	1901 3		
14	1902 5	1903 24	1904 42	1905 63	1906 54	1907 62	1908 42	1909 44	1910 19	1911 6	1912 4	1913 1		
15	1914 10	1915 47	1916 57	1917 107	1918 81	1919 64	1920 38	1921 26	1922 14	1923 6				

16	1924 17	1925 44	1926 64	1927 69	1928 78	1929 65	1930 36	1931 21	1932 11	1933 6				
17	1934 9	1935 36	1936 80	1937 114	1938 110	1939 88	1940 68	1941 47	1942 31	1943 16	1944 10			
18	1945 33	1946 92	1947 151	1948 136	1949 135	1950 80	1951 69	1952 31	1953 14	1954 4				
19	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964				
	38	142	190	185	159	112	54	37	28	13				
20	1965 15	1966 117	1967 94	1968 106	1969 105	1970 104	1971 66	1972 69	1973 38	1974 34	1975 15	1976 13		
21	1977 27	1978 92	1979 155	1980 155	1981 140	1982 116	1983 66	1984 46	1985 18	1986 13				
22	1987 29	1988 100	1989 157	1990 143	1991 146	1992 94	1993 54	1994 30	1995 15	1996 10				
23	1997 21	1998 64	1999 93	2000 120	2001 111	2002 106	2003 74	2004 42	2005 20	2006 15	2007 8			
24	2008 4	2009 27	2010 77	2011 129	2012 145	2013 137	2014 75	2015 42	2016 15	2017 14	2018 4			

Примечание: числа Вольфа в 24-ом цикле солнечной активности прогностические.
Жёлтый фон – годы с пиковыми (максимальными) значениями солнечной активности.
Синий фон – годы с минимально низкой солнечной активностью (депрессивные).

Climatic changes during the 24th cycle and their consequences

Such significant predicted changes in climatic and hydrological conditions, of course, negatively affected the activities of all, without exception, sectors of the national economy, not only in Astrakhan, the Astrakhan Oblast, but also the entire North Caspian region. This led to significant additional material costs both in the warm and cold seasons of the period under consideration.

In the North Caspian region, the anticyclonicity of the climate increased under the influence of the crest of the Azores and Siberian anticyclones. The weather has become drier. Rainfall decreased. The continental Arctic air mass in which the Siberian anticyclone is formed, as a result of intense radiation cooling in the winter season, determined sharp drops in air temperature.

An increase in the meridional form of atmospheric circulation during periods of maximum solar activity led to an even greater decrease in air temperature in the winter season due to the invasion of Arctic air along the normal polar and ultra-polar axes. This mainly affected the eastern part of the Northern Caspian.

The average annual air temperature in the 24th cycle was about 9°C, which is 0.6° lower than the long-term norm and 1.8°C lower than in the 23rd cycle (1996-2007). The decrease in average annual temperature was due to a sharp decrease in the temperature of the cold season of the year (November-March) to -3.0-3.5°C, which is 0.7-1.2°C lower than normal and 3.0-3.5°C lower, 1996 2007.

Thus, the 24th even eleven-year cycle of solar activity in the Astrakhan Oblast and the entire Northern Caspian was characterized by arid summers with little rainfall, repeatability of rather cold winters and strong east winds. The general decrease in precipitation in the Volga-Kama basin led to a decrease in the annual flow of the Volga River, to low spring floods, a decrease to critical depths in the summer and winter low-water periods and a general decrease in the level of the Caspian Sea [4, 5].

Strengthening the continental climate of the region affected agriculture, water transport, and affected the fishing industry. In the summer months there was an intensive flowering of water in the reservoirs of the Volga-Akhtuba floodplain and the Volga delta. Due to lack of water, there was a massive drying out of small and medium-sized watercourses in the floodplain and the Volga delta. Particularly susceptible to this were the water bodies of the Western steppe ilmeni region.

It required the implementation of additional volumes of dredging, land reclamation, reconstruction of many existing coastal marine and river hydraulic structures and facilities. The expenditures of the housing and communal complex for providing water to the population, especially during the summer-autumn low-water period, and for heating residential, office and industrial premises in cold seasons increased. Consumption of electric and thermal energy, various types of fuel increased significantly.

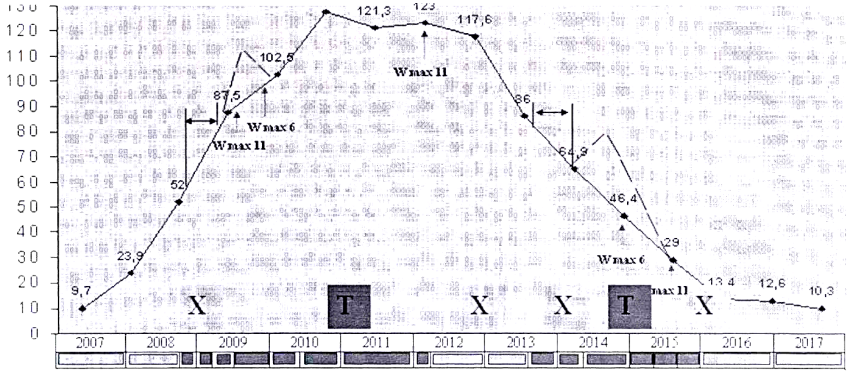


Fig. 5. *24th cycle of solar activity.*

Lowering of the level of the Caspian Sea primarily affected its shallow, northern part. In the summer, hot seasons, this led to intense heating and evaporation of water from the vast shallow waters of the Northern Caspian, an increase in the temperature of sea water to dangerous values, and the appearance of extensive zones with hypoxia.

The frequency and intensity of hazardous water drives increased, which led to massive downtime of vessels in the marine part of the Volga-Caspian maritime shipping canal, especially in winter, in the presence of drifting ice [6]. The recurrence of cold and warm winters over a 24-cycle solar activity is shown in the graph (Fig. 5).

Analysis of long-term temperature conditions (1836-2016) and preliminary climate forecast for 25th and 26th solar cycles

Climatologists have been divided into two groups.

Some believe that a global warming regime has been established on the globe. The global warming trend is irreversible and is determined by anthropogenic factors. It is proposed to take urgent measures to drastically reduce industrial gas emissions into the atmosphere in order to avoid a sharp warming of the climate and a catastrophic increase in sea level.

Others believe that changes in the temperature regime are cyclical in nature and are determined by the cyclical nature of the processes of solar activity and the change in the angular velocity of the Earth's rotation. It is assumed that solar activity has entered a phase of sharp decline. Starting around 2030, the beginning of the Maunder phase (almost complete absence of sunspots) and the associated new small ice age is predicted.

Analyzing the temperature regime of Astrakhan (regular instrumental observations since 1836) we come to an unambiguous conclusion about the cyclical nature of its changes associated with natural causes.

Cyclical nature of multi-year air temperature

The official position of WMO is this: global warming is the result of the greenhouse effect of increased CO2 emissions. This is substantiated in the third report of the International Panel on Climate Change (IPCC). However, in recent years, an alternative version has begun to take shape. So A.G. Egorov (2005) believes that the potential for explaining climate change is far from being fully realized, proceeding from the inherent cyclical nature that functions without any human intervention [7]. In the natural variability of the surface atmosphere, there are circulating mechanisms, based on which climate changes can be described without the intervention of anthropogenic factors. One of the reasons for the natural cyclical nature of climate change, the author believes, are changes in solar activity.

In the work of E.A. Kasatkina et al. [8] already posed a statement: At present, there is no doubt that solar activity plays a significant role in global climate change. As a rule, manifestations of solar activity are associated with the appearance of solar cycles with periods of 11, 22, 33 and 88-98 years. "

A.I. Ol [9] provides evidence that the 22-year periodicity of changes in meteorological elements is characteristic of many regions of the globe.

Z.M. Gudkovich et al. [10] using the example of changes in the average annual air temperature in the latitudinal zone 17.5–87.5 nl. for the period of 1579-1978 show that for 400 years the air temperature in the Northern Hemisphere experienced cyclic fluctuations. These fluctuations were global in nature and were determined by 11 and 22-year cycles of solar activity.

As an alternative hypothesis to the anthropogenic factor O.A. Anisimov et al. [11] believe that the influence of natural periodicities can be considered: from changes in the parameters of the planetary orbit and the cyclicity in the intensity of solar radiation to the frequency of volcanic eruptions, etc.

Using the example of observations of air temperature in Astrakhan for the period 1836-2016, we will try to show that an alternative to anthropogenic theory may be taking place.

The long-term regime of air temperature has a pronounced cyclic character. Periods of elevated air temperature alternate with colder ones. This is characteristic not only for the Astrakhan region, but also for the whole of Europe.

According to meteorological observations in Europe, the following was observed:

- the coldest periods:1746-1756, 1833-1843, 1923-1933.
- moderately cold periods: 1766-1775, 1855-1867, 1944-1954.
- the warmest periods: 1823-1833, 1913-1923, 1996-2007.
- moderately warm periods: 1810-1823, 1902-1913, 1986-1996.

Cold and warm periods revealed by observations in Europe are in good agreement with 11-year cycles of solar activity and are confirmed by observational data in Astrakhan (Table 2).

Table 2.

Average temperatures of cold and warm periods in Astrakhan

Period.	Duration.	№ of 11-year cycle.	Average cycle temperature
Cold	1746-1756	0	-
	1833-1843	8	8.8
	1923-1933	16	9.0
Moderately cold	1766-1775	2	-
	1855-1867	10	9.0
	1944-1954	18	9.2
Warm	1823-1833	7	-
	1913-1923	15	10.0
	1996-2007	23	10.8
Moderately warm	1810-1823	6	-
	1902-1913	14	9.5
	1986-1996	22	10.2

The coldest are even 11-year cycles, the warmest are odd. The cyclicity of the cold periods is 89 years, warm - 88 years.

Thus, the cyclical nature of the cold and warm periods, both in Europe and in the Astrakhan region, in particular, corresponds to the “secular” cycles of solar activity calculated by D.A. Bonov.

Features of the temperature regime of solar cycles

Having data on observations of air temperature since 1836, it is possible to analyze the temperature regime during VIII-XXIV eleven-year cycles.

Analysis of the data in these tables allows us to draw the following conclusions:

- we believe that the secular cycles of solar activity consist of eight 11-year cycles: VIII-XV and XVI-XXIII or four 22-year cycles, which confirms the calculations of D.A. Bonov. The duration of the first secular cycle is 91 years, of the second - 84 years;

- The indicated secular cycles are half-periods of the 190-year cycle (indiction). The duration of “indiction” is 175 years (according to Bonov's calculations - 176 years);

- the average air temperature of the solar activity cycles - “indiction”, “secular”, 22-year and 11-year is 9.6°C (average annual air temperature);

- the average air temperature of the 22-year cycles (Hoyle), which make up the secular cycle, rises from the first to the fourth, by an average of 0.3°C (9.15-9.25-9.35-9.75 C in the first secular cycle and 9.25-9.55-9.90-10.45 C in the second;

- the average air temperature of even (odd) 11-year cycles, as a part of a century long cycle, rises from the first to the fourth, by an average of 0.3°C;

- the initial (even) 11-year cycle has the lowest air temperature of all eight 11-year cycles that make up the secular (8.8 C in the first secular cycle and 9.0 C in the second,);

- the final (odd) 11-year cycle has the highest air temperature of all eight 11-year cycles that make up the secular (10.0 C in the first secular cycle and 10.8 C in the second);

- the average air temperature of an even 11-year cycle is always lower than that of an odd one in pairs that make up the 22-year cycle (this also applies to the phase of decline in the activity of 11-year cycles);

- the average air temperature of any 11-year or 22-year cycles of the initial "secular" cycle, as part of the "indiction", is always lower than the corresponding 11 and 22-year cycles of the final "secular" cycle;

- the indicated features of the temperature regime of 11-year and 22-year solar cycles extend to the average air temperatures of years (as part of these cycles), the cold seasons of the year (November-March), as well as the months of February, March and April;

- the average temperature of the cold season of the year rises from 1 to 4 even (odd) 11-year cycles as part of the "secular";

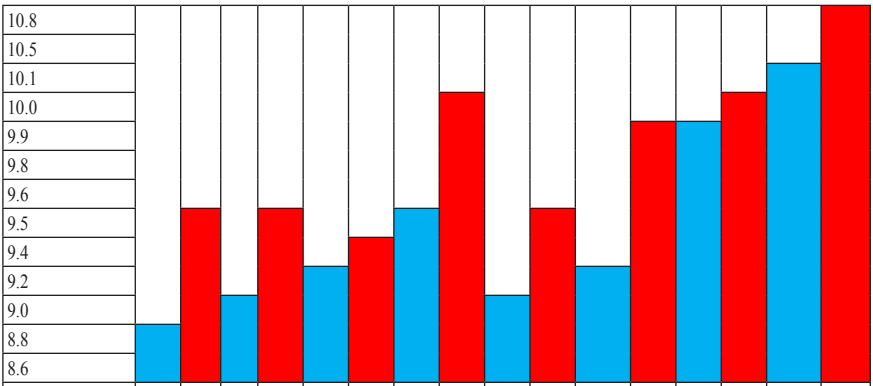
- the average air temperatures of December, February, March and April of the months of the even 11-year cycle are colder than the odd ones in the pair making up the Hoyle cycle.

The binary system in the structure of solar cycles from 11-year to “indiction” is clearly visible:

- 11 year cycle consists of two 5.5-6.0 year.
- 22-year cycle consists of two 11-year.
- two 22-year cycles make up the half-cycle of the “secular” cycle.
- “secular” cycle consists of two half-periods.
- “indiction” consists of two “secular” cycles, etc.

Figure 6 shows the long-term course of average air temperatures of 11-year cycles.

T C⁰.



№ of cycle	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII	XIX	XX	XXI	XXII	XIII
Temperature, °C	8.8	9.5	9.0	9.5	9.3	9.4	9.5	10.0	9.0	9.5	9.2	9.9	9.9	10.0	10.1	10.8

Fig. 6. *Schedule of distribution of average annual air temperatures (C°) over 11-year cycles of solar activity.*

An analysis of the temperature regime for the period from 1836 to 2016 shows:

In the multi-year regime of air temperature, a pronounced cyclicity is observed. This cyclicity is in good agreement with changes in solar activity.

Changes in solar activity lead to changes in the prevailing types of atmospheric circulation and, as a result, to changes in the temperature regime.

So the average air temperature (meteorological year, cold season) in even 11-year cycles is always lower than in odd ones - in the pair that makes up the Hoyle cycle.

In the “secular” cycle, consisting of eight 11-year cycles (Wolf cycles), the average temperature rises from the first to the fourth, both even and odd cycles.

With the beginning of the next “secular” cycle, the average temperature of the first Wolf cycle drops sharply, and then begins to rise.

The same pattern applies to Hoyle cycles (22-year).

The sectoral structure of the interplanetary magnetic field, due to the presence of unipolar magnetic fields on the Sun, predominates in even 11-year cycles of extremely cold years (76%), and in odd extremely warm years (67%).

In addition, the features of the temperature regime of the phases of activity of 11-year cycles were revealed.

The increase in the average annual air temperature observed in the city of Astrakhan since the 70s of the XX century (growth rate of 0.2°C/10 years) is due to an increase in the average air temperatures of the cold season of the year and spring, with almost the same average temperature of the warm season and autumn.

Along with the increase in average annual air temperature, the temperature regime redistributed throughout the year: spring (April) became warmer than autumn (October), the average March temperature increased from -0.4°C to +0.4°C, and the average May temperature decreased (which led to an increase in the frequency of frosts in the first decade of May).

The XXIII eleven-year solar cycle (1996-2009) became the warmest for all years of observations - the average annual air temperature +10.8°C (at a rate of +9.6°C), the average temperature of the cold season -0.2°C (at normal -2.3°C).

Probably the peak of the next increase in air temperature associated with changes in solar activity has been passed. This is confirmed by changes in the humidification mode. A sharp increase in the annual precipitation observed in 1990-2000 was replaced by a decrease.

Preliminary forecast of the 25th solar cycle

Scientists entrusted with predicting the activity of the Sun over the next 11-year solar cycle, say that it is likely to be weak, very similar to the current one. The current 24th solar cycle is decreasing and is projected to reach a solar minimum - the period when the Sun is least active - not earlier than July 2019, and no later than September 2020. In support of this theory, an analysis of the severity of winters that we spend and characterizing the last three winter seasons from 2017 to 2020 in the lower Volga and the northern part of the Caspian Sea showed that the severity of winters decreased with a decrease in FDD.

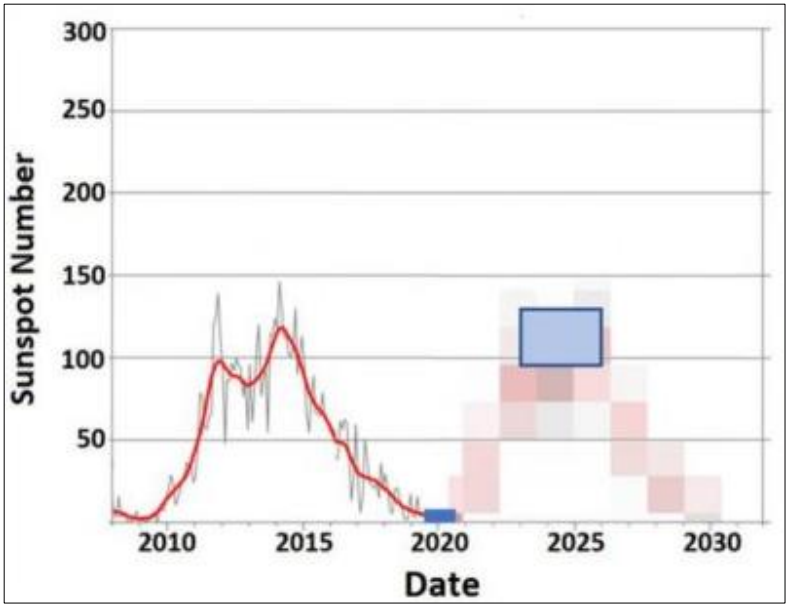


Fig. 7. *Forecast of the 25th solar cycle.*

Experts from the 25th Solar Cycle Prediction Group say the new solar cycle may have a slow start. The period of greatest solar activity (solar maximum) is expected between 2023 and 2026 with a sunspot range of 95 to 130. This is well below the average number of sunspots, which usually ranges from 140 to 220 per solar cycle. Experts are confident that the upcoming cycle should break the tendency to weakening solar activity observed over the past four cycles. "We expect the 25th solar cycle to be very similar to the 24th: another rather weak cycle, which is preceded by a long, deep minimum," says group co-chair Lisa Upton, Doctor of Philosophical Sciences and solar physicist at Space Systems Research Corporation "(Fig. 7).

Expected climatic conditions for the 25th solar cycle (from 2021-22 to 2032-33)

The first two years will be colder than normal. The sum of the average temperatures of the calendar winter will be below -20.0C. Further, to the peak of the activity of the cycle, the increase in the average annual temperature will be higher than the norm (10.5-11.0 °C) and by the end of the cycle again a steady decrease in temperature. Fluctuations in average temperatures will be determined by their fluctuations in the period November-March. At the beginning and end of the cycle, the early establishment of ice cover in the lower Volga and in the Northern Caspian.

Expected climatic conditions for the 26th solar cycle (2023-33 to 2043-44)

The beginning of the Maunder phase and the onset of the little ice age.

The influence of solar activity on climatic characteristics is regional in nature, strengthening atmospheric processes in some regions and weakening in others. Climate change along the coast and the waters of the North Caspian Sea are unidirectional. Thus, the temperature regime according to the data of the Astrakhan, Tyuleniy, Kulaly, Ganyushkino, Atyrau, Peshnoy, Fort-Shevchenko MSs changes simultaneously and in phase in 1938-2003. Periods of sharp changes in air temperature occur simultaneously and have the same trend - increase or decrease.

Given the correlation coefficient, the expected climatic conditions for Astrakhan can be extended to the entire northern coast and the water area of the Northern Caspian. The predominant synoptic process will be the Asian (Siberian) anticyclone or its crest, which will be accompanied by an extremely low amount of precipitation, long and strong winds of the eastern quarter. In the warm seasons, dust storms and dry winds. Severe ice conditions in the Northern Caspian in winter from December to March.

Conclusions and recommendations

Strengthening the continental climate of the region will affect all sectors of the economy. An additional amount of dredging, reclamation, and, possibly, reconstruction of many existing coastal marine and river hydraulic structures and facilities will be required. Housing and communal services will increase expenses for providing water to the population, especially during the summer-autumn low water season, and for heating residential, office and industrial premises in cold seasons. The consumption of electric and thermal energy and various types of fuel will increase significantly.

Lowering the level of the Caspian Sea will primarily affect its shallow, northern part. In the summer, hot seasons, this will lead to intensive heating and evaporation of water from the vast shallow waters of the Northern Caspian, an increase in the temperature and salinity of sea water to dangerous values, and the emergence of extensive zones with hypoxia. In the cold seasons, as a result of the reduced heat capacity of shallow water under the influence of low temperatures and intense wave mixing in the initial period of ice formation, a thick ice cover will form in the Northern Caspian, whose thickness will reach its maximum, long-term values by the middle of winter. In connection with the decline in the level of the Caspian and the decrease in depths in the shallow northern part of the sea, the duration of the ice period will increase, the average thickness of thermal ice will increase, and the intensity of ice hummocking will increase. Cohesive floating ice, carried by the wind and currents into the deep sea, the middle part of the sea and drifting along the coast to the south, will pose a special threat. The bottom of the sea almost everywhere in

the entire Northern Caspian will be exposed to the plowing effects of heavy drifting ice. The frequency and intensity of hazardous water drives will increase, which will pose a serious threat to the safety of navigation, especially in the marine part of the Volga-Caspian maritime shipping canal, leading to mass death of fish, especially in the initial period of ice formation in coastal shallow waters.

Development of the "North Caspian Square" license area of the "Caspian Oil Company" LLC in shallow and extremely shallow waters annually covered by ice, its direct proximity to the protected zone of the Caspian Sea with unique biological resources, lack of technical means for the construction of prospecting and search and exploration wells, transport and towing and rescue vessels of the ice class with low draft is associated with significant geological, industrial, environmental, financial, social, reputational and other risks that must be taken into account by the subsoil user and minimize them when implementing the project in order to increase its effectiveness and profitability.

One should take into account the option of lowering the water level in the Caspian Sea, in which a situation is not excluded when the depth of the sea, even taking into account the construction of approach channels and vast working areas, will not allow an unhindered approach of supply vessels to the artificial islands created for the development of the field.

By the set and significance, the risks of subsoil development in shallow water areas with annual seasonal ice cover, associated with a specially protected natural area, characterized by high bio-productivity and extremely high vulnerability in the event of accidental oil and oil product spills, may be unparalleled [12].

For stable and regular operation of the whole Volga-Caspian water transport complex as a whole during this period, it will be necessary to increase the composition of the icebreaker fleet in the Northern Caspian. It will be necessary to ensure the reliable operation of numerous ferry crossings, the operation of which currently does not stand up to criticism, especially in the ice period. The main problem is the morally obsolete fleet and the extreme deterioration of non-self-propelled ferries that require immediate replacement with new, self-propelled and all-weather, and having the ability to work independently in broken ice [13].

It will require the creation of a specialized system of hydrometeorological support for maritime activities and a service for operational monitoring of the ice situation in the lower Volga and the freezing part of the Northern Caspian (similar to the headquarters of ice operations, as it was during the times of Soviet Union, it worked well). Without such a service, ensuring the rhythmic operation of the water transport complex and navigation in the Caspian will be impossible. The service for operational monitoring of the ice situation will provide companies operating here with timely and reliable information about ice activity in this region, minimizing risks and losses, which in turn will increase economic efficiency and reduce the cost of conducting economic activities in the Caspian region seas.

Conclusion

Of course, all of the above is only scientific assumptions based on actual long-term hydrometeorological data and forecasts of colleagues in related fields of knowledge, in particular, in the field of studies of solar-active bonds. Yes, until the technology is perfect, there are many unexplored and undetected factors and relationships. But, unfortunately, there is no other alternative, since at present, and in the foreseeable future, the traditional methods of the hydrometeorological service cannot predict for such long periods. It should be noted that (fortunately or unfortunately) the previously predicted consequences of the influence of the past 24th cycle of solar activity on climatic conditions in the North Caspian region for the period from 2006 to 2017 came true almost completely!. As they say: Forewarned is forearmed!

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关于贝叶斯多维矩阵多项式的经验回归
ON THE BAYESIAN MULTIDIMENSIONAL-MATRIX POLYNOMIAL EMPIRICAL REGRESSION

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抽象。 提出并解决了输入变量回归函数中多项式参数估计的问题。 回归函数的输入和输出变量是多维矩阵。 假设回归函数的参数是具有高斯分布，已知平均值和离散矩阵的随机独立多维矩阵。 解决该问题的方法是在多维矩阵未知数中使用线性代数方程的多维矩阵系统-函数回归参数。 我们考虑了二次回归函数的特殊情况，为此我们获得了用于参数计算的公式。 对二维矩阵输入和输出变量执行二次回归函数的计算机仿真。

关键字：回归函数，参数估计，最大似然估计，贝叶斯估计，多维矩阵

Abstract. *The problem of the parameters estimation for the polynomial in the input variables regression function is formulated and solved. The input and output variables of the regression function are multidimensional-matrices. The parameters of the regression function are assumed to be random independent multidimensional matrices with Gaussian distribution and known mean value and dispersion matrices. The solution to this problem is a multidimensional-matrix system of the linear algebraic equations in multidimensional-matrix unknowns – function regression parameters. We have considered particular case of quadratic regression function, for which we have obtained formulas for parameters calculation. The computer simulation of the quadratic regression functions is performed for the two-dimensional matrix input and output variables.*

Keywords: *regression function, parameters estimations, maximum likelihood estimations, Bayesian estimations, multidimensional matrices*

1. Introduction

To date the most popular methods to estimate the parameters of the regression function are maximum likelihood method and least squares method [1, 2]. The estimations obtained by this method have good asymptotic properties and it is the justification to their application. But usage of classical methods becomes problem-

atic in the case of a small size of the sample. In this connection Bayesian method to estimate the parameters of the regression function is more attractive. The possibility of using the samples with a small size is a significant advantage of the Bayesian approach. Interest to Bayesian inference lies in the problem of optimal (dual) control of regression objects [3, 4, 5], in econometrics [6], in other areas [7, 8]. The existing investigations into Bayesian approach relate mainly to linear in the parameters and in the input variables regression functions. There are also more general results. So, in work [5] Bayesian estimations of the parameters were obtained for the regression function represented as a scalar product of the parameter vector and the vector of the basis functions. Such representation is applicable to both linear and nonlinear regression functions in the input variables. However, such an approach is bad formalized and do not has the algorithmic generality; i. e. the mathematical expression for the vector of the basis functions is not determined and the software implementation is inapplicable for any number of variables and any degree of the polynomial.

In the present paper we investigate a multidimensional-matrix polynomial in the input variables regression function. In this case there are not the disadvantages pointed above. Such an effect is achieved by the new multidimensional-matrix representation of the polynomial regression function.

2. Problem statement

Let us consider some object with q-dimensional-matrix input variable $x = (x_j)$, $j = (j_1, j_2, ..., j_q)$, p - dimensional-matrix output variable $\eta = (\eta_i)$, $i = (i_1, i_2, ..., i_p)$ [9, 10], and suppose that output variable η is stochastically dependent on input variable χ so there is conditional probability density $f(\eta / x)$. We denote $y = \varphi(x)$ regression function η on χ and assume that dependence η on χ could be represented in the form $\eta = \varphi(x) + \varepsilon$, where ε is p-dimensional random matrix. Let for some values $x_1, x_2, ..., x_n$ of input variable χ we obtained the values $y_{o,1}, y_{o,2}, ..., y_{o,n}$ of output variable η (observations, measurements) as follows:

$$y_{o,\mu} = \varphi(x_\mu) + z_\mu, \ \mu = 1, ..., n, \qquad (1)$$

where z_μ is a realization of the random matrix ε, which we will name as errors of the measurements. We will consider the Gaussian distribution of the matrix ε with zero mean value and dispersion matrix R_ε.

Here and below we will use the following notations for indices of multidimensional matrices: $i_1, i_2, ...$, are separate indices, $\bar{i}_{(p)} = (i_1, i_2, ..., i_p)$ is a set of p indices (p - multiindex), $\bar{\bar{i}}_{(p,k)} = (\bar{i}_{(p),1}, \bar{i}_{(p),2}, ..., \bar{i}_{(p),k})$ is a set of k p-multiindices.

Let the hypothetic regression function be the polynomial of m-th degree [10]:

$$\varphi(x) = \sum_{k=0}^{m} {}^{0,kq}(C_{(p,kq)} x^k) = \sum_{k=0}^{m} {}^{0,kq}(x^k C_{(kq,p)}), \ m = 0,1,2,..., \qquad (2)$$

where $C_{(p,kq)}$ and $C_{(kq,p)}$ are multidimensional-matrix parameters of the regression function, $C_{(p,kq)}$ is $(p+kq)$ - multidimensional matrix:

$$C_{(p,kq)} = (c_{\bar{i}_{(p)},\bar{\bar{j}}_{(q,k)}}),\ \bar{i}_{(p)} = (i_1, i_2, ..., i_p),\ \bar{\bar{j}}_{(q,k)} = (\bar{j}_{(q)1}, \bar{j}_{(q)2}, ..., \bar{j}_{(q)k}).$$

It is symmetric relative to p-multiindices $\bar{j}_{(q)1}, \bar{j}_{(q)2}, ..., \bar{j}_{(q)k}$. The matrix $C_{(kq,p)}$ is transposed matrix $C_{(p,kq)}$, i. e.

$$C_{(p,kq)} = (C_{(kq,p)})^{H_{p+kq,kq}},\ C_{(kq,p)} = (C_{(p,kq)})^{B_{p+kq,kq}},$$

where $H_{p+kq,kq}$ and $B_{p+kq,kq}$ are transpose substitutions of the types 'back' and 'onward' respectively [10]. We also denote ${}^{0,kq}(C_{(p,kq)}x^k)$ $(0,kq)$-rolled product of matrices $C_{(p,kq)}$, kq is product between k and q, $x^k = {}^{0,0}x^k$ is the (0,0) - rolled degree of the matrix x [9, 10].

In these conditions the measurement $y_{o,\mu}$ (1) has the probability density

$$f(y_{o,\mu} / x_\mu, C_{(p,0)}, C_{(p,q)}, ..., C_{(p,mq)}) =$$

$$= C_y \exp\left(-\frac{1}{2}\ {}^{0,2p}(R_\varepsilon^{-1}(y_{0,\mu} - \sum_{k=0}^{m} {}^{0,kq}(C_{(p,kq)}x_\mu^k))^2) \right),\ \mu = 1,...,n\ , \quad (3)$$

where C_y is a normalizing constant, R_ε^{-1} is $(0, p)$ - inverse to R_ε matrix [9, 10].

The problem consists in finding the estimations of parameters $C_{(p,kq)}$ $(C_{(kq,p)})$ of the regression function (2) by using the given measurements $(x_1, y_{o,1})$, $(x_2, y_{o,2}), ..., (x_n, y_{o,n})$.

3. Bayesian multidimensional-matrix polynomial empirical regression

In addition to the assumptions (1)–(3) we will consider the parameter $C_{(p,kq)}$ of multidimensional-matrix polynomial regression (2) as a random matrix with Gaussian priori probability density

$$f_a(C_{(p,kq)}) = K_{(p,kq)} \exp(-\frac{1}{2}({}^{0,2(p+kq)}(R_{a,(p,kq)}^{-1}(C_{(p,kq)} - C_{a,(p,kq)})^2)\ , \quad (4)$$

$$k = 0,1,2,...,m\ ,\ m = 0,1,2,...\ ,$$

where $K_{(p,kq)}$ is a normalizing constant, $C_{a,(p,kq)} = (C_{a,(kq,p)})^{H_{p+kq,kq}}$, $C_{a,(kq,p)} =$ $= (C_{a,(p,kq)})^{B_{p+kq,kq}}$ is a priori mean value $(p+kq)$ - dimensional matrix), $R_{a,(p,kq)} = (R_{a,(kq,p)})^{(H_{p+kq,kq}, H_{p+kq,kq})}$, $R_{a,(kq,p)} = (R_{a,(p,kq)})^{(B_{p+kq,kq}, B_{p+kq,kq})}$, is a

priori dispersion matrix ($2(p+kq)$ - dimensional matrix), $R_{a,(p,kq)}^{-1} = (R_{a,(kq,p)}^{-1})^{(H_{p+kq,kq}, H_{p+kq,kq})}$, $R_{a,(kq,p)}^{-1} = (R_{a,(p,kq)}^{-1})^{(B_{p+kq,kq}, B_{p+kq,kq})}$, are $(0, p+kq)$ -inverse to the $R_{a,(p,kq)}$, $R_{a,(kq,p)}$ matrices respectively. We will assume that the parameters $C_{(p,0)}$, $C_{(p,q)}, \ldots, C_{(p,mq)}$ are independent, i. e.

$$f_a(C_{(p,0)}, \ldots, C_{(p,mq)}) = \prod_{k=0}^{m} f_a(C_{(p,kq)}). \quad (5)$$

In these assumptions on the base of measurements $(x_1, y_{o.1}), (x_2, y_{o.2}), \ldots, (x_n, y_{o,n})$ we will find the Bayesian estimations $\widehat{C}_{(p,0)}$, $\widehat{C}_{(p,q)}$, …, $\widehat{C}_{(p,mq)}$ of the unknown parameters $C_{(p,0)}$, $C_{(p,q)}$…, i. e. the estimations minimizing the average risk:

$$r = E(W(C_{(p,0q)}, \ldots, C_{(p,mq)}, \widehat{C}_{(p,0q)}, \ldots, \widehat{C}_{(p,mq)})),$$

where $W(C_{(p,0q)}, \ldots, C_{(p,mq)}, \widehat{C}_{(p,0q)}, \ldots, \widehat{C}_{(p,mq)})$ is loss function, *E* is a symbol of mathematical expectation.

Theorem. Under conditions (1)–(3), (4), (5) relative to the multidimensional-matrix polynomial regression and quadratic loss function the Bayesian estimations $\widehat{C}_{(p,0)}$, $\widehat{C}_{(p,q)}, \ldots, \widehat{C}_{(p,mq)}$ of the parameters $C_{(p,0)}, C_{(p,q)}, \ldots, C_{(p,mq)}$ satisfy the following system of linear multidimensional-matrix equations:

$$^{0,(p+\lambda q)}(R_{a,(p,\lambda q)}^{-1} C_{(p,\lambda q)}) + \sum_{k=0}^{m} {}^{0,(p+kq)}(V_{k,\lambda}^{T_{k,\lambda}} C_{(p,kq)}) =$$

$$= {}^{0,p}(R_{\varepsilon}^{-1} S_{yx^{\lambda}}) + {}^{0,(p+\lambda q)}(R_{a,(p,\lambda q)}^{-1} C_{a,(p,\lambda q)}), \ \lambda = 0,1,\ldots,m, \quad (6)$$

where $S_{yx^{\lambda}}$ and $S_{x^k x^{\lambda}}$ are defined by expressions

$$S_{yx^{\lambda}} = \sum_{\mu=1}^{n} {}^{0,0}(y_{\mu} x_{\mu}^{\lambda}), \ S_{x^k x^{\lambda}} = \sum_{\mu=1}^{n} {}^{0,0}(x_{\mu}^{k} x_{\mu}^{\lambda}),$$

$V_{k,\lambda}$ is $(2p+kq+\lambda q)$-dimensional matrix,

$$V_{k,\lambda} = {}^{0,0}(R_{\varepsilon}^{-1} S_{x^k x^{\lambda}}),$$

R_{ε}^{-1} is (0, *p*)-inverse to the R_{ε} matrix, $V_{k,\lambda}^{T_{k,\lambda}}$ is transposed in accordance with substitution $T_{k,\lambda}$ matrix $V_{k,\lambda}$, and

$$T_{k,\lambda}=\begin{pmatrix}\bar{\bar{i}}_{(p)},\bar{\bar{\bar{v}}}_{(q,\lambda)},\bar{\bar{j}}_{(p)},\bar{\bar{\bar{t}}}_{(q,k)}\\ \bar{\bar{i}}_{(p)},\bar{\bar{j}}_{(p)},\bar{\bar{\bar{t}}}_{(q,k)},\bar{\bar{\bar{v}}}_{(q,\lambda)}\end{pmatrix}.$$

We do not provide a proof of the theorem.

4. Bayesian multidimensional-matrix quadratic empirical regression

Assumption $m = 2$ in the expression (2) gives us quadratic regression function:

$$y=C_{(p,0q)}+^{0,p}(C_{(p,1q)}x)+^{0,2p}(C_{(p,2q)}x^2). \quad (7)$$

In works [11, 12] one can find the algorithm of calculation of the ML-estimations of the parameters $C_{(p,0q)}$, $C_{(p,1q)}$, $C_{(p,2q)}$ for the regression function (7). Here we obtain the Bayesian estimations of these parameters.

The system of equations (6) for these parameters contains three equations:

$$^{0,(p+0q)}(R^{-1}_{a,(p,0q)}C_{(p,0q)})+^{0,(p+0q)}(V^{T_{0,0}}_{0,0}C_{(p,0q)})+^{0,(p+1q)}(V^{T_{1,0}}_{1,0}C_{(p,1q)})+^{0,(p+2q)}(V^{T_{2,0}}_{2,0}C_{(p,2q)})=$$

$$=^{0,p}(R^{-1}_{\varepsilon}S_{yx^0})+^{0,(p+0q)}(R^{-1}_{a,(p,0q)}C_{a,(p,0q)}),$$

$$^{0,(p+1q)}(R^{-1}_{a,(p,1q)}C_{(p,1q)})+^{0,(p+0q)}(V^{T_{0,1}}_{0,1}C_{(p,0q)})+^{0,(p+1q)}(V^{T_{1,1}}_{1,1}C_{(p,1q)})+^{0,(p+2q)}(V^{T_{2,1}}_{2,1}C_{(p,2q)})=$$

$$=^{0,p}(R^{-1}_{\varepsilon}S_{yx^1})+^{0,(p+1q)}(R^{-1}_{a,(p,1q)}C_{a,(p,1q)}),$$

$$^{0,(p+2q)}(R^{-1}_{a,(p,2q)}C_{(p,2q)})+^{0,(p+0q)}(V^{T_{0,2}}_{0,2}C_{(p,0q)})+^{0,(p+1q)}(V^{T_{1,2}}_{1,2}C_{(p,1q)})+^{0,(p+2q)}(V^{T_{2,2}}_{2,2}C_{(p,2q)})=$$

$$=^{0,p}(R^{-1}_{\varepsilon}S_{yx^2})+^{0,(p+2q)}(R^{-1}_{a,(p,2q)}C_{a,(p,2q)}).$$

Collecting similar terms we obtain the following system of equations:

$$^{0,p}((R^{-1}_{a,(p,0q)}+V^{T_{0,0}}_{0,0})C_{(p,0q)})+^{0,(p+q)}(V^{T_{1,0}}_{1,0}C_{(p,1q)})+^{0,(p+2q)}(V^{T_{2,0}}_{2,0}C_{(p,2q)})=$$

$$=^{0,p}(R^{-1}_{\varepsilon}S_{yx^0})+^{0,p}(R^{-1}_{a,(p,0q)}C_{a,(p,0q)}),$$

$$^{0,p}(V^{T_{0,1}}_{0,1}C_{(p,0q)})+^{0,(p+q)}((R^{-1}_{a,(p,1q)}+V^{T_{1,1}}_{1,1})C_{(p,1q)})+^{0,(p+2q)}(V^{T_{2,1}}_{2,1}C_{(p,2q)})=$$

$$=^{0,p}(R^{-1}_{\varepsilon}S_{yx^1})+^{0,(p+q)}(R^{-1}_{a,(p,1q)}C_{a,(p,1q)}),$$

$$^{0,p}(V^{T_{0,2}}_{0,2}C_{(p,0q)})+^{0,(p+q)}(V^{T_{1,2}}_{1,2}C_{(p,1q)})+^{0,(p+2q)}((R^{-1}_{a,(p,2q)}+V^{T_{2,2}}_{2,2})C_{(p,2q)})=$$

$$=^{0,p}(R^{-1}_{\varepsilon}S_{yx^2})+^{0,(p+2q)}(R^{-1}_{a,(p,2q)}C_{a,(p,2q)}).$$

With notations

$$R_{(p,0q)} = (R^{-1}_{a,(p,0q)} + V^{T_{0,0}}_{0,0}),$$

$$R_{(p,1q)} = (R^{-1}_{a,(p,1q)} + V^{T_{1,1}}_{1,1}),$$

$$R_{(p,2q)} = (R^{-1}_{a,(p,2q)} + V^{T_{2,2}}_{2,2}),$$

$$B_{(p)} = {}^{0,p}(R^{-1}_{\varepsilon} S_{yx^0}) + {}^{0,p}(R^{-1}_{a,(p,0q)} C_{a,(p,0q)}),$$

$$B_{(p+q)} = {}^{0,p}(R^{-1}_{\varepsilon} S_{yx^1}) + {}^{0,(p+q)}(R^{-1}_{a,(p,1q)} C_{a,(p,1q)}),$$

$$B_{(p+2q)} = {}^{0,p}(R^{-1}_{\varepsilon} S_{yx^2}) + {}^{0,(p+2q)}(R^{-1}_{a,(p,2q)} C_{a,(p,2q)}),$$

we rewrite this system in the form:

$$\begin{cases} {}^{0,p}(R_{(p,0q)} C_{(p,0q)}) + {}^{0,(p+q)}(V^{T_{1,0}}_{1,0} C_{(p,1q)}) + {}^{0,(p+2q)}(V^{T_{2,0}}_{2,0} C_{(p,2q)}) = B_{(p)}, \\ {}^{0,p}(V^{T_{0,1}}_{0,1} C_{(p,0q)}) + {}^{0,(p+q)}(R_{(p,1q)} C_{(p,1q)}) + {}^{0,(p+2q)}(V^{T_{2,1}}_{2,1} C_{(p,2q)}) = B_{(p+q)}, \\ {}^{0,p}(V^{T_{0,2}}_{0,2} C_{(p,0q)}) + {}^{0,(p+q)}(V^{T_{1,2}}_{1,2} C_{(p,1q)}) + {}^{0,(p+2q)}(R_{(p,2q)} C_{(p,2q)}) = B_{(p+2q)}. \end{cases}$$

This system of equations can be solved by the elimination method.

5. Conclusion

In conclusion, we outline the main results of this work and note their particularities.

1. The problem of the building of the Bayesian multidimensional-matrix polynomial regression was formulated and solved. This regression has the following particularities compared with existing regressions: 1) the more general multidimensional-matrix polynomial regression function, when input and output variables are the multidimensional matrices, is considered; 2) a new untraditional multidimensional-matrix form of the representation of the regression function in the manner of multidimensional-matrix polynomial is used. Besides, the priory distributions of the multidimensional-matrix parameters of the regression function are supposed as Gaussian. The general solution of this problem is the system of the linear multidimensional-matrix equations relative the multidimensional-matrix parameters of the regression function.

2. On the base of the general solution the algorithm of the parameters calculation of the Bayesian multidimensional-matrix quadratic empirical regression functions was obtained.

3. The computer simulation of the quadratic Bayesian empirical regressions function with two-dimensional input and output variables was performed. The simulation confirmed the correctness of the theoretical results and illustrated the important benefits of the Bayesian approach to have the algorithmic generality and to obtain the estimations on the small number of the measurements.

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低温发电

LOW-TEMPERATURE ELECTRIC POWER GENERATION

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抽象。在他的工作中，研究了关于物质和运动范围内能量转换过程的本质的现代理论思想，分析了热力学的四个定律，评估了“麦克斯韦恶魔”虚拟实验技术实施的当前尝试。

在他的工作中，从理论上计算了从低温源（土壤，水，空气，太阳辐射）自动产生热能和电能的可能性，创造了实验装置，并在该装置上证实了理论依据。2019年，已收到RF专利，并已提交PCT和EAPO国际申请;关键国家也提交了申请，创建了在实际设施中运行的功能正常的自主气候系统。

作者提出了能量定理的表述和证明。理论上证实并提出了对热力学第二定律的新解释。

概述了分布式自主式低温无碳发电的发展前景。

作者拥有50多种出版物以及20多项俄罗斯和外国发明专利。

关键字：低温电生成，“麦克斯韦恶魔”，热力学第二定律

Abstract. *In his work examined modern theoretical ideas about the nature of energy transformation processes within the boundaries of matter and motion, analyzed the four laws of thermodynamics, evaluated current attempts of technical implementation of a “Maxwell's Demon” virtual experiment.*

In his work theoretically calculated the possibility of autonomous production of thermal and electric energy from low-temperature sources - soil, water, air, solar radiation, created experimental installations on which theoretical substantiation was confirmed. In 2019 RF patent was received, PCT and EAPO international applications were filed; applications are also filed in key countries, created a functioning autonomous climate system operating at a real facility.

The author proposed the formulation and proof of the energy theorem. A new interpretation of the second law of thermodynamics is theoretically substantiated and proposed.

The prospects for the development of distributed autonomous low-temperature carbon-free power generation are outlined.

The author has more than 50 publications and more than 20 Russian and foreign patents for inventions.

Keywords: *Low - tempetature elektric generation, "Maxwell's demon", Second law of thermodynamics*

At the present stage the four laws of thermodynamics have been formulated by the collective efforts of the scientific community:

1. **The zero law of thermodynamics:** it is formulated as follows - an isolated thermodynamic system spontaneously passes into a state of thermodynamic equilibrium over time and remains in it for an arbitrarily long time if the external conditions remain unchanged.

2. **The first law of thermodynamics:** this is the law of conservation and transformation of energy for a thermodynamic system. The energy of any closed system with all the processes occurring in the system remains constant.

3. **The second law of thermodynamics:** it has several formulations. **Kelvin's formulation:** a cyclic process the only result of which is the production of work by reducing the internal energy of only one heat reservoir is impossible. **Ostwald's formulation:** a perpetual motion machine of the second kind is impossible. A perpetual motion machine of the second kind is a heat engine without a low-temperature tank. **Clausius's formulation:** heat cannot spontaneously transfer from a cooler body to a warmer one.

4. **The third law of thermodynamics (Nernst thermal theorem)** is a physical principle that determines the behavior of entropy when the temperature approaches the absolute zero. All processes at absolute zero in which the system goes from one equilibrium state to another occur without changing entropy.

The author made an analysis and concluded:

The second law of thermodynamics is the most controversial and problematic. Kelvin's formulation as well as the zero law intersect with the formulation of Clausius and are also its consequence. Namely: if "***heat cannot spontaneously transfer from a cooler body to a warmer one***" then "***a cyclic process the only result of which is the production of work by reducing the internal energy of only one heat reservoir***" will also be impossible.

Thus, the formulation of the great Clausius remains the most logically understandable, physically fair and reliably tested for the second law of thermodynamics.

But it was precisely this formulation that haunted a great scientist named James Maxwell.

The mental experiment of James Maxwell is that **"Maxwell's Demon"** allows heating the right side of the vessel and cooling the left one without additional supply of energy to the system.

In 1929 Leo Szilard showed that even a perfectly functioning demon increases its own entropy every time it receives information about the movement of a molecule. Leo Szilard tried to connect information and energy purely mathematically, but as yet there is no information about the experimental physical confirmation of Szilard's mathematical formula.

Next, Mark Reisen and his colleagues developed a new method of super-deep gas cooling which uses a laser device similar to Maxwell's demon in its actions. The method shows that gas atoms or molecules can be in ***two long-lived metastable quantum states*** and that there are many substances that meet this requirement.

The main conclusion from these experiments is as follows: finding a closed thermodynamic system in two ***long-lived metastable quantum states*** already implies a review of the zero and second laws of thermodynamics and the possibility of implementing "Maxwell's Demon" in the atomic-quantum field.

According to a report in "New Scientist", in 2010 physicists from Chuo University (in Japanese - 中央大学*)* and University of Tokyo allegedly managed to realize the mental experiment "Maxwell's Demon".

In 2015 physicists from Finland, the USA and Russia (Ivan Khaimovich from the Institute of Physics of Microstructures of the Russian Academy of Sciences) created an autonomous artificial "Maxwell's Demon". The authors published the results of their research in the journal "Physical Review Letters".

Yarzinsky equation also shows the possibility of a metastable state in thermodynamic systems.$\Delta F = Fa - Fb$ at $\Delta F = \mathrm{A}$ where: ΔF is the energy difference between the two parts of the thermodynamic system, and $\mathbf{A}$ is the work done by this energy difference.

The main conclusion made by the author from the analysis of the existing level of knowledge was as follows: ***a closed corpuscular thermodynamic system in which thermal energy is represented as the sum of kinetic energies of the corpuscles*** $\boldsymbol{Q = \sum_1^n 0,5 m_n v_n^2}$ ***consisting of two separated parts has a minimum energy difference and the possibility of its increase due to this difference. No quantitative relationship between information and energy has been established so far.***

For the technical implementation of theoretical conclusions in the field of classical physics the author used two outstanding inventions that have long been applied separately, but have not yet shown themselves to be synergistic.

The first one is a Stirling engine which works on almost any temperature difference.

The second is a heat pump which is widely used in everyday life in devices such as heat pumps, refrigerators, and air conditioners.

Theoretical novelty of the work is the proof of the energy theorem proposed by the nominee, which looks like this:

Hypothesis: In an isolated thermodynamic system consisting of two separated parts the energy from the low-temperature part of the system can be transferred to the high-temperature part of the system due to the internal energy of the low-temperature part of the system.

Proof: In order to prove the hypothesis a "Maxwell Demon" technical model is created. It consists of a closed thermodynamic system divided into two parts, a heat pump and a Stirling engine. In this system the heat pump evaporator is located in the low-temperature part of the system, the condenser and compressor are placed in the high-temperature part, the cooled part of the Stirling engine is located in the low-temperature part of the system, and the heated part is placed in the high-temperature part of the system. In this case, the Stirling engine shaft is connected to the compressor shaft which is also located in the high-temperature part of the system, which provides the ability to summarize and take into account the heat loss due to friction in the mechanical part of the structure in the energy transferred by the heat pump Q_{hp}.

Initial data of the model:

1. An isolated corpuscular thermodynamic system consisting of two parts separated by an isolating wall where the difference between the energy of the low-temperature part Q_{lt} and the energy of the high-temperature part Q_{ht} is expressed by the formula $\Delta Q = Q_{ht} - Q_{lt}$

2. A heat pump transferring energy Q_{hp} with a coefficient of transformation COP$= (4 \pm \Delta_{COP})$

3. A Stirling engine with efficiency = 25%

A Stirling engine converts the initial difference in thermal energies of the parts of the ΔQsystem into mechanical work A_{se} with efficiency of 25%. $A_{se} = 0{,}25\Delta Q$. In this case, the energy of $0.75\Delta Q$ is transferred by the working fluid of the Stirling engine to the low-temperature part of the system.

The heat pump transfers the thermal energy Q_{hp} from the low-temperature part of the system to the high-temperature one and restores the energy balance of the system by transforming the mechanical work of the Stirling engine A_{se} into thermal energy Q_{hp} with the coefficient COP $= (4 \pm \Delta_{COP})$.

As a result, the energy balance of the system looks like this:

$$Q_{hp} = A_{se} * COP = 0{,}25\Delta Q * (4 \pm \Delta_{COP}) = \Delta Q * (\pm\Delta_{COP})$$

Using the "demonic" terminology, a quarter of the initial energy difference ΔQ in the high-temperature part of the system is enough for "Maxwell's Demon" to restore this difference in full from the low-temperature part of the system. Moreover, with a lack of "demonic" forces $(-\Delta_{COP})$ it will not be possible to restore ΔQ, and with an excess of them $(+\Delta_{COP})$ ΔQ will be restored in excess. Using

the language of formulas: at $(+\Delta_{COP})\ Q_{ht} \uparrow max\, Q_{lt} \downarrow min$ the system will take an extreme metastable state with a maximum energy difference $\Delta Q \uparrow$, and at $(-\Delta_{COP})\ Q_{ht} \downarrow min Q_{lt} \uparrow max$ the system will take another extreme metastable state with a minimum difference in energy $\Delta Q \downarrow$.

The diagram of the structure and energy movement is shown in *Fig. 1*

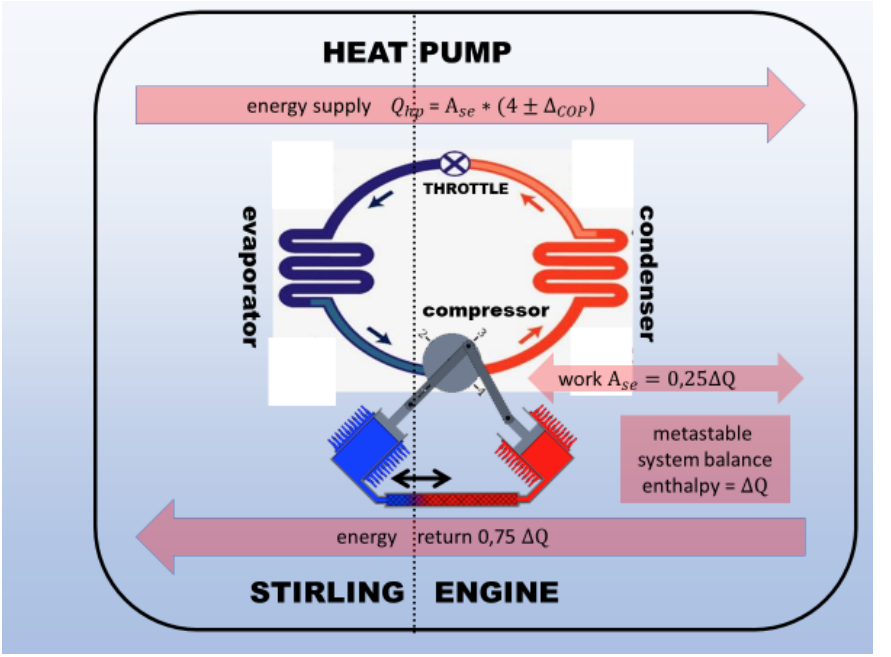

Fig.1

The structure works as follows:

a) Initially the thermodynamic system is in a nonequilibrium state with an energy difference sufficient for the operation of a Stirling engine with the conversion of thermal energy into mechanical energy with efficiency of 25%. At the same time 75% of the thermal energy is transferred by the working fluid of the engine to the low-temperature part of the thermodynamic system.

b) The Stirling engine rotates the heat pump compressor shaft.

c) By means of mechanical energy the heat pump transfers energy from the low-temperature part of the thermodynamic system to the high-temperature part with the coefficient COP $= (4 \pm \Delta_{COP})$ by the working fluid of the heat pump.

Conclusion: The author proposes to state the second law of thermodynamics as follows: ***In an isolated thermodynamic system consisting of two separated parts the energy from the low-temperature part of the system can be transferred to the high-temperature part of the system due to the internal energy of the low-temperature part of the system.***

Practical application:

Within the framework of the stated conclusions and their experimental confirmation the author received a patent of the Russian Federation 2692615, filed international applications EAPO 2019000011, PCT / RU 2018/000784. The author developed and created an experimental device - an autonomous climate system that actually works on an operating facility.

The device works without an external connection and fully ensures the climatic regime of the medical center. Electric energy is generated by a Stirling turbo engine of a proprietary design due to the temperature difference between the external and internal environment both in the heating mode and in the air conditioning mode.

The advantages of the device are the low cost of generating thermal and electric energy, ease of replication, almost complete independence from weather conditions, convenience, safety and ease of operation, which creates competitive advantages over other methods of generation from renewable sources such as solar panels and wind generators.

The area of further development of low-temperature thermoelectric power generation technology is extremely wide: from domestic autonomous refrigerators, air conditioners and heat pumps to energy supply of large facilities, complexes, transport, settlements and cities in all latitudes from the equator to the Arctic without dependence on coal, oil and gas, that is, in the format of **carbonless power-engineering**.

分布式发电源连接到电网时的要求

REQUIREMENTS FOR DISTRIBUTED GENERATION SOURCES WHEN THEY ARE CONNECTED TO ELECTRIC NETWORKS

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抽象。本文讨论了将分布式发电源连接到电网时的要求，以及在法规文件中指出的在此问题上存在一些差异的问题。

分布式发电设施包括定居点中的热电厂和中小型发电设施（柴油发电机，太阳能和风能发电站），街区发电站，这些发电站由工业企业拥有或租用。

随着分布式发电设施数量的显着增加，在将它们连接到集中式网络并维持消费者之间的电能质量方面出现了问题。俄罗斯已经通过了管理这些程序的法律和法规。本文的作者分析并比较了一些俄罗斯和国外组织用于将分布式发电设施（尤其是太阳能发电厂）连接到集中式网络的法规文件和建议。

关键词：分布式发电，微能源，太阳能发电厂，电能质量。

Abstract. *This article discusses the requirements for distributed generation sources when they are connected to the electric network and the problems of some differences on this issue, indicated in regulatory documents.*

Distributed generation facilities include heat and power plants in settlements and small and medium generation facilities (diesel generators, solar and wind stations), block stations, which are owned or rented by industrial enterprises.

In connection with a noticeable increase in the number of distributed generation facilities, problems arise in connecting them to a centralized network and maintaining the quality of electricity among consumers. Russia has adopted laws and regulations that govern these processes. The authors of the article analyze and compare regulatory documents and proposals of some Russian and foreign organizations for connecting distributed generation facilities, in particular solar power plants, to a centralized network.

Keywords: *distributed generation, microenergy, solar power plant, power quality.*

At present, three categories of generating capacities fall under the broad definition of distributed generation (generations located directly near or on the territory of consumption sources) in Russia. These objects include thermal power plants (TPP) in settlements and small and medium generation facilities, block stations, which are owned or rented by industrial enterprises. To date, the construction of the above facilities by consumers has increased markedly.

The number of distributed generation facilities in Russia, namely: solar power plants, gas piston stations, wind power plants, etc., is growing steadily. Their connection to a centralized network significantly affects the quality of electricity at the consumer. Requirements for the quality of electricity in the network are determined by GOST 32144-2013 [2] (table 1).

Table 1

Electricity quality requirements

Name	Formula	Value
Frequency deviation	$\Delta f = f_m - f_{\text{nom}}$	frequency deviation in synchronized power supply systems should not exceed ± 0.2 Hz for 95% of the interval time in one week and ± 0.4 Hz for 100% of the time interval in one week
Slow voltage changes	$\delta U_{(-)} = \left[\frac{U_0 - U_{m(-)}}{U_0}\right] \cdot 100$ $\delta U_{(+)} = \left[\frac{U_0 - U_{m(+)}}{U_0}\right] \cdot 100$	positive and negative voltage deviations at the point of transmission of electric energy should not exceed 10% of the nominal or agreed voltage value during 100% of the time interval of one week
Flicker		the short-term dose of flicker Pst should not exceed the value of 1.38, the long-term dose of flicker Pt should not exceed the value of 1.0 for 100% of the time interval of one week
Single fast voltage changes		single fast voltage changes do not exceed 5% in low voltage electric networks and 4% — in medium voltage electric networks, but sometimes voltage changes with a short duration of up to 10% Unom and up to 6% Uc, respectively, can occur several times a day

Name	Formula	Value
Voltage asymmetry in three-phase systems		the values of the voltage asymmetry coefficients in the reverse sequence KU2 and the voltage asymmetry in the zero sequence KU0 at the point of transmission of electric energy, averaged over a time interval of 10 minutes, should not exceed 2% for 95% of the time interval of one week; - the values of the voltage asymmetry coefficients in the reverse sequence KU2 and the voltage asymmetry in the zero sequence KU0 at the point of transmission of electric energy, averaged over a time interval of 10 minutes, should not exceed 4% for 100% of the time interval of one week.
Voltage dips		The duration of the voltage dip can be up to 1 min
Overvoltage		Overvoltage duration can be up to 1 min.

The quality of electricity in a network of distributed generation facilities is standardized by a document [3] that describes the restrictions on the deviation of frequency, voltage, power factor cosφ, etc. (table 2).

Table 2

Electricity quality indicators

<table>
<tr><th rowspan="3">Required class</th><th colspan="7">Electricity quality indicators</th></tr>
<tr><th rowspan="2">Duration of service, h/day</th><th colspan="3">Electricity supply,% / year</th><th colspan="3">Required power quality</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>1</th><th>2</th><th>3</th></tr>
<tr><td>A</td><td>=24</td><td rowspan="5">≥99</td><td rowspan="5">≥98</td><td rowspan="5">≥97</td><td rowspan="5">$\pm\Delta U \le 0,1U_N$
$\pm\Delta f \le 1$Hz
$TDH \le 3\%$</td><td rowspan="5">$\pm\Delta U \le 0,15U_N$
$\pm\Delta f \le 2$Hz
$TDH \le 5\%$</td><td rowspan="5">$\pm\Delta U \le 0,2U_N$
$\pm\Delta f \le 3$Hz
$TDH \le 10\%$</td></tr>
<tr><td>B</td><td>16≤x≤24</td></tr>
<tr><td>C</td><td>8≤x≤16</td></tr>
<tr><td>D</td><td>4≤x≤8</td></tr>
<tr><td>E</td><td>x<4</td></tr>
<tr><td>F</td><td colspan="7">Systems with the required quality indicators of power supply above or below the specified values can be installed in accordance with the specified requirements</td></tr>
<tr><td colspan="8">U_N - the rms value of the voltage at a certain time at the power terminals, measured over a set period of time
f - rated voltage frequency U_N.</td></tr>
</table>

The connection of micro-energy facilities that belong to legal entities or individuals to the centralized electric grid is regulated by amendments to the Federal Law N 35-FL dated December 27, 2019. This regulatory act allows for the transfer of excess electricity generated by such facilities to the grid [1]. However, the law strictly restricts connection to electric grid facilities with a voltage level of more than 1000 volts. In addition, it is possible to technically connect a microgeneration facility to a centralized network with a maximum power of not more than 15 kW.

The law [1] considers only the issues of connecting private power plants to the network, while regulatory documents, requirements for standardizing the quality of electricity, reliability of power supply, environmental friendliness, synchronization of the network and distributed generation facilities are not specified.

If we talk about one of the objects of distributed generation - the solar power station and its parallel operation with the network, then some provisions of the documents [2,3] contradict each other, which leads to the technical complication of connecting the micro-energy objects to the centralized network.

State Standards (GOST 32144-2013) [2] determine the nominal frequency in an electrical network of 50 Hz. The following standards are defined for this value:

- a change in the frequency value in synchronized power supply systems of not more than ± 0.2 Hz for 95% of the interval time in one week, ± 0.4 Hz for 100% of the interval time in one week;

- the frequency value change in isolated power supply systems with autonomous generator sets that are not connected to synchronized electric energy transmission systems should not exceed ± 1 Hz for 95% of the interval time in one week and ± 5 Hz for 100% of the time interval in one week.

According to regulatory documents and data of some energy companies (ENTSO-E, E.ON, GOST R IEC 61727 – 2016), which characterize the connection and synchronization of autonomous power supply systems (solar power plants), for certain voltage levels (0.38 kV, 35 kV, 110 kV, etc.) the different time periods for disconnecting solar power plants from the centralized network with a frequency deviation are indicated (table 3). In all documents, the normal mode of parallel operation of the power plant with the network is a frequency of 49-50 Hz, which corresponds to GOST 32144-2013. In Europe and Germany, the requirements for solar power plants are softer than in recommendations and requirements in Russia [4]. But according to [3] in Russia, the solar power station should be disconnected from the network when the frequency deviates at the level of 0.2 Hz, which leads to a mismatch between the requirements for the quality of electricity of the centralized network and the solar power station [2,3].

Table 3

Requirements to SPP for frequency deviation

Frequency, Hz	ENTSO-E (110 kV) [4]	E.ON (110 kV) [4]	JSC "SO UES" recommendations (110 kV) [4]	GOST R IEC 61727 – 2016 (0,38 kV) [3]	Suggestion of STC "UES JSC" (110 kV) [4]
	Off time				
46-47	-	-	1 s	0,2 sec	not less than 1 second
47-47,5	-	-	1 min.	0,2 sec	not less than 1 minute
47,5-48	30 min	10 min	1 min.	0,2 sec	not less than 1 minute
48-48,5	30 min	20 min	5 min.	0,2 sec	not less than 5 minutes
48,5-49	30 min	30 min	5 min.	Necessarily disconnected	not less than 5 minutes
49-50	No lim.	No lim.	No lim.	No lim.	No lim..
50-50,2	No lim.	No lim.	No lim.	Necessarily disconnected	not less than 5 minutes
50,2-51	No lim.	30 min	3 min	0,2 sec	Factory manufacturer
51-51,5	30 min	30 min	Factory manufacturer	0,2 sec	Factory manufacturer

Experimental statistics show that fast single voltage changes in low voltage electrical networks do not exceed 5%, and in medium voltage electrical networks - 4%. But sometimes voltage deviations can occur several times a day with a short duration of up to 10% and up to 6%, respectively. [2] Based on the requirements for Europe and regulatory documents characterizing the operation of SPP and a centralized network in Russia, an instantaneous disconnection of the solar power station from the network should occur when the voltage deviation is in the range of more than 25% (table 4) [3].

Table 4.

Requirements to SPP for voltage deviation

Voltage, V	ENTSO-E (110 kV) [4]	Suggestions of JSC "SO UES" (110 kV) [4]	GOST R IEC 61727 – 2016 (0,38 kV) [3]	Suggestion of STC "UES JSC" (110 kV) [4]
	Off time			
U <0,5 U_0	-	-	0,1 sec	-
50 % <U <85 %	60 min	-	2 sec	-
85% <U <110%	No lim.	-	No lim.	20 min
110% <U <135%	No more than 20 min	-	2 sec	20 sec
135 %<U	-	-	0,05 sec	1 s.

If we compare with each other the requirements for the quality of electricity in a centralized network and generated by solar power plants (table 3) specified in [2] and [5], we can conclude that these requirements are not met. This discrepancy can complicate the synchronization of the solar power station and the network.

Solar power plants should provide output and consumption of reactive power with cosφ = 0.85 [4] at the point of contact of the power plant with the power system when the active voltage of the power plant changes in the range of ± 20% of the nominal value.

The value of the power factor of the photovoltaic system with a lagging (inductive) current should be more than 0.9 [3] when the output power of the inverter AC power is more than 50% of the nominal value.

Conclusions

The issues of construction and use of distributed generation facilities in Russia are currently quite acute. This is due to the ability to produce electricity in the immediate vicinity of the consumer, while reducing transmission losses. For consumers, it is important to save money when using energy from their own power plant. In addressing these issues, difficulties arise in connecting private distributed generation facilities to a centralized network due to the varying requirements spelled out in the regulatory documents governing the operation of electric networks and microenergy facilities.

Based on this, it can be concluded that there is a need for a deeper study of issues related to the requirements for the operation of distributed generation facilities with a centralized network and the development of uniform requirements to facilitate the connection of private power plants to the electric network.

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UDC 004.4; 721.01

用于建筑系统设计的BIM技术
BIM TECHNOLOGIES FOR DESIGNING BUILDING SYSTEMS

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抽象。 本文致力于在俄罗斯信息结构发展的现阶段研究BIM技术在设计中的功能和作用。 作者指出，设计领域的复杂性和高科技水平的不断提高，在执行其任务的概念方面引发了新的问题。 还表明，世界各地的建筑和设计行业的典型问题是使用过时的方法和系统软件系统，这些方法和系统软件系统大多是机械化的，需要大量的劳动力和人力资源，包括在安装过程中的监控。 施工现场的工作周期。 因此，有理由在设计中使用BIM技术，作为改善该行业所有流程的关键有效概念。

关键字：BIM，技术，设计，信息系统，建模，改进。

Abstract. *The article is devoted to the study of the functionality and role of the application of BIM technologies in designing at the present stage of development of information structures in Russia. The author noted that the constant increase in the complexity and high technology of the design sphere leads to new questions in the concept of implementing its tasks. It is also indicated that a typical problem for the construction and design industry all over the world is the use of outdated methodologies and system software systems, which for the most part are mechanized and require a lot of labor and human resources, including monitoring during the working cycle of the construction site. Therefore, it is justified to use BIM technologies in design, as a key effective concept for improving all the processes in this industry.*

Keywords: *BIM, technology, design, information system, modeling, improvement.*

Modern construction conditions dictate more stringent requirements for the timing and cost of design works on a global level (in all countries including Russia).

The fulfillment of architectural and design works is based on preparation of precise models of construction facilities, and also is connected with performing a huge amount of mathematical calculations necessary for construction engineering analysis. The general goal of competitiveness improvement demands considerable reducing of the model creation time and acceleration of mathematical calculations of the model parameters. The relevance of this research is in that the need to provide design organizations with continuous information technology of architectural design led to the development of building information modeling technology based on the BIM technologies, which contains a principle of creating an integrated parametrical informational model of a construction including all required information about future and already existing construction sites. This article aims at interpretation and justification of the effectiveness of applying the BIM technologies in design processes.

The comprehensive concept of the BIM (Building Information Modeling or Building Information Model) is an informational modeling of a building or an informational model of the building, in the form of a three-dimensional model, and (or) of another construction site, the model being connected with an informational database, in which any element may be assigned additional attributes. This technology is an informational construction and (or) design model which consists in a synchronous interaction of all processes, as well as stages of design, construction and operation of buildings and structures. The concept implies that customers,

architects, designers, engineers and IT specialists work concurrently. The BIM technologies are an innovative approach in the modern designing basing on the recent informational technology of designing 3D structures, in which, apart from the above-said, the using of intelligent technologies are provided for [4].

Another, more informational definition can also be provided: BIM is a numerical representation and duly organized information about a construction project, which is used at all stages of the project life cycle. An important component of this technology is a single information space, that is, a data base containing all information about technical, legal, property, operational, energy, ecological, mercantile and other characteristics of the project. Owing to high accuracy and

detailed description of the model, this technology makes it possible to perform various calculations (for example, energy efficiency and energy consumption of a building, comprehensive calculations of the life duration, fire resistance and stability of both the entire building and its individual elements) and an analysis of the results.

BIM in the world is over 20 years of dynamic development. The following countries are leaders in the using of BIM in the construction of buildings, structures, and roads for various purposes: Great Britain, Netherlands, Singapore, USA, where the use of BIM technologies makes up more than 90% of the industry [7].

For creation of BIM-type informational models, computer-aided design (CAD) systems are used most often. By their designated purpose, the CAD systems (or sub-systems) are divided into the following types, which support different aspects of designing:

- CAD (Computer-aided design/drafting);
- CADD (Computer-aided design and drafting);
- CAGD (Computer-aided geometric design);
- CAE (Computer-aided engineering);
- CAA (Computer-aided analysis);
- CAM (Computer-aided manufacturing);
- CAPP (Computer-aided process planning) [6].

Many CAD systems combine the means to solve tasks relating to different aspects of designing (CAD+CAM, CAD+CAE, CAD+CAE+CAM, etc.) [2]. Such systems are named complex or integrated systems. Most modern CAD systems use the following integration methods: integration based on end-to-end CAD systems;

integration based on PLM systems; Integration using the interaction interface. The end-to-end CAD systems include a set of tools for automating the processes and process design of production and various objects of industry. The PLM systems include multifunctional and specialized modules that solve narrow tasks of specific industries more fully than universal design tools do [3].

Some systems contain data on technical structures of different nature, therefore, in order to transfer it, a conversion of data formats of different types from one to another is needed. This way of interaction is called Integration through Interaction Interfaces [1].

To date, there exists a great number of BIM technologies intended for informational modeling and designing: Autodesk Revit Structure Suite (AutoCAD Structural Detailing, AutoCAD, Revit Structure, SPDS, 3ds Max Design), ArchiCAD, LIRA-CAD applications family (LIRA-CAD, SAPFIR-3D), Tekla Structures, Digital Project, All Plan, SCAD, Autodesk, etc. Any of these software packages agrees with BIM basic principles and covers several tasks of Multi-Dimensional Modeling automated technology (2D-5D) [9].

When considering the advantages of the BIM concept both for the purposes of designing and, on the whole, for using it in other fields of business, the consulting company McGraw Hill Construction conducted a survey among the companies in the construction industry and, basing on its results, identified the following benefits from introducing BIM: 41% of the companies surveyed noted a reduction in the number of errors after the introduction of the technology; 35% and 32% drew attention to an improvement of communication between managers and designers

and enhancement of their enterprise images [8].

Generally, the introduction of the BIM technologies is occurring at an increasing rate, and quite often, through government support. In Russia, there is also a revival of interest in the information modeling of the design and construction systems, however, this process is unique to individual integrated private enterprises or companies with foreign investment, with the following main barriers to the implementation of the BIM technologies seeming to be in Russia:

1. High cost of the BIM software packages as compared to that of design services. Profitability of BIM is only possible for large, typical or foreign projects.
2. Insufficient regulation of the informational modeling normative status and its introduction into the design process at all stages.
3. Vague sharing of accountability and uncertainty in the field of intellectual property rights.
4. An unreadiness of investors to additionally invest in the informational models based on the BIM technologies, which can be used not only during construction of facilities but also in operating them [5].

At the same time, some factors may be denoted, which stimulate the introduction of the BIM technologies in Russia under current conditions:

1. Orientation of design to external Western markets, for which the BIM technologies are necessary.
2. The increase in energy costs, which forces developers and owners to switch to information technologies for design, construction and operation with a high level of forecasting and control.
3. Expectation of foreign investments and programs within the framework of developing the BIM concept in the domestic companies, and the need for effective monitoring of their implementation.

Conclusions. Thus, basing on the data analyzed and best practice of domestic and foreign researchers, and defining the notion of BIM in designing, it should be clearly distinguished which object we are talking about: just Building Information Model, Building Information Modeling, or the whole system of Building Information Management.

Taking into account the above-said, the totality of the BIM technologies may be described as a way of:

- developing a strategy of implementing a construction project, namely, its key stages: design, construction, and operation, with the help of modeling and computer simulation of the object itself and its full life cycle;
- providing integrated control of graphic data and information flows in combination with a description of the process, within the framework of a unified information environment;
- transforming individual performers into teams (project teams) to solve complex problems and integrate individual tasks into processes;

- faster, more efficient and less costly execution of various operations throughout the life cycle of a construction project.

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人为特殊物体（避难所）通风设备功能的威胁
THREATS IN THE FUNCTIONING OF VENTILATION INSTALLATIONS IN ANTHROPOGENIC SPECIAL OBJECTS – SHELTERS

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抽象。 本文提出了与获得高度密闭性的掩护设施相关的技术问题，这对于保护其内部免受故意污染的外部空气的侵入是必不可少的。 影响避难所无故障运行的另一个非常重要的因素是通风系统的可靠运行，确保受保护人员所需的空气微气候参数并将设施的内部温度保持在可接受的范围内。

关键词：人为物体，避难所，空气污染，封装，通风，特殊物体，安全区

Abstract. *The paper presents technical problems associated with obtaining a high tightness of shelter facilities, which is necessary to protect their interiors against the ingress of intentionally contaminated external air. Another very important factor affecting the trouble-free operation of the shelter is the reliable operation of ventilation systems ensuring the required microclimatic parameters of air for protected people and maintaining the inside temperature of the facility within acceptable lim its.*

Keywords: *anthropogenic objects, shelters, air pollution, encapsulation, ventilation, special objects, safety zones*

1. INTRODUCTION

In a peaceful period, each country prepares shelter facilities, whose task is to protect the population against the effects of extraordinary threats, related inter alia with the physical and chemical state of the outside air. Shelters should provide:

a) protection against primary and secondary effects of nuclear weapons, among others: shock wave hypertension and seismic of a nuclear explosion, effects of external fires, toxic industrial measures and other dangerous measures,

b) protection against chemical and biological weapons,

c) living conditions of people in a shelter.

Protective buildings or concealments are prepared in the basement of residential buildings, as well as by appropriate adaptation to perform a protective function: underground rooms, communication, commercial, warehouse services, etc.

Shelter construction has gained importance since 1989, i.e. since the emergence of a new political and military situation. Then the direct source of the conflict disappeared, resulting from system differences of different countries. A different system of international relations appeared that could pose a threat to the security of people's lives. This particularly applies to the possibility of industrial disasters, natural disasters and the threat of religious crises.

After the change of war doctrine, the role of any shelters providing concealment increased disproportionately. Civil Defence deals with this important issue. The need to maintain the required number of places in shelters, ensuring the survival of as many people as possible, is a basic task. In Polish conditions, it is not only the achievement of the 100% disguise indicator for residents that becomes a problem, but the maintenance of existing facilities in proper technical condition. Partial solution to the quantitative problem is the construction of bifunctional facilities. In this case, there is the possibility of peaceful, i.e. continuous use of the object for various purposes other than essential, with the possibility of their rapid adaptation to fulfil the basic protective function.

Shelter facilities of Civil Defence can be divided into several basic types, due to their purpose and use:

a) shelters for civilians - single-purpose facilities, designed to fulfil their basic task, awaiting continuous readiness for operation,

b) shelters for important or valuable material goods (e.g. works of art, gold supplies, etc.),

c) dual-purpose facilities that, in addition to the basic function of protecting people, other functions, a warehouse, a garage / parking lot, a service point, a basement in an apartment block, a training room, a youth club.

Single-purpose shelter facilities are built with a specific purpose, e.g. to provide cover in advance to a selected group of people (workplaces, building residents, etc.).

While the tasks and operating conditions of single-purpose facilities are clearly and strictly defined, the purpose and use of dual-purpose facilities is much more complex. Due to the need to fulfil the basic function, the bifunctional shelter must have a well-thought-out functional arrangement and an appropriate structure. There should be separate rooms in advance, fully equipped with devices for the basic shelter function. These rooms should be excluded from room operation, keeping their equipment in full working order.

Time is of the essence in the preparation of dual-purpose facilities for exploitation. While tensions in international relations can be a signal to start adaptation work, giving more time for preparation, the abruptness of sudden, unpredictable phenomena deprives these objects of time needed for preparation, and thus limits or excludes their use in the basic function. For example, for an underground car park, forces and means to remove parked vehicles should be provided, means should be gathered and kept in full working order to prepare the object to perform the basic function, with the time calculated so that the object is ready for use before a real threat occurs.

The basic issue for creating adequate sanitary and hygienic comfort of people staying in the shelter is, apart from an efficient filter and ventilation system, proper equipment with sanitary devices and accessories.

2. TIGHTNESS OF SHELTER BUILDINGS

In residential, public and other buildings, the air from the surrounding atmosphere freely penetrates inside. Also, the air inside the buildings easily leaks out. The reason for this natural exchange of external and internal air in buildings is their construction and the properties of the materials used. These buildings have holes and gaps in the doors and windows, ceilings, etc. In addition, the materials used for their construction are porous and easily breathable.

Under the conditions of using toxic agents, contaminated air will also penetrate inside the buildings.

To obtain proper tightness of buildings intended for collective protection, it is necessary to completely isolate them from the external atmosphere. However, ensuring complete encapsulation of objects is practically impossible, because even with their exact sealing, there are always small gaps between individual structural elements and pores in building materials. Therefore, some air permeability is unavoidable, even in specially sealed and secured facilities.

Contaminated air penetrates into closed and sealed rooms over time. Under certain conditions, a concentration of poisonous substances above the permissible level may form in the room, and then operation without the use of personal protective equipment is impossible.

The amount of contaminated air infiltrating the collective protection facility depends on two factors:

- air pressure difference on both sides of the wall (partition),
- size and shape of holes, gaps and pores.
- The pressure difference on both sides of the partition can arise due to the following reasons:
- wind action on the structure,
- difference in air temperature inside and outside the room,

- shockwave pressure of a nuclear explosion,
- reduction of pressure inside the room, caused by the operation of exhaust ventilation.

Encapsulation protects the inside of the shelter against penetration from the outside of contaminants, infections and other dangerous agents as well as the spread of chemical concentrations between the adopted cleanliness zones inside the shelter. The encapsulation of the shelter can be achieved by:

- making gas-tight external walls and gas-tight internal building partitions, between cleanliness zones,
- gas-tight closing of communication openings and other openings,
- maintenance during operation of a specified air pressure inside the shelter,
- ensuring that the shelter can be cut off from the outside atmosphere and replenished air losses to maintain the required overpressure (during periods when it is not taken from the outside).

3. VENTILATION OF SHELTERS

Mechanical shelters are used in shelters to:

a) ensuring the required microclimate parameters for protected and working people, regardless of the condition and quality of the outside air,

b) removal of harmful gases, heat vapours, etc.,

c) cooling engines in combustion engines, ensuring the encapsulation of the shelter by means of generating and maintaining air pressure etc.,

d) directing its flow outside the shelter in order to prevent the penetration into its interior of contaminants and infections and other dangerous agents.

It is recommended to use outside air only for ventilation of clean zone rooms. Other rooms, in a conventionally clean and conventionally dirty zone, should be ventilated with secondary air.

The ventilation air balance is prepared as follows:

a) the amount of air necessary for ventilating utility and sanitary rooms, combustion of the generating set in the engine, ex-filtration through building partitions and other needs occurring in the planned shelter.

b) the air demand for people in the shelter is determined, depending on the nature of the activity, based on the applicable air standards per person,

c) the amounts of air determined according to the above mentioned points are compared, taking the higher value for further calculations. This value determines the amount of air supplied to the shelter and forms the basis for the selection of ventilation devices.

The following mechanical ventilation systems can be carried out in shelters:

- central (main) supply ventilation system,
- central ventilation system for the needs of recirculation,

- central exhaust ventilation system,
- local ventilation systems (exhaust and recirculation),
- air generation system.

The distribution of air velocity in the occupied zone of the protective buildings depends on:

- air velocity in supply streams,
- crowding, especially from the influence of convection streams arising from the heat emitted by people,
- the temperature of the surfaces limiting the room and the wall streams arising near them,
- size and amount of furniture in the room (benches, bunks).

Experiments show that the temperature of the space-limiting surfaces in protective structures is almost equal to the temperature of the surrounding soil. In Polish conditions it is from 80C to several degrees and when filled with people it will significantly differ from the air temperature in the room. This condition will favour the formation of falling wall streams and condensation of moisture on the surface of the partitions.

Therefore, the basic task of ventilation systems used in protective constructions will be to maintain appropriate temperature, relative humidity and air velocity values in rooms, and to protect the surface of partitions against moisture condensation. Fluctuations of these parameters for physiological reasons are allowed only within strictly defined limits. The range of appropriate fluctuations in these parameters is an essential criterion for the degree of equipping the installation with air treatment devices.

Over the past decades, the views of hygienists and doctors have changed both on the amount of air necessary for ventilation or air conditioning, as well as on the justification for this amount (from 8 to 32 m3 / h for a person). The life processes of the human body (breathing, sweating) and the need to ventilate the premises of protective buildings, during insulation with 100% recirculating air, have contributed to solving this problem. Adopting 8 m3 standard for protective objects within one hour for one person fresh air can be the basis for dimensioning ventilation or air-conditioning devices in protective buildings.

For the correct selection of the size and type of ventilation or air-conditioning systems used in a protective structure, the following issues of ventilation technique should be taken into account: the function and use of the protective structure, system usage requirements, the amount of heat and moisture losses and gains, external and internal air pollution, microclimatic requirements, air distribution problems, required level of regulation of microclimate parameters, possibilities of obtaining heat and cooling energy. The correct solution of shelter filtration systems can only be achieved if the actual operating parameters of filtration or air conditioning installations are known.

Measurements of air efficiency in existing shelter filter ventilation systems help bring the operating parameters of the installation into compliance with the microclimate requirements of shelter rooms. In addition to appropriate air exchange, the ventilation system shapes the values of the supply air temperature so that, after compensating for the room's heat gains or losses, it provides a standard temperature value. In the case of air conditioning installations, the scope of requirements compared to ventilation is extended by the following processes:

- keeping relative air humidity in the room,,
- ensuring cleanliness of the supply air,
- ensuring air distribution appropriate to the needs.

4. OPERATING THREATS

In the case of anthropogenic buildings - shelters located in the underground of residential buildings, there is a very high threat to indoor air quality. These threats are caused by:

- shutting down the operation of mechanical ventilation in shelter rooms not used in the room for economic reasons,
- lack of natural ventilation of shelter rooms (solved in a way enabling its quick blocking and sealing),
- high relative humidity of internal air accelerating the biological corrosion of building materials and the development of mould fungi,
- exhalation of radon from the walls and floor laid on the ground.

It should be emphasised that the use of such shelters to protect the population (in situations where contamination of the outside air is unlikely) can bring more harm than good.

Unused, sporadically ventilated and non-vacuumed rooms, as well as renovated, are a convenient environment for the development of mould fungi. If the relative humidity is exceeded by more than 65%, the fungi grow quickly and multiply. The air of enclosed and wet rooms is an ideal environment for the development of fungi. Even the air temperature close to 0 C also does not limit their development.

Also, radon hazard is a kind of air pollution and cannot be omitted when analyzing hygiene and health conditions of human stay in shelters located most often in the basements of buildings. The greatest threat to the health of residents has α radiation from radon decay affecting the respiratory system. The most important sources of radon Rn-222 in indoor air are natural radioactive elements: Ra-226 and Ra-224 and the Th-228 track derivative. They are contained in the ground on which the building is founded and in building elements made of mineral resources (natural and waste).

The basic feature that distinguishes the heat exchange process in underground constructions from the analogous process in above-ground constructions is the impact of transient heat exchange conditions.

The transient thermal states in these buildings are caused by, among others by:

- variable load of heat gains,
- transient heat conduction into the ground,
- transient heat accumulation in the building structure material and the surrounding ground,
- variable periods of work of defensive structures.

In shelter buildings, due to the requirements for the airtightness of the object, we have limited possibilities of adjusting all microclimatic parameters.

5. SUMMARY

The conclusion is that ventilation and filtration systems in shelter facilities should be systematically improved. To specify the modernisation directions of existing shelter and defence structures, it is advisable to conduct a number of technical audits. The technical parameters of devices and installations installed in tests and measurements will help determine the actual suitability of the shelter building. Two new investment directions, public and private, may appear in the area of new facilities. These directions should create a single clear technical infrastructure system for shelters.

Technical development of shelter construction and installation systems can occur through:

- development of simple in the construction, and at the same time reliable in operation, air intake assemblies, as well as protection of the interior of the building against the creation of sudden negative pressure or air overpressure. Such a set may include mineral bulk filters, double-acting explosion-proof valves and dual-drive fans (electric and human muscle strength),
- attempts to use ground heat to heat or cool the ventilation air supplied to the interior of the protective facility,
- the use of new types of chemical filters and the typification of installation components and devices,
- use of heat recovery devices in ventilation, rational use of water, energy and waste in an environmentally friendly way.

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与特殊物体的安装有关的人为物体的操作威胁–庇护所
OPERATING THREATS FOR ANTHROPOGENIC OBJECTS RELATED TO INSTALLATIONS OF SPECIAL OBJECTS - SHELTERS

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抽象。 本文讨论了与外界环境隔离的避难所对人们健康和生命的重大威胁。这些威胁是由于住房设施维护不当以及其技术设备不足造成的。 这主要适用于安装中的二次水污染以及将受污染的外部空气渗入避难所。

关键词：人为物体，操作，避难所设施，水质，空气渗透

Abstract. *The paper discusses the significant threats to health and life of people staying in shelters isolated from the external environment. These threats result from improper maintenance of shelter installations and deficiencies in their technical equipment. This mainly applies to secondary water pollution in the installation and infiltration of contaminated external air into the shelter.*

Keywords: *anthropogenic objects, operation, shelter installations, water quality, air infiltration*

1. INTRODUCTION

Shelters must provide the opportunity to protect people against external threats. Hazard monitoring, filtering, water supply, sewage and compressed air installations have a significant place in this system. Their operation and the materials used determine the shelter's autonomy and guarantee the living and working conditions of the people. The essence are extraordinary threats and the protection of the population against contamination by toxic agents (BST) or toxic industrial agents (TSP).

Due to the fact that there are new threats such as industrial and energy disasters, natural disasters and the possibility of future war, Poland should be prepared to protect people and property. The end products of industrial disasters are also a direct threat to people's lives in peacetime.

Protective buildings are prepared during peace, in the basement of buildings, in communal, commercial and storage facilities, in the metro and in residential buildings.

The shelter's equipment with technical installations and devices should be adapted to the protective function and appropriate conditions of their operation. It is advisable to connect the shelter part to the building installation (electricity, water, central heating, sewerage, telephone). Protective buildings should be provided in conditions of atmospheric contamination, living conditions resulting from hygiene of keeping alive.

The operation of shelter facilities existing in Poland for the protection of civilians poses many difficulties. These facilities are getting older and unused for years with an appropriate level of technical use. Shelter installations of objects located in the basements of buildings are usually only supplied with them. In plumbing installations of such rarely used facilities there are too low flow speeds or even its stopping for some time. In these places, there may be a change in water quality as a result of increased concentrations of solutes or suspensions or the development of bacterial clusters. The degree of deterioration of water quality depends on the materials used, the physicochemical composition of the water, temperature and duration of water immobility.

The problem of maintaining adequate airtightness is also becoming particularly acute in existing protective structures. The external walls of buildings are made of porous materials, which causes air to flow through the partitions. In order to protect the walls of the building against the penetration of contaminated air, it is necessary to insulate the rooms by:

sealing holes, gaps, construction of hermetic vestibules and maintaining overpressure.

2.REASONS FOR SIGNIFICANT DEGRADING OF DRINKING WATER QUALITY IN A SHELTER INSTALLATION

The source of microbiological food poisoning, which is the result of the interaction of metabolic products of the bacterial flora on the human body, is very often incorrectly prepared and stored water. Literature data shows that the presence of even individual bacteria in water after a very short time results in an increase in their numbers, many times exceeding all acceptable norms; This means that, for example, after three days, water becomes unfit for consumption. Classic methods of treating such water, e.g. by boiling, only kill most bacteria, without eliminating metabolic products - bacterial toxins that are a source of food poisoning.

The conditions determining the growth rate of bacteria present in water are mainly water temperature and the presence of mineral and organic substances that are the food substrate for these bacteria. For most bacteria found in water, the optimum temperature range is 15 to 35^{o}C. In this range the fastest bacterial growth

and the phenomenon of transformation of persistent forms into biologically active forms is observed. A temperature close to 0°C extends the shelf life of water from a small number of hours to days and weeks.

Water contamination, i.e. its secondary pollution, can occur in installations or water supply systems of buildings with shelters for the following reasons (Fig. 1):

- dissolution in water of substances contained in installation materials, which is caused by corrosive or erosive phenomena,
- generation of vacuum conditions in water supply systems and with backward movement of water in the pipes sucked into the water supply system of liquid or inferior (polluted) quality,
- periodic formation at selected points of the water supply system of a pressure higher than that prevailing in the installation, as a result of which contaminated fluid may be pumped into the water supply system,
- creating conditions for the development of pathogenic bacteria

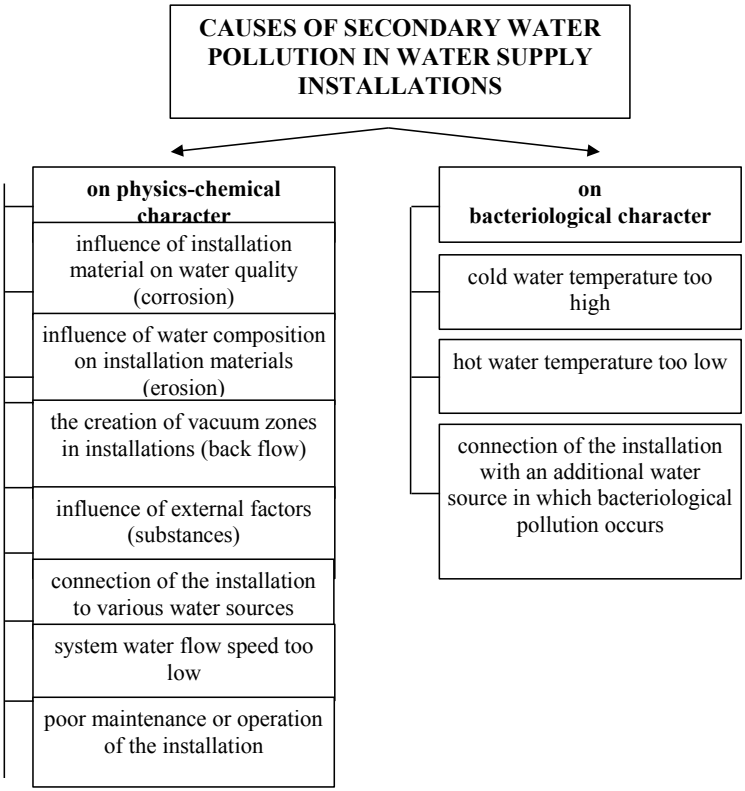

Figure. 1. *Causes of secondary water pollution in water supply installations*

The estimated duration of people's stay in the shelter affects the technical solutions of shelter installations, the volume of rooms and the amount of accumulated inventory. Due to the varying duration of action of human-threatening agents (fires, toxic agents, biological agents, radioactive contamination, etc.), the period of stay in the shelter may be from several hours to several weeks.

The demand for water for people and technical equipment in the shelter is used to meet many needs, including:

- individual needs of people (drinking, preparing meals, personal hygiene, washing dishes, flushing the toilet),
- decontamination (sanitary and special treatments),
- technical needs (cooling of aggregates, air conditioning),
- other needs (heating, supplying external customers, extinguishing fires, maintaining cleanliness of rooms and equipment).

Determining the amount of water needed will depend on: the capacity of the shelter, the time spent in the shelter, the capacity of the special treatment node, the number and size of cooled aggregates, as well as the method of water supply. Water for shelter needs can be supplied in three ways:

- from an external water supply network - a solution particularly beneficial for shelters operated continuously, also during peace,
- from own intake - it is used in shelters with a capacity of at least 250 people or in shelters important for the defence system,
- from the stock accumulated in internal tanks, which in the case of shelters fed with water from the external network to become flow tanks.

The method of water supply to the shelter from the external network is the simplest but the most risky due to the possibility of contamination and the danger of failure), but the simplest in peaceful use. Water supply from the external network and from its own intake cannot deprive the shelter of the reserves accumulated inside, which is an inviolable reserve.

The surest way to supply the protective structure with water is to accumulate water in tanks inside the shelter. However, this is related to the basic disadvantage of this system, i.e. the possibility of accumulating only strictly limited water supply. Another nuisance of this solution is the need for periodic water exchange, the use of flow tanks or its special treatment. Another requirement for the above-mentioned system is the condition of collecting water in several (and not in one) tanks due to the possibility of flooding the shelter with water from a destroyed large tank and thereby depriving the shelter of water supply.

All three ways to supply the shelter with water are not mutually exclusive, and are even recommended. The multi-source supply of the shelter is aimed at achieving the highest possible reliability of water supply.

In order to minimise the effects of adverse changes in water quality due to periods of inactivity, it is recommended to flush the installation. Fragments of installations that are rarely intended to be used or which have not been used for a long time should be isolated for a period of water standstill and should be flushed before putting them back into service. Inactive pipes must be disconnected from the installation. Deterioration of drinking water quality in the water supply system may take place with incorrect or insufficient operation and maintenance. Proper and skilful operation and maintenance of back flow preventers is particularly important.

Due to the unpredictable time of danger to people, the problem of maintaining the continuous and full readiness of the protective structure to take up the functions anticipated for it becomes particularly important. Operating services should regularly inspect the installation, with particular attention to safety assemblies, to check their proper functioning. Technical check-up may be aimed at:

- ongoing detection and removal of any damage and irregularities occurring in the process of using the installation,
- inspection of the functioning of installations and equipment constituting the building's equipment, as well as assessment of the shelter installation preparation for the winter period.

3. EXTRACTION OF CONTAMINATED EXTERNAL AIR INTO SHELTERED INTERIORS

In protective buildings (shelters), a very important issue is the tightness of the building structure. Air overpressure and tightness (airtightness) of the building protects the interior against infiltration of contaminated external air.

Building materials, of which protective and defensive objects are erected most often, i.e. concrete, reinforced concrete, brick, are characterised by high porosity and air permeability. This feature, positive for objects of general use, is very unfavourable and even dangerous for objects that can be found, e.g. in the range of mass fires.

Examples from history (World War II) indicate that in objects within the range of fires and not affected in terms of construction, people died due to lack of oxygen in the internal air or from excess carbon monoxide.

For utility reasons, various cables (cables, pipelines, ducts, etc.) must be routed inside the shelter facilities, and communication (i.e. doors, hatches, etc.) must be properly resolved. The facility has a lot of places, as well as planes through which contaminated air can penetrate the interior or clean air can be sucked out.

For a given structure, the amount of contaminated air penetrating inside the building is a function of the pressure difference on both sides of the partition, which may arise due to the following reasons:

- wind action on the structure, difference in air temperature inside and outside the room,

- atomic explosion shockwave pressure,
- negative pressure prevailing inside the room.

The largest pressure difference can occur in winter conditions, when the difference between the outside and inside air temperatures is maximum. If there are gaps in the entrances, the contaminated air will penetrate the object in winter conditions through the holes located below; warm air from the inside of the building will escape through the openings above.

Experiments and theoretical calculations show that as a result of the penetration of contaminated air into a facility, a hazardous, toxic concentration of poisonous, radioactive and biological agents may be created inside the rooms over time. If the room is not ventilated, then the concentration inside the object can reach a value equal to the outside concentration.

A very difficult task is to eliminate the phenomenon of contaminated air penetrating into defensive (protective) facilities. To achieve this, it is necessary to ensure absolute tightness of these objects, which in practice is almost impossible. Therefore, one should strive for maximum reduction of the amount of air penetrating into the object, which can be achieved by sealing the defensive structure.

Sealing the shelter facility is aimed at:

- protection against penetration of contaminants and infections (chemical, biological and radioactive) as well as combustion products in the event of a fire outside the defensive structure,
- preventing the spread within the defensive structure of contaminations generated during its use (penetration from a dirty to clean zone), and combustion of products in the event of a fire - between internal fire zones.

This aim is achieved by:

- gas-tight external and internal building partitions between the clean and dirty zone
- gas-tight closing of openings in building partitions,
- maintaining during the operation of the defensive structure a certain internal air pressure,
- ensuring the possibility of cutting off the protective structure from the outside atmosphere and supplementing natural air losses in the period when it is not taken from the outside in order to maintain the required overpressure.

4. SUMMARY

Shelter facilities are being prepared during the peace period, in the event of extraordinary threats related mainly to the condition of the outside air. For such buildings located in the basement of residential and commercial buildings, communal and storage facilities, during the period of stay of the protected persons, unpolluted drinking water and uncontaminated ventilation air must be supplied.

Due to the two functionality of such facilities and the associated sporadic use of shelter installations, operational services should systematically review installations that determine the shelter's readiness to take on the function intended for it.

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