



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 2: 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)

ISBN 978-5-905695-56-8

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

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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.

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ISBN 978-5-905695-56-8

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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”

动机是工作和学习的动力

MOTIVATION AS AN INCENTIVE TO WORK AND LEARN

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抽象。 本文讨论了学生学习活动的主要动机。 研究了动机变化的历史方面，即随着学生的成长动机参数的变化。

关键词: 动机, 动机, 激励, 学生, 激励, 老师, 教育活动, 职业。

Abstract. *The article discusses the main motivations for students' learning activities. The historical aspect of changes in motivation, changes in the parameters of motivation as students grow up, is studied.*

Keywords: *motive, motivation, incentive, student, incentive, teacher, educational activity, profession.*

In the era of the global pandemic, when students all over the world are forced to study remotely, the issue of motivating students' learning activities becomes especially relevant. With distance education, the main problem is to maintain the quality of education at the highest level, which is impossible without motivational components. The basis of successful educational work of any student is a high level of motivation for this type of activity, and the result obtained, in turn, is an important factor in the quality of training of future specialists. Every state is important people with a high level of professionalism, enterprise, initiative and the ability to make innovative decisions. Thanks to motivation, in a special way, the key stages of the interaction of each individual with society are traced.

Motivation is an internal activity that contains incentives for the manifestation of personal abilities in life, as well as in the workplace. The creation of motivation for the educational activities of university students is determined by the fact that during training information is presented that is needed for future profession-

alism and the desire to work effectively. Timely detection of professional motives, hobbies, revealing hidden abilities, as well as predispositions is an important condition for satisfaction in the future profession. Analysis of the structure of professionally-oriented motivation of students in higher educational institutions, understanding of motives that push them to work, makes it possible to deliberately solve problems of increasing the efficiency of their activities. [4]

Motives for choosing a profession are a particularly significant factor leading to success in training. Under the motives of professional activity we understand the awareness of the real needs of the individual. This may be, for example, higher education, personal development, self-knowledge, professional development, raising social status and others. These motives are satisfied by the fulfillment of educational tasks and encourage a person to explore future professional activities. [1]

In the historical aspect, the motives for entering higher education institutions were as follows. In 1920-1940, young people strove for knowledge, cultural values, there was an interest in learning as such, since during this period education became accessible to everyone. In the era of total industrialization (1950-1960s), which was supposed to facilitate the transition of the country to a new qualitative state, the importance of technical education increases, the country requires highly qualified engineers. In 1970-1980, the prestige of education was based on fashion. Analyzing the changes in the reasons for entering universities, an expansion of a number of reasons was revealed. And, if in 1961, 10 reasons for motivating higher education were identified, then in 1994 - 82.

In the 1960s, the main motive for entering a higher educational institution was the desire to get a profession. The individual development of the personality of the future specialist was poorly motivated, since Soviet higher education developed primarily as a “forge of cadres” for the national economy. The dominant motive for the attractiveness of the future profession, in particular engineering, in the answers of first-year students of the 1970s was an interest in directly participating in the development of scientific and technological progress (about 50% of all first-year students).

The next motive for higher education was the future material well-being. Back in the 1950s, a specialist with higher education received twice as much as a non-graduate worker, and in the 1970s, the proportion changed, and the gap began to widen.

In the 1980s, the first place in motivation was given the opportunity to do interesting and meaningful work and fully use their own abilities, respect in the team. The creative content of the profession has grown, and material interest has decreased. Perhaps this was because not many professions combined these factors.

At a crucial stage in the history of Russia in the early 1990s, the leading motive was the desire to simply get a diploma of higher education. At the same time, the applicant chose a university, motivated by the ease of admission to it.

Already in 1994, the structure of motives changes quite significantly. The leading motives are to be a highly educated, cultured person (58%), achieve success in life (54%), make a career (37%), have a certain social status (20%). Although the motive of obtaining a profession continues to occupy a rather high place (41%), studies show a drop in this indicator.

To identify the leading motives on the path to future professional activities for modern students, we conducted a study.

The base of the empirical study was the "Voronezh State University of Forestry and Technologies named after G.F. Morozov". This study involved 140 students (foreign students and Russian) of different courses, starting from the first to the fourth.

The studies revealed that first, second, third year students prioritize family and study, for them the motive is the desire to achieve the approval of the father and mother, to justify the parents' hopes that their efforts in children are not in vain.

Hence the desire to study and pass exams for excellent grades. For 4-year students, the main priority is work, the educational process loses its significance. The research data is presented in Figure 1.

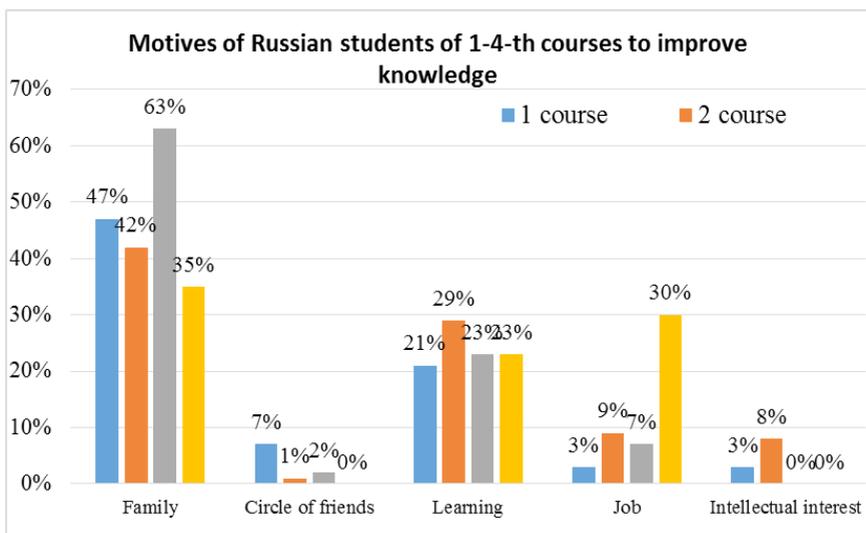


Figure 1 – Motives of Russian students of 1-4-th courses to improve knowledge

First, second, third year students are interested in getting an education, it is important and crucial. And fourth-year students think that just being a student is not enough for them, practical experience is needed. The data indicate that students are more motivated during this period to generate income and, therefore, are trying to earn more money than to study.

The motivation for choosing a profession for fourth-year students is that it will help them avoid unemployment due to its prestige.

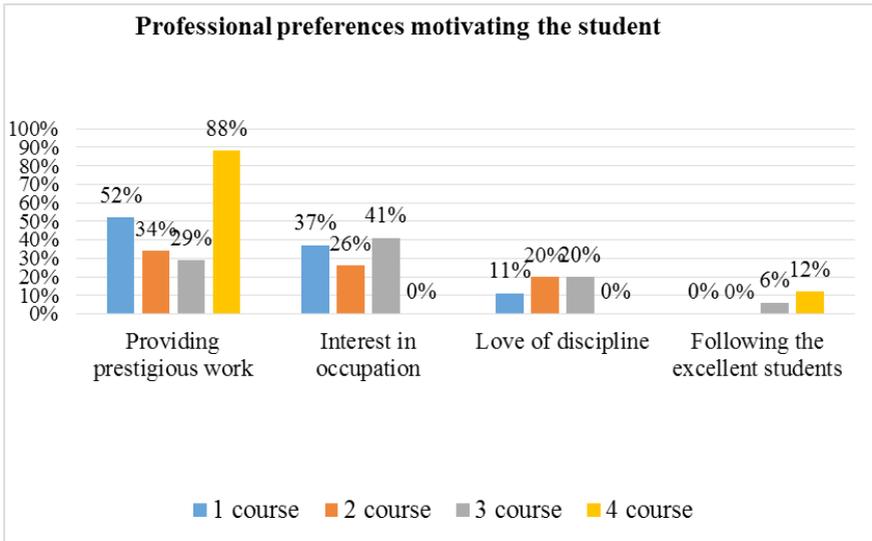


Figure 2 - Professional preferences motivating the student

The prestige of the profession is one of the main social mechanisms governing the process of professional self-determination, and is understood as a comparative assessment of the significance and attractiveness of various professions on the basis of certain values. Students' activity also affects their future success in professional activities. At the university, in the educational process, students are involved in many projects, in writing creative, scientific, and term papers. It is at this stage that the teacher-student communication takes place, communication that will give the student a useful and instructive experience for the future. Below, in figures 2 and 3, the professional preferences and motivations of the student are presented.

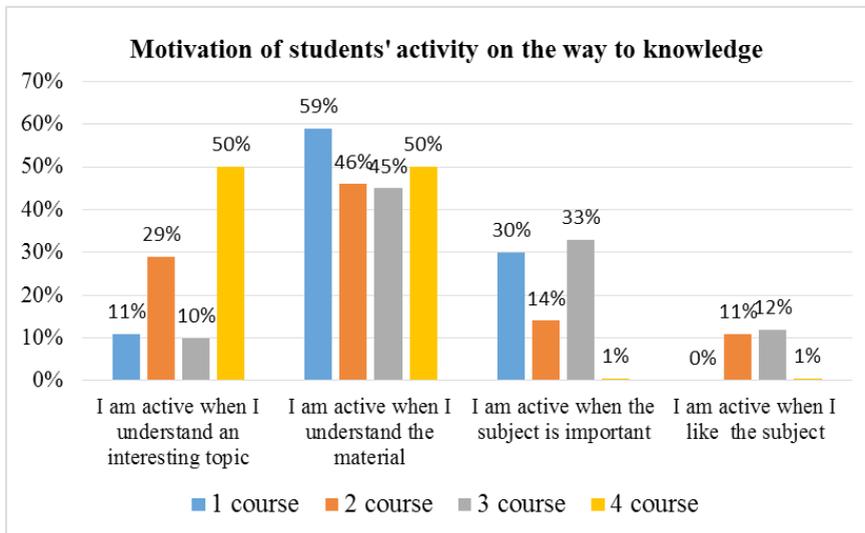


Figure 3 - Motivation of student activity on the way to knowledge

The results of the analysis show that first-year students are active in the classroom when they understand the material, and graduates are active when there is a prospect of obtaining a prestigious job.

In the second study, only foreign students took part, this was undertaken to compare with the performance of Russian students. It was revealed that foreign students oriented to a career in Russia are more susceptible to changes in motivation to study than those who do not plan to stay in Russia. Among the motives for studying at a university, foreign students coming to the first year of study in Russia can be distinguished as follows.

First place - new knowledge, skills and desire to become a good specialist; the second is the learning process; third place - communication with the teacher, the data are presented in table 1.

Table 1 - Motives in the first year of study at a university with foreigners

Motive	Number of respondents, %	
	Western Europe	Asia
Communication with new friends	74	63
New knowledge, skills	65	82
Demands of parents	54	40
Fear of expulsion	35	53
Communication with teacher	30	43

The first year of study involves being in a stressful situation. The student breaks away from the family, learns to live in a new team. However, after three years, changes in their motivation are observed (data are presented in table 2). In the first place is the motivation for communicating with the teacher. Students highly appreciate the opportunity of personal communication with highly specialized specialists who play a key role in their preparation for a future specialty.

We see that during the period of study at the university, foreign students have reduced motivation in the following positions: communication with new friends decreases by 34% and 28%, and the desire to acquire new knowledge and skills decreases by 27% and 50%. Students get used to the new environment, the level of stress from being in the new environment is reduced. Unfortunately, in recent years, the authority of parents to stimulate learning has been declining. Due to the total employment of modern parents, children are not always able to freely communicate with them.

Table 2 - Motives in the fourth year of study at a university with foreigners

Motive	Number of respondents, %	
	Western Europe	Asia
Communication with new friends	40	35
New knowledge, skills	38	32
Demands of parents	34	30
Fear of expulsion	48	35
Communication with teacher	50	60

Currently, student studies and teacher work is carried out exclusively in a remote format. Teachers use modern technologies during the educational process: Skype, Viber, WhatsApp, Zoom, Moodle. Our university has long gained experience working with students remotely, which allowed us to quickly and efficiently begin the implementation of the educational process in accordance with the requirements of the Ministry of Science and Higher Education of the Russian Federation. In this regard, the motivation of the students has undergone changes. For primary school students, the main motive is the ability to acquire knowledge, and for graduate students – the desire to obtain a diploma of higher education. In conditions of self-isolation, students increased the need for personal communication with the teacher, the number of requests for joint scientific work increased.

Students want to see the following actions from teachers:

1. Teachers must prove to their students the importance of the subject taught, its relevance in their future professional activities. Since students, as a rule, enter a university not just to obtain a diploma, but to receive a profession that they have chosen for themselves, in which they are interested and consider their life calling.

2. Teachers should maintain formal and informal contact with the student. If between a teacher and a student, in addition to lectures and seminars, communication is nullified, then in this case it is difficult to say something about the student's motivation. It is important for the student to have support in the person of the teacher in the pursuit of learning and a senior friend who is able to give advice when parents cannot help in resolving some issue.

3. Teachers should not use excessive rigor and lack of praise in their practice. It is important to remember that excessive rigor, especially in the absence of support, as well as constant criticism are poor assistants in the formation of motivation to study [2].

Recall the theory of needs of the American psychologist Maslow. He wrote about the levels of human needs, which were: survival, security, socialization, prosperity and self-expression. The impulse to action will disappear if we misplaced our own needs; satisfying erroneous needs, we will continue to be in disharmony [3].

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社会因素及其在塑造商业企业形象中的作用
**SOCIAL FACTOR AND ITS ROLE IN SHAPING THE IMAGE OF A
COMMERCIAL ENTERPRISE**

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抽象。今天，人们越来越关注社会责任对组织形象的影响，并因此对进一步的商业活动的影响。作者研究了商业企业形象中社会责任因素的本质，并探讨了其理解途径。本文通过观察社会责任组织的主要特征，分析了社会因素在塑造商业企业形象中的作用。总之，使用对社会企业正面形象的形成可能产生必要影响的各种社会责任表现形式的重要性是合理的。

关键词：慈善，志愿服务，组织形象，商业活动，赞助，社会责任，金融投资。

Abstract. *Today, more and more attention is paid to the impact of social responsibility on the image of the organization, and, accordingly, on further commercial activities. The author studies the essence of the social responsibility factor in the image of a commercial enterprise and approaches to its understanding. The article analyzes the role of the social factor in shaping the image of a commercial enterprise by observing the main features of a socially responsible organization. In conclusion, the importance of using various manifestations of social responsibility that can have the necessary impact on the formation of a positive image of a commercial enterprise is justified.*

Keywords: *charity, volunteerism, image of the organization, commercial activity, patronage, social responsibility, financial investments.*

At present, the steady profit generation in the process of selling products/services to consumers for a long time determines the commercial success of this type of organization. This success also means that, all other things being equal, the customer will choose the products/services of this organization. Therefore, by forming a favorable image of the company, it is just possible, in the long term, to achieve stable commercial success.

The image of a commercial enterprise arises for potential consumers in the form of a certain image of the organization, which was formed based on the goals set.

Create the desired image of a commercial enterprise, it is necessary to take into account the influence of all image-forming factors, both external and internal. The external image is based on such important components as public opinion formed by the advertising company, product quality, public work, media relations and social responsibility – that is, it demonstrates the importance of the client, the need to fully meet their needs through interaction with the company, and all this is aimed at building trust [10].

Neglect of any of these factors threatens the company with loss of trust of potential customers, violation of the integrity of the image of the organization, and of course, the occurrence of material losses in commercial activities [9].

Therefore, modern organizations have increasingly come to the conclusion that investing in creating the image of a "socially responsible organization" is considered prestigious and fashionable.

The main feature of a Mature person is considered to be responsibility. This characteristic is fundamental to the image of a business person and a successful professional. It is worth understanding the importance of social responsibility in relation to the organization.

One of the characteristics of the image of a commercial enterprise is such a concept as "corporate social responsibility", which became widespread in Europe in the early 70s of the last century.

Let's consider what approaches exist to understanding the social responsibility of a commercial enterprise (table) [6].

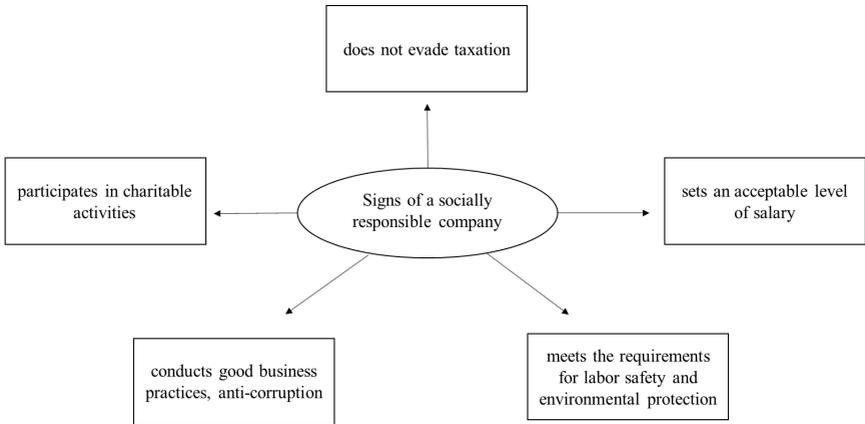
**Approaches to understanding the social responsibility
of a commercial enterprise**

№	Name	Characteristic
1	Traditional (commercial)	The interests of the owner are of paramount importance in the company's activities. The main goal of the company is to make a profit in the competition and avoid fraudulent and deceptive methods of work. Compliance with the law and prescribed business rules in this case reflects the social responsibility of the organization
2	Ethical	The company's ethical obligations to its founders, creditors, managers, clients, and government must be observed. regulatory bodies and employees of the organization itself, and many others who can influence the success of the organization and the achievement of its goals
3	Socio-humanistic	Necessity of companies to act on a voluntary basis in the public interest, to Finance funds for solving urgent problems and for improving society as a whole

Thus, the social responsibility of a commercial enterprise is understood as the corporate capacity for social response through voluntary practices of various contents, which favorably affects the overall image of the company.

In 2004, there was an initiative from the Russian Union of Industrialists and entrepreneurs (RSPP) to create a set of fundamental principles of socially responsible business practices of any type of organization, better known as the Social Charter of Russian business. As you know, more than 250 Russian companies and organizations have joined the Social Charter, that is, a total of about 5 million employees [11]. This indicates the growing interest of enterprises in forming the desired image through the introduction of a social responsibility factor.

By 2008, Russia is joining the United Nations Global compact (UN). This action implies that the main features of social responsibility will be introduced into the activities of commercial enterprises (picture) [3]:



Main features of a socially responsible organization

When studying the categories of charitable activities and volunteer practices, it is worth noting that they are synonymous, because they denote certain ways of self-expression and self-realization of citizens who act individually or collectively for the well-being of other people or society as a whole.

At this stage of the Genesis of the concept under study, the following main forms of charitable activity are distinguished, which are used by modern enterprises engaged in commercial activities [6]:

1. Sponsorship in the form of cash donations. Organizations provide financial assistance, as well as through specially created charitable funds.
2. In-Kind assistance in the form of services rendered or the supply of necessary equipment.

3. Volunteer activity in the form of corporate delegation of employees of the organization – voluntary participation of employees in external social programs that are not part of their official duties.

The main difference between volunteer activities of commercial enterprises is that they do not involve direct financial investment. Volunteering is the free provision of time, special knowledge, skills, information, and contacts by volunteers to recipients. Those employees of the enterprise who participate in volunteer activities, perform either their professional duties, but free of charge, or take part in non-core socially useful activities for them. At the same time, the first option is preferable for society, because it gives more socially useful results.

When various forms of charitable activity are regularly carried out in relation to the same recipient, we can already talk about patronage – the gratuitous transfer of various funds to entities that directly preserve and develop the national cultural heritage. For example, by providing a useful book for a wide range of readers free of charge, it becomes possible to demonstrate the social responsibility of the organization, its devotion to the traditions of patronage, and at the same time attract more potential customers and increase revenue [8].

Charity and patronage should not imply any benefits, they are reflected only in the help and support of specific citizens or socially significant events. However, there is a certain benefit, which is expressed in image capital [1].

Only in the case of anonymous actions of the benefactor, image goals are not pursued. Commercial enterprises, on the other hand, are interested in actively demonstrating their involvement in certain events, attracting the media and/or posting information on their own website. In this case, charity initiatives turn into funds aimed at creating a positive image of the organization [4].

Summarizing the above, we note that, of course, forming the image of a socially responsible enterprise, the company's management should not avoid taxation and use "gray" schemes for its optimization. There are many special programs and websites that allow you to analyze the company's cash flow and all its financial and accounting statements completely in the public domain. The counterparty verification service is also becoming particularly relevant now, and its main purpose is to identify unfair commercial enterprises. Neglect of this feature of a socially responsible organization will undoubtedly affect the image of the organization in the most unfavorable light, starting from the loss of partners, and ending with the payment of large fines.

It should be noted that the salary level reflects not only the external image-forming factor – the social responsibility of a commercial enterprise, but also the internal factor of forming a favorable image of the company for its own staff. It will always be more pleasant for an employee to work in an organization where their work is appreciated, as a result of which they feel responsible attitude of the Manager to their subordinates [2].

In addition, do not forget that the conditions for labor safety and measures to protect the environment are now given special attention. Both employees and clients perceive the image of a socially responsible company, where they clearly care about the staff, monitor the convenience and safety of work. Therefore, the trend of environmental protection is gaining momentum, which can be manifested both in small formats, such as the economical use of paper and the further delivery of waste paper for recycling, and in larger ones, such as Toyota, which seeks to minimize the environmental consequences of the company's activities and creates environmentally friendly cars with the possibility of complete recycling. It is obvious that such actions are reflected in the formation of the overall image of the organization.

Of particular importance for the image of a commercial organization is the sign of a socially responsible company, which implies a fair business policy and implementation of anti-corruption measures, where interaction occurs exclusively with decent organizations that also conduct their activities within the framework of the above criteria. It is established that the image of the counterparty is superimposed on the image of its own organization, which is why many companies have separate sections on the websites of "our clients" or "our partners", where the largest and most successful organizations with a favorable image in the market are indicated.

Meeting all the characteristics of a socially responsible commercial enterprise, the company has a positive impact not only on the image of the organization, but also on the overall well-being, which can be expressed in the absence of staff turnover, a greater share of loyal customers, a decrease in accounts receivable when working with bona fide, solvent contractors, and many other manifestations [7].

It is worth noting that over the past fifteen years, both in Russia and around the world, there has been a significant advance in understanding the need for the existence of factors of social responsibility of the organization and its content in the overall image of the company [5].

Managers of a commercial enterprise need to select the appropriate forms of social responsibility implementation and be interested in implementing actions that meet the interests of both the society, the organization itself, and interested parties.

In general, we can conclude that those commercial enterprises that have reached certain heights and are striving for further development, growth and new victories in the market, today pay great attention to the factor of social responsibility in the formation of their image.

This is due to the fact that the presence of signs of a socially responsible organization favorably affects the formation of the desired image of the company, which, in turn, determines the future welfare of the commercial enterprise. As the research shows, commercial enterprises that conduct and participate in socially

responsible projects receive 20-30% more clients with a high level of trust in the company and its product/service, which, in turn, and as a result, significantly increases its profitability. All this allows us to state the economic feasibility of investing in socially responsible measures to improve the image of a commercial enterprise.

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粮食进口替代和俄罗斯农业部门的均衡发展：现状，趋势和前景
**FOOD IMPORT SUBSTITUTION AND BALANCED
DEVELOPMENT OF THE AGRICULTURAL SECTOR OF RUSSIA:
CURRENT STATUS, TRENDS AND PROSPECTS**

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抽象。 本文讨论了在经济制裁的背景下俄罗斯联邦食品进口替代的现状，趋势和前景。 对俄罗斯粮食和农业原料出口对俄罗斯农工综合体运行的10个财务指标和8个自然指标的依赖关系进行了因子分析，并计算了与宣布的进口替代策略相对应的指标。 充分证明了农业部门平衡发展的必要性，在此框架内确保了粮食市场各个行为者的经济和社会利益平衡。

关键词：进口替代，粮食出口，均衡发展，因子分析。

Abstract. *This article discusses the current state, trends and prospects of food import substitution in the Russian Federation in the context of economic sanctions. A factor analysis of the dependence of the Russian export of food and agricultural raw materials on 10 financial and 8 natural indicators of the functioning of the Russian agro-industrial complex was carried out, and indicators corresponding to the declared import substitution strategy were calculated. The necessity of the balanced development of the agricultural sector, within the framework of which the achievement of a balance of economic and social interests of various actors of the food market is ensured, is substantiated.*

Keywords: *import substitution, food export, balanced development, factor analysis.*

In 2014, Western countries initiated and introduced, in the opinion of the authors, unreasonable economic sanctions against the Russian Federation, the response to which was the food embargo of the countries that supported the sanctions policy against Russia, which has been ongoing ever since. As a result of the period from 2014 to 2018, the import of food and agricultural raw materials in

the Russian Federation decreased by 25.7% from 39.8 to 29.6 billion US dollars, while at the same time, Russian exports grew almost proportionally - from 19.2 to 24.9 billion US dollars (+22.8%) (Fig. 1).

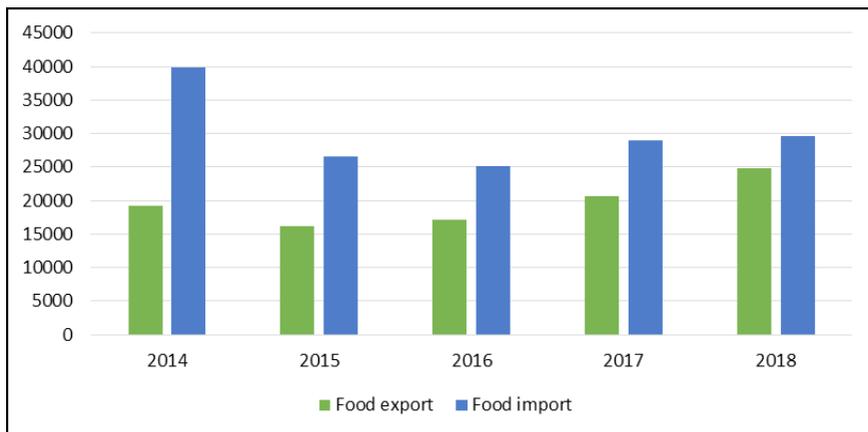


Figure 1 – Dynamics of export and import of food in the Russian Federation 2014-2018, million US dollars

Source: Information portal of the Federal state statistics service of the Russian Federation [Electronic resource] / Access: <http://www.gks.ru>.

Since 2015, the term “import substitution” has been actively included in the vocabulary of both Russian farmers and leaders of all levels in relation to food issues, which is understood as the termination of the import of a certain product into the country in connection with the organization of its production on the spot [2, p. 149]. At the same time, import substitution is urgently and strategically distinguished. The main approaches to urgent food import substitution are associated with the prevention of deterioration in the nutrition of the population and are based on a quick search for other, more loyal importers, who instead left the market. In strategic import substitution, key efforts focus on the consistent increase in domestic production of agricultural products and the deep modernization of the agricultural economy using innovative technologies [1].

The adoption of administrative barrage measures allowed to free a sufficiently substantial niche of the Russian food market for domestic agricultural producers, which served as an incentive to increase food production within the country. Thanks to this, over the indicated period, the growth rate of food production in value terms by domestic agro-industrial complex amounted to about 10% annually and by 2019 reached the figure +46.5% compared to 2014 (Fig. 2).

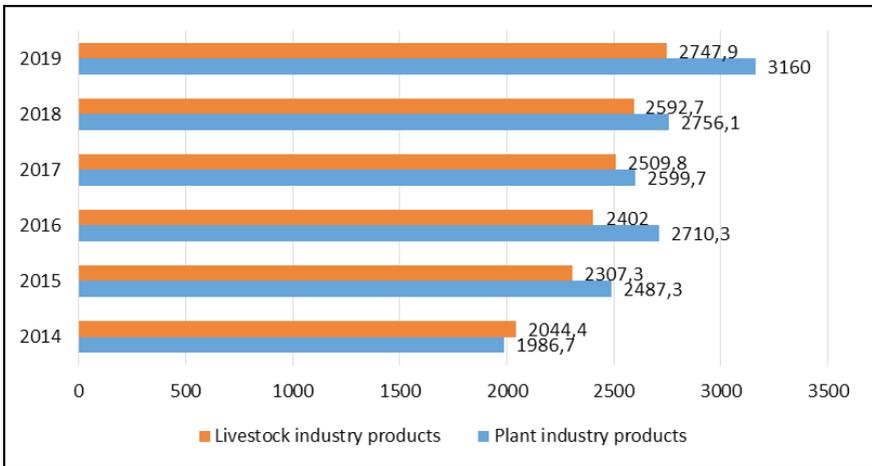


Figure 2 – Dynamics of agricultural production in the Russian Federation from 2014 to 2019 at actual prices, billion rubles

Source: Information portal of the Federal state statistics service of the Russian Federation [Electronic resource] / Access: <http://www.gks.ru>.

As a result, food imports to Russia declined for almost all types of food products, with the exception of flour and vegetable oils (Tab. 1).

Table 1 - The share of imports of certain food products in the Russian Federation in 2014-2019, %

Product	Years					
	2014	2015	2016	2017	2018	2019
Meat and poultry, including offal	19.6	13.4	11.0	10.5	7.5	7.3
Beef, including offal	59.1	50.3	43.5	44.6	37.9	36.1
Pork, including offal	17.0	12.3	9.6	9.9	2.1	3.0
Sausage products	2.4	1.2	1.5	1.6	1.6	1.1
Animal oils	35.7	25.8	24.8	27.0	18.0	26.6
Cheese	40.6	23.0	29.6	27.1	27.8	30.1
Flour	1.0	0.6	2.1	1.5	0.9	1.0
Groats	0.6	0.3	0.2	0.2	0.4	0.3
Vegetable oils	14.0	17.5	17.2	14.8	17.5	16.8
Milk powder and cream	45.2	56.4	59.8	54.2	33.7	39.4

Source: Information portal of the Federal state statistics service of the Russian Federation [Electronic resource] / Access: <http://www.gks.ru>.

Moreover, imports of meat and poultry have decreased by 62.8%, beef – by 38.9%, pork – by 83.4%, sausages – by 54.2%, animal oil – by 25.5%, cheese - by 25.8%, grain – by 50%, milk powder and cream – by 12.8%. The indicated dynamics made it possible to talk about the achievement of food safety criteria in the Russian Federation as a whole.

Certain successes in the implementation of the concept of food import substitution in Russia led to the emergence of a number of new tasks related to the further development of domestic agriculture. In a presidential decree of May 7, 2018, an ambitious task was set for the Russian agro-industrial complex, to increase agricultural exports to 45 billion US dollars a year by 2024 [3].

To determine the trends and prospects for the implementation of the aforementioned, the authors calculated the correlation dependence of food exports from the Russian Federation on 10 financial and 8 in-kind indicators of the functioning of the Russian agro-industrial complex (Tab. 2).

Table 2 - Calculation of the correlation dependence of Russian food exports on financial and physical indicators of the functioning of agro-industrial complex¹

№	Indicators	Type of function	Coeff. "a"	Coeff. "b"	Coeff. of correlation	Coeff. of determination	Av. quad. deviation	Number of degrees of freedom (n-2)	Statistics	
									F _{obs}	F _{cr}
<i>Financial indicators</i>										
1.	The level of agricultural production	exponent $y=ae^{bx}$	73,8189	0,00055	0,9896	0,9794	0,0878	7	334,2	5,591
2.	The level of population spending on food	exponent $y=ae^{bx}$	82,3882	0,00212	0,9812	0,9629	0,1181		181,8	
3.	Government support costs for agro-industrial complex	hyperbola $y=a/x + b$	-312251	1924,1	0,7524	0,5661	304,64		9,136	
4.	Costs of production and sale of goods (works, services) in agro-industrial complex	linear $y=ax + b$	0,85122	-636,9	0,9893	0,9748	73,317		271,5	
5.	The total value of fixed assets	hyperbola $y=a/x + b$	-6399491	2429,7	0,9743	0,9493	104,11		131,1	
6.	Balanced financial result (profit minus loss)	exponent $y=ae^{bx}$	269,465	0,00570	0,9441	0,8914	0,2021		57,49	
7.	Financial turnover in agro-industrial complex	linear $y=ax + b$	0,76138	-469,25	0,9970	0,9940	35,781		131,1	

¹Indicators №№ 1-7, 11 are calculated based on the results of statistical observation for the period from 2010 to 2018; №№ 8-9, 12-18 – for the period from 2014 to 2018; № 10 – for the period from 2015 to 2018.

№	Indicators	Type of function	Coeff. "a"	Coeff. "b"	Coeff. of correlation	Coeff. of determination	Av. quad. deviation	Number of degrees of freedom (n-2)	Statistics	
									F _{obs}	F _{cr}
8.	Average annual prices for grain and cereal	power function $y=ax^b$	0,00393	1,3957	0,6283	0,3948	0,2515	3	1,957	10,13
9.	Debt of agricultural producers on loans	hyperbola $y=a/x + b$	-4038041	3930,4	0,9575	0,9169	101,79		33,10	
10.	Fixed investments	linear $y=ax + b$	3,99008	-287,31	0,8882	0,7890	136,61	2	7,482	18,51
<i>Natural indicators</i>										
11.	The average annual number of people employed in agriculture	linear $y=ax + b$	-0,57494	4267,0	0,9736	0,9479	105,53	7	127,4	5,591
12.	Number of tractors	power function $y=ax^b$	3,05564E+13	-4,4367	0,9768	0,9543	0,0691	3	62,66	10,13
13.	Number of combines	power function $y=ax^b$	2,52139E+12	-5,2679	0,9679	0,9368	0,0812		44,51	
14.	Mineral fertilization	power function $y=ax^b$	219,581	2,0053	0,9096	0,8274	0,1343		14,38	
15.	Organic fertilization for crops	power function $y=ax^b$	6,35103E-10	6,7432	0,9929	0,9859	0,3830		210,8	
16.	Use of fresh water for irrigation	power function $y=ax^b$	2,22716E+36	-8,6939	0,9667	0,9345	0,0827		42,80	
17.	Energy capacities in agro-industrial complex	exponent $y=ae^{bx}$	3038955	-0,0853	0,9416	0,8866	0,1088		23,46	
18.	Sowing areas of agricultural crops	power function $y=ax^b$	6,3481E-107	22,3014	0,8736	0,7632	0,1573	9,67		

Source: compiled by the authors

The data obtained show that the greatest impact on the export of food and agricultural raw materials from the Russian Federation is influenced by such financial indicators as the level of agricultural production (*if nothing has been produced, then there is nothing to export*), the value of population spending on food in the domestic food market (*solvent demand as a key financial support for Russian agricultural producers*), as well as a balanced financial result of economic activity of agro-industrial complex (*no one will work for no profit*). Such indicators as the cost of production and sale of goods (works, services), total cost of fixed assets, financial assets turnover in the agro-industrial complex and agricultural debt on loans, despite high correlation indicators, due to a significant standard deviation, are not balanced and cannot be used as a base for forecasting, because it contains significant errors.

Such indicators as average annual prices for grain and cereal, investments in fixed assets of the agro-industrial complex, and sowing areas of agricultural crops in the context of the issue under study are not statistically significant, because in all cases $F_{obs} < F_{cr}$.

We should also pay attention to government spending on supporting the agro-industrial complex. As you can see, this indicator does not have such a strong effect on stimulating food exports from the Russian Federation, as is commonly believed. In addition, of all the financial indicators of this criterion, the maximum spread of the standard deviation and the F_{obs} value are in the same order range with respect to F_{cr} , which makes it not a reliable value for the subsequent assessment. In our opinion, this circumstance is explained by the fact that almost all the financial resources allocated by the Russian government to support the national agro-industrial complex are not spent in the interests of export-oriented companies, but are used in most cases to solve the current and seasonal problems of agricultural producers not at all connected with the export. In our opinion, this indicator has an indirect effect on food exports through stimulating the growth of agricultural production.

As for the natural indicators, the greatest correlation dependence of export on the application of organic fertilizers for sowing ($r = 0.9929$) should be noted here, which is explained by the predominant export of grain and cereal from the Russian Federation. Equally important in this matter are the provision of farmers with technical equipment, the use of irrigation systems and the development of energy capacities. The average annual number of people employed in agriculture, due to a significant standard deviation, also cannot be a profile criterion.

The highlighted key indicators and correlation dependencies make it possible to establish what the functioning parameters of the Russian agro-industrial complex should be in order to increase agricultural exports to 45 billion US dollars a year by 2024².

So, in order to export food and agricultural raw materials by 45 billion US dollars, the level of domestic agricultural production should increase from 5348.8 in 2018 to 6670 billion rubles in 2024 (+24.7), i.e. grow by an average of 4.1% annually. The total level of food expenses for Russian citizens for the same period should increase from 1316.8 to 1680 billion rubles (+27.6% or +4.6% annually), the balanced financial result of economic activity of agro-industrial complex from 301.9 up to 417 billion rubles (+38.1% or +6.4% annually), the use of organic fertilizers from 68.8 to 75.4 million tons (+9.6% or +1.6% annually).

²Further calculations were carried out based on the weighted average exchange rate of the US dollar to the Russian ruble according to the results of 2019 – 64.7326 rubles per 1 US dollar. Access: https://www.audit-it.ru/currency/sr_vz.php.

At the same time, if urgent measures are not taken, then by 2024 the number of tractors in Russian agriculture will decrease from 211.9 to 181.7 thousand units, combines from 56.9 to 49.8 thousand units (-14.3% to the level of 2018, or -2.4% annually for both indicators), energy capacities in the agro-industrial complex will fall from 90.3 to 81 million hp. (-11.5% or -1.9% annually), and the use of water for irrigation from 6570 to 6062.8 million m³ (-8.4% or -1.4% annually).

Thus, the data obtained indicate that a “simple injection” of financial resources into the agricultural sector for the growth of export supplies is not enough, a comprehensive approach is required, implying a balanced development of the national agro-industrial complex, which ensures the achievement of a balance of economic and social interests of various parties of the food market..

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国家如何加强市场参与者的积极互动: 方法和工具

HOW THE STATE CAN STRENGTHEN THE POSITIVE INTERACTION OF MARKET PARTICIPANTS: METHODS AND TOOLS

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抽象。已经确定, 只有国家在不干扰市场运作的情况下, 才能增强市场参与者的积极相互影响, 并增加市场的“透明度”和市场主体的“意识”; 它显示了如何在原始方法和工具的帮助下执行此操作

关键词: 国家与市场, 市场参与者, 参与者的互动, 原始方法和工具

Abstract. *It is established that only the state, without interfering in the functioning of the market, can strengthen the positive mutual influence of market participants and increase the "transparency" of the market and the "awareness" of its subjects; it is shown how to do this with the help of original methods and tools*

Keywords: *the state and the market, the market actors, the interaction of the participants, original methods and tools*

Introduction. It is known that market entities do not always interact successfully, without mutual reproaches and accusations. Here, with specific examples, we systematize the totality of interests of participants in market relations, propose a number of methods, the use of which by state authorities will contribute to the positive interaction of the state and the market. The proposed methods and tools are universal.

[**Explanation.** Recall first the interpretation of the terms and tokens used: *"The market is a place where there is an exchange between sellers and buyers of goods and services. Market actors: 1) individuals; 2) legal entities; 3) the state. Market objects - that's all about what a buying-selling relationship arises ... A clean, perfect (free) market is usually considered in theory, but in practice is unattainable. Conditions for achieving a perfect market: ... 4) "transparency" of the market (awareness of market participants about all events ... "* (Big economic encyclopedia. – M.: Eksmo, 2007. – 816 P.).]

1. What are interests and difficulties that market participants face?

First, about interests. Let's start with an individual buyer. It can be assumed that most buyers, deciding to buy something, would like to **know**:

**what are the prices* for the goods they need in the nearest stores, pharmacies, etc. (and, in some cases, in other areas of the city, other administrative-territorial entities);

**what is the consumer quality* of this product (values of quality characteristics: freshness, functionality, usability, appearance, etc.);

**what will be the costs* of operation, maintenance of the purchased goods;

*and what, for example, is the *time spent* on obtaining a specific result (solving a *specific* problem, implementing a *specific* function, mastering *user instructions*, etc.)

*what is the *total cost of ownership* (TCO) of this product, etc.

A similar interest is observed *in both the buyer-legal entity, and the buyer-state*, government.

And *what else* is the *seller-legal entity* interested in? Both the seller-manufacturer of the goods and the seller of goods of different manufacturers *are interested*:

**in minimizing their costs* to increase profits; **in knowing the prices and consumer quality characteristics of similar products* from competitors.

Now we define the interests of the *state*. This one is simple. **A socially oriented state is interested in:** **accelerating the country's economic development and increasing the life expectancy* of citizens; **in increasing the share of "happy" people* who are satisfied with life in their country.

On the problems and difficulties of market entities. Here we pay attention to the almost insurmountable difficulties that "fall" on the *buyer-subject of the market (individuals, legal entities and the state)* in the process of searching and selecting a product, for example, a machine tool, a computer program, a car that has the characteristics of a consumer quality that a consumer needs.

Suppose that we are talking about buying a *software product* (SP), for example, about buying a software for accounting personnel, or for automating accounting, or workflow, or monitoring execution, etc. But it turns out that there are *hundreds or thousands* of such SPs. The question is, **how do you know**

***what is their price**, is it available to the buyer, and how much time will it take to find such information, and who or what (*what tools or methods*) can provide assistance, help in solving this problem;

***which SPs have the features that the buyer needs.** However, finding out or evaluating this is very difficult. Indeed, in many market SPs, the number of characteristics (functions) realized by them amounts to hundreds and thousands. Thus, the number of functions of software products (SP) for automating operations in the back office of an investment company exceeds 300 [2], the number of SP functions

for document automation - 500 [3], the number of SP functions for accounting automation and only in budget organizations - 900 [4]. The number of modifications of goods for the same purpose is growing;

**and what are the time costs to implement, to perform the functions necessary for the buyer (such information may be decisive at the time of purchase, if the number of executions required by the buyer per unit of time of some functions is very large;*

**how successfully the SP interface is implemented (understandable, convenient for perception, pleasant to the eyes, etc.); *what are the costs of maintaining SP; *what is the total cost of ownership of SP, etc.*

It seems to us that it is unlikely that there will be a buyer *in the country* who has the right amount of *knowledge, time and opportunity* to find an SP that satisfies his wishes (of course, only if such an SP is available on the market).

[**Note 1.1.** We believe that today the probability of having such a “thrifty” buyer (as, indeed, such an event) is $<10^{-6}$. **So, what kind of "transparency" of the modern market and the "awareness" of its subjects in this case can we speak of?**]

Similar problems are faced by individual buyers of some other goods, such as medicines. After all, there are a lot of types of drugs. And there are many those with the *same composition of ingredients*, which have not only *different prices*, but also *different names*.

[**Note 1.2.** It turns out that if, with *someone's* help, for example, with the *help of the state*, the buyer-individual could satisfy his desires by seeing the entire price list *in the public domain* and buying the product he is interested in for a *lower price* for ΔP , the product that has the right to *this buyer* with the composition of consumer-quality characteristics, then only an *individual satisfied* with the purchase could **by spending these unexpectedly received ΔP of monetary units on something else that he needed *become even happier.*]

No less difficulties await the *seller-legal entity*. After all, they also **do not know**,

**how realistic is it to achieve a reduction in the cost of production or sale of goods and HOW to do it; *HOW to evaluate the consumer quality characteristics of SP competitors and identify which of the missing competitors SP functions it is desirable to implement.*

As for the problems that the state has to face, the state, represented by the **government** of the country, often **does not know** HOW, *without explicitly interfering in the market's functioning*, **increase revenues in the revenue side of the country's budget; *increase the life expectancy of citizens; *buy equipment, computer programs and other goods with the best characteristics of consumer quality and at the lowest price to equip medical, educational, scientific and other state and municipal*

institutions; *improve the **working conditions** of working citizens to strengthen their health and increase life expectancy, increase labor productivity and increase the overall comfort of their lives in their country.

After all, it is known that the mood, well-being, health of an employee largely depends on production conditions: on the convenience of the workplace, lighting, ventilation, noise level, temperature and many other factors that simultaneously affect not only health, but also performance, labor productivity of an employee.

[Note 1.3. On the level of “awareness” of a market entity called the state. Thousands of legal entities are represented on the **modern** market, which produce under the conditions of commercial secrets and sell **thousands** of **similar goods and services** that are identical in purpose in the process of commodity-money exchange: *with different costs, using *different technological processes, *with a different number of operations, *using different equipment and *different tools and, obviously, *with different resource consumption (i.e., with different expenses of time, materials, labor, energy, finance) and, of course, *with different working conditions of workers.]

The question is, **how** in such a situation can the state, **without violating the conditions** of a *perfect* (free) market, **eliminate** all these *numerous obstacles in order to realize its interests?*

2. How can the state ensure increased “transparency” of the market and “awareness” of its subjects

In the process of analyzing the interests and relationships of market entities, it was established that **all market entities** are really *interested in being able to*

*buy goods that have the *characteristics* of consumer quality that this entity *needs at a minimum price*; *reduce legal costs and increase profits; *take care of improving the *working conditions* of working citizens.

It seems to us that **only the state** can provide all participants in market relations with such opportunities.

2.1. Informing market entities about paid services provided by the state for assessing the consumer quality of goods (using software products as an example). First, we recall that there can be a lot of *characteristics of consumer quality* for goods for *one purpose*, and the *time spent* on implementing the *same functions* for such goods can vary significantly, and the *number of times the same function can be performed by different customers* can vary by thousands times.

So, today on the market there are many software products for one purpose, differing in a number of parameters characterizing the consumer quality of the product, including the most important characteristics, such as *functional plenitude* - FP software applications and the resource consumption of the operation process - labor, time, finance on the use and maintenance of software products (SP). Therefore, it is obvious that the assessment of the consumer quality of SP, providing the

opportunity to save labor and financial resources, is extremely relevant. After all, the potential buyer-user has many questions:

What are the criteria for the optimal selection of the desired SP from a set of comparable developments of the same purpose? What features should a purchased or designed software product have? How to quickly assess the possible cost of time, labor and financial resources for the processes of active use of SP? How to choose the best option for the SP interface from the point of view of the customer-user?

Answers to these questions are given in [4-16]. At the same time, the state can evaluate (at the request of market participants) *the consumer quality of goods in the form of a paid service*, since such information, being *exclusively in demand in the market conditions*, is at the same time practically *inaccessible to most individuals and legal entities* due to the very *high resource intensity* of the processes of obtaining it. In such a situation, **only the state** can offer and provide a service that includes original procedures *assessment of *functional completeness*, *assessment of *the user's time spent on applying SP*, *assessment of *the quality of the appearance of the SP*, *quality of *the documentation support*, *assessment of *the security of the SP*, *assessment of *the total cost of ownership of SP* and the *results of processing* an expert survey in a comparative assessment of the consumer quality of *complex software systems under various experimental conditions*.

2.2. Prompt reporting of prices for goods and services in domestic and foreign markets (for example, on the website of public services or at the request of market entities)

Consider the situation *with prices for services* (see [17]). As an analysis of the real situation on the services market shows, even *within the same city*, the *price range for the same services* is very wide. Moreover, *not only the price of services differs significantly*, but also the *time spent by customers* on getting the same service *from different firms*. And this situation is due *not only* to the insufficient development of *competition*, but also to the fact that the processes of selling the *same services* for different firms differ, as a rule, both in the *composition of operations*, and in the *time it takes to carry out* the same operations, and in the *resource intensity* (*labor; material, energy and cost*) of operations and process as a whole. It is obvious that for a potential buyer of a service - *medical, educational, legal, household*, etc. - in many cases it is difficult to choose a seller among many candidate firms. After all, the buyer needs to know, *firstly*, about whether the service of interest to him is provided in the city, if so, by what firms and at what addresses; *secondly*, how much does the service cost from different sellers; *thirdly*, what are the costs of the client's time when purchasing a particular service from a particular seller; and, finally, from whom it is possible to obtain more complete information about the characteristics of the consumer quality of services from different firms. However, since the *number of sellers* in the services market is *constantly chang-*

ing - some go broke and leave the market, others, after registering in the corresponding government services, are introduced into various market segments, it is difficult, or rather, *impossible*, to quickly *track* this process for the *buyer*. At the same time, **only** the *state* that **registers** sellers and controls the activities of market entities has the opportunity to **positively influence** the functioning of the market for services.

Publication of pricing information **in the public domain** - on the websites of authorities - **forces sellers of goods and services not to fall** outside the range of prices and time spent by the buyer. The described *methods and tools* ***can be used** to process the opinions of customers in the sale of any goods and **any** services; **allow to:** **assess the likelihood* of receiving services for a certain price and time; **compare the performance* of firms that sell services; **conduct a comparative analysis* of the costs of financial resources and time to obtain specific services *from different sellers*; **more accurately assess the impact* of various factors on the consumer quality of goods and services and *introduce* new technologies to **reduce the resource intensity and prices** of goods and services offered, **contributing to the growth of public welfare**.

2.3. Informing market entities about the services provided by the state to assess the level of working conditions when performing various technological processes and works. Earlier, we proposed a method for assessing the level of working conditions [18, p. 163-200], which is based on the use of the original automatic classification (recognition) algorithm, and the training sample is formed as a combination of 3 arrays: an array of physiological indicators, an array of sanitary and hygienic indicators, and an array of technical and economic indicators. The procedure for classifying and assessing the level of working conditions when performing specific technological processes (works) using the training sample formed in this way is described in [18, 19].

2.4. The provision of services by the state to legal entities on the optimal choice of a market niche - a “profitable” market segment (based on monitoring results of domestic and foreign markets). It is known that for the optimal choice of a market niche, it is necessary to determine what the consumer needs, how to *segment the market*, and which market segment the company will serve "*when it penetrates markets characterized by a high degree of competition.*" However, this is not so simple. Indeed, with the development of scientific and technological progress, the goods and services offered to the market, such as automobiles, smartphones, computers, software products, are becoming more complicated. In such a situation, only the **state** can assist *legal entities* in finding a *market niche* for successful entry into a competitive market, implement multi-segment *differentiation of the market*, identifying *which specific characteristics of the consumer quality of the goods* interest *different groups* of buyers.

2.5. Informing legal entities about goods with minimal resource intensity (identified as a result of a directed search in accessible markets). It is known that the *volume of costs* of certain *resources* for the manufacture of a product of the *same name* is a *random variable*. Suppose that we are interested in spending time and money on the implementation of the production and sale of certain goods, i.e. *processes* of *supply, manufacturing, marketing and management* carried out in the course of production and business activities. These costs can be estimated using the *process-statistical* method of accounting for resource costs (PSMARC), focused on the integration of visual and simulation models [15]. Visual IDEFi-models, complementing the traditional modeling of business processes based on the IDEF0 standard, are widely used in the *reengineering of business processes* in various subject areas. The possibility of sharing models IDEF0 and IDEF3 [20] allows you to *expand the range of simulated tasks* and add additional information about the subject area to the model. Universal methodological, algorithmic and software is widely used in various subject areas [21].

CONCLUSION. The article for the first time **states* that *only the state*, without interfering in the processes of market functioning, can *strengthen the positive mutual influence of market participants* and increase the "transparency" of the market and the "awareness" of its subjects; **Authors' methods and results are proposed* that allow: 1) to systematically present the totality of the interests of market entities and the difficulties they face. 2) For the first time, to form an original set of actions, by implementing which the state will be able to contribute to the fulfillment of "conditions for the attainability of a perfect market": 3) To justify the feasibility of providing the state with a paid service for assessing the characteristics of the consumer quality of goods and the prompt provision of open access to information on prices for goods and services. 4) For the first time to show that the state, as the *copyright holder*, *can take advantage* of the unique results of scientific research conducted at *state industrial research institutes* for labor protection and carry out (*at the request of legal entities and trade union organizations*) an assessment of the level of working conditions when performing various *business processes*. 5) Substantially *affirm the conclusion* that, in conditions of *high resource intensity of the procedure* for the optimal choice of a market niche, only the *state* will be able to *assist legal entities* to successfully enter a *competitive market*, *implement multi-segment differentiation of the market*, identifying those *characteristics of consumer quality of goods* that interest *different groups* of customers. 6) Show that minimizing the resource consumption of goods, services and business processes is the *main source* of financial *support* **accelerated economic development, growth of GDP, GDP per capita, GDP by SP; *increase the duration and standard of living of citizens; *increase the likelihood of legal entities entering foreign markets with less resource-intensive goods (with the same consumer quality).*

The article was prepared based on the results of studies carried out with the support of the Russian Foundation for Basic Research (RFBR) - project 15-01-06324/15 "Modeling of production and management processes for rapid assessment and optimization of resource consumption of goods and services: the formation of universal methodological and instrumental support".

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基于数字平台的企业发展原则
**PRINCIPLES OF ENTERPRISE DEVELOPMENT BASED ON
DIGITAL PLATFORMS**

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抽象。本文考虑了基于数字平台的商业模式在现代经济中的领导作用。对企业平台的发展进行了分析。突出了平台企业在数字经济中的鲜明特点。阐述了基于数字平台的企业发展的主要原则（开放性，可访问性，模块化）。

关键词：数字平台，企业平台，业务生态系统，网络效应，可持续发展。

Abstract. *The article considers the leading role of business models based on digital platforms in the modern economy. An analysis of the development of enterprise platforms is made. Distinctive features of platform enterprises in the digital economy are highlighted. The main principles (openness, accessibility, modularity) of enterprise development based on digital platforms are formulated.*

Keywords: *digital platform, enterprise platform, business ecosystem, network effect, sustainable development.*

Introduction

The digital economy - is a priority area of modern world development. The effective use of new digital technologies will in the near future determine the competitiveness of individual companies, industries and countries. One of the leading directions in the development of the digital economy is the spread of new business models based on digital platforms.

M. Alstin, J. Parker and S. Chaudari have made convincing arguments in favor of the indisputable advantage of digital platforms over traditional business models [1]. In the works of Russian researchers A.I. Kovalenko [2], S.A. Yablonsky [3], V.D. Markova [4], A.V. Plotnikova [5] and others consider various aspects that ensure the superiority of digital platforms. The main advantage of the new platform enterprises is the quick direct interaction between sellers and buyers. This allows you to significantly expand the possibilities of joint consumption of goods and services (network effect) and significantly reduce transaction costs.

But the main evidence of the superiority of business models based on digital platforms is the facts. Such a fact in 2019 was the rating of the largest companies by capitalization. All five first places were taken by companies working on a new platform business model: Apple, Microsoft, Alphabet (Google), Amazon, Facebook.

For organizations and companies operating within the framework of traditional business models and organizational structures, the following issues become extremely relevant:

1. How to adapt to the digital economy?
2. How much time is there to adapt?
3. Which industry enterprises should use new digital technologies in the first place?

For most traditional enterprises (especially small and medium), the answers to these questions are very negative. As a rule, for the large-scale implementation of digital technologies, they lack the necessary intellectual base and financial capabilities for the acquisition and use of intellectual property. New principles for building enterprises on the basis of digital platforms can significantly expand the opportunities for traditional enterprises to participate in the work of platforms without large financial costs. It is also another important advantage of the new platform enterprises.

Features of the interaction between ecosystem participants are considered by S. Muegg [6]. Some aspects of attracting new manufacturers to the existing platform, especially the manifestations of the network effect, are studied by A. Hagey and E. Altman [7], A. Hagi and J. Wright [8] and other scientists. OECD in the 2017 Digital Economy Survey calls the study of barriers to participation in the platform business of large and small firms the most important area of managerial science and statistics [9].

Main part

In one of the most famous works on the topic under discussion, “Platform Revolution” (2016), J. Parker, M. Alstin, and S. Chaudari S. give the following definition of a platform. “A platform is an enterprise that provides mutually beneficial interactions between third-party producers and consumers” [10, p. 33]. In fact, this is an intermediary enterprise that itself does not produce and does not consume any values.

The modern enterprise platform has four members:

- owner;
- provider;
- manufacturers (create an offer);
- consumers (use the offer).

It is the presence of providers that distinguishes modern platforms from traditional ones. Platform enterprises did not emerge now; they are not a consequence of the development of modern digital technologies, as modern researchers sometimes try to imagine. S.N. Konopátov and N.V. Salienko fairly note, that such a platform is an analog telephone switchboard, on which the telephone network is closed [11]. The manual telephone switchboard was created in the 19th century and, according to modern terminology, is a one-way platform. A one-way platform includes users of the same type (in this example, these are subscribers), the value of the platform for users is to increase the number of subscribers. This increases the number of telephone connections for each user.

However, based on the understanding of the platform as an enterprise providing mutually beneficial interactions between third-party producers and consumers, the trading company should be considered the earliest platform. It has two major components from the point of view of ensuring the interaction of the manufacturer and the consumer. The first is the material component of the platform (trading floor, warehouses, access roads). The second component is the rules for the interaction of manufacturers with the platform (types of contracts, payment terms, etc.).

Any trading company (store, shop, bazaar, market) is essentially a platform. It can be a one-sided platform, if goods (services) produced by the owner of the store or shop are sold. But more common are bilateral platform enterprises that connect consumers with third-party manufacturers. Such bilateral platforms are also commodity and stock exchanges.

Multilateral platforms require active participation in the development of the platform of the platform owner. Active participation is not only and not so much in updating the platform's material base by the owner. It consists in attracting new third-party participants who will take part in the development and introduce new forms of interaction between producers and consumers of goods (services). The prototype of modern multilateral digital platforms are such formats of trading enterprises as shopping centers, shopping and entertainment centers, distribution companies. Such enterprises attract consumers with different needs, manufacturers of different industries, and also create additional forms of interaction between them: home delivery, after-sales service, credit sales, etc.

Thus, in the modern economic space, three types of platform enterprises have formed and are functioning: unilateral, bilateral and multilateral.

The introduction of the Internet and digital technologies has significantly affected the efficiency and direction of development of the platform business. One and two-sided platform enterprises began to create their sites, attracting new producers and consumers to cooperation, reducing, and in some cases abandoning the material base. Enterprises appeared - bilateral platforms, without or with a minimum material base and full-time employees (Uber, Airbnb, Alibaba.).

Multilateral platforms in the field of innovative technologies have become the locomotives of the modern economy. Companies such as Microsoft, Apple, Google, Yandex, due to the network effect, are growing rapidly, so they have a huge number of consumers, suppliers and developers; at the same time, both sides of the platform at any time have a huge choice on the other side for every taste, price, delivery time. In addition, enterprises - digital platforms provide and quickly improve additional services. It refers to:

- convenient system of ordering, providing and paying for services;
- risk insurance;
- consumer reviews of the services they're provided, etc.

Companies based on digital platforms are successfully pushing enterprises from the market on traditional platforms based on the possession of material resources: taxi fleets, supermarkets, hotels, etc.

Another important distinguishing feature of modern platform enterprises is the new principles of their construction. Recent years of research, as a rule, link platform enterprises with the development of business ecosystems.

It should be noted that the concept of business ecosystems was not accidentally penetrated into economic and managerial practice. This is due to global changes in the goal-setting of the business.

The introduction of environmental principles in the system of scientific knowledge began in the 70s of the last century. This concerned not only the orientation towards universal environmental safety, but also consisted in the penetration of environmental approaches into various fields of knowledge. In 1993, J. Moore proposed considering the company as part of a business ecosystem that is interconnected with various industries [12].

The logical conclusion to this process was the emergence of the concept of sustainable development. Accordingly, changes began in traditional economic science. There was an understanding of the need to move from the narrow goals of economic development - the efficient use of resources, to a wider circle - ensuring the viability of economic facilities in the long term. As a result of this, changes have occurred in the goal-setting of the business: the main goal of the company's activity is not maximizing short-term profit, maximizing the value of the business. The key goal of business in the XXI century is already becoming the long-term viability of the company by creating intangible assets and maximizing its value for stakeholders.

Thus, Western companies went through three consecutive stages in the process of their development in formulating a priority goal.

1. Maximum profit based on the efficient use of all resources.
2. The maximum market value of the company.
3. Long-term viability of the company.

Moreover, the transition from one goal to another does not mean a denial of the goals of the previous stage, but is based on them.

Russian companies are experiencing difficult growth problems in this regard. In the Soviet planned economy, such goal-setting was meaningless, and therefore absent. Most Russian companies since the 1990s are still at the first stage of goal setting. Maximum profit and efficient use of all types of resources is a priority activity for them. Focusing on the maximum capitalization of the business is the lot of a small number of large corporations. After 2010, only a few companies make the choice as the priority goal of the long-term viability of the organization.

This situation is not accidental. The transition from one type of goal to another is an evolutionary process. It cannot be achieved and supported with the help of federal laws or the creation of scientifically based methods. It occurs when the thinking and value orientations of business owners and organization managers change.

The study of biological ecosystems helps to formulate new principles for the construction and management of modern organizations. Such principles include openness, mutual trust and modularity of construction. First of all, we are talking about large business organizations that ensure economic progress through innovation and the scale of production and marketing. The main modern forms of such organizations are associations in the form of holdings, strategic alliances and network organizations.

The openness of associations helps to attract a greater number of participants in them, the emergence of competition between them, which, on the one hand, leads to the crowding out of inefficient organizations. On the other hand, this allows the creation of redundancy in production and consumption, which helps to maintain such a union in crisis situations. The modularity of building a system means its formation from relatively autonomous units. This increases the sustainability of the development of associations.

Conclusion

An analysis of the most successful platform enterprises leads to the following conclusions. A digital platform is valuable to members using its services. This value is formed due to two major sources:

1. New technological opportunities for interaction between platform participants.
2. New principles for building relationships between platform participants.

New digital technologies present completely different opportunities for platform participants than in traditional business models. The speed of interaction, the amount of processed information, and the accuracy of decisions are many times increased.

The new principles on which relations between platform participants are built are a direct reflection of the properties of biological ecosystems. Each biological ecosystem is an open system. In nature, there are only natural barriers to preventing new entrants. For platform enterprises, there are only artificial barriers for new entrants. Artificial restriction of platform participants can be created either by the platform owner or by law. The most important principles for building modern platform enterprises are:

1. The openness of the platform to external interactions. Entry/exit barriers for sellers, buyers and providers should be minimal.
2. Relations between platform participants should be based on trust in each other, rather than on formal (contractual) dependence.
3. Platforms (especially multilateral) should be built on a modular approach, which helps to strengthen their stability.

The rules of interaction between the platform and the participants contribute to the best economic results with the most complete consideration of the provisions of ecosystem sustainability mechanisms. But the openness of the business platform is a priority over them. The more the platform will be open to new participants, the easier and more complete the redundancy and variety of elements will be created in it, modules will be formed, information will be exchanged, participants will be naturally selected.

Thus, the use of the principles of ecosystem functioning can have a major impact on the performance of modern digital platforms. In the Russian, as, among other things, and in any other economy, the successful development of enterprises based on digital platforms is determined by the solution of two issues: trust and responsibility.

A higher degree of openness (minimum number of entry barriers) of the platform is possible on the basis of greater trust of the participants and the platform owner to each other. This, in turn, assumes that the platform participants predominate responsibility based on consciousness, and not fear of punishment. The problem of lack of trust between participants in the platform enterprise is a key barrier to ecosystem development. It is a crucial obstacle to the transition from traditional business models to digital business models.

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有效管理蔬菜种植资源潜力的经济和数学方法
**ECONOMIC AND MATHEMATICAL METHODS IN EFFECTIVE
MANAGEMENT OF THE RESOURCE POTENTIAL OF
VEGETABLE FARMING**

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注解。本文展示了使用经济和数学建模方法来提高在蔬菜种植农民（农场）农场（农场）中利用资源潜力的效率的技术。为了实现这一目标，提出了以阿拉木图地区特定农场为例的生产类型结构组合的模型开发。研究表明，使用经济和数学优化模型将显著提高蔬菜农场的生产效率和资源潜力。在这种方法的基础上，还可以解决根据阿拉木图地区的条件证实所有类型农业形态资源潜力的最佳参数的问题。

本文是根据哈萨克斯坦共和国教育和科学部的项目编号为AR05130910“科学委员会”的研究成果而编写的，主题为：“有效管理资源潜力的信息技术和数学方法”哈萨克斯坦共和国的农业企业”。

关键词：经济和数学方法，生产潜力管理，作物轮作，轮作表，生产资源利用建模，资源潜力的最佳结构。

Annotation. *The paper shows the technology of using economic and mathematical modeling methods in order to increase the efficiency of using the resource potential in vegetable-growing peasant (farm) farms (farms). To achieve this goal, a model development of a combination of the structure of production types on the example of a specific farm in Almaty region is proposed. The results of the research show that the use of economic and mathematical optimization models will significantly increase the efficiency of production and use of the resource potential of the vegetable farm. On the basis of this method, it is also possible to solve the problems of substantiating the optimal parameters of the resource potential of all types of agricultural formations for the conditions of the Almaty region.*

This article was prepared on the results of research under the grant project number AR05130910 "Committee of Science" The Ministry of Education and Science of the Republic of Kazakhstan on the topic: "Information technologies and mathematical methods in the effective management of the resource potential of the agricultural enterprises of the Republic of Kazakhstan".

Keywords: *economic and mathematical methods, management of production potential, crop rotation, rotation table, modeling of the use of production resources, optimal structure of resource potential.*

Introduction. Today, there are significant problems that hinder the accelerated development of the agricultural sector in Kazakhstan. Their main reasons lie in the fact that management practices are dominated by the old stereotype of thinking, ignorance and lack of ability to use modern achievements of applied science and information technology. All this, of course, reduces the effectiveness of managing production and economic activities, constrains the practical application of modern scientific and technical developments, innovative technologies, and advanced production experience [1, 2, 3, 4, and 5]. The same situation is observed in the scientific developments of the majority of Kazakh agricultural economists.

Currently, the methods of economic and mathematical modeling (or EMM) are very poorly used in the management of production potential in agricultural formations of Kazakhstan. Of course, today, in order to increase the efficiency of using the resource potential, there is an urgent need to use the method of optimizing processes in crop production and animal husbandry in agricultural formations of Kazakhstan. Crop production and animal husbandry in many agricultural formations of the Almaty region are developing disproportionately and have not actually received their optimal development [6, 9, 10 and 11]. The issues of rational planning and management of agricultural production with the use of modern innovative achievements of information technologies and applied mathematical methods have fallen out of the field of view of researchers.

In modern conditions, the relevance of the problem of efficient use of production potential is due to the low level of efficiency both in terms of the scale of production of agricultural products, and in terms of rational use of the available resource potential. The task is complex and requires the use of a systematic approach and the use of modern research methods, including information technologies, for its optimal solution.

Continuing to study these problems remains one of the most relevant in the field of innovative management of the use of the resource potential of agricultural formation.

Methodology and research methodology. The purpose of our research during the implementation of the project AP05130910 [6] was to conduct a systematic analysis of the proportions, conditions and factors of functioning of agricul-

tural formations in the Almaty region. All this is carried out using mathematical tools, and on this basis to develop methodological recommendations to assess the level of utilization of productive capacity, simultaneously providing a rationale and quantitative measurement of increase of efficiency of its use and production growth of production volumes.

To substantiate the optimal solution of the problem under consideration, a set of interrelated economic and mathematical models for managing production and economic activities of agricultural formations has been developed. The goal is to improve the use of agricultural production potential [6, 9, 10 and 11].

Results and analysis. In the Almaty region, out of the many existing peasant (farm) farms, a significant part is engaged in vegetable growing in combination with grain or forage crops. Based on the prevailing production conditions of the region, we selected the vegetable-growing peasant (farm) farm of the farm "Luch" of the Enbekshikazakh district of the Almaty region as a model farm.

Distinctive features of economic and mathematical modeling of vegetable farming activities. Vegetable farming is a labor-intensive industry and family farms are usually small in size. In this regard, the crop rotation should be short-rotation and as specialized as possible. Vegetable farms are characterized by the possibility of applying a variety of crop rotations and cultivating a wide range of crops. Each such vegetable farm has its own specific aspects, the applied technological techniques are purely individual. The results of vegetable farming farms are largely determined by difficult to predict weather conditions, so forecasting production costs is difficult and determining income is very conditional. Therefore, when optimizing the parameters of the resource potential of vegetable farms for the criterion of optimality, you can take the cash proceeds from the sale of products.

The task can be formulated as follows: "it is Necessary to determine how much arable land is needed for the organization of the economy, on what area and what vegetable crops to grow, how much and what vegetable products will be produced in physical and monetary terms so that the monetary revenue from the sale of products is maximum. Provided that the main amount of work is performed by the members of the farm, and the hired labor is used, if necessary, only for seasonal work." This is a General statement of the problem. Depending on the selected strategy, it can be refined in each case.

The mathematical model for optimizing resource potential parameters has the same structure as shown in [6, Appendix B, p. 96-102], with the exception of some features. In particular, the following notation is used to record the mathematical model of vegetable farms:

J_1 - labor resources and labor reserves by types and categories of employees;

d - land share of one member of the economy (the rate of free transfer of land to the ownership of one person), ha ;

I_{ij} - minimum, I_{ij} - maximum specific weight of vegetable crop area, in the vegetable crop rotation;

C_{ij} - prices for agricultural products or output of marketable products from one hectare of j-th crop.

Write the target function as follows:

$$Z = \sum_{j=1}^n c_j x_j \rightarrow \max \quad (1)$$

The product of the cost of commercial products from one hectare to the area of each crop sown, summed by product type, expresses the revenue of the farm from the sale of products. This indicator is selected as a criterion for the optimality of the problem. You must find the maximum value of the function if the following restrictions are met:

1. Restrictions on the number of farm workers and the use of labor resources.

In the model, the number of employees is set for convenience. Farms are organized primarily as family farms and the number of full-time employees is mainly determined by the size of the family, and wage labor is used only for seasonal work, mainly vegetable harvesting, and sometimes weeding, if the weather conditions do not allow you to do without manual weeding. The model assigns at least one variable and one restriction to the number of farm workers, the free member of which is the number of farm workers. Mathematically this condition can be expressed as follows:

$$x_j = B_i \text{ where } j \in J_1, \quad i \in I_1 \quad (2)$$

If necessary, you can model the balance of employees and specialists, by profession, qualification, and so on.

Restrictions on the use of labor resources can be expressed as follows:

$$\sum_{j=1}^n a_{ij} x_j \leq b_i, \quad i \in I_1 \quad (3)$$

These restrictions can take into account the use of labor resources for the entire production cycle and for busy periods, a separate line is modeled for wage labor. Restrictions ensure that no more labor is required to perform the work than is available on the farm, taking into account seasonal hiring of workers.

2. Restrictions on land resources:

$$\sum_{j \in J_3} a_y x_j - \sum_{j \in J_1} dx_j - \sum_{j \in J_2} x_j \leq 0, \text{ where } i \in I_2 \quad (4)$$

The land use area of a farm in the model is defined as follows. In the left part of the restriction, the first term expresses the expenditure of arable land for sowing, and the second and third in total show the presence of land, the second - land

owned by members of the economy, the third - the area of land leased by the farm. Area of land, ownership is defined as the product of land share of one member households to their numbers in the economy, and the area of leased land is defined as missing up to optimal land management.

In General, the restriction ensures that a certain land area will be sufficient for the organization of a vegetable farm, and no more land will be allocated for sowing than there is land owned by members of the farm plus the leased area of arable land.

3. Restrictions on the area of planting of vegetable crops:

$$\sum_{j \in J_2} l_{ij} x_j \leq \sum_{j \in J_3} x_j \leq \sum_{j \in J_2} l'_{ij} x_j \quad (5)$$

or we can write it differently (formulas 6 and 7):

$$\sum_{j \in J_2} l_{ij} x_j - \sum_{j \in J_3} x_j \leq 0, \text{ where } i \in I_3 \quad (6)$$

$$\sum_{j \in J_2} l'_{ij} x_j - \sum_{j \in J_3} x_j \geq 0, \text{ where } i \in I_3 \quad (6)$$

The area sown for each vegetable crop ranges from the minimum to the maximum possible area in the crop rotation. For vegetable crops, the set of which is quite diverse, it is not difficult to find the necessary assortment of this type of vegetables in each of the groups of vegetable crops. The restrictions of this type, in fact, are the balance of the maximum possible areas of each vegetable crop in the crop rotation.

4. Requirements of crop rotations can be expressed as:

$$\sum_{j \in J_3} w'_{ij} x_j - \sum_{j \in J_3} w''_{ij} x_j \left\{ \begin{array}{l} \leq \\ = \\ \geq \end{array} \right\} 0, \text{ where } i \in I_4 \quad (8)$$

These ratios are used to model agrobiological features of production, crop rotation in crop rotation, and numerical proportions between crops of different crops. In highly specialized vegetable farms that use vegetable rotation, sometimes you can do without restrictions of this type, using only restrictions on the area of sowing of each vegetable crop. If the farm uses vegetables grains and vegetables forage crop rotations, sometimes the use of coefficients of bundles that reflect the agrobiological features of this crop is necessary.

5. Restrictions on determining production volumes:

$$\sum_{j \in J_3} v_{ij} x_j - \sum_{j \in J_4} x_j = 0, \text{ where } i \in I_5 \quad (9)$$

The first term models the gross yield of this type of product as the product of yield per acreage, the gross yield of the farm. This way you can group the production of vegetables and other products by types and homogeneous groups of crops.

Source information and numerical model. To create a numerical model of the problem of optimizing the resource potential of vegetable farming, it is necessary to determine the stock of its labor. The labor reserve of a farm depends on the number of its members and the time that one employee can work in a vegetable farm for a year. The calculations assume that an adult able-bodied person can work 2000 hours a year in vegetable growing, and the amount of wage labor is limited - no more than 600 hours per member of the farm.

After determining the number of members of the farm, you must select its strategy. Here the farmer has a wide field of activity, as the possible range of vegetable products is very large. After determining the management strategy, select the crop rotation, on the basis of which the numerical model will be developed. There is also a wide range of options for vegetable farms, offering a wide variety of types of vegetable, grain and feed crop rotations.

After selecting the crop rotation and justifying the numerical values of coefficients, resource consumption rates and output rates, coefficients of links between variables and coefficients of estimates, you can start compiling a numerical model.

Now we will start to solve the problem of optimizing the parameters of resource potentials of the vegetable farming farm "Luch" of the Enbekshikazakh district of Almaty region. We have selected this farm as a typical (model) one. The entire strategy of the farm is connected with the developed crop rotation. To do this, a rotation table of crop rotation is compiled. The rotation table of crop rotation is a plan for placing crops and fallows by fields and years of crop rotation. When compiling a rotation table, the types of crops grown themselves are taken into account, since some crops require returning to the same field after a long period of time. In our case, after 5 years. Then for this farm the most optimal is the rotation table 1 of the Field crop rotation, in the form of:

Table 1 - Rotation table of 5-Field crop rotation

field	field number crop Rotation by year 1 2 3 4 5 1				
	1	2	3	4	5
1	Steam	Winter	Potatoes	Corn	Melons
2	Winter	Potatoes	Corn	Melons	Steam
3	Potatoes	Corn	Melons	Steam	Winter
crops 4	Corn	Melons	Steam	Winter	Potatoes
5	Melons	Steam	Winter	Potatoes	Corn

Figure 1 shows a numerical model of the problem of optimizing the parameters of the vegetable farm "Luch" in Almaty region.

Taking into account additional variables, the numerical model of the problem contains 34 rows, 20 variables, 141 elements, and the density of the matrix is -20.7%.

As we can see, this task requires relatively little initial numerical information.

Note, first of all, that the model has only one constant - the number of full-year employees in the farm. In the model, it is set. It is set in the model. In the conditions of the Almaty region, it makes practical sense to solve the problem of optimizing the parameters of a peasant vegetable-growing farm with 5, 6, 7, 8 and 9 full-time employees. On average, according to the results of a questionnaire survey, there are 5 employees per farm.

The calculation of technical and economic coefficients of the matrix does not cause any special difficulties. Labor costs per hectare in man-hours, crop yields, and the cost of commercial products per hectare of crop production are all common indicators. The rest were determined on the basis of accepted standards and legislation [7 and 8]. The matrix of the economic and mathematical model for optimizing the resource potential of the vegetable farm "Luch" in Almaty region is shown in figure 1.

Optimal parameters of the resource potential of vegetable-growing peasant (farmer) farms in the conditions of Almaty region, on the example of the farm "Luch".

Taking into account the wide variety of possible types of agricultural land plots, several types of tasks were developed and solved to optimize their parameters. Problems were solved using the "solution Search" add-on in MS Excel. Some fragments of the results of solving the problem are shown in figure 2.

First of all, consider the results of solving the above problem (table 2). Out of ten possible crops, four were included in the optimal solution. The management strategy of this farm is based on the sale of three types of products: cobs of cucumbers in the stage of milk-wax ripeness, tomatoes and wheat grains. Vegetable corn is in demand everywhere, brings good income. Corn cobs are readily bought by the population at markets, in shops in fresh form.

№	A	B	C	D	E	F	G	H	I	J	K	L	M	N	
Matrix of the economic and mathematical model of the problem of evaluating the efficiency of using the															
№	Limitations	Numerical value, employees, pers.	Hired labor, person-hours	Arable land, ha			Seeding area, ha								
				in the ownership	rented	in total	Winter wheat	Tomato	Beets cutteen	Carrots	Luke	Watermelon	Melons ²		
		X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	X ₈	X ₉	X ₁₀	X ₁₁	X ₁₂		
6	Variable value	9,00	5400,00	33,48	70,98	104,46	0,00	20,89	0,00	10,35	0,00	20,89	10,54		
7	1 Number of employees, pers.	1													
8	2 The labor of all people-CH	2000	1					-25,6	-10,72	-695	-704	-943	-380	-230	
9	3 Hired labor, person-hours	600	-1												
10	4 Arable land owned, ha	3,72													
11	5 PL of leased arable land, ha			-1	1										
12	6 Total arable land, ha			-1	-1	1									
13	7 Sown area, ha					1	-1	-1	-1	-1	-1	-1	-1	-1	
14	Net steam not less than, ha						-1								
15	Net steam not more than, ha						-1								
16	8 Winter wheat, ha min							1							
17	9 Winter wheat, ha max							-0,2	1						
18	10 Tomatoes, ha min								1						
19	11 Tomatoes, ha max								-0,2	1					
20	12 Table beetroot, ha min									1					
21	13 Table beet, ha max									-0,2	1				
22	14 Carrots, ha min										1				
23	15 Carrots, ha max										-0,2				
24	16 Onion, ha min											1			
25	17 Onion, ha max											-0,2			
26	18 Watermelons, ha min												1		
27	19 Watermelons, ha max												-0,2	1	
28	20 Melons, ha min														
29	21 Melons, ha max													-0,2	
30	22 Potatoes, ha min														
31	23 Potatoes, ha max													-0,2	
32	24 Corn on the cob, ha min														
33	25 Corn on the cob, ha max													-0,2	
34	26 Zucchini, ha min														
35	27 Zucchini, ha max													-0,2	
36	28 Yield of C from 1 ha							47,5	375	263	152	85,8	273,5	142,3	
37	29 Production of commercial vegetables from 1 ha, C									250	250	150	74	250	130
38	30 Production of commercial corn cobs from 1 ha C														
39	31 Production of commercial wheat grain from 1 ha, kg							45,8							
40	32 Selling price of 1 TS, thousand tenge							3,844	22,276	3,798	20,706	3,895	17	35	
41	33 The amount of gross products, thousand tenge							182,59	8353,5	998,874	3147,312	334,191	4649,5	4980,5	
42	34 Revenue from 1 ha, thousand tenge							176,06	5569	949,5	3105,9	288,23	4250	4550	

Figure 1 – Matrix of an economic and mathematical model for optimizing the resource potential of vegetable farming farm "Luch" in Almaty region

Stores, restaurants, cafes offer to conclude contracts for the supply of young corn cobs on schedule, canneries and fast freezing shops are interested in the rate of larger batches of corn cobs of milky -waxy ripeness.

A	B	C	D	E	F
1	Microsoft Excel 14.0 report on the results				
2	Leaf: [KFC (vegetable) without grains 29.08.xls]List1				
3	Report created: 30.08.2019 13: 30:10				
4	The result: a Solution is found. All restrictions and optimality conditions are met.				
5	Solution search module				
6	Module: Searching for solutions to linear problems using the simplex method				
7	Solution time: 0.046 seconds.				
8	Number of iterations: 39 number of subtasks: 0				
9	Search parameters for the solution				
10	Maximum time Without limits, Number of iterations Without limits, Precision 0.000001, Use automatic scaling				
11	Maximum number of subtasks Without limits, Maximum number of integer solutions Without limits, Integer deviation of 1%, Considered non-negative				
12					
13					
14	The cell of the target function (Maximum)				
15	Cell	Name	Original value	Final value	
16	\$WS\$42	Revenue from 1 ha, thousand tenge Left side of restrictions	0,00	395589,03	
17					
18					
19	Variable cells				
20	Cell	Name	Original value	Final value	Integer-valued
21	\$C\$6	Value of variables X1	0,00	9,00	Continue
22	\$D\$6	Value of x2 variables	0,00	5400,00	Continue
23	\$E\$6	Value of X3 variables	0,00	33,48	Continue
24	\$F\$6	Value of x4 variables	0,00	70,98	Continue
25	\$G\$6	Value of X5 variables	0,00	104,46	Continue
26	\$H\$6	Value of X6 variables	0,00	0,00	Continue
27	\$I\$6	Value of X7 variables	0,00	20,89	Continue
28	\$J\$6	Value of x8 variables	0,00	0,00	Continue
29	\$K\$6	Value of X9 variables	0,00	10,35	Continue
30	\$L\$6	Value of X10 variables	0,00	0,00	Continue

Figure 2 - Machine printout of the results of solving the problem of optimizing the resource potential of the farm "Luch" (results Report)

Tomatoes are also a specific product that is constantly in demand, and winter wheat grain is a traditional commodity on the food market. The combination of vegetable, grain, and melon production can provide stable farm incomes and open a wide range of opportunities for expanding entrepreneurial and commercial activities. So, for example, you can start seed production of winter wheat; zucchini, tomatoes, corn cobs can be delivered to consumers according to the schedule, selecting the varietal composition of each crop and adapting the technology of their production.

Scientific research of the SCO countries: synergy and integration

A	B	C	D	E	F	G
31	SMS6	The value of variables X11	0,00		20,89	Continue
32	SN56	Value of X12 variables	0,00		10,54	Continue
33	SO56	Value of X13 variables	0,00		0,00	Continue
34	SP56	Value of x14 variables	0,00		20,89	Continue
35	SO56	Value of variables X15	0,00		0,00	Continue
36	RS56	Value of x16 variables	0,00		20,89	Continue
37	SS56	Value of x17 variables	0,00		18633,34	Continue
38	TS56	Value of variables X18	0,00		0,00	Continue
39	SUS6	Value of X19 variables	0,00		0,00	Continue
40	SV56	Value of X20 variables	0,00		470018,35	Continue
41						
42						
43	Limitations					
44	Cell	Name	Cell value	Formula	Condition	Allowance
45	SWS8	Total labor, person-h Left side of restrictions	0,00	SWS8=\$Y58	Binding	0
46	SWS10	Arable land in ownership, ha Left part of restrictions	0,00	SWS10=\$Y59	Binding	0
47	SWS39	Production of commercial wheat grain from 1 ha, C Left part of restrictions	0,00	SWS39=\$Y639	Binding	0
48	SWS37	Production of commercial vegetables from 1 ha, C Left part of restrictions	0,00	SWS37=\$Y637	Binding	0
49	SWS41	Amount of gross output, thousand tenge Left side of restrictions	0,00	SWS41=\$Y641	Binding	0
50	SWS7	Number of employees, pers. The left part of the restrictions	9	SWS7=\$Y57	Binding	0
51	SWS9	Hired labor, person-hours The Left part of the restrictions	0,00	SWS9<=\$Y59	Binding	0
52	SWS38	Production of commercial corn on the cob from 1 ha C Left part of restrictions	0,00	SWS38=\$Y638	Binding	0
53	SWS34	Zucchini, ha min Left part of the limit	20,89	SWS34>=\$Y534	Without a binding	20,89
54	SWS35	Zucchini, cauliflower, left part of the restrictions	0,00	SWS35<=\$Y535	Binding	0
55	SWS31	Potatoes, ha max Left part of restrictions	-20,89	SWS31<=\$Y531	Without a binding	20,89152
56	SWS32	Corn on the cob, ha min Left side of restrictions	0,00	SWS32<=\$Y532	Binding	0,00
57	SWS33	Corn on the cob, ha max Left part of restrictions	-20,89	SWS33<=\$Y533	Without a binding	20,89152
58	SWS29	Melons, nuts, and the Left side of restrictions	-20,89	SWS29<=\$Y529	Without a binding	20,89152
59	SWS30	Potatoes, ha min Left side of restrictions	0,00	SWS30>=\$Y530	Binding	0,00
60	SWS25	Bow, GA max Left part of restrictions	-20,89	SWS25<=\$Y525	Without a binding	20,89152
61	SWS27	Watermelons, ha max Left part of restrictions	0,00	SWS27<=\$Y527	Binding	
62	SWS28	Melons, ha min Left side of restrictions	0,00	SWS28>=\$Y528	Binding	0,0
63	SWS24	Bow, ha min Left side of restrictions	0,00	SWS24>=\$Y524	Binding	0,0
64	SWS26	Watermelons, ha min Left side of restrictions	20,89	SWS26>=\$Y526	Without a binding	20,8
65	SWS23	Carrots, nuts, and the Left side of restrictions	-10,54	SWS23<=\$Y523	Without a binding	10,540446
66	SWS22	Carrots, ha min Left side of restrictions	10,35	SWS22>=\$Y522	Without a binding	10,3
67	SWS21	Table beet, ha max Left part of restrictions	-20,89	SWS21<=\$Y521	Without a binding	20,8915
68	SWS12	Total arable land, ha Left side of restrictions	0,00	SWS12<=\$Y512	Binding	
69	SWS11	PL of leased arable land, ha Left part of restrictions	0,00	SWS11=\$Y511	Binding	
70	SWS14	Net steam not less than the Left part of the limit	0,00	SWS14>=\$Y514	Binding	0,0
71	SWS13	Sown area, ha the Left part of the restrictions	0,00	SWS13>=\$Y513	Binding	0,0
72	SWS18	Tomatoes, ha min Left side of restrictions	20,89	SWS18>=\$Y518	Without a binding	20,8
73	SWS19	Tomatoes, hares, Left side of restrictions	0,00	SWS19<=\$Y519	Binding	
74	SWS20	Table beetroot, ha min Left part of restrictions	0,00	SWS20>=\$Y520	Binding	0,0
75	SWS16	Winter wheat, ha min Left side of restrictions	0,00	SWS16>=\$Y516	Binding	0,0
76	SWS15	Pure steam is no more ha Left part of the restrictions	0,00	SWS15<=\$Y515	Binding	
77	SWS17	Winter wheat, ha max Left part of restrictions	-20,89	SWS17<=\$Y517	Without a binding	20,8915

Figure 2 (continued) - Machine printout of the results of solving the problem of optimizing the resource potential of the farm "Luch" (sustainability Report)

The ability of farms to meet the special needs of the consumer will provide additional income and serve as a source for improving production. Providing a high level of profitability, this strategy requires a clear organization of production, constant stress and risk.

Let's consider the optimal parameters of the resource potential of a vegetable-growing peasant farm for the conditions of the Almaty region, calculated according to this model, but focused on a different strategy of farming - the production of vegetables only (table 2). The strategy was based on the production and sale of traditional vegetables.

The set of vegetable crops should not be very large, they should be sold on the market, in shops, public catering enterprises, and if necessary, to processing enterprises.

Table 2 – Optimal parameters of resource potential in the OVOS of grain farms for the conditions of Almaty region, on the example of the farm " Luch» (1-option)

Farm parameters	Number of full-time annual employees, people				
	5	6	7	8	9
Arable land area, ha	58.03	69.64	81.24	92.85	104.46
incl.: owned, ha	18.60	22.32	26.04	29.76	33.48
leased arable land, ha	39.43	47.32	55.20	63.09	70.98
Acreage, ha					
winter wheat	11.61	13.93	16.25	18.57	20.89
tomatoes	11.61	13.93	16.25	18.57	20.89
zucchini	11.61	13.93	16.25	18.57	20.89
corn on the cob	11.61	13.93	16.25	18.57	34.78
net steam, ha	11.61	13.93	16.25	18.57	34.78
Production of vegetables and melons,					
total	5826.4	6991.7	8157.0	9322.3	10487.5
including: tomatoes	2901.6	3481.9	4062.2	4643.0	5222.9
zucchini	2924.8	3509.8	4094.7	4679.7	5264.6
corn cobs	464.3	557.1	650.0	742.8	835.7
wheat	531.6	637.9	744.2	850.5	956.8
Economic indicators					
Use of labor resources, people in Excess	6432,9	overweight or obesit. 7719,4	overweight or obesit. 9006.0	Excess. 10292,6	overweight or obesit. 11579,2
Sum of gross production, thousand tenge	163912.9	196695,	229478,	262260.6	295043.2
Revenue from sales of products, thousand tenge*	128542.5	154251,	179959,	205668.0	231376.5
* In July 2017 prices					

Naturally, all requirements of crop rotations and production technologies must be strictly observed. From table root crops, the model only includes sea salt. The optimal plan includes the production of watermelons, melons and zucchini. In the structure of crops, they occupy the same specific weight, well the turnaround time for the care of plants, harvesting, stable demand, to a large extent their production is mechanized, and only a cleaning of the tomatoes will require hired labor (table 3).

As you can see from these tables, economic indicators can give preference to farms that produce only *vegetable-growing* production at any size full annual workers, their efficiency exceeds the sum of the value of gross output 1.59 times and the volume of sales of 1.70 times than 1-option *vegetable and grain* activities.

Table 3 – Optimal parameters of the resource potential of vegetable-growing peasant farms for the conditions of the Almaty region, on the example of the farm " Luch» (2-option)

Farm parameters	Number of full-time annual employees, people				
	5	6	7	8	9
Arable land area, ha	58.03	69.64	81.24	92.85	104.46
incl.: owned, ha	18.60	22.32	26.04	29.76	33.48
leased arable land, ha	39.43	47.32	55.20	63.09	70.98
Acreage, ha					
tomatoes	11.61	13.93	16.25	18.57	20.89
carrots	5.75	6.90	8.05	9.20	10.35
watermelons	11.61	13.93	16.25	18.57	20.89
melons	5.86	7.03	8.20	9.37	10.54
courgettes	11.61	13.93	16.25	18.57	20.89
net steam, ha	11.61	13.93	16.25	18.57	20.89
Production of vegetables and melons,					
total	10351.9	12422.2	14492.6	16563.0	18633.3
including: tomatoes	2901.6	3481.9	4062.2	4642.6	5222.9
carrots	862.6	1035.1	1207.6	1380.1	1552.7
watermelons	2901.6	3481.9	4062.2	4642.6	5222.9
melons	761.3	913.5	1065.8	1218.0	1370.3
zucchini	2924.8	3509.7	4094.7	4679.7	5264.7
Economic indicators					
Use of labor resources, people	Bases'.+ paid	Bases'.+ paid	Bases'.+ paid	Bases'.+ paid	Bases'.+ paid
The amount of gross products, thousand tenge	261121,3	313345,6	365569,8	417794,1	470018,4
Revenue from sales of products, thousand tenge*	218660,6	262392,7	306124,8	349856,9	393589,0
* In July 2017 prices					

However, for the use of labor resources, this statement is not very true where a different situation occurs. For example, vegetable production activities are very labor-intensive, with almost any number of full-time employees, the farm fully uses both basic and simultaneously hired labor resources. In any grain form of activity, on the contrary, at any number of full-time employees, there is an excess, even of basic labor resources, and the farm does not make sense to hire workers from the outside.

The total volume of labor resources is reduced by 1.98 times than in the second variant. Naturally, an increase in the volume of labor resources will also increase material and monetary costs. Therefore, we believe that the correct decision in relation to the form of activity of vegetable farms should be made in practice based on the production situation, market conditions, demand and demand for manufactured products.

Note that under this technique it is possible to solve also the task of assessment of optimal parameters of resource potential of vegetable KFKH to the terms Northern, Western and southern Piedmont areas of Almaty region with the use of irrigated crop rotations and perennial grasses.

Thus, the research results show that the application of economic and mathematical optimization models will significantly increase the efficiency of production and use of the resource potential of the farm "Luch".

Conclusion

1. The high demand for agricultural products and lack of competition served as an impetus for the development of vegetable-growing farms in Kazakhstan. One of these farms is the farm "Luch" of Yenbekshikazakh district of Almaty region, which is engaged in the production of vegetable products.

2. Land resources play an important role and are the basis of the production activities of Luch farm, and, in particular, the strategy of the farm is associated with strict compliance with the requirements of a reasonable crop rotation. Therefore, the farm needs to solve the problems of the most complete and rational use of land resources, in order to increase the productivity of vegetable crops grown. To solve this problem, it is necessary to apply the results of research works performed on the materials of the farm "Luch", where the problem of optimizing the parameters of the resource potential of this economy using methods of economic and mathematical modeling and IT-technologies was solved. A 5-Year crop rotation with the cultivation of the most optimal combination of vegetable crops is justified and proposed.

3. Implementation of the results of these studies allows the enterprise to achieve innovative, economic and social effects and, in particular, the use of economic and mathematical optimization models to significantly increase the efficiency of using the resource potential of the farm "Luch".

4. The total volume of labor resources is reduced by 1.98 times than in the second variant. Naturally, an increase in the volume of labor resources will also increase material and monetary costs. Therefore, we believe that the correct decision in relation to the form of activity of vegetable farms should be made in practice based on the production situation, market conditions, demand and demand for manufactured products.

5. The developed economic and mathematical model of optimal functioning of the production system of the farm "Luch" allows, along with other related tasks, to solve a number of economic problems related to the justification of the optimal use of resource potential in various production situations.

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时装和美容行业有效营销发展的特点

FEATURES OF THE DEVELOPMENT OF EFFECTIVE MARKETING IN THE FASHION AND BEAUTY INDUSTRY

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注解。在当今激烈的竞争时代，时尚发展的前景和成功不仅取决于新服装系列与现代趋势，其美感，非凡性或创造力的一致性。这个问题很有争议。的确，一方面，开发人员或设计师必须为成功实现其收藏而竭尽全力；另一方面，制造商与消费者之间的关系直接取决于在全球范围内运营的公司所使用的营销传播工具。时尚和美丽。这就是为什么在时尚和美容行业的组织中形成有效营销的问题非常重要，并且对于所有打算使其活动适应现有时尚趋势的人们进行研究都是必要的。

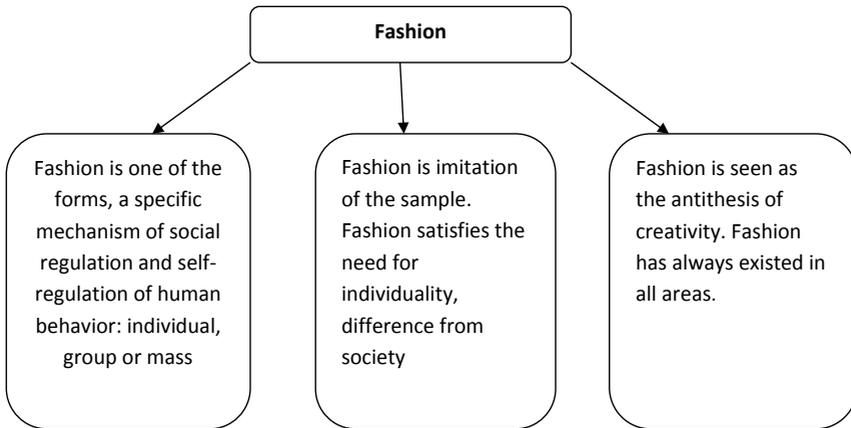
关键词：时尚，美容，市场营销，营销传播工具，竞争，效率，制造商，消费者。

Annotation. *The prospects and success of fashion development at the present time, the time of fierce competition, depend not only on the conformity of the new clothing collection to modern trends, its beauty, unusualness or creativity. This issue is very controversial. Indeed, on the one hand, a developer or designer must do everything for the success of his collection, and on the other hand, the relationship between manufacturers and consumers directly depends on the tools of marketing communications used by a company operating in the world of fashion and beauty. That is why the question of the formation of effective marketing in the organization of the fashion and beauty industry is very relevant and necessary for study by all who intend to adapt their activities to existing fashion trends.*

Keywords: *fashion, beauty, marketing, marketing communications tools, competition, efficiency, manufacturer, consumer.*

Fashion is a complex, multifaceted phenomenon. Therefore, there is no unambiguous definition that would fully reflect the essence of this concept. Many scientists consider fashion through the prism of sociocultural, art history and other factors.

Interpretation of the concept of fashion through its relationship with various aspects of human life and society



After analyzing the figure, we can conclude that fashion in the broad sense of the word is a process that is aimed primarily at the formation of an individual personality and, in addition to this, images that become the basis of estimates and judgments.

From all interpretations of the concept of “fashion”, three definitions can be distinguished:

- fashion - “synchronously closed structure with a certain property: change” (Yu.M. Lotman);

- fashion - “not only a cultural phenomenon, but also the sociocultural institute of modern society with its characteristic functions, structure and forms” (P. A. Sorokin);

- Fashion - “a system of group preferences that embody not only taste, but also a specific, common for many way of behavior” (T. Hill).

The concept of “fashion” is very multifaceted, as shown by the three definitions presented.

Characteristic features of the concept of "Fashion":

- constant variability;
- the ability to shape the tastes of the subject and manage them;
- the ability to design, predict, disseminate and implement certain values and behaviors in society.

As you know, a successful business cannot exist without designers, specialists in the field of materials, experts in building delivery lines and logistics, and experts in developing strategies. The beauty and fashion industry includes all as-

pects of design, production, marketing and distribution, from the development of the layout of the future product to the implementation of the final product, brand development and its promotion. [7]

Over the past three years, the fashionable clothing market in Russia has been growing by 10-15%. The number of stores is constantly growing, demand is growing and consumer activity is growing. The market, in turn, quickly responds to the needs of customers, as a result of which the supply in the market is also growing. Therefore, with the growth of the well-being of the Russian population, the fashionable clothing market in the country should tend to grow. It is noted that in the coming years, the market will continue to develop at the expense of middle-class goods. [2]

Specificity and marketing opportunities in the fashion business

In the fashion market there are a huge number of different brands and brands that are similar in terms of the offered assortment and current pricing policy. In order to be competitive and stand out against all competitors, each organization should pay great attention to the marketing policy and actively pursue it. This should concern pricing, assortment formation, product promotion, sales promotion. Without a marketing policy, even global brands will not be able to cope with competition and most likely will leave the market.

Marketing in the fashion industry became widespread in the second half of the 20th century; in another way, it was called fashion marketing. It was at this time that a huge number of styles, trends in clothing and fashion trends appeared, which became one of the most efficient and prosperous sectors of the economy.

Fashion finally turned into a socio-economic phenomenon, which was not just a mirror reflecting the changes taking place in society, but also an engine that initiated and provoked changes and innovations. Fashion-marketing is necessary in order to establish contacts and interaction with the buyer, to draw his attention to the clothes, shoes, accessories that are offered on the fashion market.

At the moment, the market for fashionable clothes can be divided into two main areas in the industry: sewing and textile. In these industries, global trade is about \$ 350 billion. In 2011, the share of imports in the volume of commodity resources of these types of industries was 33%, and in 2010 - 34%.

The fashion industry is characterized by very high competition and the presence of a large number of target audiences. Therefore, each company tries to gain and maintain its market position. In this case, marketing tools must be selected carefully and carefully, and the selection result must be particularly accurate, because consumers in this industry have a differentiated taste.

When implementing marketing activities for organizations that operate in the fashion market, it is rational to apply the 5P concept.

- **Product:** This item represents the management of sales of clothing collections, forecasting the demand for the range, availability in stock, the attractiveness of serving clothes on display cases, etc. This is necessary to build consumer loyalty to a given brand.[4]

- **Promotion:** the specifics of marketing communications in the fashion world. This item is also necessary to build consumer confidence and commitment to the brand. Today, companies conduct market research to determine not only the obvious needs of the buyer, but also their secret desires. Some organizations that are engaged in market research conduct magnetic resonance imaging of the brain of potential consumers. [1] Stores, having received all the necessary information about their customers, focus on promotion at points of sale. The rooms include pleasant background music, fill the shops with enticing aromas, thus, as if imposing hidden messages on them that act on our subconscious. And, you must admit, if you just remember the melody or hear the fragrance that you felt in a particular boutique or showroom, you will be immediately pulled into that place or you will want to buy something.

- **Price:** in the beauty and fashion industry it is very important to effectively build a pricing policy using tricks such as “the price of a new collection” or “seasonal discounts”. Buyers are very price sensitive due to their psychology. [1]

- **Location:** The location of the store plays a huge role. If the store is in an impassable place. Then the buyer may not reach him or simply not find him. When choosing a store’s future location, you need to pay attention to such items as the image of the shopping area, the density of competition, patency, the level of socio-economic development of the area, the availability of parking near the store and others.

- **People:** This item is necessary to build a positive, profitable relationship between the consumer and the seller. This is often achieved through personal sales, where the seller of a particular store becomes a good adviser, psychologist or even a friend to the client. This item is also aimed at dividing consumers into target groups, since the choice of clothes, accessories directly depends on age, social status, income.

Features of marketing in the fashion industry:

1. Marketing as part of a socially significant factor

Fashion is a social and cultural phenomenon. Therefore, a certain style or brand must correspond to its social group in each specific situation. For example, at a charity ball you need to present clothes from new collections: evening or cocktail dresses in a romantic style. But business negotiations suggest the presence of a business style in clothes. On this basis, successful marketing within the fashion industry, as a rule, is often built on the consumer's perception of the social significance of clothing in a given situation.

2. Marketing in the conditions of a quick change of collections

Changes in the fashion world do not depend on either social or temporal factors. Fashion trends are very dynamic, so it is very important to predict and determine the trends of the next season, because the success of the collection and the number of sales depend on this. . [3]

3. Marketing mix in the fashion industry

Advertising, PR, personal sales, direct marketing, sales promotion and other tools of marketing communications are actively used by world companies, but the fashion and beauty industry can carry out such promotion events as:

- fashion shows in which models advertise collections. This action combines spectacularly decorated catwalks, vibrant music and lighting, the participation of famous people, stars. For people, this is a real show that is remembered and for a long time walks between consumers in the stories of the remaining photos.
- Such events do not take place without the participation of the media, which publish information about the events in fashionable newspapers, magazines, TV and the Internet. .[5]

4. Fashion brand marketing

Demand and recognition are the main criteria for the success of a brand. Great attention needs to be paid to brand building, which should be memorable, competitive, eye-catching, etc. And then the success of the company working under this brand is ensured.

The result of well-organized marketing is sales growth, as well as a sustained consumer commitment to a particular brand.

Trends in the fashion market, taking into account the marketing component

The fashion of the new time, the 21st century, behaves very boldly, according to experts. Under the influence of fashion, many traditions are violated and even many countries undergo changes. “It’s funny to follow fashion and not silly to follow,” Bernard Shaw said. This phrase speaks of the difficult relationship of fashion with society.

The modern fashion market is characterized by the following:

- The market requires the prompt and accurate work of marketers, as fashion trends are changing rapidly;
- Great competition between suppliers.

The leader at present is China, which has a huge impact on the production of clothing in the world and its marketing. In China, there are approximately 40 thousand textile and garment manufacturing enterprises, 24 thousand textile factories with 19 million textile and garment workers. The projected growth rate is up to 17% per year, with constantly increasing productivity. China annually produces about 20 billion units of clothing. If you look into the wardrobe, then every inhabitant of the planet will find at least 4 wardrobe items from China.

Today, the following countries are the main ones on the world market of textiles and clothing:

- China (export of textile and clothing products in value terms is about \$ 150 billion),
- India (\$ 20 billion)
- Pakistan (\$ 10 billion).

In conclusion, we can say that the role of marketing in the fashion market is very high. Each company should pay enough attention and funds to promote its products. The trends presented make it possible to judge that the modern fashion industry is characterized by a rapid pace of change in fashion trends, which is due to factors such as globalization of world space, individualization of consumer demand, changing climatic conditions, etc. These trends allow you to build marketing forecasts of fashion changes and develop marketing campaigns so that each brand finds its own consumer.

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UDC 631.55:631.57:633.34

收割谷壳的合理性和联合收割机的摇瓶机螺旋输送机的参数, 用于收割大豆时
秸秆的移动, 破碎和散布

**JUSTIFICATION OF GATHERING OF CHAFF AND PARAMETERS
OF THE SCREW CONVEYOR FOR STRAW SHAKER OF THE
COMBINE FOR MOVEMENT, CRUSHING AND SCATTERING OF
STRAW WHEN HARVESTING SOY**

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抽象。考虑了收集谷壳作为提供牲畜饲料的资源的问题。已经提出了一种螺钉, 该螺钉用于沿着侧壁的联合收割机的侧面在左侧和右侧移除, 切碎和散布秸秆, 并安装了额外的料仓, 用于在筛磨机后面收集谷壳。开发了用于去除, 切碎和抛洒秸秆的螺杆参数, 并确定了驱动秸秆的动力。

关键字: 大豆, 联合收割机, 稻草, 切碎, 谷壳, 收割, 饲料价值。

Abstract. *The problems of collecting chaff as a resource for providing livestock feed are considered. An screw has been proposed for the removal, chopping and spreading of straw on the left and right along the side of the combine for the side-walls and the installation of an additional bunker for collecting chaff behind the sieve mill. The parameters of the screw for the removal, chopping and throwing of straw are developed and the power for its drive is determined.*

Keywords: *Soy, combine, straw, chopping, chaff, harvesting, feed value.*

In the Amur Region, the investment project “Creating a Soya Cluster in the Amur Region” is being implemented. The goal of the project is the organization of a stable production and technological sequence from the cultivation of grain

crops and soybeans through their processing to the production of feed as a basis for the development of livestock meat and dairy industries. On this basis, by 2024, agricultural producers are planning to increase the production of grain and soybeans over one and two million tons and the number of cattle by 100 thousand heads [1].

In the structure of feed production, straw makes up from 17 to 25% of the need for roughage. Cereal straw, if collected in livestock farms, is mainly used for bedding for animals. The limited use of straw and chaff is mainly due to the high cost of harvesting it and the lack of technology and a complex of machines for collecting the most nutritious soybean chaff. When harvesting grain and soybeans in the Amur Region, a simple technology is used, in which the straw is chopped and, together with chaff, is thrown onto the field. Shredded straw when planting or cultivating in the soil is necessary to replenish humus and maintain soil fertility, and soybean chaff, with its high nutrient content of 0.56 feed units, is a good energy feed for animals of all kinds [2].

Currently, a number of technologies have been developed for harvesting the non-cereal part of the grain and soybean crops for farms in the Amur Region that represent complex and time-consuming operations. To test these technologies, separate machine instances have been created and for a larger implementation volume, certain investments are required. Actual needs for them are found especially in livestock farms, since when using chaff in feeding animals, weight gain and milk productivity increase and feed costs for production are reduced.

The aim of the work is to substantiate the technology for collecting chaff and the parameters of the trough-shaped screw for removing straw, descending from the straw shaker keys left and right along the combine, chopping and scattering it, and determining the power consumption necessary for moving and chopping.

Soybean in the structure of crop rotation occupies more than 70% of the arable land. With an average yield of 1.5 t/ha, the yield of chaff is 0.75 t/ha or taking into account the humidity of chaff during the harvesting period, 0.6 t/ha of dry matter chaff. From one hectare of soybean crops, 0.34 tons of fodder units can be additionally harvested due to chaff, and with a crop area of more than 900 thousand hectares, up to 300 thousand tons of fodder units can be additionally harvested and public and private animal husbandry provided with feed.

The collection of a valuable feed product - chaff when it leaves the pitched board of the combine using universal devices PUN - 5, PUN - 6 is prevented by a straw chopper. Grinding and scattering of grain and soybean straw in the harvesting technology cannot be ruled out, since the incorporation of chopped straw by cultivation or disking maintains the fertility of the fields. It is possible to move the placement of the device for chopping and spreading straw on a

combine harvester to a straw shaker. Then, after the sieve mill of the combine, you can install PUN-5 and an additional hopper for collecting chaff with unloading in the vehicle.

In the technology of combine harvesting soybeans with collecting chaff, for the removal of straw descending from the straw shaker of the combine, a scheme for moving straw with a trough-shaped screw, consisting of a screw with left and right windings of a spiral and an open short-trough trough, is proposed. The straw coming to the screw is divided into two parts and the screw is led left and right behind the side of the combine (RF Patent № 2417572). The main factor determining the operational reliability of the device is the correct choice of design parameters and operating conditions of the screw, taking into account the physical and mechanical properties of the transported straw.

To move the straw coming down from the straw shaker of the combine, it is necessary to identify the optimal structural (D, d, S) and kinematic (n, ω) parameters of the screw where: D - the diameter of the helix of the screw; d - the shaft diameter; n is the rotation frequency; S - the pitch of the screw; ω - the angular velocity.

A straw particle, resting on the helical surface of the horizontal screw and pressed against the casing wall, in stationary mode has a motion described by differential equations [3, 4].

$$\left. \begin{aligned} N_s \cos \alpha + f_s N_s \sin \alpha + f_k N_k \cos \beta - mg &= 0 \\ f_k N_k \cos \beta - f_s N_s \cos \alpha - N_s \sin \alpha - mR \frac{d^2 \varphi}{dt^2} &= 0 \\ mR \omega_0^2 + mR \left(\frac{d\varphi}{dt} \right)^2 - N_k - 2mR \omega_0 \frac{d\varphi}{dt} &= 0 \end{aligned} \right\} (1)$$

Under the helix effect of the screw surface, straw particles do not move parallel to its axis, but helix-like with variable speed in the axial and radial directions depending on the distance of the straw particles to the screw axis, friction coefficients and back pressure.

The vector of the absolute speed of the transported material is equal to $\bar{V} = \bar{V}_f + \bar{V}_i = \bar{V}_1 + \bar{V}_2$, where $\bar{V}_1 = \bar{V}_i = \omega_0 R$ - is the portable speed (axial component of the absolute speed or speed of sliding of straw on the casing wall, m/s); $\bar{V}_2 = \bar{V}_f$ - is the relative velocity (sliding velocity along the helix surface, m/s).

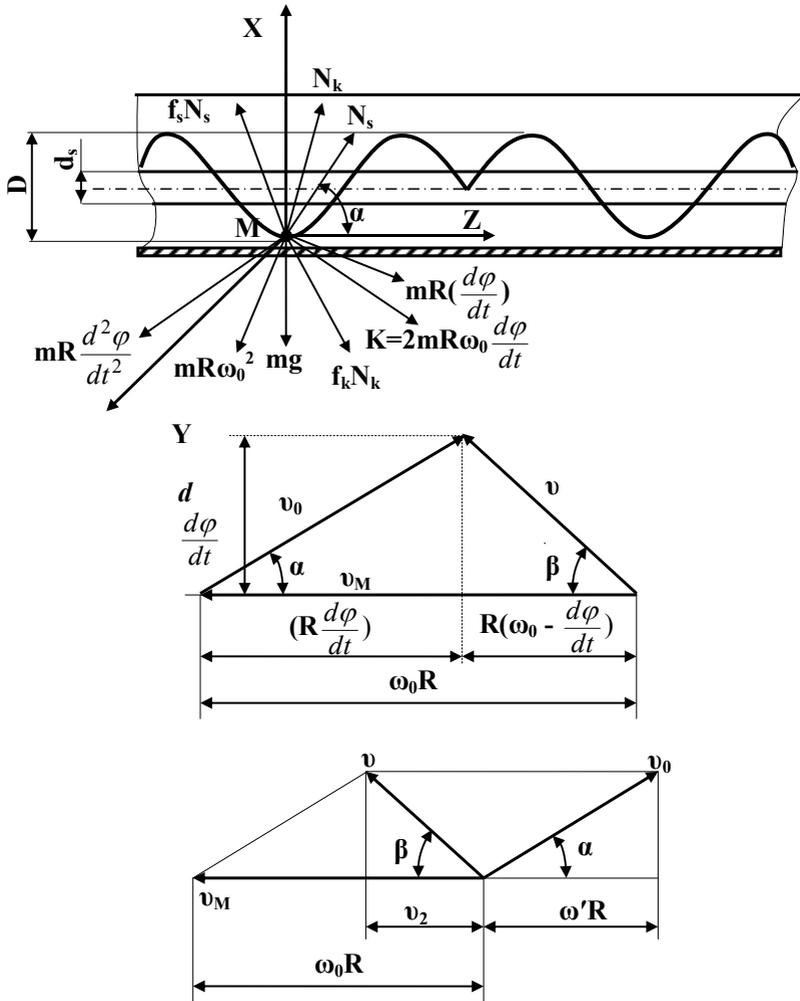


Fig. 1. Effective forces and speeds of movement of straw particles in the screw.

where N_s – normal screwblade reaction, N;

f_s – coefficient of friction of straw particles on screw blades;

$\alpha = \arctg S/2\pi$ – elevation angle of helix screw line, rad;

$R = D/2$ – radius of the screw blade, m

m – the mass of straw, kg;

g – gravity acceleration, m/s^2 ;

N_k – normal reaction of the casing, N;

β – the angle between the vectors of absolute and transfer speed, rad;
 f_k – coefficient of friction of particles on the wall of the casing;
 $\varphi = f(t)$ – the angle by which the straw particle deviates when the screw rotates
 at a constant speed ω_0 , rad;
 t – time, s;

$\frac{d\varphi}{dt} = \omega'$ – angular velocity of the relative motion of the particle, s⁻¹;

$mR \frac{d^2\varphi}{dt^2}$ – tangential inertia, N;

$m\omega_0^2 R$ – centrifugal inertia force in a transfer motion, N;

$mR \left(\frac{d\varphi}{dt}\right)^2$ – centrifugal inertia in relative motion, N;

$2m\omega_0 R \frac{d\varphi}{dt}$ – Coriolis force, N.

From the speed plan we determine: the axial component of the absolute speed or sliding speed along the walls of the casing will be equal to

$$v_1 = v \cdot \sin\beta = \frac{\omega_0 R \sin\alpha \sin\beta}{\sin(\alpha + \beta)}. \quad (1)$$

The tangent component of velocity, which characterizes the peripheral velocity of a point in absolute rotational motion, will be equal to

$$v_2 = v \cdot \cos\beta = \frac{\omega_0 R \sin\alpha \cos\beta}{\sin(\alpha + \beta)}. \quad (2)$$

The value of the axial velocity of the particles of the material being moved in the screw is affected by the angle of inclination of the axis of the screw γ , radius R , angle of elevation of helix of the line α , angular velocity ω_0 , friction coefficients of helix and moving straw f_1 and f_2

In the horizontal screw at $\gamma=0$, the particle, starting from the lowest position at $\beta=90^\circ - (\alpha+\varphi)$, will necessarily reach the generator at the angle $\varepsilon\theta = \text{arctg} [f_1 \text{tg}(\alpha+\varphi)]$ and move along it with the translational speed $v_1 = \omega_0 R \text{tg}\alpha$.

The frequency of rotation of the screw blades can be determined by the formula

$$n = \frac{30\omega_0 \sin\alpha \cos\beta}{\pi \sin(\alpha + \beta)}, \quad (3)$$

The decrease in the axial movement of straw particles can be taken into account by the lag coefficient

$$K_o = 1 - (\cos^2 \alpha_{av} - 0,5 f \sin 2 \alpha_{av}), \quad (4)$$

where $f = \operatorname{tg} \varphi$ - the coefficient of friction;

$\alpha_{av} = 0,5(\alpha_1 + \alpha_d)$ – arithmetic mean of the angle of elevation of the helix lines on the periphery α_d and on the shaft α_1 of the screw, here

$$\alpha_1 = \arctg[S/(\pi D)], \quad (5)$$

$$\alpha_d = \arctg[S/(\pi d)], \quad (6)$$

where S - the pitch of the turns of the screw, m;

D and d - the diameters of the screw and screw shaft, m

The process of transporting straw by the helix conveyor is very complicated, it is affected by: rotation speed n, and in fact, at first, productivity increases and then decreases, the methods of loading and unloading straw, its size, humidity and coefficient of friction.

For normal operation of the helix conveyor for straw, it is necessary to ensure the ratio of possible feeds: loading, transporting and chopping units.

We select the shape of the trough-like casing of the screw, taking into account a comparative assessment of the shape of the loading devices. The feed for unloading will be greatest with an axial and circular pattern, when the cross-sectional areas of the helix casing and the discharge pipe are approximately the same. By installing simple chopping devices consisting of a cutting knife and a counter-cutting grill in the round discharge sides when unloading the chaff, it is possible to achieve the required chopping of straw.

Having expressed the actual volume of transported straw over the length of one step $V_g = F_c S = V = 0,785(D^2 - d_s^2)H$ – the feed of straw by a screw-discharge device is determined.

$$M = 0,125(D^2 - d_s^2) \cdot (H - \delta) \cdot (1 - K_o) \cdot \rho \psi \omega, \text{ kg/s} \quad (7)$$

where D – screw diameter, m; d_s – shaft diameter, m; H – screw pitch, m;

ω – angular speed of rotation of the screw, rad/s; ρ – straw density, kg/m³;

ψ – interturn space fill factor; δ – the thickness of the screw round in the axial direction along the outer diameter, m;

From the expression (7) it follows that the supply can be made by changing any characteristic from this formula.

To ensure the required supply, we set the following parameters:

- we take the screw diameter equal to 0.4 m, based on the fact that the straw has an average length of 0.48 m and falls on the screw at an angle;

- the step of the helix line is chosen equal to 1-1,2d, also based on the fact that the straw has an average length of 0.48 m;

- the shaft diameter is determined from the calculation $\frac{D}{d_s} = 2 \div 3$ and then $d_s = 0,2$ m.

With the developed form of the trough-like screw casing, the installed diameters of the screw and drive shaft, as well as the screw pitch for moving straw, the corresponding calculations were carried out and the screw productivity was plotted against the rotational speed and differential fill factor (Fig. 2)

In addition to the process flow diagram and unit design, the friction coefficient of straw has a significant influence on the movement of straw in the screw. With its increase and the screw rotation speed, the displacement performance decreases taking into account the lag coefficient, since the inhibitory effect of the load increases due to increased straw moisture, as well as the action of the centrifugal force casting straw to the casing. The analysis shows that the increase in productivity of straw movement (feed) occurs up to 20.93 rad/s, and then its decrease is noted.

The feed rate of the horizontal auger is increased 1.8 times depending on the increase in the rotational speed, and to ensure the movement of straw with a grain yield of 2.0 t/ha, it is necessary to provide the horizontal auger with an angular velocity of at least 20.93 rad/s.

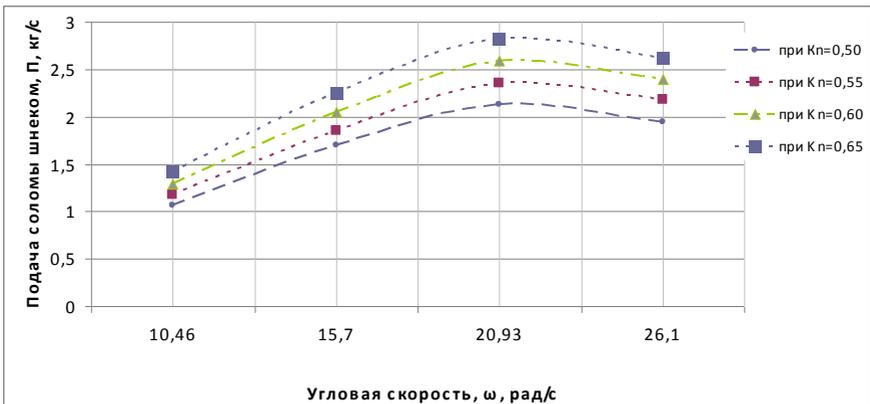


Fig. 2. The dependence of the movement of straw by the screw (M) on the angular velocity (ω) and the feed coefficient of the screw (kn)
 We determine the power consumption N for moving and grinding at given kinematic parameters of the screw.

Power N and specific energy consumption $\frac{N}{\Pi}$ depend on the speed and angle of inclination of the screw. Since in our case a horizontal screw is considered, in which $\gamma = 0$, then the energy intensity of the transportation process increases with increasing frequency of rotation of the helix screw, which ensures straw removal.

During the operation of the screw, power N is consumed to overcome the resistances:

N_1 – friction of straw on the chute, W ;

N_2 – friction of straw on the helix, W ;

N_3 – friction in thrust bearings W ;

N_4 – friction in radial bearings, WN_4

N_5 – cutting a sheaf of soybean stalks

Then the total power is determined

$$N = k_i k_j [(N_1 + N_2)k + N_3 + N_4] \eta + N_5, W \quad (8)$$

where $k_i = (1,05 \div 1,2)$ – inertia overcoming coefficient at start-up;

$k_j = (1,10 \div 1,25)$ – coefficient taking into account the jamming of straw during movement;

$k = (1,05 \div 1,4)$ – coefficient of resistance from cargo mixing;

η = Efficiency of the drive mechanism.

Neglecting the power spent on friction in thrust and radial bearings, we determine the power of the screw needed to move and chop straw. Depending on the soybean yield and auger productivity, the power consumption increases by moving and grinding and amounts to 8.6 kW.

The estimated power is 4.3% of the engine power of the combine and does not have a significant effect on reducing the productivity of the combine.

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提高地质技术措施的效率以减少水的流入

INCREASING THE EFFICIENCY OF GEOLOGICAL AND TECHNICAL MEASURES TO REDUCE WATER INFLOWS

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注解。 本文考虑了水井生产的问题。 据分析,目前尚无根据该地点发展的物理,地质和技术条件应用该方法的标准。 结果表明,随着开发设施地质异质程度的提高,注水淹没储层和最终采油量急剧下降。

关键词: 地球物理调查, 储层岩石, 驱油, 饱和液体。

Annotation. *The article considers the problems of watering well production. It is analyzed that at present there are no criteria for the application of the method depending on the physical, geological and technological conditions for the development of the location. It was revealed that the full coverage of the reservoirs by water flooding and the final oil recovery sharply decreases with increasing degree of geological heterogeneity of the developed facilities.*

Keywords: *geophysical surveys, reservoir rocks, displaced oil, saturating liquids.*

Analysis of the results of reservoir separation during the construction and repair of wells shows the possibility of a better solution of many issues in the process of construction of wells with lower costs than with cattle. These include, in particular: shutting off aquifers and waterfloods, preliminary isolation of bottom water, improving the efficiency of well operations and repair work. It should be borne in mind that geophysical studies on the assessment of oil-water contact, the separation of aquifers and oil-bearing reservoirs in the section are more effective in the process of well construction.

Residual reserves or not recoverable by existing industrially developed development methods reach approximately 55-75% of the initial geological oil reserves in the bowels and represent a large reserve for increasing recoverable resources using enhanced oil recovery methods.

Coverage of the reservoir volume by the impact largely depends on the features of the geological structure of the deposits, heterogeneity of the reservoir properties of the formation rocks, physico-chemical properties of saturating fluids, and the effectiveness of the oil field development system. Of these, the most significant effect is permeability heterogeneity. The main methods of influencing productive formations, aimed at increasing the current and final oil recovery, are based on artificial water flooding of reservoirs and are carried out by implementing various methods of areal, behind-the-column, in-circuit and other water-flooding systems. The greatest increase in the coverage of the reservoirs by the influence of: selective flooding, which allows the rational use of the energy of the injected water; focal, cyclic flooding; the use of increased pressures on the discharge line, as well as the selection of the optimal grid of wells.

In real conditions, the structure of the development object turns out to be reservoirs that are heterogeneous in geological structure, reservoir properties and productive characteristics, which leads to a deterioration of the conditions for producing a part of the reservoir that has low permeability, to their uneven flooding, to a decrease in the coverage factor of the object by exposure, to the selection of large volumes of injected water and ultimately to the deterioration of technical and economic indicators of development. In conditions of layer-by-layer and zonal heterogeneity of formations, one of the ways to intensify oil production is focal-selective flooding, which allows the most rational use of the energy of injected water and more fully takes into account the nature of the heterogeneity of the structure of the development object.

According to the classification of factors for watering production wells, compiled according to the results of published studies, the main reasons for watering production wells are divided into two large groups:

-technical; geological, physical and technological.

Elimination of these causes creates favorable conditions for the development of multilayer deposits using methods for regulating development by water flooding and others based on hydrodynamic effects on the reservoir.

The group of technical reasons includes leakages in the production string due to loosening of threaded joints, corrosion damage, burn-through by electric current, mechanical damage to pipes during repair work and other violations of the well support above the productive perforation interval. Methods for restoring the technical condition of the well support include cementing the annulus and eliminating casing violations by injecting plugging material, changing pipes, and installing overlapping devices.

The main feature that is characteristic of all waterflooding methods is the uneven distribution of water in the reservoir: formations with better filtration characteristics are flooded, while some less permeable formations and layers remain

undeveloped. The unevenness of the waterflooding process and the incomplete development of reserves are explained by the exceptional complexity of the geological structure of the productive formations.

However, the analysis and actual data on the forced selection of fluids from the reservoirs show that at present there are no criteria for the application of the method depending on the physical, geological and technological conditions of field development. In essence, the method is based on changing the heterogeneity of the production facility, which consists of several formations isolated from each other, differing in fluid mobility, in which case disconnection from the development of formations with high filtration characteristics for water is not excluded.

A review of the work shows that the full coverage of the reservoirs by water flooding and final oil recovery sharply decrease with increasing degree of geological heterogeneity of the developed facilities. In heterogeneous formations, injected water breaks through to high-permeability layers to production wells, leaving oil unplaced in low-permeability layers, sections, and zones. Modern methods for regulating waterflooding of deposits, based on hydrodynamic effects on the reservoir, contribute to an increase in coverage by the impact of sites not involved in the development.

In the development of multilayer deposits in which oil strata are separated from aquifers by impermeable clay interlayers of small thickness (less than 4 m), reliable isolation of oil and aquifer strata is not achieved. Figure 1 shows the dependence of the frequency of watering wells P on the thickness of the uncoupling layer h , and in the table the intensity of the change in the function $P = f(h)$ in various intervals. The dependence $P = f(h)$ is shown by curve 1 for the first year of operation of the wells, with a thickness of the uncoupling interlayer of 2 m, 45% of the wells are flooded, with a thickness of 1 m - 80%.

Table 1
Change in watering frequency

The thickness of the uncoupling layer, m	in the first year of operation after well construction	in the third year of operation after well construction	in the first year of operation after repair cementing
0-1,5	40,0	30,0	11,3
1,5-4	21,2	14,8	5,6
more than 4	2,8	6,0	2,0

Comparisons of the intensity of the change in the function $P = f(h)$ in the first year of operation after water insulation works (curve 2) and after their construction (curve 1) shows a sharp decrease in the interval of the thickness of the uncoupling layer 0-4 m. This is obviously due to an increase the reliability of the separation of

the layers during waterproofing by cementing, in which the channels formed after erosion of the clay crust are filled with cement mortar. In both cases, cementing was carried out by grouting cement with subsequent perforation by cumulative perforators of the PK-103 type with a density of 20 holes per linear meter and the liquid is lifted by deep pumps. Premature flooding of wells after their construction and their waterproofing works by cementing are of a different nature.

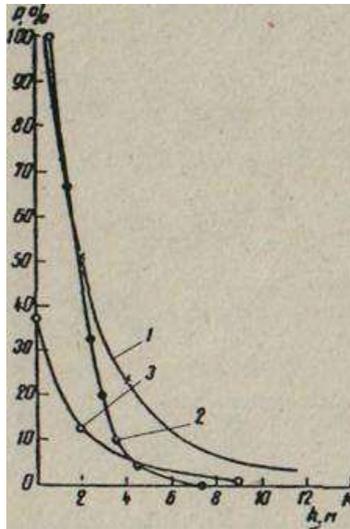


Fig. 1. Dependence of the frequency of watering wells P on the thickness of the uncoupling layer h : 1 - after a year of operation 856 wells of the Romashkinskoye field; 2 - the same wells after 3 years of operation; 3 - after a year of operation after waterproofing cementing works.

In the first case, premature watering of wells occurs due to the presence of clay peel on the walls of the well and its subsequent erosion, in the second - due to the formation of cracks in the cement ring, due to the impact of significant dynamic loads during various technological operations in the well. A generalization of the results showed that premature watering of the wells to a large extent depends on the thickness of the uncoupling layer. A sharp change in the intensity of the increase in the function $P = f(h)$ with a thickness of the uncoupling layer of 3-4 m characterizes this interval as critical, which causes a difference in the reasons and hence the methods for preventing premature watering of wells. With the existing technology of cementing wells, it is not possible to completely remove the clay cake from its walls, as a result of which in the hardened space the cement does not have direct contact with permeable formations.

The second group of watering factors combines the causes associated with watering wells with water entering the reservoir. During the joint operation of the strata, the natural rate of watering of wells depends on the physical and geological properties of the rocks and saturating fluids, which is accelerated by artificial flooding at high injection pressures. The difference in the viscosity of water and oil greatly enhances the process of uneven advancement of the water front both in thickness and in area. In the geological study of the largest oil fields of the Ural-Volga region, Western Siberia and other regions, variability of the thickness of sandy layers, their reservoir properties and lithological composition was established. The following typical forms of the distribution of terrigenous reservoirs are distinguished: - the reservoir character of the distribution of siltstone sandstones in vast areas with a sandstone thickness of 3-8 m / s with complete replacement of the reservoir with clays or individual interlayers; - overproduction of sandstones and clays. Those and other lithological varieties are widespread in area, sandstones wedge out in clays and vice versa; - the distribution of sandstones in the form of sleeves, cords, bands of clay and, accordingly, the presence of lithological limited sleeve-like, lace deposits, the width of which can vary from 100 - 200 m to 5 - 6 km; - continuous distribution of sandstones with a thickness of more than 10 - 15 m over a vast area exceeding the deposits in this field; - in most cases, the permeability in the direction parallel and perpendicular to the bedding is different; - the minimum permeability observed in the intervals of the formation directly adjacent to its roof and sole. The influence of the geological structure of the productive horizon on the nature of watering of reservoirs and wells during the development of fields by water flooding has been studied by many researchers.

The randomness of the distribution of zonal, layer-by-layer, intra-layer heterogeneity does not in all cases make it possible to regulate the uniformity of the progress of the waterflooding front only by the placement of wells at the beginning of the development of the deposits or by changing the productivity of the wells. With zonal heterogeneity of the formation in high-permeable areas, even with very small oil withdrawals, the leading introduction of contour water occurs, and in weakly permeable areas with strong intensification of oil selection, the contour waters are introduced with a sharp lag. With artificial waterflooding, these processes are manifested in more contrast.

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开发用于农业存储设施净化的臭氧发生器
**DEVELOPMENT OF OZONE GENERATORS FOR
DECONTAMINATION OF AGRICULTURAL STORAGE
FACILITIES**

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抽象。开发用于臭氧生产的工业发生器有助于解决技术问题，延长保质期并保持农产品的质量。

设计安装在仓库中的臭氧发生器，这有助于对这些房间进行除臭和消毒，以免受到有害细菌和其他感染的影响。

臭氧使用安全，不会影响产品质量，而是有助于并保护其免受病原体侵害。

关键词：发生器除臭除臭浓度压缩机设计消毒臭氧发生器排放过滤器电极。

Abstract. *The development of an industrial generator for ozone production contributes to solving technological problems, increasing the shelf life and preserving the quality of agricultural products.*

Designing an ozone generator installed in warehouses, which helps to deodorize and disinfect these rooms from harmful bacteria and other infections.

Ozone is safe to use and does not affect the quality of products, but rather contributes to and protects them from pathogens.

Keywords: *generator, deodorization, concentration, compressor, design, disinfection, ozonizer, discharge, filter, electrode.*

The development of an industrial ozone generator is primarily associated with technological problems that are solved by this technical tool and the actual conditions for its use. For example, for the tasks of deodorizing and disinfecting rooms

of a relatively large volume (up to 500 m³), in which there are processed objects, the area of which is comparable to the area of the room itself (packaging with products). In addition, high and low temperatures (from plus 60-70 to minus 20°C), high humidity (up to 90%), the presence of dust or aerosol particles, as well as unstable AC power supply are possible.

Based on the fact that for processing volumes it is advisable to use a generator installed in an arbitrary place of a given volume (room) or a group of generators located in an optimal way (at the corners of the room or in different directions), a mobile design of the generator or its parts is necessary. The generator units must withstand elevated temperature and humidity, and the design of the reactor part of the generator should have minimal sensitivity to dust passing through the reactor. The presence of special filters and compressors that supply air to the generator in this case excludes large mass-dimensional parameters. A compressor with a capacity of 50-60 m³h⁻¹ weighs about 1,500 kg.

A preliminary calculation of the required air ozonator performance to achieve and maintain a given effective concentration of ozone in the chamber (room) shows the following. According to the mass balance during processing, the required productivity of the designed technological G_{oz} ozonizer is:

$$G_{oz} = KC_{oz}(V/T), \quad (1)$$

where C_{oz} - the ozone concentration in the ozonized chamber of volume V, T - the total ozonation time of the object, K - the coefficient reflecting the ozone consumption for chemical interaction, thermal decomposition, and other factors that reduce the ozone concentration. In practice, it can be assumed that the coefficient K = 5-10, and T (total processing time) is estimated to be 1-2 hours.

To disinfect a chamber or room with a volume of up to 400-450 m³, an ozonizer device with a capacity of at least 15-30 gh⁻¹ is required (at C_{oz} = 10 mgm⁻³). It is possible to use two portable devices with a capacity of up to 10 gh⁻¹ each, which only increases the reliability of such processing. Thus, the real productivity of the ozone generator (ozone-air mixture) can be up to 10 gh⁻¹ and the generator will have small weight and size parameters.

To design an ozone generator installed in a room for deodorization and disinfection, it is advisable to use a design with blown "tip" electrodes (on a positive corona discharge) in a cylindrical reactor.

Structurally, the ozone synthesis reactor represents a tube in which electrodes are located at high potential. In this case, stainless steel was used for the electrodes (cathode and anode). The choice of pipe sizes is associated with the ability to effectively blow internal electrodes with an air stream from a standard reliable small-sized industrial fan. The most effective is the use of a fan such as VN-2 (productivity 35-40 hp⁻¹, that is, a flow of up to 40 l/s without taking into account the resistance to air flow), which has high reliability.

The diameter of the external electrode is determined by the size of the fan (the diameter of the fan blades), which is about 110 mm, thus, the optimal size of the external electrode will be 120-130 mm. The length of the electrode is determined by the planned performance of the ozone generator and resistance to air flow, taking into account the presence of discharge electrodes inside. For the layout, an electrode length of about 300 mm was chosen. The wall thickness is about 2.5 mm and is determined by the need for structural rigidity (constancy of the diameter of the electrode during processing and assembly). The inner part of the electrode should not have protrusions, tips and sharp edges, inhomogeneities on the surface.

The most complex structural element of the ozone generator (reactor part) is the discharge electrode. This electrode (electrodes) should provide a sharply inhomogeneous electric field in which the discharge develops. A sharply inhomogeneous field is characteristic of gaps created by needle-plane, wire-plane, and ball-plane electrodes with a small ball radius and a relatively large distance between the electrodes. A feature of sharply inhomogeneous fields is the high field strengths of the electrode with a small radius of curvature, even with a relatively small voltage across the discharge gap.

At high values of the applied voltage, the discharge in the gap near the electrode with a small radius of curvature passes through several stages. First, avalanches arise, which, depending on the direction of the field (depending on the polarity of the electrode) develop to or from the electrode. As a result of the separation of charges in avalanches, an excess space charge of the same sign is formed near the electrode, which creates its own field, which reduces the field at the electrode (screening effect) and sharply amplifies the field in the gap before the charge. It is known that the streamer is a thin channel of partially ionized gas, at the front end of which there is an excess charge of high concentration, called the streamer head. In the field of this charge ionization, avalanches are formed, which ensures the formation of a new excess charge and the advancement of the streamer deep into the gap in accordance with the direction of the external field.

A corona discharge occurs at a certain initial voltage in a sharply inhomogeneous field, while the initial voltage is much less than in a uniform one. In a sharply inhomogeneous field, there may be a state in which streamers reach the opposite electrode, but gap breakdown does not occur, since there is no transition to a spark. For the formation of a spark, an increase in voltage is required so that at least one of the streamer channels turns into a spark. In the spark stage, a sharp increase in current occurs, accompanied by heat, the gas in the channel heats up and thermal ionization begins.

As the discharge electrodes, providing sharply inhomogeneous electric fields for this design, we used disks and strips of stainless steel and other materials with triangular tips along the outer perimeter of multi-pointed electrodes. The multi-

pointed electrode system was initially prototyped by separate electrodes and fragments of identical electrodes. The length of individual electrodes was up to 10 mm, the interelectrode distance was about 10 mm. A non-corona flat electrode made of stainless steel or a nickel strip had dimensions up to 100x250 mm. The maximum (positive and negative) DC voltage was supplied from the upgraded UV-50-50 unit (continuously adjustable from 1 to 50 kV) through a limiting resistance of 10-50 M Ω . In this case, the current – voltage characteristic (CVC) of the corona discharge in air was determined for currents from 1 to 100 μ A, and the mode of transition of the corona discharge to spark was studied. The distance between the electrodes was varied from 1 to 20 mm by moving the electrodes with a micrometer screw (accuracy up to 10 μ m).

The current – voltage characteristics of the positive corona showed that the current flow pattern and the characteristic itself noticeably change from measurement to measurement. The current – voltage characteristic for the positive corona is shown in Fig. 3.6. It should be noted that for distances between the electrodes less than 4-5 mm, the discharge current can reach 10-20 μ A and a transition of the discharge to the spark mode is observed, which makes it difficult to obtain a stable discharge (the resulting streamer almost immediately closes the interelectrode gap).

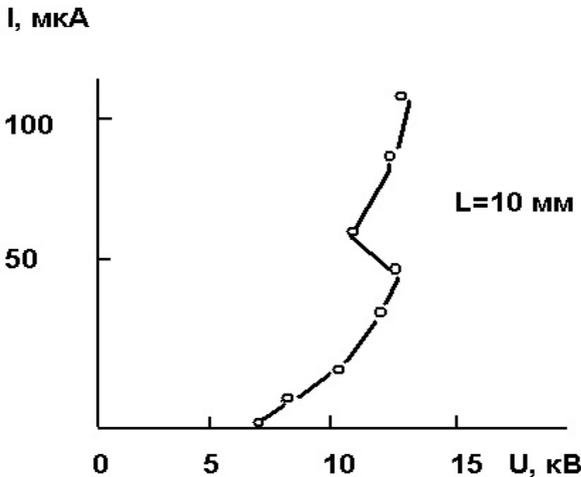


Fig. 1. Volt-ampere characteristic of corona discharge from 1 electrode

At interelectrode distances of the order of 10 mm or more, the CVC has a section of continuous current growth with increasing voltage, then the corona discharge mode can change (discharge currents above 30 μ A), current pulses may appear, which is apparently associated with the generation of “prebreakdown” positive streamers

and their attenuation when moving to a flat electrode. As the voltage increased, the length of the streamer discharges increased, which ultimately led to the appearance of spark discharges, which could be stopped only after the voltage decreased from 10-15 kV to 2-3 kV. Due to the irregularity of the repetition of current pulses and the occurrence of spark discharges, the boundary defining the limiting value of the currents of the “safe” discharge had a significant scatter. Over time, the CVC of the discharge changed and assumed a certain averaged value. The same CVC changes were observed after washing the electrodes or their machining.

Measurements of the current on the surface of the non-corona electrode showed that the current density was weakly dependent on the polarity of the electrodes and the width of the zone to which the discharge current (zone diameter) falls was approximately doubled between the electrodes. When streamers occur, the current density increases, and the discharge zone narrows (approximately 5-10 times).

Studies of a multi-pointed electrode system showed that with a distance between the tips of more than 5 mm, all the tips worked almost identically and the discharge current increased in proportion to the number of tips. At distances less than 4-5 mm, a noticeable difference in the currents of neighboring tips appeared (by 30-50%). The total discharge current I in a system with an extended multi-tip electrode was determined by the number of tips N and their relative position (screening). In the ideal case, the total current was determined by the sum of the currents of the single tips $I = \sum I_i$.

With mutual screening, the field strength at the top of the tips apparently decreased and the ion space charge increased. With a decrease in the step between the tips, the current corresponding to the nucleation of streamers decreases, which probably indicates that the conditions for their appearance are provided at a lower field strength at the tip with a decrease in the degree of field inhomogeneity.

The developed ozone synthesis generator (Fig. 2) consists of the following elements:

External cylindrical (negative) stainless steel electrode.

The internal (positive) point electrode of the individual parts.

Insulators for supporting the internal electrode.

A fan for blowing and rotating the internal electrodes of the device.

Housing for mounting and protecting electrodes.

A distinctive feature of the design of such a generator is the possibility of rotation of the tip electrodes inside the cylindrical external electrode. The rotation speed is set by an electric motor (from 500 to 4500 rpm). As studies have shown, in this case, there is a change in the nature of the discharge in this system. The rotation of the electrodes at a speed of over 500 rpm dramatically changes the picture of the development of spark discharges in the generator. A spark discharge that appears on any electrode is disrupted due to the continuous movement of the

electrode and forced blowing of the electrodes. With increasing voltage at the discharge gap, the number of spark discharges and the load current increase, but the picture does not change fundamentally. This allows to increase the discharge current many times (5-6 times) and the performance of this ozone generator.

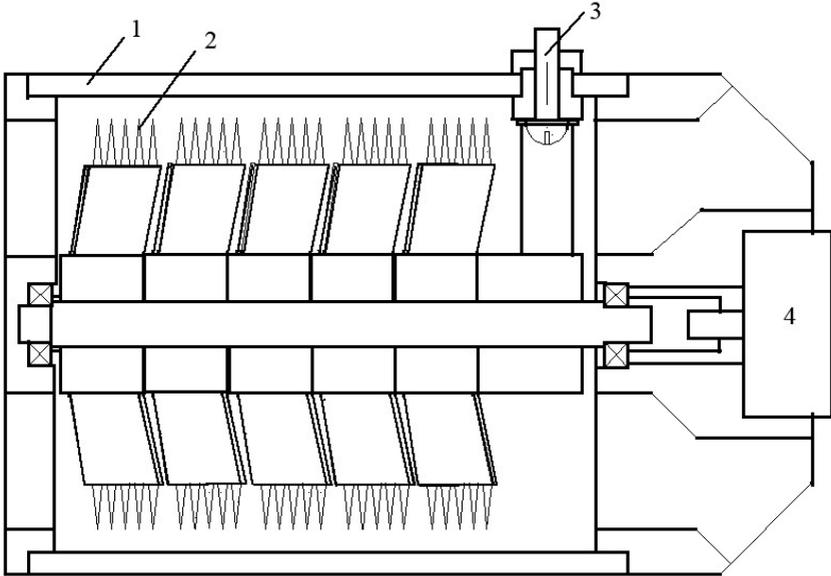


Fig. 2. The design of the discharge part of the ozone generator

1-outer cylindrical electrode, 2- inner point electrode,
3- high voltage input, 4- electric motor.

Below is a photograph of the reactor part of the ozonizer (Fig. 3)

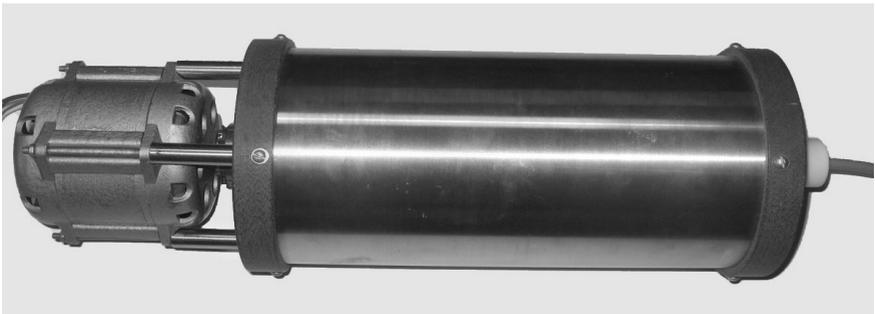


Fig. 3. The reactor part of the ozone generator

In addition, the coating of the tip of the electrodes with materials having a high oxidation resistance, for example, a coating of silicon, lead, and gold alloys, has a positive effect on the operational characteristics of the ozonizer.

To supply the ozone generator, a power supply unit is required that ensures stable corona discharge in the ozone synthesis reactor. As studies have shown, the power supply should, first of all, provide the following basic characteristics of the corona discharge process:

1. The discharge voltage - from 9 to 14 kV.
2. The discharge current in operating mode - from 1 to 15 mA.
3. Voltage reduction or shutdown at a current of more than 20 mA.
4. Stability of maintaining discharge for 2-3 hours.
5. Indication of discharge mode and overload.

A simple and reliable circuit consisting of a step-up transformer, a rectifier, control devices and switching elements was used to create a prototype of a corona discharge ozonizer power supply. The power supply consists of a housing in which the high-voltage part and measuring instruments are assembled.

The most important part of the power supply is a step-up transformer for high voltage. The transformer has a network winding, a compensation winding, a signal lamp power winding and a high voltage winding. The supply voltage is $220 \text{ V} \pm 22 \text{ V}$ with a frequency of $50 \pm 1 \text{ Hz}$. The voltage of the signal winding is about 6.3 V, the open circuit voltage of the high-voltage winding reaches $10000 \text{ V} \pm 300 \text{ V}$. The primary winding is formed when the mains and compensation windings are connected.

A feature of the transformer is that it has a steeply falling external characteristic. To obtain such a characteristic, the transformer has a magnetic shunt with a non-magnetic gap (a set of gaskets), which provides a significant scattering flux (large inductive resistance). Scattering fluxes are closed through a magnetic shunt. At idle current, the magnetic flux generated by the primary winding closes mainly through the magnetic circuit (its magnetic resistance is much less than the shunt).

Under load, the scattering fluxes increase and create EMF scattering in the primary and high voltage windings and the voltage in the high voltage winding decreases. In case of a short circuit, the magnetic fluxes of the primary and high voltage windings are scattering fluxes and the induced EMF balances the voltage applied to the primary winding, limiting the short circuit current.

The mains voltage is supplied to the transformer input through a starter and a fuse. The mains voltage is indicated by a lamp on the power supply panel. The output voltage from the step-up transformer through a limiting resistance of the order of 510 Ohms is supplied to the rectifier, consisting of 8 diodes (poles) with balancing series resistances of about 100 M Ω .

To stabilize the voltage, a high-voltage capacitor of the order of 0.1 μF is used. The rectified voltage is supplied through the limiting resistance directly to the output connector of the power supply unit from the fluoroplastic elements. A milliammeter with overload protection elements is included in the negative pole circuit of the block. The positive output of the power supply through limiting resistance is connected to a milliammeter indicating high voltage. A relay is included in the signal winding of the transformer, which is tuned to operate in the presence of current overload.

When the unit is turned on and the voltage is applied to the transformer, the open circuit voltage immediately appears (about 13-14 kV), which decreases when a current load of about 5-10 mA appears. When a spark occurs, the current increases and the voltage automatically drops to the level of 0.5-1.5 kV, which is sufficient to stop the spark discharge. In this case, there is a signal of current overload in the corona discharge.

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表面条件对产品变形行为和汽车钢板冲压性能的影响

**THE EFFECT OF SURFACE CONDITION ON THE DEFORMATION
BEHAVIOR OF PRODUCTS AND THE STAMPABILITY OF
AUTOMOTIVE SHEET STEEL**

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抽象。 分析了各种表面处理方法对产品 in 张力下的行为及其机械性能的影响。 提出了一种新的方法来提高技术延展性并改善冷轧汽车钢板的可成形性。

关键词: 表面, 胶结, 氮化, 离子轰击, 拉伸变形, 强度, 延展性, 可冲压性。

Abstract. *The influence of various methods of surface treatment on the behavior of products under tension and their mechanical properties is analyzed. A new method is proposed for increasing technological ductility and improving the formability of cold-rolled automotive steel sheets.*

Keywords: *surface, cementation, nitriding, ion bombardment, tensile deformation, strength, ductility, stampability.*

Introduction

Based on theoretical and experimental studies in the field of physical materials science, it is proved that the surface layer of a deformable solid is “an independent functional subsystem and radically affects the scale levels of localization of plastic flow and fracture of the material as a whole” [1,2].

The surface condition can be changed in various ways: surface hardening, chemical-thermal treatment, intense plastic deformation, ultrasonic and radiation exposure, coating.

Ion-plasma coatings are widely used in modern industry to obtain special operational properties of the surface (wear resistance, heat resistance, reduce friction coefficient). In vacuum-arc deposition technology (Arc-PVD method), an obligatory preliminary operation is ion bombardment (IB) of a surface in order to clean it and improve the adhesion interaction of the coating with the substrate. However, it

is known that the IB itself changes the fine structure, roughness, and stress state of the surface. This allowed us to consider IB as an independent operation, which can significantly change the operational properties of products from structural steels.

Expanding and deepening research on the role of surface conditions after various processing methods in the deformation behavior and the formation of the mechanical characteristics of products is relevant, since it makes it possible to control the properties of both the surface and the entire volume.

Of particular interest and importance is the question of determining the effect of the surface state on the technological properties of the material and workpieces, which has not yet been considered at all.

Analysis of publications

The authors of [1] argue that the surface plays a decisive role in the nature, location and time of destruction of a solid. In [2], differences in deformation behavior and mechanical properties of the surface and inner layers of the product are noted.

A significant effect of surface treatment on the "stress-strain" diagram is shown in [3]. The possibility of changing the properties of the product under the influence of surface treatment is evidenced by [4]. The authors of [5, 6] showed that surface treatment with concentrated energy fluxes leads to structural-phase transformations and changes in product properties.

In [7], it was proved that IB increases the temporary resistance σ_t by 17%, and the conditional yield stress $\sigma_{0.2}$ by 34%, while the relative elongation δ remains at a sufficient level, and the relative narrowing ψ increases significantly. The authors note that such a unique increase in structural strength is due to the formation of a combined submicro- and nanocrystalline structure in a thin surface layer, which, according to modern concepts [8, 9], significantly reduces embrittlement of a product.

In addition, there are works in which the difference in the behavior of the surface and inner layers of the material is not recorded [10].

It should be noted that most of the studies were performed on pure and ductile mono- and polycrystalline metals. Tests were subject to microsamples in the form of wire and thin ribbons. There are very few studies of massive objects from structural steels, which are the main material in many sectors of the national economy, and their results are mixed.

Of particular interest is the study of the effect of IB on the process ductility of cold rolled sheet steel. The evolution of the car body design, the ever-increasing demands to reduce its weight and increase efficiency dictate the need to improve the quality and reduce the cost of steel sheet for car elements made by cold stamping.

Purpose and objectives of the work

The purpose of the work is the potential to increase the strength of products while maintaining their ductility, as well as the technological characteristics of the material of these products by changing the state of the surface.

To solve these problems, the following tasks were posed: 1 - study the effect of chemical-thermal treatment and ion bombardment on the deformation behavior during tension of massive samples of structural steels; 2 - study the influence of the state of the surface layer on the deformability of the material of the product to be cold worked.

Key research findings

Chemical-thermal treatment - nitriding

After improvement, standard bursting specimens of $\varnothing 5$ and 10 mm made of 40X steel (quenching in oil from 860 °C and subsequent high tempering at 650 °C with a holding time of 1.5 h – Q + H.T.) were subjected to further nitriding in different modes for obtaining the depth of the hardened layer of 0.08, 0.25 and 0.35 mm.

The tensile curves of specimens $\varnothing 5$ mm are shown in Fig. 1.

From fig. 1 it follows that nitriding to a shallow depth (0.08 mm) increases strength without a drop in ductility (curve 2).

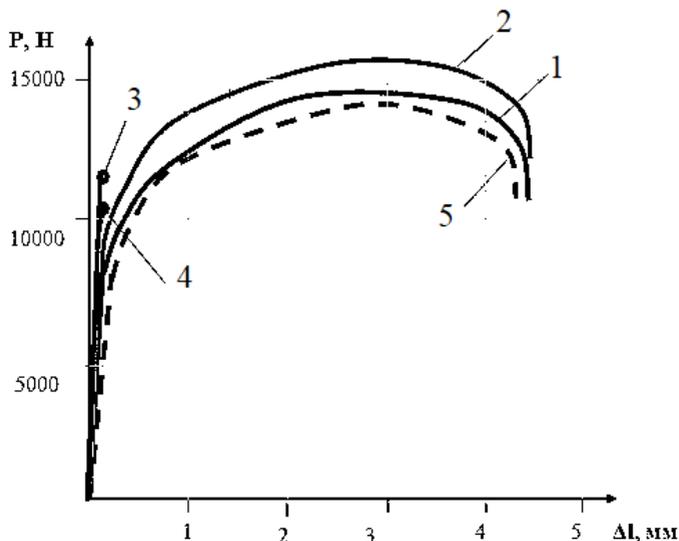


Fig. 1. The tensile curves of samples of steel 40X: 1 - Q + H.T.; 2 - nitrided layer 0.08 mm; 3 - 0.25 mm; 4 - 0.35 mm; 5 - after removal of the nitrided layer

An increase in the nitrided layer (curves 3 and 4) leads to embrittlement of the samples with a decrease in strength. After removing the nitrided layer, the character of the stretching curve 5 completely corresponds to curve 1 (sample without nitriding). Statistically processed data on the mechanical properties of the samples are shown in table 1.

Table 1 - Mechanical characteristics of samples of steel 40X after nitriding to different depths

Layer thickness mm	σ_s , MPa	$\sigma_{0.2}$, MPa	δ , %	y
Q + H.T.	705	435	19	52
0,08	780	465	19	49
0,25	535	-	-	-
0,35	475	-	-	-
Removed layer	710	430	19	51

The table shows that an increase in the depth of the nitrided layer leads to a drop in strength with a complete loss of ductility. So, when nitriding to a depth of 0.25 mm, σ_s decreases by 25%, $\sigma_{0.2}$ is no longer recorded, and ductility drops to zero. After removing the nitrided layer, the properties return to their original values. This fact confirms the earlier conclusion that the differences in mechanical properties are due solely to the influence of the surface layer on the behavior of the sample during deformation. Similar data were obtained for samples with a diameter of 10 mm.

Low energy titanium ion treatment

Tensile tests were carried out for flat steel samples (200 × 20 × 1.2 mm) of annealed steel 20, which were subjected to low-energy (1-3 keV) IB with titanium ions on a "Bulat" NNV-66-I1 installation in an argon atmosphere (pressure ~ 0.13 Pa) at an arc current of 95–100 A and a voltage of 1000–1100 V.

Both sides of the sample were alternately bombarded, total processing time 2 min.

Figure 2 shows the tensile curves, from which it can be seen that after IB the character of the deformation behavior of the samples changes - both strength and ductility grow simultaneously, and the ductility growth is very significant.

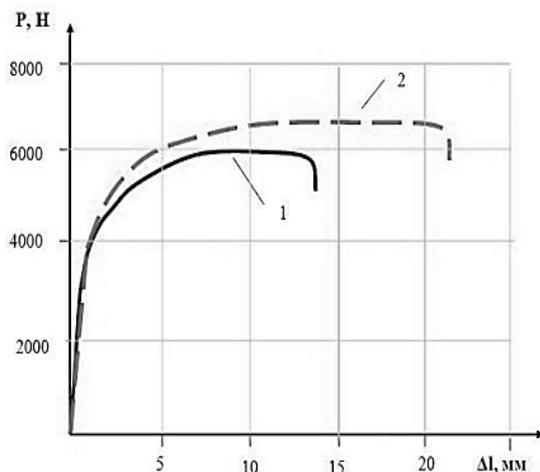


Fig. 2. Tensile curves of flat samples of steel 20: 1 - before IB; 2 - after IB

The mechanical properties of the samples in different states are shown in table 2.

Table 2 - The results of tensile tests of flat samples

Condition	$\sigma_{0,2}$, MPa	σ_t , MPa	δ , %	d	ψ , %	HV5, MPa
Without IB	220	390	13	11	15	130 -133
After IB	250	425	24	20	39	129 -133

The quantitative characteristics given in Table 2 indicate that with an increase in σ_t by 14 %, δ increases by almost 80%, and ψ - more than 2 times. Moreover, the uniform elongation δ_u increased by 82%. It should be emphasized that the hardness of the sheet after IB remained at the initial level and therefore the change in properties is not associated with the material, but is due to its different behavior during deformation. This is well illustrated by the tensile curves of the samples.

Such a significant increase in ductility, namely δ_u , must certainly affect technological ductility in the manufacture of products by pressure treatment methods.

To clarify this issue, studies were conducted on the impact of IB on the stampability of cold-rolled automotive sheet steel 08kp.

Steel is intended for the manufacture of products by the method of cold deformation with a very deep drawing (VD). According to GOST 9045-93, the VD category for 08kp steel with a sheet thickness of 0.5 mm provides a spherical hole depth of 9.0 mm, which is obtained by drawability tests according to the Ericksen method. The ability for a particularly complex drawing (PCD) and a very particu-

larly complex drawing (VPCD) is provided for more ductile steel 08Y with a hole depth of 9.4 and 9.7 mm, respectively.

Unilateral and bilateral bombardment of a sheet of 08kp steel 0.7 mm thick with Ti ions in an argon atmosphere was carried out. Eriksen drawability test results are shown in table 3.

Table 3 - Drawability test results

Condition	Depth of the hole, mm	Drawability
Without treatment	9,05	VD
Unilateral IB	10,7	VPCD *
Bilateral IB	10,9	VPCD *

* - hole diameter exceeds GOST requirements for VPCD ability

The table shows that the IB surface of a cold-rolled steel sheet from 08kp steel significantly increases technological ductility and improves the drawability of 08kp steel (from category VD to category VPCD).

A general view of the samples before IB (a) and after IB (b) subjected to an extrusion test is shown in Fig. 3.

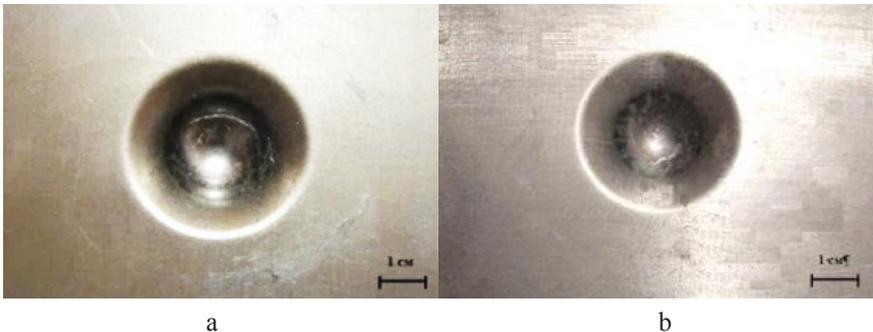


Fig. 3. Samples after extrusion tests: a – before IB; b - after IB on both sides

After IB, the depth of the well far exceeds the standard requirements for the extrusion category VPCD (9.7 mm). No heat treatment will provide such an effect of improving the formability of a cold rolled sheet. The proposed method for improving the technological ductility of cold rolled sheet steels is protected by patent [11].

Considering the scale of sheet cold stamping of products from thin-sheet low-carbon cold-rolled steels, the results of this work are of undoubted practical interest.

Conclusions

1. It has been experimentally proved that it is the state of the surface that determines the behavior of the product during deformation, which leads to changes in its properties, while the mechanical characteristics of the core remain unchanged.

2. When nitriding to a shallow depth (~ 0.8 mm), the strength increases while maintaining high ductility. An increase in the depth of the nitrided layer leads to embrittlement of the product, which can be explained by an increase in the ratio of the area of the hardened layer to the cross-sectional area of the product.

4. IB is an effective way to increase the structural strength and reliability of products. After IB of flat tensile samples of steel 20, the strength increased with a significant increase in ductility (δ and $\delta_u \sim 2$ times, and ψ - more than 2 times!). Such high ductility combined with increased strength cannot be achieved by any volumetric treatment.

5. IB significantly improves the process ductility of cold-rolled automotive steel, designed for the manufacture of products by cold plastic deformation. With increased strength, the ability to draw 08kp steel is higher than the requirements of the VPCD category, which is provided for cleaner in chemical composition and 08Y ductile steel.

6. In many areas of the national economy, products are made of cold rolled sheet steels by cold stamping and improving their technological plasticity will reduce the number of defective products due to poor deformability. In addition, it becomes possible to reduce the number of transitions during stamping, reduce the costs of the stamping tool, and increase labor productivity.

7. In the practice of machine-building enterprises and in other industries (construction, energy, agricultural and household appliances), stamping of sheet blanks is often not good enough, which leads to tangible economic losses. Until now, there were no methods to increase the ability to deep draw an already finished sheet.

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牵引发动机机车以不同方式干燥的主要电气技术参数的试验研究
**EXPERIMENTAL STUDIES OF THE MAIN ELECTROTECHNICAL
PARAMETERS OF INSULATION OF TRACTION ENGINES
LOCOMOTIVES DURING DRYING IN DIFFERENT WAYS**

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抽象。 本文比较了两种干燥牵引电机绝缘的方法,即对流法和使用热红外辐射的方法。 描述了实验原理。 分析了干燥后主要电气技术参数的结果。

关键词: 牵引机车车辆, 牵引电动机, 可靠性, 匝间短路, 绝缘干燥, 热辐射, IR 辐射。

Abstract. *This article compares two methods for drying the insulation of traction motors, namely the convective method and the method using thermal infrared radiation. The principle of the experiment is described. The results of the main electrotechnical parameters after drying are analyzed.*

Keywords: *Traction rolling stock, traction motor, reliability, inter-turn short circuits, insulation drying, thermal radiation, IR radiation.*

During operation, traction rolling stock of railways is subjected to a complex effect of factors of various nature, while traction motors (TM) are subject to the most intense impact, especially on sections of railways with poor track structure. Analysis of statistical data shows that more than 30% of all failures of freight mainline electric locomotives accounted for TM. In turn, the weak point of TM is insulation, which accounts for up to 75% of the total number of

TM failures, including up to 3%. The main cause of insulation failures is electrical breakdown and inter-turn faults, which indicate a possible low quality of insulation [1].

Currently, in the manufacture and repair of insulation, its physical and mechanical properties are laid at the stage of impregnation in varnish or compound, followed by drying in high-power convective electric furnaces (on average 80 kW) for a duration of 12 hours, which leads to significant energy costs and equipment downtime at repair positions [2, 3]. In addition, convective drying causes defect formation on the surface of the polymer insulation due to heating from the outside to the inside.

Scientists at FSBEI HE "Irkutsk State Transport University", together with "EnergopneumoTrans" LLC, offer technology and hardware systems for drying the insulation of electrical equipment using thermal (infrared - IR) radiation, which can reduce the drying time by 4 times, with a reduced power of the proposed systems more than 3 times [4].

To confirm the hypothesis of defect formation on the insulation surface after convection drying, experimental studies were carried out on comparative assessments of the quality of polymer insulation samples after drying in different ways: using the standard convective method and the proposed method using thermal radiation [5].

For the experiment, identical samples of the insulation system used on the windings of the anchors of the traction motors were prepared. A 3 mm thick copper sheet was taken, on which 3 types of insulating tape were wound, simulating the armature winding: 3 layers in the half-roof of "Elmicaterm" glass-mica tape, 1 layer in the half-roof of the "Isoflex" polyamide film, 1 layer in the half-roof of the LES tape (figure 1). A sensitive thermocouple was placed on top of the copper plate to control temperature. Such samples were prepared 20 pieces.

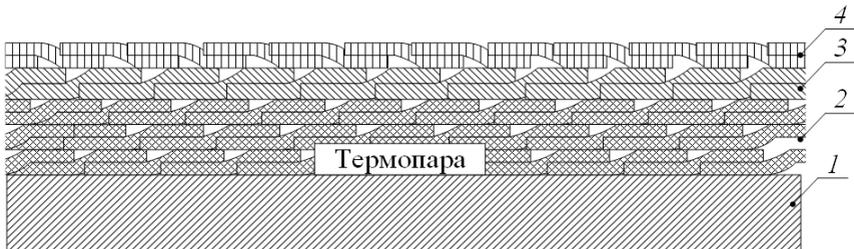


Figure 1 - Layout of insulation layers on the sample

- 1 - copper plate, 2 - 3 layers in the half-roof of "Elmicaterm" glass-mica tape,
- 3 - 1 layer in the half-roof of "Isoflex" polyamide film,
- 4 - 1 layer in the half-roof of LES tape

Samples were impregnated by dipping in the PK-11 (E) compound under the same conditions (Figure 2). Some of the samples were dried in a convection oven for 12 hours, the rest on a laboratory bench using thermal radiation for 2, 2.5 and 3 hours. After the samples, the microstructure of the surface layer was analyzed under a microscope. As a result of the experiment, a conclusion was made: for samples obtained using thermal radiation, the structure is more uniform (Figure 3).

The figure clearly shows defects in the form of microcavities on samples dried in convective furnaces, and their absence on samples obtained using infrared radiation. In addition, these defects significantly reduce the surface quality of polymer insulation, which adversely affects its operation.

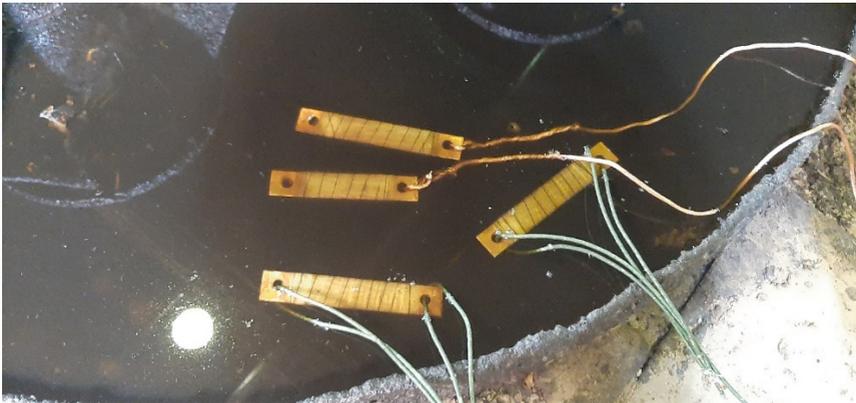
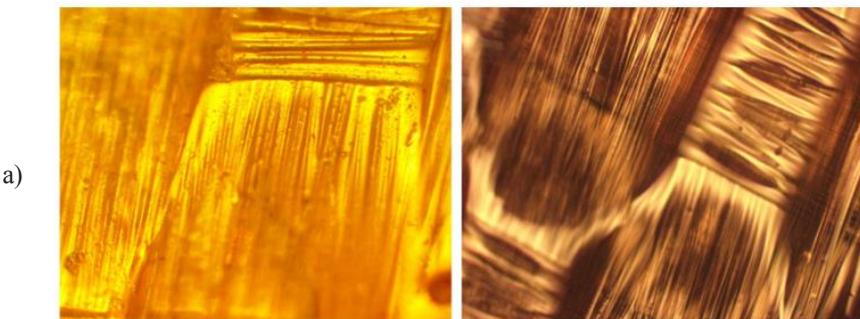


Figure 2 - Impregnation of samples in the compound PK-11 (E)



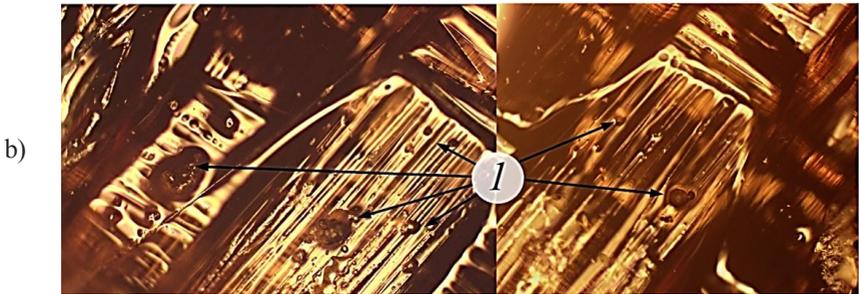


Figure 3 - Images of the surface of the polymer insulation of the samples dried under infrared radiation (a) and in a convection oven (b): 1 - cavities (defects)

The next stage of experimental research was a comparison of the main electrotechnical parameters of the samples after drying in different ways, which were carried out at the factory in the laboratory of the "Elinar" group of companies, which is one of the largest manufacturers and suppliers of electrical insulation materials for power equipment in the world [6]. During the comparison, the main operational parameters were checked for the samples: dielectric loss tangent, resistance, dielectric strength, and soluble content (table 1).

Table 1 - Comparison results of the main electrotechnical parameters of the samples after drying in different ways

Sample name	Thickness, mm	tg		Resistance, Ohm ² m		Dielectric strength kV/mm	Soluble part % mass
		Ref.	155 C ^o	Ref. (*10 ¹³)	155 C ^o (*10 ⁹)		
Sample PK-11, IR, 2 hours	2,7	0,004	0,44	3	3,40	7,5	9
Sample PK-11, IR, 2.5 hours	2,6	0,008	0,51	6	2,50	7,0	8,1
Sample PK-11, IR, 3 hours	2,4	0,002	0,37	6	13,00	8,3	8,1
Sample PK-21, IR, 2 hours	2,8	0,003	0,42	6	8,00	7,9	10
Sample PK-21, IR, 2.5 hours	2,6	0,002	0,39	4	7,00	5	8,9
Sample PK-21, IR, 3 hours	2,4	0,005	0,39	6	9,00	7,9	7,4
Sample PK-11, convection, 12 hours	2,4	0,002	0,45	6	4,00	8,3	9,3
Sample PK-21, convection, 12 hours	2,6	0,002	0,45	6	5,00	7,7	11,6

The results show that for samples dried using thermal radiation at a shorter time, similar results were obtained as with convection. In this case, the resistance of the samples during drying by thermal radiation is higher, and the soluble content is lower, which indicates a high intensity of the drying process, without defect formation.

This fact confirms the hypothesis of a decrease in the reliability of insulation of electrical components of electric rolling stock using the convective drying method, in terms of the formation of channels for breakdown of insulation or overlap, as well as a decrease in its quality as a whole.

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根据制动蹄的质量和几何形状模拟制动蹄的温度
**MODELING THE TEMPERATURE OF THE SHOE DURING
BRAKING, DEPENDING ON ITS MASS AND GEOMETRY**

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抽象。 本文讨论了铁路机车制动力形成的特点。 考虑到制动衬块的几何特征,分析了轮毂接触区域中的热过程特征。 考虑了垫的温度对摩擦系数的影响的问题。 给出了考虑到块的几何形状的热过程的有限元建模的结果。 提出了在摩擦区域中垫磨损对温度的依赖性的观察结果。

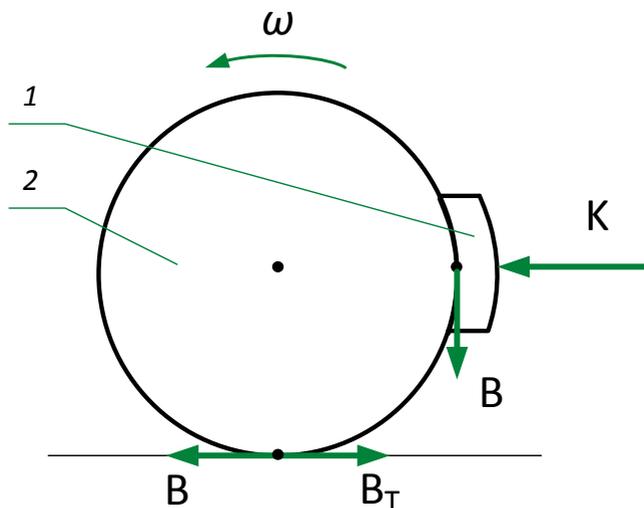
关键词: 机车车辆, 铁路交通安全, 摩擦制动器, 制动衬块, 摩擦系数, 制动距离, 制动过程中的热过程。

Abstract. *This article discusses the features of the formation of the braking force of railway rolling stock. The features of thermal processes in the contact area of the wheel block are analyzed, taking into account the geometric features of the brake pads. The issue of the influence of the temperature of the pads on the coefficient of friction is considered. The results of finite element modeling of thermal processes taking into account the geometry of the block are presented. Observations of the dependence of pad wear on temperature in the friction zone are presented.*

Keywords: *Rolling stock, railway traffic safety, friction brakes, brake pad, friction coefficient, braking distance, thermal processes during braking.*

Rail transport is of great importance in the economies of large countries. Rail transport must meet two basic requirements: transport safety and cargo speed [1]. For speed and safety, the most important system is the train's brakes. The most important characteristic of the braking system of a train is the braking distance, which depends on the braking force.

Braking force is a force that creates artificial resistance to the movement of the train, acting opposite to the movement of the train from the rail to the wheel.



*Figure 1 – Scheme of forces acting in the system block, wheel, rail:
1 – brake shoe; 2 – wheel*

When the shoe is pressed by force K on the wheel, friction force B is generated between the shoe and the wheel, which is tangentially directed to the side opposite to the movement of the wheel. According to the rules of mechanics, force B can be transferred to the point of contact of the wheel with the rail as shown in Figure 1. Force B is applied from the wheel side to the rail. Due to the traction force, the relay creates a reaction force B_T directed opposite to the movement of the train. The braking force is equal in magnitude to the friction force between the block and the wheel, i.e. fair equality $|B_T| = |B|$.

$$B = \varphi_K \cdot K,$$

where φ_K – coefficient of friction;

K – pressure force of the brake pads to the surface of the wheel.

It is generally accepted that the friction coefficient depends on the speed of the train and the pressing force K . The values of the friction coefficients are deter-

mined empirically at special stands or by braking the trains from several identical cars. This coupling is accelerated by the pusher locomotive to maximum speed, after which the pusher lags behind, and the train brakes with a certain force of pressing the pads. The next such experiment is carried out with a different force of pressing the blocks, as a result of which a family of curves is obtained that are approximated in a function. It is also important to note that the coefficient of friction substantially depends on the material of the pads.

After approximating the experimentally obtained data, the following equations of the coefficient of friction for cast iron and composite brake shoes were derived:

$$\varphi_K = 0,6 \cdot \frac{1,6K+100}{8K+100} \cdot \frac{\vartheta+100}{5\vartheta+100}, \quad (1)$$

$$\varphi_K = 0,44 \cdot \frac{0,1K+20}{0,4K+20} \cdot \frac{\vartheta+150}{2\vartheta+150}. \quad (2)$$

Figure 2 shows the curves of friction coefficients depending on the speed of the train for composite brake shoes and cast iron. Both graphs are built for the force pressing brake shoe on the wheel $K = 30\text{kN}$.

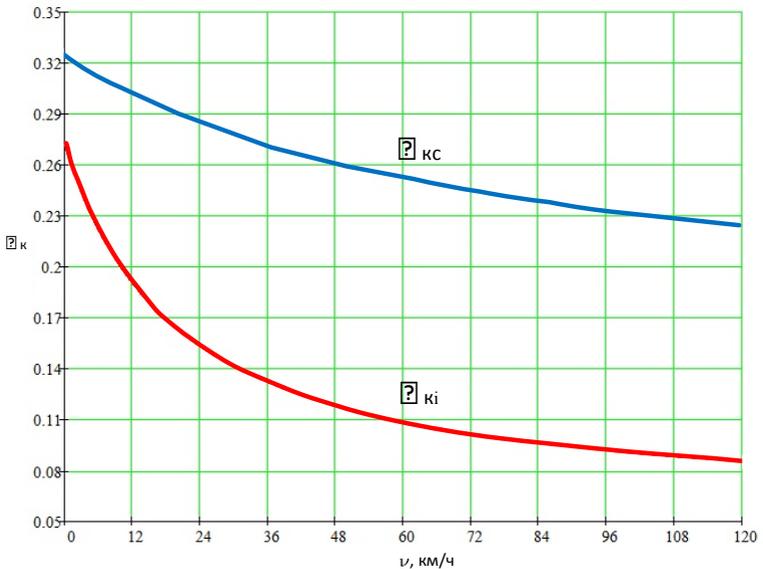


Figure 2 – Dependence of the friction coefficient of cast iron φ_{ki} and composite φ_{kc} brake shoes on the speed of the train

From the analysis of the curves in Figure 3, we can conclude that the values of the coefficient of friction of the composite brake shoe in the entire range of train speeds are higher, and the graph itself is more gentle compared to the coefficient of friction of cast-iron brake shoe. In other words, composite brake shoes have a greater coefficient of friction than cast iron.

If we analyze expressions (1) and (2) in more detail, we can conclude that with an increase in the pressing force K , the friction coefficient decreases, this may seem strange because with an increase in pressure, the diffusion and adhesion force between the brake shoe and the wheel increases, which should lead to an increase in the coefficient of friction. Also, from the analysis of these expressions, one can notice that with increasing speed, the friction coefficient decreases. Both of these dependences can be explained by an increase in thermal energy in the friction zone both with increasing pressure and with increasing speed. An increase in thermal energy in the friction zone leads to an increase in temperature, which in turn increases ductility and reduces adhesion forces.

Such dynamics can be explained with the help of equations describing the relationship between the wheel speed, the force of pressing the brake shoe and the thermal power that needs to be dissipated. Power dissipation can be found by the formula for kinematic systems:

$$P = M \cdot \omega,$$

where M – the braking torque, $\text{kN}\cdot\text{m}$;

ω – rotational speed, rad/s .

And the braking torque M can be found by the formula:

$$M = B_T \cdot R_c,$$

where B_T – braking force, $\text{kN}\cdot\text{m}$;

R_c – wheel radius, m

According to the first law of thermodynamics, the energy in the process of braking, the mechanical energy of the train moves into heat. In a number of works devoted to the study of the coefficient of friction as a function of temperature, results are obtained that allow us to assert a significant relationship between temperature and braking force [2].

It is important to note that the temperature in the friction zone will depend on both the amount of input power and the total heat capacity of the brake shoe and its heat transfer. The heat capacity depends on the material and mass of the brake shoe, and the heat transfer on the cooling conditions and the total area of the brake shoe.

If we analyze the existing forms of brake shoes, we can conclude that the temperature in the contact zone of the brake shoe – wheel is different for the various types of brake shoes that are available on the brake market. Figure 4 shows how significantly the area of heat exchange with the environment, as well as the volume and, accordingly, the mass of brake shoes. This means that the rate of temperature rise, as well as its steady-state value, will differ for different types of

brake shoes. According to [3, 4], we can conclude that for different types of brake shoes there will be different temperatures at the same speeds and pressures. The results of this observation allow us to take this fact into account when managing the brakes and when designing the brake systems.

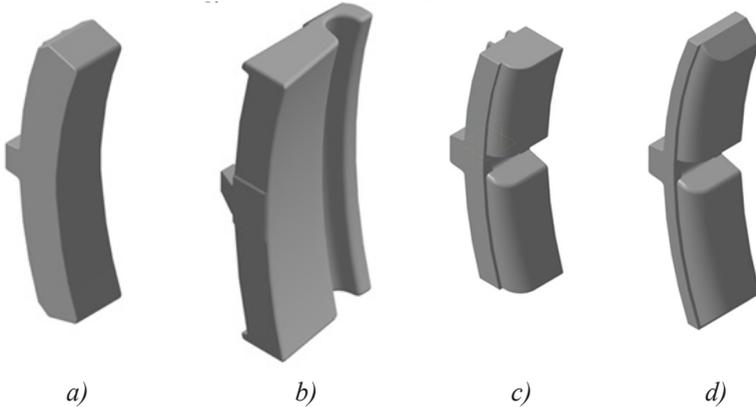


Figure 3 – Cast-iron brake shoes type C (a) type M (b) composite brake shoes type 25610-N (c) type 25130-N (d)

If we develop the idea that the temperature of the brake shoe during braking depends on its geometric and mass characteristics, then we can assume that when the brake shoe is worn during operation, its mass and heat transfer area change. This means that the temperature in the friction zone of the brake shoe-wheel of a worn-out brake shoe will be higher than that of a new one, and therefore, the friction coefficient will decrease with wear of the brake shoe.

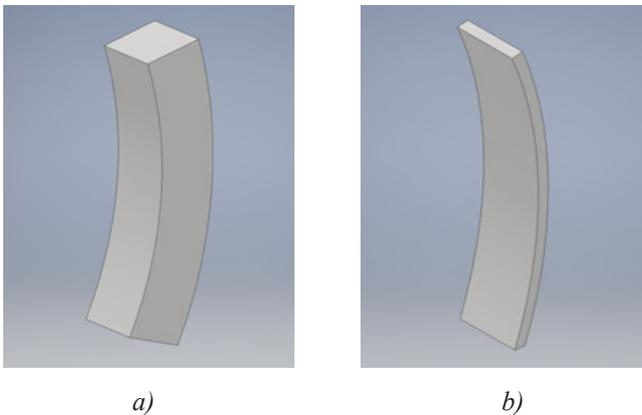


Figure 4 – New brake shoe (a) worn brake shoe (b)

In order to develop this hypothesis, we carried out finite element modeling of heating brake shoes with varying degrees of wear. A worn brake shoe loses weight by 5 times relative to its original state and the heat transfer area by 2.5 times. This is clearly seen in Figure 4.

Figure 5 shows the finite element model of brake shoe in the process of studying the thermal field. In more detail, the method of finite element modeling of thermal processes can be seen in [5]. The model shows that with a large mass, the brake shoe does not have time to warm up to the base, as a result of which the heat outflow from the contact zone of the wheel and brake shoe has a high intensity.

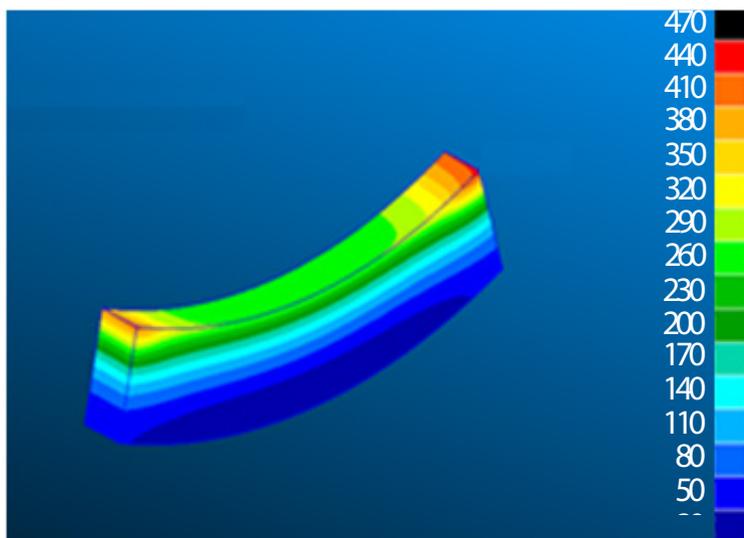


Figure 5 – The finite element model of brake shoe in the process of studying the thermal field

As a result of theoretical and computational studies, it can be concluded that brake shoes having a high degree of wear during braking are heated to a higher temperature, which has a significant effect on the braking force. These findings can be taken into account when managing trains and when designing brake systems for rolling stock.

The article was published at the expense of the state task on the topic "Increasing the velocity of trains by increasing the efficiency, manageability and performance control of rolling stock auto brakes".

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预防与卫生保健有关的感染的某些方面
**SOME ASPECTS OF PREVENTION OF HEALTH CARE-
ASSOCIATED INFECTIONS**

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抽象。当前,患者和医疗组织工作人员的感染安全性问题变得至关重要。这是由于存在多种传染(寄生)疾病传播途径:与家庭,空气中的飞沫,人工制品等接触。医务人员之间发生卫生保健相关感染(HCAI)的其他风险是由诸如以下因素造成的。作为紧急医疗服务,大量患者同时到达(疾病的严重性,流行性上升等),大量正在进行的实验室研究是人为因素。

关键字。卫生保健相关的感染,微生物对消毒剂和皮肤防腐剂的抵抗力。

Abstract. *Currently, the problem of infectious safety of patients and staff of medical organizations is becoming of paramount importance. This is explained by the presence of many routes of transmission of infectious (parasitic) diseases: contact household, airborne droplets, artifacts, etc. Additional risks for the occurrence of health care-associated infections (HCAI) among medical personnel are created by factors such as emergency medical care, the simultaneous arrival of a large number of patients (the massive nature of the disease, the epidemic rise, etc.), a large number of ongoing laboratory studies, the human factor.*

Keywords. *Health care-associated infections, resistance of microorganisms to disinfectants and skin antiseptics.*

In modern conditions of development of health care and humanity as a whole, the prevention of health care – associated infections (HCAI) is one of the global problems of the world. The solution to these serious issues today is subordinated to the activities of a significant number of scientists, numerous healthcare practitioners and most large companies representing their products and services on the world market. At present, it is difficult to overestimate the social and economic damage that the HCAI cause annually to the world community. Thus, according to official statistics, in the USA more than 2 million patients suffer from HCAI annually, 88,000 patients die, annual economic damage is 4-10 billion dollars; in the UK, taking into account registered HCAIs, hospital treatment of patients increases by 3.6 million days, the annual economic damage is about 1 billion pounds [3-5].

Unfortunately, today in the Russian Federation there is no generalized reliable statistical information about the specific social and economic burden caused by the HCAI population, there are only certain ideas about its scale, which are based on the results of scientific studies of domestic scientists in recent years. It has been shown that HCAI affects 5-10% of patients in hospitals and occupies tenth place among the causes of mortality. In Russia, according to official statistics, approximately 25-30 thousand cases of HCAI are recorded annually (0.7-0.8 per 1,000 patients), however, domestic researchers believe that their true number is at least 2-2.5 million people (i.e. no more than 1-5% of the real incidence is subject to registration!). Depending on the action of various factors, the incidence of HCAI varies. Some groups of patients are especially vulnerable: newborns, elderly people, patients with severe underlying pathology and multiple concomitant diseases, patients undergoing aggressive and invasive medical procedures, organ transplants, etc. In these groups, the incidence rates of HCAI are significantly higher [4].

Health care – associated infections significantly reduce the patient’s quality of life, leading to a loss of reputation of the healthcare institution.

The intensive development of high-tech, invasive diagnostic and treatment methods, combined with the wide spread of multidrug-resistant microorganisms, determines the need for continuous improvement of HCAI surveillance and control systems.

The causative agent of infection is one of the main links in the epidemic process. It should be emphasized that, in relation to almost all HCAI nosoforms, there are no specific preventive measures, and therefore disinfection and sterilization measures determine the basis of their prevention system. Given this, the problem of the resistance of HCAI pathogens to antibacterial drugs, including antibiotics, disinfectants (DS) and skin antiseptics, is currently in the focus of close attention of scientists and practitioners of practical public health in many countries. The presence of resistance of microorganisms to disinfectants has been studied for several years. The presence of resistance to various groups of disinfectants in different types of microorganisms has been established. Knowledge of the mechanisms of resistance of microorganisms range from revealing the genetic aspects of its formation to quaternary ammonium compounds (QAC) and oxygen-containing DS to the lack of reliable ideas and only a description of the phenomenon of resistance. Even less is known about the prevalence of resistance and the influence of various factors on its formation [7,2,9].

One of the priority places in the effectiveness of medical care for people with the occurrence of infectious diseases, including HCAI, is the ever-increasing frequency of occurrence of poly-, extreme- and pan-resistant strains of microorganisms to the effects of antimicrobials. Recently, various publications highlight the problem of growth in the development of HCAI pathogens not only for antibiotics, but also for disinfectants.

The use of antibacterial drugs and antiseptics leads to the constant selection of microorganism strains resistant to these factors that form the microbial landscape of a medical organization. This dictates the need for its monitoring in dynamics, which allows us to develop a strategy for the adequate use of antimicrobial agents. Regular microbiological monitoring of the resistance of microorganisms released from patients and from nosocomial objects to disinfectants allows us to assess the proportion of the most important microorganisms from the epidemiological point of view, their level of resistance, and to correctly select and timely disinfectant rotation [6].

The next factor in the emergence of HCAI in medical organizations is equipment that comes in direct contact with the patient, his biological environment and personnel. The processing of equipment (including endoscopic), instruments and auxiliary equipment is quite laborious and complicated, while poor-quality cleaning, disinfection and sterilization, as well as a limited time resource for disinfection measures (due to the increased flow of patients) pose a risk of patients and HCAI staff. The solution to this problem is to use for disinfection (including combined with complete sanitation), high level disinfection and sterilization of modern disinfectants that do not fix organic compounds, do not spoil the treated surfaces, as well as utensils, medical devices (MD) and patient care items from corrosion-resistant metals, glass, rubber and plastics, polymeric materials, and cost-effective. The use of chemical indicator strips is justified as a method of rapid control of disinfection measures (control of the concentration of active substance in working solutions).

Maintaining an epidemically safe nosocomial environment in healthcare facilities is critical to ensuring HCAI prevention.

Recently, the use of the latest technologies in cleaning events in medical organizations has become increasingly relevant. One of the promising ways to implement disinfection measures is the use of the aerosol disinfection method, based on the conversion of the disinfectant to a finely divided state using special equipment, and the introduction of aerosol into the indoor air. The aerosol method has several advantages. This is a high efficiency of processing rooms, including inaccessible and remote places; simultaneous disinfection of air and surfaces in rooms, ventilation and air conditioning systems; minimization of the human factor (carrying out processing in the absence of people).

A separate group of factors affecting HCAI are the performance of medical procedures, including procedures for caring for the patient. These manipulations prevent, significantly reduce or delay infectious complications in patients. Of particular importance in hospitals are issues of nursing care and the use of appropriate MDs for the care of severe patients at the ICU, due to the significant length of stay in these departments of patients with certain nosologies (botulism, HFRS, leptospirosis, sepsis) [1,8].

Of no small importance is the organizational and methodological work with medical workers to comply with the rules of hygienic processing of staff hands as the most likely factor in transmitting HCAI during various types of manipulations and operating processes.

All this indicates the need to introduce modern effective methods of infection control into healthcare practice, which will improve the quality of medical care and reduce the risk of nosocomial infection of patients and staff.

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编码亲免疫蛋白的转录本的稳定性

STABILITY OF TRANSCRIPTS ENCODING IMMUNOPHILINS

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抽象。 本文介绍了编码亲免疫蛋白的mRNA基因的比较分析结果。 已经确定，大多数基因的特征在于存在几个转录物变体，所述转录物变体的不同之处在于三个主要非翻译区的长度。 mRNA的腺苷酸化的经典途径被认为是其稳定性的主要调节因子。 评估了ARE和microRNA依赖性降解对基因表达的转录后调控的贡献。

关键词: 基因, mRNA, 三个主要非翻译区, 分子伴侣。

Abstract. *The article presents the results of a comparative analysis of mRNA genes encoding immunophilins. It has been established that most genes are characterized by the presence of several transcript variants that differ from each other by the length of three prime untranslated region. The classical pathway of deadenylation of mRNA is supposed to be the main regulator of its stability. The contribution of ARE- and microRNA -dependent degradation to the post-transcriptional regulation of gene expression was evaluated.*

Keywords: *gene, mRNA, three prime untranslated region, chaperones.*

Currently, immunophilins include two large groups of proteins with peptidyl-prolyl-c/s/zrans-isomerases activity. The first group is formed by cyclophilins proteins that interact with cyclic nonribosomal peptide cyclosporin A. The second group includes macrolide binding proteins tacrolimus (FK506), the group is called FK506-binding proteins (FKBP). Cyclosporin A and tacrolimus are widely used in medical practice as immunosuppressive drugs in organ and tissue transplantation. Most immunophilins are chaperones and are necessary to maintain the conformational properties of protein structures [1,2]. The genes encoding these proteins do not form clusters; they are scattered throughout the genome, and the level of their expression varies depending on the type of cells or tissues [3]. It is known that the proteins encoded by these genes are involved in the development of many pathological processes, including the adaptation and replication of viruses entering the cell [4].

Research in the study of the mechanisms of post-transcriptional regulation of gene expression belongs to the rapidly developing field of molecular genetics in recent years. Most researchers agree with the statement that the features of the course of a pathological process depend on the number of gene expression products involved in this process. Several mechanisms regulating the stability and lifespan of mRNA in a cell are currently known. These include decapping, deadenylation, ARE-dependent degradation, nonsense-mediated decay, microRNA-mediated mRNA degradation, and some others [5]. Nevertheless, the question of the functional significance of each of these pathways for regulating the expression of a particular gene remains open. It is generally accepted that the regulatory sequences of three prime untranslated regions play a key role in this process. The following are the results of a bioinformatics analysis of three prime untranslated regions of immunophilin genes. An assessment is made of their possible role in the regulation of post-transcriptional gene expression.

Materials and methods of research. During the study, the data placed in the NCBI and Ensembl databases were used to form a sequence sample. RNA sequence annotation was performed using RegRNA 2.0 software [6].

Results of the study. The study analyzed the lengths of three prime untranslated regions of thirty-one gene coding for immunophilin family proteins. For the vast majority of them, there is a large variability in the lengths of the analyzed section, which does not have a clear explanation at the present time. With a sufficient degree of certainty, it can be assumed that the lifespan of mRNAs with short untranslated sequences mainly depends on the performance of two multi-protein complexes, Ccr4-Not and Pan2/Pan3, which provide deadenylation due to the 3'-5'-exonuclease activity. However, variants of long transcripts with extended three prime untranslated regions are found in a large number of genes encoding this family of proteins. Therefore, the identification of regulatory sequences in these RNA variants is an important step in understanding post-transcriptional regulation of expression.

During the analysis, special attention was paid to two regulatory sequences (motives) that are essential elements of two independent biochemical processes that ensure the degradation of the mRNA molecule. The first sequence, AU-rich element (ARE), binds the AUF1 protein to the 3' end of the transcript, leading to the displacement of poly (A) -binding protein (PABP) and rapid degradation of the molecule. The second group, microRNA response elements that regulate targeted degradation. To search for these sequences, a sample of the longest transcripts of each gene was generated. The list of genes and sequences is presented in the table.

Table. List of genes and nucleotide sequences

cyclophilins			FK506-binding proteins		
gene	chromosome	accession number	gene	chromosome	accession number
PPIE	1p34.2	NM_006112.4	FKBP1B	2p23.3	NM_004116.5
PPIH	1p34.2	NM_006347.4	FKBP7	2q31.2	NM_181342.3
PPIAL4E	1q21.1	NM_001144032.2	AIPL1	3p14.3	NM_014336.5
PPIG	2q31.1	NM_004792.3	FKBP5	6p21.31	NM_001145777.1
PPIL3	2q33.1	NM_130906.3	FKBP9	7p14.3	NM_007270.5
PPID	4q32.1	NM_005038.3	FKBP14	7p14.3	NM_017946.4
PPWD1	5q12.3	NM_015342.4	FKBP6	7q11.23	NM_003602.5
PPIC	5q23.2	NM_000943.5	FKBP15	9q32	NM_015258.2
PPIL1	6p21.2	NM_016059.5	FKBP2	11q13.1	NM_004470.4
PPIL6	6q21	NM_173672.5	AIP	11q13.2	NM_003977.4
PPIL4	6q25.1	NM_139126.4	FKBP4	12p13.33	NM_002014.4
PPIA	7p13	NM_021130.5	FKBP11	12q13.12	NM_021939.4
PPIF	10q22.3	NM_005729.4	FKBP3	14q21.2	NM_002013.4
PPIB	15q22.31	NM_000942.5	FKBP10	17q21.2	NM_021939.4
PPIL2	22q11.21	NM_016059.5	FKBP8	19.13.11	NM_012181.5
			FKBP1A	20p13	NM_000801.5

According to the results of the screening, it was found that AU-rich elements is rarely found in the 3'-untranslated region of the transcripts of the analyzed genes. In particular, these sequences were found in two transcripts of cyclophilins genes: PPIE and PPIG. And also, in some variants of the transcripts of the FK506-binding proteins: AIPL1, FKBP7, FKBP14. A different result is observed when analyzing the frequency of occurrence of potential microRNA response elements. A total of sixty-six potential binding sites were identified. The corresponding microRNAs are registered in the miRBase [7]. The genes encoding these microRNAs are located on different chromosomes and are expressed independently of each other. In most cases, one gene of the immunophilin family corresponds to a single microRNA gene, some transcript variants of which contain a potential binding site for targeted degradation. Exceptions are the microRNA genes: hsa-miR-4739, hsa-mir-4739, hsa-miR-5096, for which a potential binding site was suggested in the transcripts of two different genes. However, these data do not have experimental confirmation and need additional verification. It is important to note that in seven cyclophilins genes and three FK506-binding proteins genes, potential microRNA response elements were not found. One binding site was annotated in five genes. In other cases, long gene transcripts contain multiple microRNA binding sites, the functional significance of which is not known.

Conclusion. The presence of short and long transcripts of the same gene significantly complicates the interpretation of the results and assessment of the contribution of one or another mechanism of mRNA degradation to the post-transcriptional regulation of gene expression. It can be suggested that for the genes of this family, the classical pathway of deadenylation of mRNA is the main regulator of its stability. An analysis of the regulatory sequences of 3'UTR long transcripts suggests that ARE-dependent mRNA degradation is apparently not a key mechanism for regulating expression at the post-transcriptional level for most genes. The role of microRNA in initiating the degradation of immunophilin transcripts is not fully understood. Some genes do not contain microRNA response elements in 3'UTR; in the other, they are not present in all transcript variants. It is reasonable to assume that the mRNA length variation itself is a mechanism for regulating gene expression, which requires special research.

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危险因素对儿童正畸牙槽远端闭塞的正畸治疗质量的影响
**IMPACT OF RISK FACTORS ON THE RESULTS' QUALITY OF
ORTHODONTIC TREATMENT OF DENTAL ALVEOLAR DISTAL
OCCLUSION IN CHILDREN**

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抽象。远端闭塞 (DO) – 是最常见的牙颌畸形, 已发表的数据证明。因此, 我们的研究目的是以临床病例为例, 探讨危险因素对正畸牙根型远端闭塞患儿正畸治疗结果质量的影响。在检查患者时, 使用了主要的 (临床) 和其他的 (仪器性) 研究方法。我们的研究使得弄清某些因素对牙面异常的二级预防和治疗效果的影响成为可能。

关键字: 远端闭塞, 牙槽骨形式, 正畸治疗, 儿童。

Abstract. *Distal occlusion (DO) – is the most prevalent dentofacial anomaly, as evidenced by published data. Therefore, the aim of our research was to analyse the influence of risk factors on the quality of the results of orthodontic treatment of children with a dentoalveolar form of distal occlusion using a clinical case as an example. The main (clinical) and additional (instrumental) research methods were used in the examining of the patient. Our research made it possible to clarify the influence of certain factors on the effectiveness of secondary prevention and treatment of dentofacial anomalies.*

Keywords: *distal occlusion, dentoalveolar form, orthodontic treatment, children.*

Relevance

Distal occlusion (DO) – is a common dentofacial anomaly, as evidenced by published data. Distal occlusion is detected in 11% of children during routine examination. The prevalence of DO in the second transitional period of mixed dentition (9–11 years) is 2 times higher in comparison with the first transitional period of mixed dentition (6–8 years). DO is 24.5 - 37.3% of all detected occlusion anomalies of teenagers. DO is diagnosed in more than 40% of children turning for orthodontic treatment [1-7].

Distal occlusion is characterised by the relationship of dentitions in the sagittal direction in which the mesiobuccal cusp of the upper first permanent molar contacts anterior to the mesiobuccal groove of the lower first permanent molar. DO has two varieties - Divisions I and II of Angle's Class II malocclusion depending on the incline of the incisors. There are dentoalveolar and skeletal forms of DO [3]. Often, patients with distal occlusion and other dentofacial anomalies, which are combined and are cause functional and aesthetic disorders, turning for the orthodontic treatment [3-5,7,8].

Clinical manifestations of distal occlusion are attracting attention due to the high prevalence and impact on the quality of life of patients [5,6,9,10]. So, in the examination of children with DO, the researchers revealed the relationships of the first permanent molars according to Angle's Class II malocclusion in the vast majority of cases. The authors suggested that DO in all these children was due to a violation of the size or position of the upper jaw and its dentition based on the results of a clinical functional test according to Eschler-Bittner [1].

The relationship of the first permanent molars from the right and from the left may differ from each other and from Angle's criteria. The position of the first permanent molars in the mesio-distal direction in the first transitional period of mixed dentition is affected by the width of the crowns of temporary molars. The upper permanent molars migrate in the mesial direction in case of premature loss of the upper temporary molars. As a result, the relationship of the first permanent molars according to Angle's Class II malocclusion is formed. Depending on the situation, the upper molars are distalised to achieve a relationship according to the Angle's Class I using orthodontic appliances with mechanical action [9,11-15]. The features and effectiveness of DO treatment in patients with abnormalities of the sizes of permanent teeth are analysed [6,9,11,16]. The mechanism of action of various intraoral orthodontic appliances used to eliminate DO is discussed.

Purpose of the study - to analyse the influence of risk factors on the quality of the results of orthodontic treatment in children with a dentoalveolar form of distal occlusion using a clinical case as an example.

In accordance with the purpose, the tasks were identified: To determine the deviations in the sizes of the crowns of teeth and dentitions from the individual norm, to determine the proportionality of the segments of the dentitions. To study the effect of premature loss of temporary teeth on the formation of dentofacial anomalies. To analyse abnormalities in the position of teeth and relationship of antagonist teeth, dentitions and risk factors depending on the period of occlusion formation in the dynamics of orthodontic treatment in a patient with distal occlusion.

Material and research methods

The analysis of the clinical case was carried out. In the study of the patient, the

main (clinical) research methods were used: survey, examination, tests to study the respiratory function, speech function, biting, chewing, swallowing, Ilyina-Markosyan and Eschler-Bittner clinical functional tests [3,5,7].

Additional (instrumental) research methods were used to clarify violations of the harmony of the face, the structure of the dentition and occlusion [3,5- 7,11,17].

Photometry of the face was carried out in direct (face symmetry, face proportionality, Isar facial morphological index) and lateral (Ricketts method, Dreyfus profile field, profile angle) projections.

The sizes of tooth crowns were studied on diagnostic models of jaws in comparison with the average data by Ustimenko [18]. We have determined the proportionality of the width of the crowns of the incisors by the Tonn index, the proportionality of the segments of the dentition by the Gerlach formula. The width of the dentitions and length of the anterior parts of the dentitions were compared with the individual norm according to the Pont and Korkhaus tables. We have analysed the longitudinal length of the dentition using the Nance method. The condition of the jaws' bone tissue, temporary and permanent teeth, the tilts of permanent teeth in the dynamics of treatment were analysed using the method of orthopantomography [19].

Results and discussion

For the first time, patient L. turned to the orthodontist at the age of 7 years in the first transitional period of mixed dentition with complaints about the incorrect position of the lower incisors. His parents revealed violations of the position of the lower incisors during their teething.

From the anamnesis - L. was born on time, full-term, was growing and developing in accordance with age. Somatic diseases were not identified. Did not go to the dentist for treatment. Tooth 84 was removed due to tooth decay implications at the age of 6 years. The hereditary of dentoalveolar anomalies has not been established.

The configuration of the face was not changed. The relationships of the temporary canines was physiological, the distal surfaces of the crowns of the second temporary molars-antagonists were in one plane. L.'s parents refused to make an orthopantomogram and face photos.

The diagnosis was formulated based on the information received: neutral occlusion, dental arches contraction, crowded incisors, secondary tooth adentia of 84. The risk factors for dentomaxillary anomalies were revealed - the absence of physiological tremas in the front of the dentitions, the crowded position of erupting lower incisors, secondary tooth adentia of 84. The relationship of the distal surfaces of the crowns of temporary molars-antagonists in one plane assumed the eruption of the first permanent molars according to Angle's Class II malocclusion.

The removable expansion plates on both dentitions was made for the patient in accordance with the plan of orthodontic treatment. The defect of the lower dentition on the right has been restored to prevent unwanted migration of teeth towards the defect, to prevent shortening of the lateral segment and to prevent breaking the contact of antagonists teeth. It was recommended to exclude "bad habits", functional disorders, to observe a correct posture.

The proposed measures were intended to eliminate existing deviations and to create conditions for the formation of the physiological occlusion. However, the patient refused to use orthodontic appliances and did not visit the orthodontist for 1.5 years.

The patient reapplied at the age of 8 years 6 months with complaints about the crowded position of the lower incisors. The violations of posture that included tilting the head back and excessive bending of the cervical spine were identified. The face configuration of the patient was slightly changed. The profile of the face was convex, $\square n\text{-sn-pg} = 164^\circ$. The contours of the lips and soft tissues of the chin remained within the Dreyfus profile field. The protruding lip points did not touch the pn-pg aesthetic line (Ricketts). The proportionality of the departments of the lower third of the face was violated.

The dental formula of patient L. at the age of 8 years 6 months corresponded to the first transitional period of mixed dentition. The physiological diastema (1.0 mm) between the upper permanent central incisors, the absence of space for eruption of the upper lateral incisors, the crowded position of the lower incisors, the asymmetry of the lower dentition, the shortening of the right lateral segment, the absence of space for eruptions 42 were identified. The middle lines of the dentitions were not coincided, the relationship of the temporary canines was physiological on the left and was class II on the right.

No bone pathology was detected, the formation of the roots of erupted teeth and the tooth germs corresponded to the first transitional period of mixed dentition on the orthopantomogram of the jaws of L., aged 8 years, 6 months. We paid attention to the delay in the resorption of the roots of temporary teeth, the absence of space in the mandibular arch for the eruption of permanent lateral incisors.

The dentition was expanded and elongated according to the plan of orthodontic treatment. The patient used removable expansion plates with mechanical action, including those with improved designs [12]. It was recommended to consult an orthopedic surgeon to normalize posture. The patient performed therapeutic myogymnastics. Posture has improved. The face configuration was slightly changed, as evidenced by the value of the facial morphological index ($\text{IFM} = (\text{oph-gn} \times 100) / \text{zy-zy} = 87.5$). The contours of the lips and soft tissues of the chin remained within the Dreyfus profile field. The protruding lip points did not touch the pn-pg aesthetic line (Ricketts). $\square n\text{-sn-pg} = 163^\circ$. We noticed a decrease of the

lower facial height (oph-sn)>(sn-gn) and a violation of the proportionality of the departments of the lower third of the face (sn-st):(st- gn) = 1:2,1.

All temporary teeth were removed at the age of 12 years under the control of orthopantomography due to the delayed eruption of permanent teeth. Orthodontic treatment were continued with removable expansion plates. Neutral occlusion was achieved. The deep overbite was fixed. The position of the incisors improved, but their crowded position remained. A place in the lower dentition for the eruption of the permanent canines and second premolars was created. A satisfying result of orthodontic correction of the sizes of the dentitions implied the correct eruption of the lateral teeth [15]. In this regard, the patient was recommended to exclude functional disorders and "bad habits", to visit the orthodontist twice a year to control the eruption of permanent lateral teeth and the formation of a permanent occlusion. The patient and his parents were satisfied with the result of the treatment and stopped visiting the orthodontist; recommendations were not followed.

The patient again turned to the orthodontist with complaints about the crowded position of the lower incisors at the age of 15 years. The examination revealed an improvement of a posture and of a head's tilt as a result of eliminating "bad habits" and playing sports. The tension of the facial muscles during the conversation and a slight restriction in opening the mouth were payed attention. A "bad habit" to lean hand on the chin was revealed.

The configuration of the face at rest was harmonious, the profile was aesthetic. Photometry performed at the time of occlusion showed a decrease of the lower facial height. The correct cusp-to-fissure occlusal contacts of the posterior teeth were determined in the oral cavity. The upper incisors overlapped the lower incisors by more than 1/2 their height. The lower incisors were long-axis rotated and in the crowded position.

Measurement of diagnostic models of the jaws showed an asymmetry in the width and height of the dental crowns. The proportionality of the segments of the dentitions were impaired. The macrodontia of single teeth was determined. An absence of space in the arches for the eruption of the tooth germs of 28, 38, 48, the curvature of the permanent teeth roots were revealed on the orthopantomogram. There was no tooth germ of 18.

The diagnosis was formulated: neutral occlusion, deep overbite, crowded position of the incisors, long-axis rotation of the teeth 12, 22, 31, 32, 41, 42.

The patient and his parents were explained the need to control correct posture, to exclude "bad habits" and functional disorders. We recommended orthodontic treatment by the Damon Q brackets with the corresponding power elements. The patient and his parents were directed to remove the tooth germs of 28, 38, 48 and were warned about the possibility of some problems while teeth

moving and the formation of occlusion. They agreed with the treatment plan but asked to remove the tooth germs later cited family obligations.

A satisfying result was achieved by the orthodontic treatment with the Damon Q brackets with the corresponding power elements. A slight asymmetry of the position of the curved teeth roots was payed attention on the orthopantomogram after completion of the orthodontic correction of occlusion. The position of the tooth germs of 28, 38 and 48 significantly had been getting worse in the dynamics of observation from 15 to 17 years. The tooth germs of these had been removed.

Conclusion. Our research made it possible to clarify the influence of certain factors on the effectiveness of secondary prevention and treatment of dentofacial anomalies. Late turning for the dental treatment led to the destruction and extraction of the tooth 84 due to tooth decay implications three years before the time of eruption of the first premolar. Orthodontic treatment that was began at the age of 7 years about neutral occlusion and dental arches contraction could create conditions for the incisors teething, prevent further deformation of the lower dentition and improve the situation. But it was interrupted.

The absence of replacement of the lost tooth 84 promoted the mesial migration of the lateral teeth on the affected side, the asymmetry and the shortening of the lower dentition. It was managed to normalise the relationships of the first permanent molars and to create conditions for the eruption of permanent canines and premolars, when the patient reapplied after 1.5 years in the first transitional period of mixed dentition. An attempt to expand the dentitions and to normalise the position of the incisors with removable expansion plates wasn't successful.

Regular pressure on the chin ("bad habit") and the formation of excessive bending of the cervical spine promoted further deterioration of occlusion. The orthodontist diagnosed distal occlusion in combination with the deep overbite the next time the patient complained about the crowded position of the lower incisors. The clinical situation was gotten worse by a delayed eruption of permanent teeth of unknown etiology, asymmetry in the width of the crowns and the curvature of some permanent teeth roots. The effect of the insufficient cooperation of the patient and his parents with dental specialists on the results of secondary prophylaxis and orthodontic treatment is also visible.

Findings

1. Premature 84 tooth loss led to the shortening of the right lateral segment, to the asymmetry of the lower alveolar arch and to the disruption of the occlusal contacts.
2. The asymmetry of the tooth crowns' sizes and the curvature of some permanent teeth roots made it difficult to achieve an orthodontic result in accordance with the generally accepted "six keys of occlusion" according to Andrews.

3. Late removal of the tooth germs of 28, 38, 48 had been leading to the deterioration in their position (tilt) in the dynamics of observation (15-17 years).
4. Violation of the proportionality of the thirds of the patient's face with distal occlusion was a manifestation of the combination of the dentoalveolar form of the distal occlusion with the deep overbite.
5. The results of orthodontic treatment were influenced by insufficient motivation and cooperation of the patient and his parents with dental specialists.

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基于蒙医学“六基症”理论的“胃包如病”临床表现及治疗
**A BRIEF DISCUSSION ON THE MANIFESTATIONS AND
TREATMENTS OF STOMACH BAORU DISEASE FROM THE THEORY
OF SIX FUNDAMENTAL DISORDERS PERSPECTIVES**

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摘要: 本文以蒙医学经典著作《甘露四部》中论述的“六基症”理论为基本依据, 结合现代蒙医临床胃包如病诊疗现状, 对胃包如病的病因、分类、临床症状及治疗进行了概要讨论。同时, 作者以“六基症理论”为疾病分类的基本原则, 概括总结了胃包如病六种亚型症候的临床表现。

关键词: 六基症 赫依 希拉 巴达干 楚苏 希拉乌素 粘浩日海 胃包如病

Abstract. *Depending upon the the theory of Six Fundamental Disorders which is documented in the Four Ganlu treatises in Mongolian Medicine and combining with the current clinical observation and treatments on the Stomach Baoru disease, this article discussed generally the pathogenesis, categories and manifestations of the disorders. Meanwhile, the six sub-types' manifestations of Stomach Baoru disease are carefully described here through the author's investigation according to the primary principles of this theory, and summarized the clinical characteristics and treatment of the six sub-types of Stomach Baoru disease.*

Key Words: *Six Fundamental Disorders; Khii; Shar; Badgan; Chusu; Sharvsv; Nianhorhai , Stomach Baoru disease*

I. Introduction

At the end of the 17th century, Ishibaljur^[1], a modern Mongolian medicine expert, put forward the theory of “six fundamental disorders” in Mongolian medicine (the theory of “six fundamental disorders” or “six causes” for short).

On the basis of the “three roots” (also known as “three voxels” or “three filths”) theory in “Khii” (primordial Qi), “Shar” (bile), and “Badgan” (mucus, tissue fluid, etc.),^[2,3] the “six-base disease” theory introduces the pathogeny of

"three elements" called "Chusu" (blood), "Sharvsv" (yellow water), and "Nianhorhai" (pathogenic microorganism, also including beneficial flora of human body). It is a core theory with the characteristics of modern Mongolian medicine theory, which systematically explains the pathogenesis of six fundamental disorders of Mongolian medicine—Khii disease, Shar disease, Badgan disease, Chusu disease, Sharvsv disease and Nianhorhai.

When the interaction and influence between the "three roots" and "three elements" (Chusu, one of the seven essential substances and its metabolic "rough substance" Sharvsv, as well as Nianhorhai, the special pathogenic pathogens) of human body and the metabolism and development activities of the seven essential substances (chylus, blood, muscle tissue, adipose tissue, bone, bone marrow nerve tissue, and reproductive fluid) are in a relatively balanced state, human physiological health can be maintained. If the six causes of "six fundamental disorders" deviate or lose their relative balance under the influence of internal and external factors, Then, due to the increase, loss and disorder of the six causes, "Khii disease", or "Shar disease", or "Badgan disease", or "Chusu disease", or "Sharvsv disease", or "Nianhorhai disease", or other aggregated diseases happen, which can destroy the functional structure of other organs and systems in the body, resulting in complications or systemic diseases. The theory of "six fundamental disorders" in Mongolian medicine is a unique theoretical system that continues to this day to explain human physiology and pathology, and is also the core theory of Mongolian medicine in clinical treatment of various diseases based on syndrome differentiation^[4-10]. The author's "six causes" are applied to the clinical and treatment of stomach diseases caused by accumulated heat, which is of more practical significance.

II. Stomach Baoru disease

2.1 Concepts and Symptoms

According to the theory of six fundamental disorders in Mongolian medicine, Khii-Shar-Badgan's "aggregation disease" combined with Chusu is "Baoru disease". When Baoru disease mainly involves stomach organs, it is called "stomach Baoru disease". Compared with clinical digestive system diseases in modern medicine, Stomach Baoru disease should belong to the category of peptic ulcer. This disease is a common and multiple digestive system disease in Mongolian medicine. According to Mongolian medical pathology, Stomach Baoru disease is caused by human life activities suffering from "three karma" (body, language and psychological activities)^[11, 12], as well as "four external factors" (diet, daily life, climate, and environment) and other special factors. The relative balance of the internal environment of the body has been destroyed (deviating from the constant equilibrium state of the system), especially the diseases caused by the sepsis produced after the decomposed Badgan in the stomach interacts with Chusu, Shar,

Khii and Nianhorhai, and mixing with Sharvsv, and then infiltrating the gastric mucosa. This disease is a polymeric chronic gastropathy with more than one abdominal pain, loss of appetite, acid regurgitation and belching as its main clinical manifestations [13, 14]. In the classic works, most of them are divided into four types [15]: diffusion (divided into internal dispersion and external dispersion), expansion (divided into partial penetration and non-partial penetration), sudden volumes (divided into abrupt volumes and non-sudden volumes), and aggregation (new volumes and old volumes). The author thinks that in clinical application this classification is not as good as that of “six causes” and the latter has more practical significance.

2.2 Therapeutic drugs

According to the records of *Sibu Ganlu* and other documents and the experience of the late famous Mongolian doctor Dushi [6] and the current famous Mongolian doctor Ashi in Inner Mongolia today, In their clinical work, they often use 16 kinds of diets, 4 kinds of food, clothing, housing and transportation, 30 kinds of prescriptions and 16 kinds of therapies to treat diseases, which are less applied according to the classical categories, and are more inclined to classify and treat diseases with “six causes”. Therefore, the classification of “six causes” has more clinical guiding significance.

III. The etiology, clinical manifestation and treatment of Khii disease among “six fundamental disorders”

3.1 Function of normal and healthy “Khii”

As one of the “three roots” of the human body, Khii, in a normal, healthy and balanced state, plays the role of completing the physiological functions of human organs and nerve functions, and is one of the essential vital energy elements of the human body. In a normal state, Khii performed “breathing smoothly, acting, working, contributing to latent diseases, and making his senses clear and his body strong” [15].

3.2 Clinical manifestations of Khii disease

Healthy Khii was damaged by the irregular life as a result of the faults in conduct karma, speech karma and thinking karma^[11,12], pessimistic mood, lack of sleep, poor diet, lust and excessive thinking, etc., and frequent diet of buckwheat, strong tea and other bitter, cold food, nutrient deficiency for long-term consumption of low-nutrient food, living in a cold environment wearing thin clothing and other living factors, some seasonal factors such as summer, dawn and night, plus some special factors (under the historical conditions at that time, the causes of diseases such as tetanus and plague that were difficult to explain, the same as below). Due to the adverse effects of these “four external causes”, the function of Khii appears to be overactive, declining and disordered, which makes the “three root” function lose relative balance and lead to Khii disease. The main manifesta-

tions include trembling, yawn, chills, retching, blurred perception of five senses, restlessness, mood instability, palpitations, insomnia, systemic wandering pain, dizziness, warmth preference, fasting pain. The constitution of the elderly is Khii-dominated, and they are susceptible to Khii disease. In addition to signs and symptoms such as the pressing pain at the acupoint of Khii, the pulse is empty, the tongue coating is dry and red, and the urine is light with much large foam.

3.3 The clinical manifestation of stomach Baoru disease of Khii type

In addition to the symptoms of Khii disease, the clinical manifestations of stomach Baoru disease of Khii type include epigastric distension, chest tightness, lack of food, acid regurgitation, aggravation in case of depression, ease in case of belching or venting, and testiness and so on.

3.4 Treatment of stomach Baoru disease of Khii type

The adjustment of eating behavior of Khii disease is mainly based on the consumption of spicy, sweet, warm and nutritious food such as scallion, mutton and brown sugar, and the anti-Khii drugs. The living environment of the patients is mainly arranged in a quiet, elegant and comfortable place with a comfortable mood, so that the symptoms can be alleviated to cure.

IV. The etiology, clinical manifestation and treatment of Shar disease among “six fundamental disorders”

4.1 Functions of healthy Shar

As one of the "three roots" of the human body, Shar exists in the middle of the body. Under normal, healthy and balanced state, it can transform the heat energy of human body and participate in the function of material metabolism. It is one of the essential vital energy elements in human body. Under normal state, Shar performs the function of “feeling hungry and thirsty, feeding and digestion, providing heat and energy to maintain physical and mental activities”^[15].

4.2 Clinical manifestations of Shar disease

Healthy Shar is damaged by the faults in conduct karma, speech karma and thinking karma, and frequent diet of garlic, wine and other spicy, acid, and warm food, long-term consumption of high calorie food and other dietary factors; living in a hot and warm environment, sunburn, fatigue and other living factors; in case of autumn, noon, midnight and other seasonal timing factors, plus trauma and so on. Due to the adverse effects of the “four external causes”, the function of Shar appears to be overactive, declining and disordered, thus making the "three roots" function lose relative balance and lead to Shar disease. The main symptoms are pain in the mouth, fever, headache, chest and back pain, preferring sour and spicy food, and pain aggravation after eating, etc. The constitution of the middle-aged and young people are Shar-dominated, and they are susceptible to Shar disease. In addition to signs and symptoms such as pressing pain at the acupoint of Shar, the pulse is tense, full, stringy, or rapid; the tongue coating is yellow, thick and greasy,

and the urine is yellow with strong odor.

4.3 The clinical manifestation of stomach Baoru disease of Shar type

In addition to the symptoms of Shar disease, the clinical manifestations of stomach Baoru disease of Shar type include epigastric pain, burning sensation, obvious relief of pain after ingestion, or pain after ingestion, dry and bitter mouth, appetite for cold drinks, acid vomiting, noise, irritability, constipation and other symptoms and signs.

4.4 Treatment of stomach Baoru disease of Shar type

The dietary behavior regulation of Shar disease is mainly based on eating cold food or medicine such as fresh goat meat and fresh milk of cow and goat. The cool environment is suitable for patients and the symptoms were relieved to cure after resting at ease.

V.The etiology, clinical manifestation and treatment of Badgan disease among “six fundamental disorders”

5.1 Function of normal and healthy “Badgan”

Badgan, as one of the “three roots” of the human body, is one of the essential and important life energy elements of the human body to complete the functions of digesting food, regulating body fluid function and secreting substances under normal, healthy and balanced conditions. Under normal conditions, Badgan performs the function of “strong body, strong will, tough joints and soft body when sleeping”.

5.2 Clinical manifestations of Badgan disease

Healthy Badgan is damaged by the faults in conduct karma, speech karma and thinking karma, and the frequent diet of lettuce, immature fruit, pork and other sweet, cold food, continual eating before full digestion and other dietary factors, living in windy and damp cold environment and other living factors; in the case of spring, early morning, dusk and other seasonal factors. Under the bad influence of the “four external causes”, the function of Badgan is overactive, declining and disordered, thus making the “three roots” function lose relative balance and leading to Badgan disease. The main symptoms include loss of appetite, vomiting, abdominal distension, hiccup, fatigue, body coldness and aggravation after meals and so on. The constitution of children is Badgan-dominated, and they are susceptible to Badgan disease. Besides signs and symptoms such as pressing pain at the acupoint of Badgan, the pulse is dull, late and weak, and the tongue coating is white, wet and slippery, and the urine is white with weak smell.

5.3 The clinical manifestation of stomach Baoru disease of Badgan type

The clinical manifestations of stomach Baoru disease of Badgan type include not only the symptoms of Badgan disease, but also symptoms and signs such as faint stomachache, preference for warmth and pressure, easy attack or aggravation in case of cold or tiredness, abdominal distension after eating, tiredness and

fatigue, mental fatigue and laziness, aversion to cold, cold limbs, loose stool, light and tender tongue, tooth marks on the edge of tongue, thin and white tongue coating, heavy and thin pulse or late pulse.

5.4 Treatment of stomach Baoru disease of Badgan type

The dietary behavior regulation of Badgan disease is mainly based on eating warm foods such as fish and yogurt, adding clothes or mucus-removing, emetic and diuretic drugs. A warm environment is more suitable for patients, and the disease condition is alleviated to cure after appropriate physical activity.

VI. The etiology, clinical manifestation and treatment of Chusu disease among “six fundamental disorders”

6.1 Function of normal and healthy “Chusu”

Chusu (blood), as one of the “three elements” of human disease, is also one of the “seven substances” that make up human diet, blood, muscle, fat, bone, bone marrow, semen, etc.. Under normal, healthy and balanced conditions, Chusu spreads all over the body through blood vessels, maintaining the foundation of human life, forming an important link in metabolism, and becoming an important material basis for transforming and nurturing muscles.

6.2 The clinical manifestation of Chusu disease

In the process of subtle transformation of diet into blood, healthy Chusu often induces or accompanies Shar fever, disorders in the “three karma” of body, language and psychological activities, and dietary factors such as eating leeks and hot food. due to the adverse effects of “four external factors” such as living in a warm environment, the function of Chusu appears in prosperity, decline and disorder, which leads to the relative balance between “three roots” and “three elements”, leading to Chusu disease. Chusu disease is one of the most characteristic and dominant diseases in Mongolian medicine^[16-19]. Diseased Chusu (blood) can also form endotoxin or splenic disease, Chusu-Shar disease and other diseases in the body. The main symptoms and signs are chest and rib tingling, facial redness, corneal red filaments, high fever, irritability, headache, sore throat, dry mouth, avoiding light, epistaxis, gingival blood, skin purple spots, mouth and tongue blood blisters and so on. The diagnosis of Chusu disease is mainly based on the above-mentioned clinical manifestations, moreover, some special manifestations of pulse, red tongue, yellow, fissure, black, and yellow-red urine should be observed.

6.3 The clinical manifestation of stomach Baoru disease of Chusu type

In addition to the symptoms of Chusu disease, the clinical manifestations of stomach Baoru disease of Chusu type also showed high fever, irritability, headache, red throat, dry mouth, epistaxis, gingival blood, skin purple spots, mouth and tongue blisters and other symptoms and signs.

6.4 Treatment of stomach Baoru disease of Chusu type

The dietary behavior regulation of Chusu disease is mainly pungent taste, cold

food or medicine; the patient is expected to live in a cool environment and rest at ease, and the disease condition is alleviated to cure after bloodletting treatment.

VII. The etiology, clinical manifestation and treatment of Sharvsv disease among “six fundamental disorders”

7.1 Function of normal and healthy “Sharvsv”

Sharvsv is one of the “three elements” of disease and the “essence of bile” produced in the derivation process of the “seven substances”. Under normal, healthy and balanced conditions, Sharvsv exists in all parts of the human body, especially in skin and joints, which lubricates the joints of the whole body and makes them move with ease.

7.2 The clinical manifestation of Sharvsv disease

Sharvsv disease refers to the pathological changes caused by abnormal states such as excessive, weak and dysfunction caused by inducement and external interference of healthy Sharvsv. Sharvsv disease is divided into cold and heat. Heat Sharvsv disease is accompanied by disordered Khii and Shar. Cold Sharvsv disease is accompanied by disordered Khii and Badgan. Therefore, Sharvsv disease has both pathological manifestations of cold and heat. According to the degree of influence of "three roots" and "four external factors" on healthy Sharvsv, its function may be excessive, weak and disordered, resulting in heat or cold Sharvsv disease. However, the pathological changes of Sharvsv can cause various diseases such as rheumatoid arthritis, various rashes, and edema, etc. by combining and accumulating.

7.3 The clinical manifestation of stomach Baoru disease of Sharvsv type

The clinical manifestations of stomach Baoru disease of Sharvsv are mainly skin damage, pruritus, rash, bone and joint swelling and pain, and pathological changes.

VIII. The etiology, clinical manifestation and treatment of Nianhorhai disease among “six fundamental disorders”

8.1 Normal and healthy Nianhorhai

Nianhorhai or Myxovirus (pathogenic microorganisms, viruses, bacteria, mold, mycoplasma, chlamydia, gastrointestinal parasites, trichomonas, tooth decay, etc.) is one of the "three elements" of disease. Under normal, healthy and balanced conditions (healthy immune system function), Nianhorhai or myxovirus does not invade skin, head, digestive tract, reproductive tract, blood and other body parts.

8.2 The clinical manifestation of Nianhorhai disease

Nianhorhai or myxovirus is adversely affected by the "four external factors". When it is excessive, weak and dysfunctional (imbalance of normal flora in the body, acid-base imbalance in the internal environment, etc.), it will attack skin, mucosa, head, digestive tract, reproductive organs, blood, etc. to lead to Nianhorhai disease. There is no difference between cold and heat in Nianhorhai disease,

but it is infectious. Nianhorhai of pathological changes can cause various myxovirus diseases (bacterial infectious diseases, viral epidemic diseases, influenza, virulent infectious diseases, etc.) by combining and accumulating. Therefore, Nianhorhai disease also belongs to "six fundamental disorders" in disease classification.

8.3 The clinical manifestation of stomach Baoru disease of Nianhorhai type

The clinical manifestations of stomach Baoru disease of Nianhorhai type are mainly abdominal pain, abdominal distension, nausea in the morning, acid regurgitation, belching and hunger. In severe cases, the symptoms include nausea, vomiting, chills, cold sweat on the back, erect hair, joint pain, dyspnea, occasional high fever, irregular heart rate, irritability, reddish brown body surface, accompanied by cramps, vomiting, diarrhea and so on.

IX. Conclusion

The theory of "six fundamental disorders" in Mongolian medicine, founded by modern Mongolian medical scientist and famous Wise Ishibaljur, is a theoretical hypothesis that organically integrates and systematizes the traditional "three roots" theory of Indian, Tibetan and Mongolian medicine with the "three elements" pathological theory of Mongolian medicine. The "six fundamental disorders" deduced and explained by this theoretical hypothesis is the basic principle of clinical disease classification and diagnosis in Mongolian medicine, and this principle is also applicable to guiding the clinical etiological classification, diagnosis and treatment of stomach Baoru disease. The clinical manifestations and treatment of six etiological subtypes of stomach Baoru disease are the experience summary of Mongolian doctors' long-term clinical observation and practice, and have more clinical guiding significance.

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毒血症对婴儿严重烧伤中血压昼夜节律的影响
**THE EFFECT OF TOXEMIA ON THE CIRCADIAN RHYTHM OF
BLOOD PRESSURE IN SEVERE BURNS IN INFANTS**

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抽象。根据对收缩压 (SBP), 舒张压 (DBP) 监测结果的分析, 作者发现, SBP 的每日显着波动是第3组最严重儿童的特征。儿童是由于组3中交感肾上腺系统衰竭的病情严重而引起的。SBP昼夜节律的顶峰相和水相峰迁移是烧伤毒血症期间幼儿血液动力学适应性的重要组成部分 疾病, 在稳定SBP和DBP值中起作用。烧伤越严重, SBP, DBP的差异范围越大, 则每周血压波动的增加幅度越大。

关键词: 毒血症, 烧伤, 婴儿, 血压, 昼夜节律。

Abstract. *Based on the analysis of the results of monitoring systolic (SBP), diastolic (DBP), the authors revealed that significant daily fluctuations in SBP are characteristic of the most severe children of group 3. The decrease in DBP at 1 day in the most severe children was due to the severity of the condition on the verge of depletion of the sympathoadrenal system in group 3. Migrations of the acrophase and bathyphase peaks of the SBP circadian rhythm were an important part of the adaptation of hemodynamics of young children during toxemia in burn disease, playing a role in stabilizing the SBP and DBP values. The more severe the burn injury, the greater the range of differences in SBP, DBP, the greater the increase in the weekly period of fluctuations in blood pressure.*

Keywords: *toxemia, burns, infants, blood pressure, circadian rhythm.*

Relevance. *With imperfection of the subcortical parts of the brain of young children (up to 3 years old), a higher metabolism, a high content of water in the*

brain tissues are noted, which leads to the appearance of a more severe symptom complex of shock, a period of toxemia, septic toxemia and burn exhaustion. The cardiovascular system has great compensatory capabilities, which leads to persistent circulatory disorders, a state of decompensation of the contractile function of the heart develops due to its increased contractility. Due to the high risk of complications and mortality, the problem of developing effective timely corrective measures remains relevant [1,2,3].

Purpose. Study the effect of toxemia on the circadian rhythm of blood pressure in severe burns in infants.

Material and research methods. A total of 29 children were studied from the age of 5 months to 3 years. Patients were examined depending on the severity and area of damage, age, duration of treatment in the ICU. So in infancy, the number of children in ICU up to 10 days was 17 (1 subgroup), 11-20 days - 7 children (2 subgroups), more than 21 days (21-40 days - 5 infants). Assessment of the severity of the burn was carried out by calculating the surface area of the damaged skin and using the Frank index. An assessment is given of changes in the structural characteristics of the circadian rhythm of systolic (SBP), diastolic (DBP) blood pressure in terms of mesor, acrophase, bathyphase, daily amplitude, circadian index (CI) of SBP and DBP during burn toxemia in children under 3 years of age. CI - the ratio of the average in daylight to the average blood pressure in the nighttime. Calculated according to age-related regulatory data, CI SBP is 1.16, CI DBP is 1.2. A detailed analysis of reliably significant deviations, intergroup differences of the studied parameters was carried out. The results were obtained by monitoring with hourly recording of the studied parameters. The research data were processed by the method of variation statistics using the Excel program by calculating arithmetic mean values (M) and mean errors (m). To assess the significance of differences between the two values, Student's parametric criterion (t) was used. The critical level of significance was taken equal to 0.05. Intensive therapy from the moment of admission was aimed at removing from burn shock, simultaneous anesthesia and intravenous administration of crystalloids, volemic solutions under the control of hemodynamics, volume of diuresis. Regular administration of painkillers, cardiogenic, desensitizing, stress-limiting agents, vitamins. According to indications, hormones and blood substitutes were used. Humidified oxygen was inhaled. For all children, vitamins C and group B were used, antipyretic and hypersensitizing agents, as well as drugs against stressful damage to the gastrointestinal tract, convalescence, septicotoxemia and toxemia. According to indications, early surgical necrectomy, prophylaxis of coagulopathy, energy-deficient state, volemic disorders, and correction of "tachycardial syndrome" were successfully carried out.

Results and discussion.

Table 1

Characterization of infants with thermal burns.

Groups	Age in months	Height, cm	Weight, kg	S, %	2-3 A	3 B	IF, units	Number n/d in the hospital	n/d ICU
1	19,3±6,2	81,6±8,8	10,9±2,2	32,7±9,8	32,7±9,8	0,1±0,03	33,4±10,1	15,4±3,5	6,8±1,8
2	14,2±4,6	79,7±5,7	10,1±1,9	33,6±7,6	24,8±7,4	9±2,8	48,4±11,28	41,6±10,2	12,8±1,3
3	10,1±2,1*	71±2,5	9,9±0,8	32,7±4,9	26,7±2,2	6±2,7*	71,3±8,4*	49,3±3,8*	26,3±2,4*

* reliably relative to data in 1 group

As shown in Table 1, there were no significant differences in anthropometric data (height, body weight), burn surface area, or lesion area of grade 2-3A. However, a significant age difference was found. Children of group 3 were younger than patients of group 1 by 9 months ($p < 0.05$). The area of 3B degree lesion reliably prevailed by 5.9% ($p < 0.05$), IF ($p < 0.05$) was more than twice as large, which accordingly led to an increase in the duration of intensive therapy in ICUs by 20 days ($p < 0.05$) and treatment in a hospital for 34 days ($p < 0.05$) due to the severity of the condition. Thus, the main factors affecting the severity of the condition of children with thermal burns of infancy were age (the younger the child, the more severe the condition), the area of skin surface damage of grade 3B, and IF. Thus, age, IF index, and area of thermal damage of degree 3B can serve as objective indicators of the severity of thermal burns and can predict the duration of intensive care in ICU and inpatient treatment.

Table 2

Dynamics of phase structures of the circadian rhythm of systolic blood pressure during toxemia in severe burns in children under 3 years of age

days	Mesor, mmHg			SBP in acrophase, mmHg			SBP in bathyphase, mmHg		
	Group 1	Group 2	Group 3	Group 1	Group 2	Group	Group 1	Group 2	Group 3
1	98,7±6,9	101,6±5,7	93,6±10,5	102,3±7	120±6,7*	112±5	88±4"	91,5±2"	85±10"
2	99,5±6,8	98,3±5,3	93,1±9,5	100,7±7,3	101,5±4	98,3±12,2	97,8±6,8	95,3±5,3	86,7±4,4
3	97,6±6,7	99,0±5,7	93,9±5,2	100,6±7,3	101,7±5	101,7±7,7	94,9±6,9	95,8±4,2	87,7±1,8"
4	97,9±6,4	99,6±4,4	98,0±5,8	101,1±6,6	104,3±5	104±6	95,6±5,1	95,8±6,1	93,3±4,4"
5	101,8±5,1	101,1±6,8	98,2±4,7	103,3±4,7	106,3±6,2	102±4,7	99,9±6,6	97,3±4,3	91,7±5,6
6	102,0±6,3	102,0±6,9	95,4±4,1	105,6±6,9	105,6±8,5	101,7±5,6	99,7±5,4	98,8±4,5	91,7±2,2"
7	103,7±5,3	101,6±7,0	95,5±3,5	106,2±6,6	105,7±4,9	105±3,3	101,5±7,5	97±6,3	89±1,3"
8	104,5±5,7	99,2±4,9	99,4±7,8	108,1±3,6	103,7±8,9	107,7±5,1	101,6±6,5	94,8±4,8	90±6,1"
9	106,5±3,7	99,6±4,6	100,3±9,0	112,3±1,8	102,5±4,2*	103,7±11,6	97,7±5,1"	97±5,3	93,3±4,4
10		100,6±5,0	100,2±6,8		104,6±3,7		107,5±7,5	98,2±5,4	95±3,3
11		97,8±5,3	96,8±4,0		103,3±5,7		103,3±4,4	91,7±11,7	88,3±2,2"

12		99,1±3,1	100,0±4,5		105±5	105±3,3		95±5	95±3,3 ^{***}
13		100,5±3,8	99,7±5,9		107,5±2,5	105±6,7		92,5±2,5 ^{***}	95±5
14		96,0±4,4	99,4±7,4		102,5±7,5	104,7±9,6		90±5 ^{***}	90±13,3
15			97,1±6,3			103,3±7,8			91,7±2,2
16			96,7±4,7			101±4,7			93,3±4,4
17			95,9±3,9			100,7±0,9			90±4 ^{***}
18			96,2±3,6			103±3			90±10
19			99,1±6,8			108,3±2,2			92,5±2,5 ^{***}
20			95,8±4,6			99,3±2,9			92,3±3,1
21			102,7±6,0			108,3±8,9			97,7±5,1
22			100,4±3,6			104±2,7			96,7±4,4
23			103,9±3,5			110±3			100±6
24			106,3±4,5			113±3			100±5 ^{***}
25			98,3±4,8			112,5±2,5			90±3 ^{***}

* significantly relative to the indicator in the first group

^{***} significantly relative difference between the indicator in bathyphase and the value in acrophase in the same groups

As can be seen from the data tab. 2, the SBP mesor indices remained within the normative values throughout the entire period of toxemia in all patients. However, on the first day, a significant difference was found in SBP in children of group 2 in acrophase from the same indicator in group 1 by 18% ($p < 0.05$). On day 9, the maximum value of the SBP circadian rhythm in children of group 2 became significantly lower than the indicator in group 1 by 8% ($p < 0.05$). It is noteworthy that on the 9th day the SBP in acrophase in children of the 3rd group did not differ from the data in the 1st group due to the large scatter of data in the 3rd group. Thus, despite the absence of differences in the values of the SBP mesor between the groups by the end of the toxemia period in children of the 1st group on the 9th day with a burn surface area of the skin of $32.7 \pm 9.8\%$, predominantly 2-3a degrees, 3b-0.1±0, 03%, IF - 33.4 ± 10.1 units; the highest SBP value in acrophase (10% higher than in groups 2 and 3) was detected in children of group 1.

In addition, a significant difference was found between the SBP in acrophase and the bathyphase in group 1 on the first and ninth days by 13% ($p < 0.05$, respectively). In group 2, the difference between SBP in acrophase and bathyphase was significant at 24%, 13%, 12% ($p < 0.05$, respectively) on 1.13.14 days. In group 3, the difference between SBP in acrophase and bathyphase was significant at 24% on day 1, to a lesser extent on subsequent 3,4,6,8,11,12,17,19,24,25 days, which indicated that migrations of acrophase and bathyphase peaks, SBP circadian rhythms were an important part of the hemodynamic adaptation of young children during toxemia in burn disease. The revealed significant diurnal fluctuations of SBP were more characteristic for the most severe children of group 3.

Table 3

Dynamics of the phase structures of the DBP circadian rhythm during toxemia in severe burns in children under 3 years old

Days	Mesor, mmHg			The value in acrophase, mmHg			The value in bathyphase, mmHg		
	Group 1	Group 2	Group 3	Group 1	Group 2	Group 3	Group 1	Group 2	Group 3
1	56,0±5,0	58,3±4,5	51,9±6,3	58,6±8,1	65±5	59±4	50±5,2	53,3±4,4	40±5
2	58,5±5,1	57,9±3,8	52,6±8,5	60,2±5,2	63,3±5,6	60±8,1	55,8±5,8	55,8±5,6	48,3±7,8
3	57,6±5,1	57,2±5,0	54,1±5,1	59,6±4,5	60,2±3,6	60,7±6,2	55,3±4,4	55,8±5,8	49,3±0,9
4	57,4±4,4	58,2±2,9	55,6±5,3	60,1±5,4	59,8±1,9	60±6,7	55,1±4,7	55,8±4,2	48,3±5,6
5	59,4±4,7	58,0±5,1	55,7±3,6	61,9±5,7	62±5,3	63,3±2,2	56,9±5,1	52,5±5	50±3
6	58,5±4,6	56,8±5,0	53,3±4,4	61,2±3,7	59,7±8,1	58,3±2,2	55,8±4	52,5±6,2	46±4**
7	60,0±4,6	61,3±3,8	54,8±4,8	63,6±4,3	63,5±6,2	62,3±5,1	56,7±3,3	58±5,7	48,3±8,9
8	60,2±4,6	58,3±3,6	59,2±5,6	64,4±5,5	61,7±1,7	63,3±11,1	57,3±5,8	55,8±5,8	55±6,7*
9	57,7±3,4	58,2±3,9	55,6±5,0	62,4±5	61,8±5,2	65±10	50,3±6,9	55,2±5,2	46,7±4,4
10		57,1±3,9	57,7±3,2		60,3±3,2	62,7±3,6		53,3±3,3	52,7±3,6*
11		57,3±5,1	56,8±3,4		64,8±6,5	61,7±2,2		52,5±8,3	51,7±7,8
12		56,6±3,5	56,7±3,6		62,5±2,5	60±5		52,5±2,5	55±3,3*
13		54,0±2,3	56,1±3,2		60±5	60±7		50±5	48,3±2,2
14		58,5±2,1	55,4±4,2		65±5	58,7±1,1		55±5	51±4,7
15		58,0±5,8	57,0±3,7		60±5	60,7±0,9		50±4,5	53,3±4,4*
16			55,7±3,7			65±10			51,7±2,2
17			57,1±3,7			60±3,3			52,7±3,6*
18			54,7±3,6			60±4,5			48±3
19			57,0±5,1			61,7±5,6			53,3±4,4*
20			58,6±2,7			63,3±4,4			53,3±4,4*
21			59,4±5,8			65,3±3,6			53,3±4,4
22			61,6±4,1			67,3±8,4			55±3,3*
23			60,5±2,6			65±6,7			56±2,7*
24			61,6±4,2			67±4			55±3,3*
25			56,6±5,5			67±6			48±4

* significantly relative to the indicator in the first day

** significantly relative to the indicator in group 1

Indicators of mesor, acrophase of circadian rhythm DBP (Table 3) in the first day and throughout the period of toxemia did not differ from the normative age indicators in all children. Only in group 3, the DBP value in the bathyphase in the first day turned out to be lower than in the second group, then in the following days it increased relative to 1 day by 8.10, 12.15, 19.20, 22, 23.24 ($p < 0.05$, respectively). A decrease in vascular tone at 1 day in the most severe children was due to the severity of the condition on the verge of depletion of the sympathoadrenal system. An increase in the value of bathyphase in children of group 3 indicated effective intensive care.

As shown in Fig. 1, in group 1, the maximum range of diurnal changes in SBP was detected on days 1 and 9, which led to the formation of a 9-day period of changes in the SBP mesor, i.e., an increase in the weekly period of oscillation by two days, which is associated with an adaptive change in the weekly biorhythm at burn 2-3A degree area of $32.7 \pm 9.8\%$. In group 2, the oscillation period was 13 days, that is, an increase in the area of the burn of degree 3B to $9 \pm 2.8\%$ with the same total area of the burn surface caused an increase in IF to 48.4 ± 11.2 units, an increase in the range of daily fluctuations in SBP and DBP 1 day (Fig. 1.2), increase the weekly period of fluctuation of SBP to 13 days, and DBP to 11 days. That is, the heavier the burn injury, the greater the magnitude of the differences in SBP, DBP, the greater the increase in the weekly period of fluctuations in blood pressure. In group 3, on day 1, the range of diurnal fluctuations in the circadian rhythm of SBP was 27 mmHg, diastolic 18 mmHg. That is, in the 3rd group, on the first day, the most significant instability of blood pressure parameters was observed. On the following days of the toxemia period, diurnal fluctuations of SBP ranged from 10 mmHg to 22 mmHg at 25 days. While the daily fluctuations of DBP were in the range of 8-18 mmHg during the first 9 days, 5 - 13 mmHg from 9 to 16 days (a seven-day period of oscillation), 7 - 13 mmHg last 9 days. Thus, 3 near-week periods of fluctuation in the diurnal range of DBP were revealed, when changes in the diurnal range of SBP were relatively less pronounced. Changes in the swing range of SBP and DBP occur in waves, consistent with an understanding of such changes in biorhythms, such as a reaction to stress. The stronger the stress reaction, the greater the range of diurnal fluctuations, increases the period of weekly biorhythm during toxemia. Thus, we can say that the instability of the tone of the peripheral vessels in infants was more significant and was dependent on the severity of the injury and age than the rate of cardiac output. The results obtained fit well with the idea that in young patients, the main load in the process of adaptation of hemodynamics in a stressful situation is due to a change in the functional work of the heart under conditions of more pronounced instability of the vascular compensatory reaction of the peripheral vascular tone.

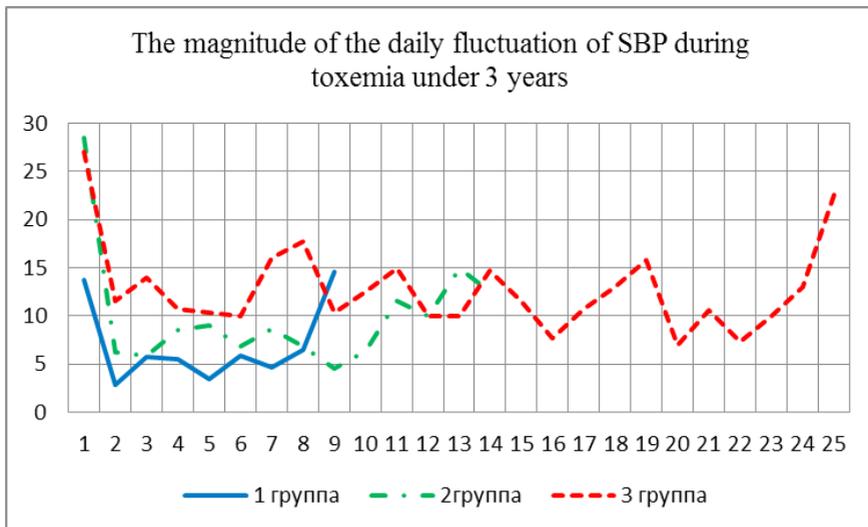


Fig.1

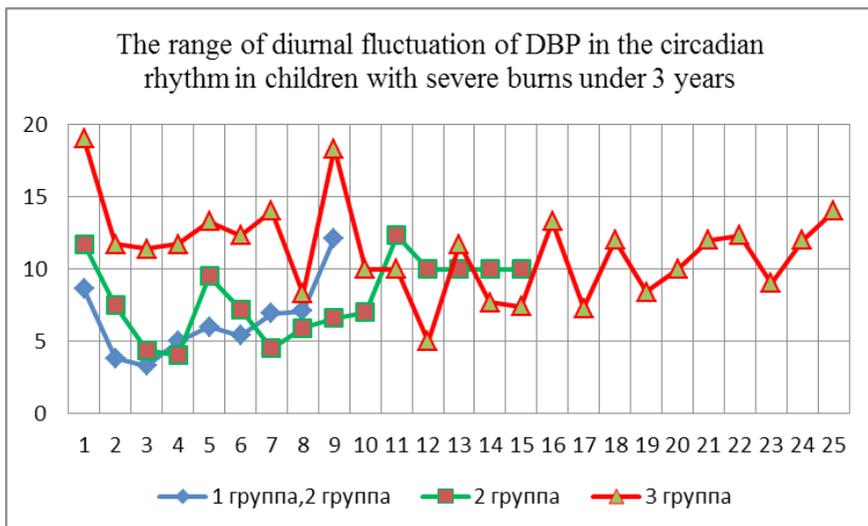


Fig.2

Table 4
Duration of migration of acrophase and bathyphase SBP circadian rhythm during toxemia

	Day			Night		
	Group 1	Group 2	Group 3	Group 1	Group 2	Group 3
Acrophase	77 % (7 out of 9)	57% (8 out of 14)	80% (20 out of 25)	23% (2 out of 9)	43% (6 out of 14)	20% (5 out of 25)
Bathyphase	66% (6 out of 9)	35% (5 out of 14)	44% (11 out of 25)	33,3% (3 out of 9)	65% (9 out of 14)	56% (14 out of 25)

Table 5
Duration of migration of acrophase and bathyphase values of DBP circadian rhythm during toxemia

	Day			Night		
	Group 1	Group 2	Group 3	Group 1	Group 2	Group 3
Acrophase	55% (5 out of 9)	80% (12 out of 15)	84% (21 out of 25)	45% (4 out of 9)	20% (3 out of 15)	16% (4 out of 25)
Bathyphase	66% (6 out of 9)	66% (10 out of 15)	52% (13 out of 25)	34% (3 out of 9)	34% (5 out of 15)	48% (12 out of 25)

Table 4 presents the duration data from the total length of stay in the ICU of the displacement of the peaks of circadian rhythms of SBP during toxemia. Thus, acrophase migrated in daylight in children of the 1st group for 77%, 2 - 57%, 3 - 80%, characterizing the insignificance of shifts in the acrophase SBP during toxemia in children. Only in group 2, 43% of children showed pathological inversion of the SBP circadian rhythm. The displacement of the acrophase of the DBP circadian rhythm by nighttime in children of the 1st group was more than 45% (Table 5). As for the migration of DBP bathyphase in the circadian rhythm, a pathological shift in the light interval of the day was detected in children of groups 1 and 2 (66%), and 52% in group 3. That is, the longer period of toxemia of the circadian rhythm bathyphase DBP was shifted by daylight hours in 1 - 66%, 2 - 66%, 3 - 52%. The latter characterizes that in the daytime the peripheral vascular tone was less than in the night, that is, an unfavorable situation for cardiac function and capillary perfusion, which can exacerbate oxygen deficiency, tissue and organ hypoxia.

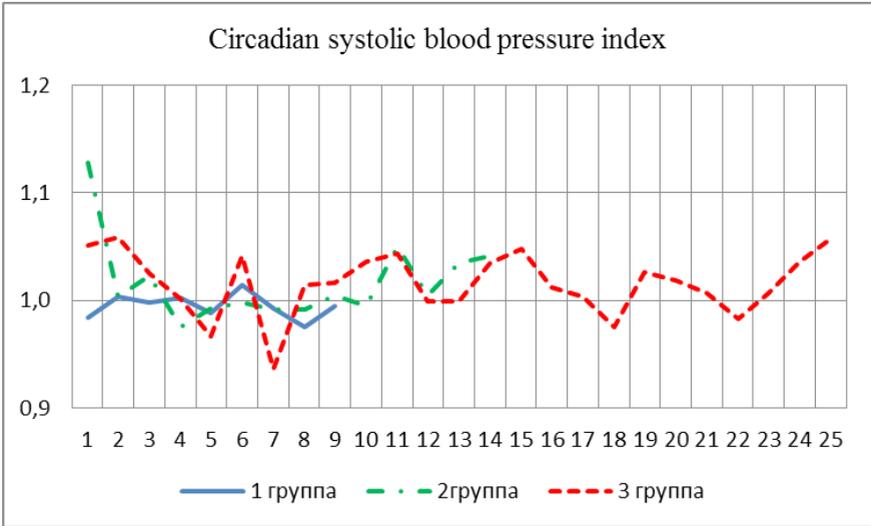


Fig.3

The circadian SBP index (Fig. 3) in group 1 ranged from 0.97 to 1.02 (with a norm of 1.16), in group 2 - 0.97 (4 days) to 1.13 (1 day), in group 3 - 0.94 (7 days) to 1.06 on the 25th day. That is, the rigidity of the diurnal fluctuations of SBP was revealed, apparently, due to the effective medication correction aimed at maintaining a stable cardiac output.

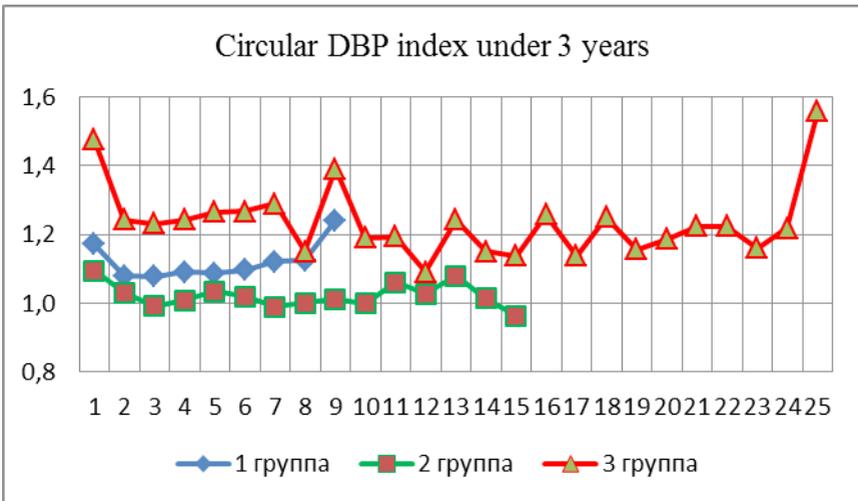


Fig.4

The circadian DBP index (Fig. 4) in group 1 ranged from 1.08 (on day 2) to 1.24 on day 9 (at a rate of 1.2). In group 2, CI DBP was 0.96 (15th day), 1.1 in 1 day. In group 3, the minimum CI DBP value was detected on day 12 (1.1), the maximum 1.56 on day 25. That is, the most stable indicators, but the most rigid, were identified in the 2nd group of children. The largest differences CI DBP in group 3. But in all the examined patients, CIDBP turned out to be lower than the normative value, that is, it testified to the rigidity of fluctuations in the tone of the peripheral vessels, which can be explained not only by compensatory hypersympathotonia, but also by the effectiveness of drug correction. Confirmation is the most pronounced range of CI DBP fluctuations in the heaviest 3 group.

Conclusion.

Significant daily fluctuations in SBP are characteristic of the most severe children of group 3. The 1-day DBP reduction in the most severe children was due to the severity of the condition on the verge of depletion of the sympathoadrenal system in group 3. The migrations of acrophase and bathyphase peaks of SBP circadian rhythm were an important part of the hemodynamic adaptation of young children during toxemia in burn disease, playing a role in stabilizing SBP and DBP values. The more severe the burn injury, the greater the range of SBP, DBP drops, the greater the increase in the weekly period of blood pressure fluctuations.

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急性粘连性肠梗阻的预防和预后
**PREVENTION AND PROGNOSIS OF ACUTE ADHESIONS
INTESTINAL OBSTRUCTION**

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目的。 制定预防和预后急性粘连性肠梗阻的方法。

材料与方法。 在2011-2019年的监督下,共有108例急性粘连性肠梗阻(AAIO)诊所收治的患者。 大多数患者年龄在35至80岁之间。 男性-38,女性-70。

结果。 一个新的AAIO预防概念已经被开发出来。 建议的治疗方案可以排除31.81%的急性粘连性肠梗阻的诊断。 由于采取了一系列的预防和治疗措施,AAIO的解决率为28.18%。

结论。 拟议的预后预防方案可以排除急性粘连性肠梗阻的诊断,并有助于在28.18%的病例中保守解决AAIO。

关键词: 急性粘连性肠梗阻, 治疗, 预后, 预防。

Purpose. *Develop an approach for the prevention and prognosis of acute adhesive intestinal obstruction.*

Material and methods. *Under the supervision in 2011-2019, there were 108 patients admitted with a clinic of acute adhesions intestinal obstruction (AAIO). Most patients were between 35 and 80 years old. Men - 38, women - 70.*

Results. *A new AAIO prevention concept has been developed. The proposed treatment regimen makes it possible to exclude the diagnosis of acute adhesive intestinal obstruction in 31.81% of cases. As a result of a set of preventive and treatment measures, AAIO was resolved in 28.18% of cases.*

Conclusions. *The proposed prognosis prophylaxis scheme allows the diagnosis of acute adhesive intestinal obstruction to be excluded and contributes to conservative resolution of AAIO in 28.18% of cases.*

Keywords: *acute adhesive intestinal obstruction, treatment, prognosis, prevention.*

Introduction. Improving the quality of diagnosis and the effectiveness of treatment of adhesive bowel disease remains an urgent practical public health problem. Adhesive intestinal obstruction is a violation of the patency of the gastrointestinal tract [1,9,11]. It is one of the manifestations of peritoneal adhesive disease, characterized by the presence of intraperitoneal adhesions and scars[5,7,8]. In a

significant number of patients, adhesive intestinal obstruction has a chronic recurrent nature. The share of this pathology among other types of obstruction reaches 30-40% [6,10,11].

Acute adhesive intestinal obstruction (AAIO) is one of the common and serious diseases in abdominal surgery. According to our data, its specific gravity in the structure of all types of intestinal obstruction is 35.75%, which generally corresponds to the information of other authors [1,4,5]. Treatment of patients with adhesive disease of the abdominal cavity is a very difficult task, which is associated with the severity of the clinical course and the development of formidable complications, and the absence of adequate unified methods for preventing relapse [2,3].

Purpose of the study. Develop an approach for the prevention and prognosis of acute adhesive intestinal obstruction.

Material and methods. The study was performed on the basis of the surgical departments and the Department of Surgery, Faculty of Continuing Education and Professional Retraining of Specialists with a course of endoscopic surgery of the Dagestan State Medical University. Under the supervision in 2016-2019, there were 108 patients admitted with the AAIO symptoms. For a more detailed study of the results of treatment, patients were divided into groups (table. 1). Most patients were between the ages of 35 and 80 years old - there were 38 men and 70 women. The distribution of patients was related to the reasons for which they were operated on initially.

Depending on the effectiveness of conservative therapy, patients were divided into 3 groups. The 1st group included 37 (7.3%), in whom conservative therapy made it possible to exclude acute surgical pathology in a short time. Group 2 comprised 56.5% of patients previously operated on for various reasons in the traditional way. Their AAIO was confirmed both clinically and by instrumental diagnostic methods. In 18.1% of patients in this group, conservative therapy performed completely stopped the manifestations of AAIO, and they were discharged without surgical intervention. The remaining 81.9% of patients underwent laparoscopic adhesiolysis, and conservative measures were performed at the preoperative preparation stage. The 3rd group included 10% of patients, and they were able to resolve AAIO with the help of conservative measures, in the remaining 90% of patients and surgical treatment was carried out according to the traditional method.

Table 1
Age structure of patients

Age	Number of patients	Men	Women
35-65	46 (42,6%)	27 (58,7%)	19 (41,3%)
66-78	62 (57,4%)	29 (46,8%)	33 (53,2%)
Total	108 (100%)	56 (51,9%)	52 (48,1%)

Results. Regardless of the period of admission and the combination of clinical symptoms, a complex of conservative therapy was prescribed to all patients in the admission department. Based on our assumption that adhesive disease is an independent, polycyclic, progressive disease, which is based on a generalized, hyperergic reaction of connective tissue to external stimuli (inflammatory processes, dietary disorders, colds, exacerbation of chronic diseases), our scheme of conservative therapy for The initial stage of adhesive disease included the following activities.

In order to perform decompression of the upper gastrointestinal tract (GIT), a gastric tube was probed. It is known that an increase in pressure in the intestinal lumen with subsequent violation of the blood supply to the intestinal wall plays an important role in the pathogenesis of intestinal obstruction of any etiology.

To reduce edema and inflammation of the abdominal cavity, hormonal therapy was carried out - intravenously prednisone at 3 mg/kg body weight in 5 or 10% glucose solution.

It is known that any violation of intestinal motility is directly dependent on the tone of smooth muscle and the content of K^+ ions in the circulating fluid, adequate blood supply to the intestinal tube. Therefore, we believe that it is fundamentally important to restore the volume of circulating blood with the indispensable inclusion of 10% potassium chloride solution at the rate of 0.5 meq/kg body weight in the volume of infusion therapy. After correction of hydroionic balance. The rest of the treatment was carried out according to the traditional scheme (glucose-salt solutions, stimulation of peristalsis with anticoagulant drugs, proserin).

We considered the criteria for the effectiveness of conservative therapy to stop or reduce the intensity of pain, bloating, decrease in vomiting or disappearance of the discharge through the nasogastric tube, the presence of stool after enemas and gas exhaustion, normalization of GIT peristalsis, decrease in the level of intoxication: decrease in the leukocyte intoxication index (LII), tachycardia, subfebrile condition, weakness, malaise, dry mucous membranes.

One of the effective criteria for conservative therapy (including preoperative) was the radiological characterization of GIT function. In 31 (88.5%) patients admitted to the clinic, an overview radiography of the abdominal organs in an upright position was performed in the admission department. In 2 (5.71%) X-ray studies were not carried out, since they were admitted to a hospital with a clinic of acute appendicitis, without surgical interventions in the anamnesis, and 2 (5.71%) were taken to the operating room due to a very pronounced pain syndrome without X-ray examination.

In 12 (38.70%) of 31, typical radiological signs of intestinal dysfunction were determined both independently and in combination with each other (fluid level in different parts of the abdominal cavity, gas bubbles of the intestines and asymmet-

ric gas filling of the intestine). Liquid levels were found in 77.4% of 12 patients, intestinal gas bubbles - in 41.98%, asymmetric gas filling of the intestine with a zone of homogeneous dimming - in 45.26% of patients. We attach particular importance to the third factor (asymmetric gas filling of the intestine), since we believe that it is one of the indirect signs indicating adhesion conglomerate.

In a contrast study of GIT with 10% barium sulfate, they emphasized the delay in the progress of barium, which is concentrated as a “depot” in any part of the GIT. We consider it decisive in determining tactics. The method is possible only in the absence of vomiting or copious discharge through the nasogastric tube, which does not allow it to be carried out in all patients and, therefore, its significance is reduced. We used this technique in 27 (87.09%) patients; in 9 (29.03%), a “depot” of barium sulfate was detected in front of the obstacle. This indicator is higher in operated patients, in which the progress of the contrast medium along the GIT was controlled. It amounted to 70.96% (22 of the 31 examined).

Both in the preoperative and in the postoperative period, all patients, along with the traditional status assessment and laboratory control, underwent LII counting according to the generally accepted method [3-4]. For standards, we took indicators of 0.3-1.5. To a mild degree of the bacterial component, the indicator was attributed to 2.3; moderate severity - up to 3.5. An indicator of more than 3.5 indicates a severe degree of bacterial tension [3-4]. If after the first regimen of conservative therapy the patient's condition did not worsen (LII, tachycardia, pain, etc.), then we considered it possible to conduct repeated courses of conservative therapy. The use of such tactics made it possible to exclude the diagnosis of AAIO in 12 patients (Table 2).

Table 2

Distribution of Patients with Excluded AAIO by age and gender, abs. (%)

Age	Number of patients	Men	Women
35-65	12 (32,4%)	4 (33,3%)	8 (66,7%)
66-78	25 (67,6%)	10 (40%)	15 (60%)
Total	37 (100%)	14 (37,8%)	23 (62,2%)

It is noteworthy that the prevalence is between the ages of 35 and 78 years, as in the distribution of the total number of patients. After a single course of therapy in 38.8% and a double regimen in 41.15% of patients, the condition improved significantly, abdominal pain disappeared, vomiting, bloating stopped, peripheral blood counts improved, intoxication decreased (Table 3).

Table 3 shows that basically repeated courses of conservative therapy were required for patients with complaints of abdominal pain - 51.81%. According to other criteria, in most patients it was enough to conduct one scheme, which is

confirmed statistically using the Pearson criterion. An analysis of a retrospective history study revealed that these patients did not have a cyclical, seasonal disease, and pain, as a rule, arose after a gross violation in the diet. Further examination revealed the causes of abdominal pain.

The most common causes stimulating AAIO in previously operated patients were reactive pancreatitis (24.53%), acute mesadenitis (16.18%), exacerbation of chronic gastroduodenitis (6.17%), intestinal dyskinesia and biliary dyskinesia (8.11%), intestinal colic (4.18%), urinary tract infection and caprostatics (4.12%), as well as acute cholecystitis, neuralgia, sigmoiditis, acute pyelonephritis, helminthic invasion, atonic colitis, benign ovarian syndrome, irritable bowel syndrome, vegetovascular dystonia, abdominal infiltrate (2.16%). It is important to emphasize that our treatment regimen can be considered not only an integral part of conservative therapy and preoperative preparation, but also included in the algorithm for differential diagnosis of organic and functional diseases of GIT.

Table 3
The main clinical symptoms in patients with excluded AAIO, abs.

Symptoms	Conservative therapy		
	Total	Men	Women
Abdominal pain	37 (100%)	14 (37,6%)	23 (62,2%)
Bloating	3	2	1
Nausea	6	1	5
Vomiting	4	1	3
Stool and gas retention	4	1	3
Subfebrile condition	3	2	1
Weakness and malaise	6	2	4
Dry mucous membranes	4	1	3
Tachycardia	3	1	2
Leukocytosis	4	1	3
Total patients	37 (100%)	14 (37,8%)	23 (62,2)

Note. $\chi^2 = 45,45$, $p < 0,001$.

Thus, the proposed scheme of conservative therapy allows us to exclude the diagnosis of acute adhesive intestinal obstruction in 31.77% of cases and contributes to the conservative resolution of AAIO in 28.18% of cases.

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在脑电参数中表现出人类运动活动的自愿成分
**MANIFESTATION OF THE VOLUNTARY COMPONENT OF
HUMAN MOTOR ACTIVITY IN EEG PARAMETERS**

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抽象违反任意行为和运动活动,各种形式的脑部病理特征(包括颅脑创伤)的行为,极大地使患者的神经康复过程复杂化。尚未确定运动行为的任意分量的脑电图相关性。我们可以假设,动作的任意部分的结构和功能组织与执行,计划,调节和控制任何有目的活动的执行功能(EF)的各个部分存在一定的相似性。

这项初步研究旨在基于主动和被动运动测试以及“递减”测试(作为研究结构和功能组织的模型)中的脑电响应的比较,确定运动行为的任意组成部分的相关性(EF)。

研究发现,通过主动运动测试,包括任意成分,相对更自动化的被动运动以及相对于背景倒数,健康人的EEG相干性(EEGCoh)的空间组织变化具有相似性。两项检查均正常的EEGCoh地形图是正常的(自愿性活动和其他EF分量严重受损的患者,其正常行为(额叶皮层区域的变化,左侧突显,以及对称的顶皮导联)。严重的颅脑外伤,并且可以充当运动行为中任意部分的EEG标记。

关键词:运动的任意组成部分,脑电图,连贯性,执行功能

Abstract. *Violations of arbitrary behavior and motor activity, characteristic of various forms of cerebral pathology, including craniocerebral trauma, greatly complicate the process of neurorehabilitation of patients. EEG correlates of an arbitrary component of the motor act have not yet been determined. We can assume that there is a certain similarity in the structural and functional organization of an arbitrary component of the motor act with the individual components of the executive functions (EF) that initiate, plan, regulate and control any purposeful activity.*

This pilot study is aimed at identifying correlates of an arbitrary component of the motor act based on a comparison of EEG responses in active and passive motor tests, as well as in the “counting down” test (as models for studying the structural and functional organization of EF).

The studies revealed similarities in changes in the spatial organization of the EEG coherence (EEGCoh) of healthy people with an active motor test, including an arbitrary component, a relatively more automated passive, as well as when counting down relative to the background. The topographic patterns of EEGCoh that are normal for both tests are normal (changes in the frontal cortical areas, accentuated on the left, as well as in the symmetrical parietal leads) are violated in a patient with severely impaired voluntary movements and other EF components after severe traumatic brain injury, and can act as EEG markers of an arbitrary component of the motor act.

Keywords: *arbitrary component of motion, EEG, coherence, executive functions*

In neurophysiological (EEG) studies of the formation and implementation of voluntary human movement, two main directions can be distinguished. The first, which is being actively developed in connection with the development and implementation of the BCI method in neurorehabilitation, as well as the success of the neuroimaging fMRI, is aimed at identifying EEG markers of the motor component of the motor act [1-4]. In particular, in a series of our previous studies based on comparisons of motor fMRI and EEG responses [2], 1) the locality, stereotype and reproducibility of the fMRI response when clenching a fist in healthy people was shown, which justifies the use of this paradigm in testing motor activity normal and pathological; 2) the revealed topographic identity of the main cortical fMRI response with active (independent) and passive (performed with the help of another person) hand movement determines the use of a passive motor test for mapping motor zones in patients with disorders of the motor sphere and consciousness; 3) an increase (relative to the background) of the coherence of the high-frequency “working” EEG alpha3 rhythm (10.5–12.5 Hz) in the zone of the main cortical fMRI response (motor cortex of the contralateral hemisphere movement), characteristic of active and “passive” movement, allows us to consider this pattern in as an EEG marker of the motor component of the motor activity of a healthy person.

The second direction of EEG studies is associated with the identification of correlates of an arbitrary component of the motor act. In the presence of a number of publications on this subject using variable methodological approaches [5–7], these indicators have not been clearly defined to date. Meanwhile, it is precisely the disturbances in the randomness of motor activity that are characteristic of various forms of cerebral pathology, including craniocerebral trauma, that significantly complicate the process of neurorehabilitation of patients.

It can be assumed that there is a certain similarity in the structural and functional organization of an arbitrary component of the motor act with the individual components of the so-called *executive functions*, which is understood as a set of processes that initiate, plan, regulate and control any targeted activity [8, 9]. In the literature, the main components of executive functions (EF) - the programming, regulation and executive functions of targeted behavior - are primarily associated with the activity of the prefrontal parts of the frontal lobes of the brain [10; 11]. In [12], based on a comparison of the fMRI and EEG data, the adequacy of the “counting down” task was shown as a model for studying the structural and functional organization of EF, as well as the informativeness of the EEG coherence, the topography changes of which are closest to the fMRI response. Distinct changes in fMRI and EEG-Coh were detected in the prefrontal and anterotemporal regions, larger than the left hemisphere, and also in symmetrical parietal regions. According to the literature, the parietal hemispheres also belong to the EF system, taking part in switching between tasks, initiating and correcting tasks in real time [Petersen, Posner, 2012]. The predominant structural and functional involvement in the left hemisphere counting task demonstrated in [12] is consistent with the notion of specificity of such components of the EF as initiation and planning of voluntary activity for the left hemisphere [10].

In our opinion, the topographic features of changes in EEGCoh revealed in [12] can be used as markers of EF activation in other, simpler types of functional activity of a person, such as an arbitrary motor act.

The present pilot study was aimed at finding probable correlates of an arbitrary component of the motor act based on a comparison of EEG responses in active and passive motor tests, as well as in the “counting down” test.

Material and research methods

The main sample of observations consisted of 11 healthy male right-handed subjects aged 21 to 39 years with no clinical impairment and an uncomplicated history. They studied the changes in EEG during the performance of motor tests: independent clenching - unclenching the fingers into a fist, separately of the right and left hands, as well as performing this movement with the help of another person (active and passive motor tests).

As an example, with a violation of an arbitrary component of motor activity, EEG changes were analyzed during active and passive motor tests with the right hand in a patient K., 41 years old, who suffered a severe traumatic brain injury (STBI) (as a result of a car accident), accompanied by a bruise and parenchymal hematoma right parietal lobe, subdural hematoma of the left frontal-parietal-occipital region, lesions in the temporal lobes, traumatic subarachnoid hemorrhage. 7 months after the injury, the patient was conscious, moved independently, followed instructions - however, with severe violations of voluntary behavior, according to neuropsychological testing.

EEG in normal and pathological conditions was recorded through 18 channels, monopolar, relative to the ear reference electrodes, according to the scheme 10-20% of symmetrical occipital, parietal, central, frontal and temporal cortical regions with a quantization frequency of 100 Hz and a passband of 0.3–35 Hz. The recording was carried out in a state of calm wakefulness with eyes closed, in the background, when performing motor tests. Each subject underwent spectral-coherent analysis of one and a half minute artifact-free realizations of the EEG background and each functional sample based on the "Neurocartograph" software and computer complex (MBN, Russia). Coherency (EEGCoh) was calculated for all possible combinations of lead pairs in the ranges of physiological rhythms: delta (0.4-3.9Hz), theta1 (4.3-5.5 Hz), theta2 (5.9-7.4Hz), alpha1 (7.8-8.6Hz), alpha2 (9-10.2Hz), alpha3 (10.5-12.5Hz), beta1 (12.9-20.7Hz), beta2 (21.1-30.1Hz). The significance of differences in EEGCoh during a functional test with respect to the background, as well as for different motor tests, was determined based on the nonparametric Mann – Whitney test [2].

All studies were carried out in accordance with the principles of biomedical ethics formulated in the Helsinki Declaration of 1964 and its subsequent updates. Voluntary written informed consent was obtained from each study participant to take part in it.

The results were compared with the data of a study [12], in which healthy people analyzed the EEG and fMRI changes in healthy subjects while counting down (from 100 to 7).

Results and discussion

The starting point of the study was our assumption that an arbitrary component of the motor act can be reflected in the EEGCoh topography when comparing EEG records accompanying passive and active motor tests. At the same time, a passive motor test was considered as more automated, not requiring arbitrary human efforts, while when performing an active movement of a hand, an arbitrary component is certainly present.

Figure 1 shows the results of such a comparison with movements of the right (1 I) and left (1 II) hands in 11 healthy subjects. The local component of the motor EEG response in the form of amplification of the EEGCoh alpha3 range in the motor cortex of the contralateral movement of the hemisphere [2] is not expressed, which is explained by the significant similarity of changes in EEGCoh with active and passive hand movements.

At the same time, in both examples, differences in EEGCoh between passive and active motor tests are found, similar in topography and frequency to changes in this indicator when counting down: for symmetrical frontal leads in the delta range, as well as left hemispheric leads in the alpha and beta1 bands; for symmetric parietal cortical zones in theta1, 2 and beta1 frequency ranges. A larger number of EEGCoh differences is detected when moving the left hand - probably as more complex action for right-handed people to perform [14], which requires a higher EF effort.

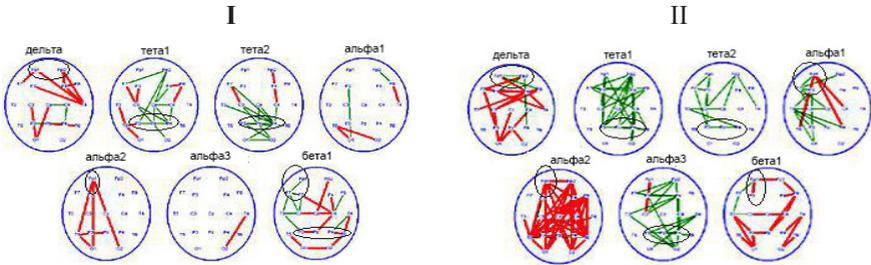


Figure 1. Significant differences in EEGCoh physiological rhythm ranges between passive and active motor tests in healthy subjects (N=11).

I - movement of the right hand. II - movement of the left hand.

Red lines indicate a significant excess, green lines show a decrease in coherence during an active motor test compared to a passive one ($p < 0.05$). Ellipses mark EEGCoh changes that are most similar in topography to the EEG response loci in the “counting down” test [12].

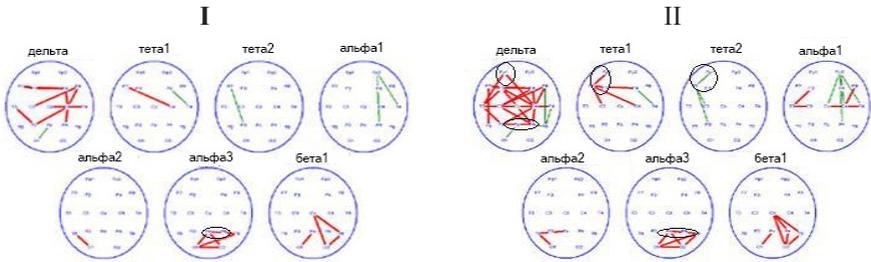


Figure 2. Differences in EEGCoh in the ranges of physiological rhythms between passive and active motor tests of the right hand in patient K. with severe impairment of voluntary behavior and motor activity after STBI.

Red lines – excess, green lines – decrease in coherence during an active motor test compared to a passive one. I - at $p < 0.05$, II - at $p < 0.1$.

Similar EEG testing was also conducted in a patient with severe impaired voluntary behavior after STBI: impoverishment of interests, leveling of emotional reactions, and difficulties in implementing any behavioral programs.

Figure 2 shows the results of comparing EEGCoh between the passive and active motor tests of his right hand. Figure 2 I shows that statistically significant ($p < 0.05$) differences in EEGCoh, similar in topography and frequency to the norm (Fig. 1), are not detected, as well as with the data of the countdown test [12]. First of all, this concerns the activity of the frontal-pole leads of the left hemisphere.

There is a very local zone of changes in EEGCoh in the parietal region, but not bilateral or left hemisphere, as normal, but right hemisphere.

Only at $p < 0.1$ (Fig. 2II) do EEGCoh test differences that are similar to normal appear as a statistical trend: greater EEGCoh reactivity of the frontal-pole regions of the left hemisphere, but only in the slow-wave frequency ranges - delta and theta with active motor test compared with passive. The fragmented representation of individual “EEGCoh markers of randomness” similar to the norm in topography in the form of a statistical trend ($p < 0.1$) may reflect, in our opinion, the presence of a certain neurorehabilitation potential in the patient.

Conclusion

This study revealed similarities between the topographic and frequency differences of EEGCoh between the passive and active motor tests of healthy people with those in the countdown test as a model for studying the structural and functional organization of EF. These data confirm our assumption that EEGCoh topographic patterns that are similar for motor and EF tests (changes in the frontal cortical areas, accentuated on the left, as well as in the symmetrical parietal leads) can act as markers of voluntary motor act. It is also confirmed by the differences from the EEGCoh norm revealed in the work when comparing the passive and active motor EEG responses in a patient with severe impairment of randomness and other EF components after STBI.

Supported by RFBR grant 19-29-01002 mk

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DOI: 10.4236/jbbs.2019.96020.

传统构造系统发展的影响分析
ANALYSIS FACTORS OF THE EFFECTS OF THE DEVELOPMENT
OF TRADITIONAL TECTONIC SYSTEMS

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抽象。

简介：这项研究基于关于系统性质的科学假设，这些假设是影响传统构造（建筑）系统中特殊状态和起源的影响因素。研究的主题是建筑物和结构中最明显（主要）的建筑系统，具有以下各个阶段的特征：历史，技术和社会发展。这项研究的相关性与在传统构造系统中大规模应用的评估以及在建筑活动中开发考虑的物质对象的有希望的可能性有关的评估有关。

材料和方法：公认的逻辑研究方法（分析，系统解决方案，归纳）及其使用最新和经过验证的信息材料的综合。

结果：通过进行研究，建立了影响因素的主要类型（组），这些因素决定了状态和方向发展的特殊性，传统构造（建筑）系统的定性和定量指标。在本文中，将介绍概念上的设备，其类别为：“构造”和“系统”，作为主题标志显示电压过程中的特征以及内部空间中建筑图像的状态。显示了构造学的价值，作为一种特定的手段，即建筑表现力，它与建筑（建设性）系统及其创建过程中的客观规律有机地联系在一起。建立了空间构造中地物构造解决方案中构造映射中功能，构造和艺术美学成分之间的自然相互作用。被认为是主要（传统）类型的建筑系统（以命令系统为例）中呈现的构造特征，其特征是其建筑形式的个体逻辑，表现力和规律性。

结论：在这项研究中，主要影响因素的定性指标需要适当的定量论证加以补充，这可以用来预测传统系统的未来发展。

关键词：构造，建筑系统，材料特性，影响因素，支撑结构，构造特征，成分，协调技术和手段。

Abstract.

Introduction: *this research is based on the scientific hypothesis about the systemic nature at influencing factors that determine the peculiarities state and genesis in traditional tectonic (architectural) systems. The subject of research is the most visible (main) types architectural systems in buildings and structures, characteristic of the various stages of: historical, technological and social de-*

velopment. The relevance this research is related to the assessment at the scale application at traditional tectonic systems and the assessment in promising possibilities for the development of the considered material objects in architectural activity.

Materials and methods: *generally accepted logical research methods (analysis, systems solution, generalization) and their synthesis using up-to-date and verified information materials.*

Results: *As a result of the conducted research, the main types (groups) of influence factors were established, which determined the peculiarities in state and direction development, qualitative and quantitative indicators at the traditional tectonic (architectural) systems. In this article are presented the conceptual apparatus, which are in categories: "tectonics" and "system", as subject signs display of the features in voltage processes and the state at internal space the architectural images. The value of tectonics, as a specific means architectural expressiveness, which organically associated with the architectural (constructive) system and the objective laws in its creation, is shown. The nature interaction of the functional, constructive and artistic-aesthetic components in tectonic mapping at features architectural solutions in the formation the objects in spatial environment is established. Are considered the tectonic features of the presentation in main (traditional) types architectural systems (by the example of order systems), which are characterized by individual logic, expressiveness and regularities his architectural formation.*

Conclusions: *In this research examined the main qualitative indicators at influence factors that need to be supplemented with an appropriate quantitative justification, which can be used to predict the future development traditional systems.*

Key words: *tectonics, architectural systems, properties of materials, factors of influence, supporting structures, tectonic features, composition, techniques and means of harmonization.*

In the most General case, a system (from the Greek "sistema" — "whole, composed of parts") means a certain community (integrity), organized on the basis of a certain principle, in which all the elements are so interdependent from one another that they act in relation to the environment and other systems, as a single and integral entity [1,2].

Architectural activity involves the creation of such artificial (architectural) systems, which are commonly understood as organized material structures, which are characterized by the following main features [3,4,5]:

- its own functional purpose;
- a set of individual (unique) or common (typical) features;
- the original aesthetic value and cultural level of the display;

- authentic author's vision of adaptation and interaction with the surrounding natural (natural landscape) and artificial (architectural, urban planning) environment;
- the way the internal spatial structure interacts with external social and social factors.

The formation of an architectural image is carried out by organizing the way of interaction between the design solution and the artistic and aesthetic representation of the corresponding architectural system. The choice of a design solution is determined by the tectonic features of the functioning of the structural elements included in the structural system, the properties of the structural materials, and the technological techniques necessary for their manufacture and construction.

Tectonics is a specific means of architectural expression that is organically connected with the architectural (structural) system of an architectural object (building or structure) and the objective laws of its creation — strength, stability and balance, taking into account the strength properties of materials, the principles of transmission and perception of load combinations. In the theory of architecture (as a special field of architectural science), the concept of "tectonics" is associated with various aspects of the architectural image: the expression of an artistic and aesthetic concept; the display of the interaction of the structural basis and form [6,7,8].

The formation of the architectural tectonic systems and display the main features of their functioning and performance is based on composite solutions to their spatial structure, which is formed in accordance with the rules and worldview of the era, the level of development of the productive forces of society and the contemporary social and public conditions [9,10].

Depending on the level of development of scientific knowledge, the state of technical and technological capabilities for manufacturing and practical implementation through appropriate construction techniques, architectural systems are classified into several main or traditional types (order, arch-vaulted, wall, frame-rack) [11,12,13,14].

Each of the main types of architectural systems is characterized by certain tectonic features, technical (technological) logic, capabilities, and certain patterns for architectural shaping. The architectural practice of various (past) historical epochs allowed us to establish and develop a certain pattern of tectonics, as a result of displaying the interaction of structural elements in a particular type of architectural system.

For example, order tectonics (from Latin: "ordo») architectural systems are characterized by a harmonious combination of vertical (columns) and horizontal (beams) bearing elements, which allows the interaction of parts and the whole within a single aesthetic system. Structural elements of order tectonics are visually perceived as stable, strong and not flat, due to the implementation of their design

and artistic features. In a basis proportional to the ratio of the thickness of the vertical bearing structural element order (column) height laid some norm purely aesthetic properties, respectively, changing the proportions of the orders is not caused by knowledge about the real stress of the material design, but changes the aesthetic standards [15,16,17].

The formation and development of tectonic features of the representation of an architectural object is caused and justified by the peculiarities of understanding and implementation of the laws of natural, social, technological processes occurring at the appropriate stage of historical, social and cultural development. The architectural practice of various (past) historical epochs allows us to analyze the influence of certain techniques and means of harmonization on the features of identifying artistic, aesthetic and tectonic expressiveness of structural elements in a certain type of traditional architectural system (form) [18,19,20].

One of the most important features that characterize the integrity of the composition is the harmonious unity of artistic and aesthetic expressiveness and rational constructive system of the architectural image. The solution of the question of the artistic and aesthetic properties of the design is characterized by a special, specific complexity. The assessment of an architectural object includes indicators of the quality of the design solution and artistic expression, which allow us to identify the content, reveal the meaning and idea of the architectural image [21,22].

Tectonics of a constructive solution (traditional tectonic system) is a special means of displaying the artistic idea of the author of an architectural image and directly depends on the accepted worldview of the historical epoch. Thus, the tectonic representation is not only a source of inspiration and renewal of the concepts of architectural form, but also a reflection of the meaning of life of the epoch.

Conclusion and discussion

The research has shown a complex and multi-factor composition of processes and phenomena that contributed to the formation and development of features of the tectonic display of the main (traditional) architectural structures. The historical and geographical scale of the functioning and Genesis of these systems indicates the possibility of their subsequent application in architectural activities, taking into account possible, promising (innovative) modifications of the structural, material and artistic and aesthetic components, as well as harmonization as part of an integral spatial composition of the architectural image.

Способность и расположенность к возможным структурным, функциональным и художественным трансформациям является перспективной особенностью и потенциальной областью применения для развития более технологичных приемов формообразования (возведения) и способов организации внутреннего пространства архитектурных объектов различного функционально-технологического назначения.

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二十一世纪初俄罗斯亚北极地区极小冰川的状况 (Putorana高原案例研究)
**STATE OF THE VERY SMALL GLACIERS IN SUBARCTIC
REGIONS OF RUSSIA AT THE BEGINNING OF XXI CENTURY
(PUTORANA PLATEAU CASE STUDY)¹**

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摘要：北极地区的冰川作用主要表现为小型冰川作用，覆盖面积达数万平方公里。在亚北极地区，小冰川主要分布在乌拉尔，普托拉纳高原，拜兰加山脉，韦尔霍扬斯克山脉北部，楚科奇高原等地，其绝对高度为400至1400 m。它们位于气候雪线以下，它们的存在主要取决于气候因素。早在1970年代初期，就为前苏联境内的所有此类地区编制了完整的冰川目录，其中包含有关已识别冰川物体主要形态特征的信息。的确，目录的内容主要是基于对航空照片的分析，并且路线研究仅覆盖了小部分冰川（顺便说一下，这只是偶然的）。因此，没有讨论详细的冰川特征，也无法讨论。在这种情况下，应考虑2002年8月，2003年，2004年，2019年在Putorana高原的莫斯科国立大学地理系的野外分队进行的冰川探险。 [科瓦连科，2011年]。

关键词：小冰川，北极，亚北极，气候变化，冰川退化，森林大火。

Abstract. *The glaciation of the subarctic territories is represented mainly by small forms of glaciation and covers an area of several tens of thousands of km². In the Subarctic, small glaciers are mainly distributed in the Urals, the Putorana Plateau, in the Byrranga Mountains, in the northern part of the Verkhoyansk Range, on the Chukchi Highlands, etc., located at absolute heights of 400 to 1400 m. They are located below the climatic snow line, and their existence is determined mainly by oroclimatic factors. Back in the early 1970s, complete catalogs of*

¹The work was supported by the RFBR (grant 18-05-60080_Arctic).

glaciers were compiled for all such areas within the territory of the former USSR, containing information on the main morphological characteristics of the identified glaciological objects. True, the content of the catalogs was based mainly on the analysis of aerial photographs, and only a small part of the glaciers was covered by route research (by the way, only occasional). Therefore, no detailed glaciological characteristics were discussed and could not be discussed. In this context, glaciological expeditions carried out by the field detachment of the geographical faculty of Moscow State University on the Putorana Plateau in August 2002, 2003, 2004, 2019 should be considered. [Kovalenko, 2011].

Keywords: *small glaciers, Arctic, Subarctic, climate change, glacier degradation, forest fires.*

In our country, the modern engineering development and operation, in particular, of the subarctic territories requires comprehensive knowledge about all the components of local landscapes that are so sensitive to anthropogenic influences and natural fluctuations of natural processes. Small-scale icing, which is widespread in various glacial regions of Russia, is undoubtedly one of those elements of the geographic envelope that give particular character to local ecosystems.

A characteristic feature of the climatic conditions of the Yenisei-Putoran region are strong winds, the average speed of which is 5-7 m/s. In the Norilsk region, wind speed can reach 40 m/s. The strongest winds are observed in winter and spring; they are usually accompanied by heavy rainfall. The number of days with snowstorms per year varies from 30 to 74 in the forest-tundra subzone, from 32 to 78 in the northern taiga subzone (Igarka), from 7 to 80 in Turukhansk [Sarana, 2003].

The region clearly shows climatic zonality and altitudinal zonation. In the southern part of the Yenisei plain, the average annual air temperature is -7.6 °C (Igarka), in the region of Norilsk -9.8 °C, in the region of Volochanka -12 °C.

The main feature of the temperature regime of the territory is that the Putorana plateau lies in the area where the average annual air temperature is negative. The negative temperature lasts for 9 months and according to the data of the Norilsk weather station is -7.9 °C, the average summer temperature is 11.9 °C and the average winter temperature is -25 °C. (rp5.ru). At the latitude of Norilsk, summer is practically absent, if for summer we take an interval of at least 30 days with a temperature above 15 °C. The maximum temperatures (10-15 °C) are confined to July, and the minimum (-25-30 °C) are observed in January. The absolute amplitude of fluctuations in air temperature over 14 years for Norilsk is 82.7 °C. (rp5.ru). The transition of air temperature to the region of negative values occurs, as a rule, in late September - early October. At the same time, a stable snow cover begins to form. The annual rainfall is small: from 300-350mm in the tundra to 500mm in the northern taiga. Snow cover lasts for 8-9 months.

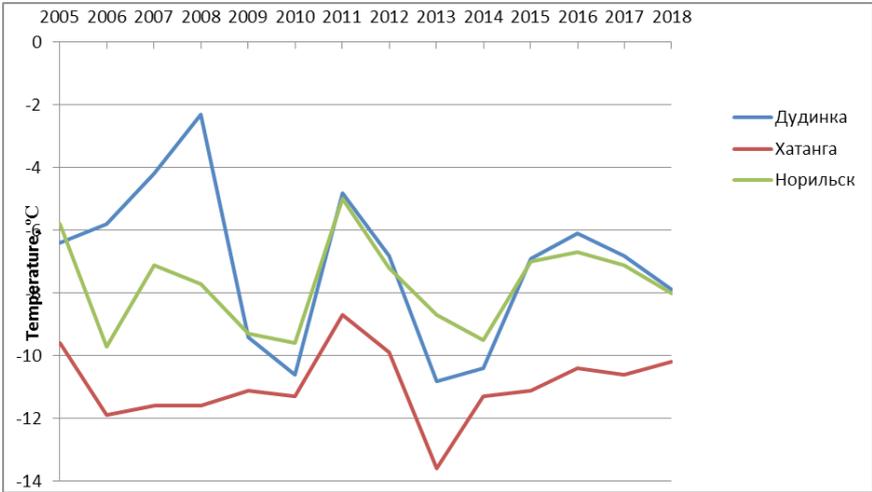


Fig. 1 Average annual air temperatures over 14 years at nearby weather stations (rp5.ru).

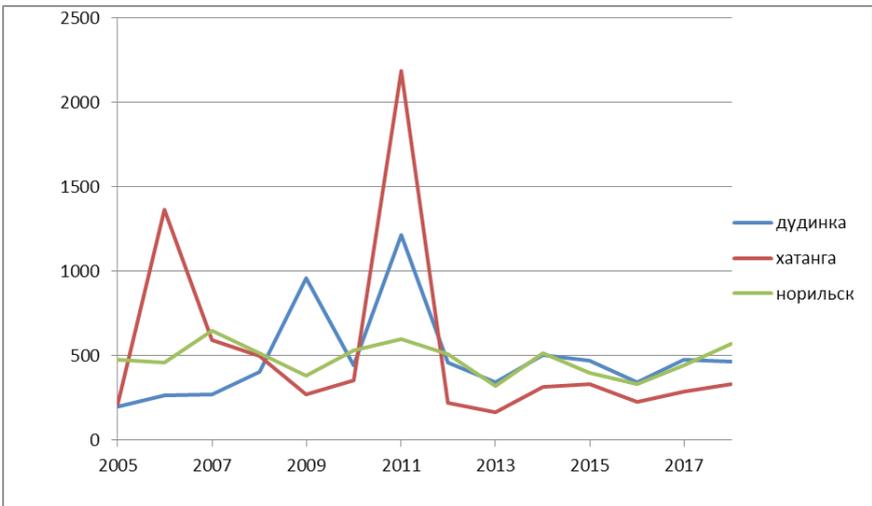


Fig. 2 Average annual precipitation for 14 years at the nearest weather stations (rp5.ru).

The area of the Putorana plateau is characterized by the spread of a wide range of natural disasters that are dangerous for the population and economic activity - these are snow avalanches, water flows, mudflows, floods, ice, landslips and landslides [Avalanche-hazardous areas of the Soviet Union, 1970; Perov et al., 1968; Geography of avalanches, 1992]. Avalanche activity on the Putorana Plateau is determined by favorable conditions: steep slopes are complicated by erosion channels, high snowfall, increased snowstorm activity. However, the available information on avalanches of the plateau is very scarce. In the monograph “Avalanche Hazardous Areas of the Soviet Union” [1970] it is reported that the conditions of relief and snowfall are very favorable here, but in the conditions of permafrost and low temperatures, the processes of redistribution of matter in the snow mass are very slow, which affects the stability of snow on the slopes. Avalanche activity intensifies in the spring-summer period. The greatest degree of danger should be expected in the most snowy and deeply dissected western half of the mountains. To the east and south, the degree of avalanche danger falls and disappears.

Currently, 61 glaciers have been identified on the Putorana plateau, and their total area is 7.18 km². In addition to glaciers, perennial snowfields are widespread on the plateau, the area of which, judging by visual observations, is larger than glaciers [Sarana, 2005].

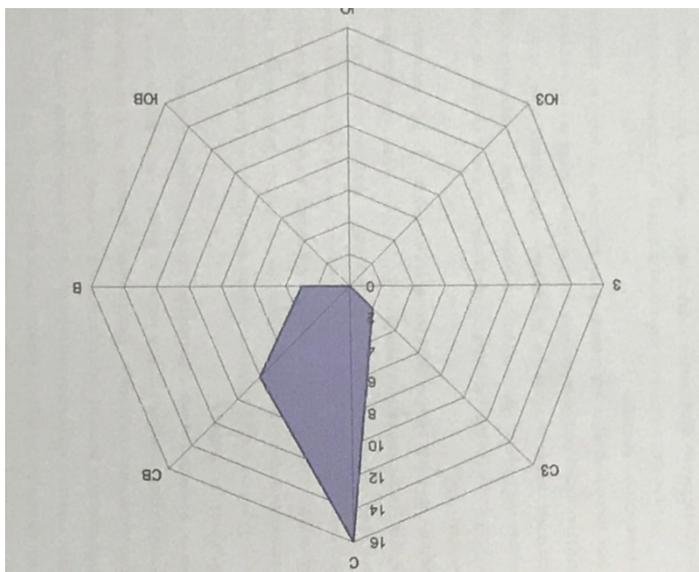


Fig. 3 Relation of glaciation to the exposure of slopes

In 2002-2004 and in 2019, expeditions were carried out by the field detachment of the geographical faculty of Moscow State University, during which work was done to study the snow cover and glaciers of the northern ledge of the Lam Mountains, which allowed to obtain a number of new information about the current state of glaciation in the western part of the Putorana plateau, where most of the famous glaciers are located [Kovalenko, 2011].

Field work carried out on the glaciers of the Putorana plateau, together with other studies, allows us to characterize the size of glaciation, to reveal the structure, regime of glaciers and their relationship with the topography and climate.

The most important regularity of the spread of the Putorana plateau glaciers – is their confinement to the western and northwestern parts of the mountains, which is associated with a significant amount of solid precipitation here, which is brought by the western air masses. A characteristic feature of Putoran glaciers – is their predominantly northern orientation. The vast majority, 41 glaciers, have a northern exposure (Fig. 3), 14 – glaciers – north-eastern, five glaciers occupy the north-western slopes and only one glacier opens eastward.

In 2002-2004 and 2019, the field detachment of the geographical faculty of Moscow State University studied in detail 2 glaciers - № 30 and № 31, and one perennial snowfield (Fig. 4). These are classic Karo-slope glaciers, which are not wide stripes located along the upper parts of the leeward slopes. Perhaps these small forms inherit some previous, more ancient stage of the Quaternary glaciation. They are characterized by small size, about 150 m in length and about 250 m in width. Small, possibly moraine hills are located within the enclosing cars [Kovalenko, 2006].



Fig. 4 Northern ledge of the Lam Mountains with glaciers № 30 and 31 (Yandex maps snapshot)

A characteristic feature of the morphology of glaciers – is the significant steepness of their surface: the average slope is 26° . The confinement of glaciers № 31 (Fig. 6) and 30 (Fig. 5) to the northern part of the Lama Mountains is due to the prevailing direction of snow-bearing air currents, as well as favorable orientation with respect to the sun's rays [Kovalenko, Popovnin, 2005].



Fig. 5 Glacier №30



Fig. 6 Glacier №31

To evaluate the current change in the glaciation area of glaciers № 30 and 31 in the Lamsky mountains of the Putorana plateau, the satellite images of Landsat 1973 and Sentinel were decrypted with a spatial resolution of 10 m in August 2016, 2018 and 2019. The images used for decryption were selected taking into account the smallest cloud cover and were taken at the end of the ablation period. The area change since 1973 was calculated (Table 1) and a scheme of areal variations of glaciation for 2016-2019 was constructed in ArcMap program (Fig. 7). Also, the obtained data were compared with the results of glaciological field studies.

Table 1. The change in the area of glaciers № 30 and 31 since 1973

Year	Glacier 30	Glacier 31
1973	0,15	0,16
2002	0,12	0,14
2003	0,136	0,148
2004	0,092	0,109
2016	0,082	0,083
2018	0,062	0,06
2019	0,095	0,092
Change since 1973	0,055	0,068
Change,%	36	42
Change since 2016	0,013	0,009
Change,%	15,85	10,84

These values of the errors in measuring the area are very large and can significantly change the picture of the reduction of glaciation, given the small area of the studied snow-ice-firn formations. So the maximum area measurement error for 2016-2018 for glacier № 30 is 0.013 km², and for № 31 0.014 km².

If we neglect the measurement error, then we can say that over the past two decades, the boundaries of these formations have changed significantly, and in 2019 their area even increased. Thus, glacier №31 increased in area from 2018 by 0.032 km². The area of glacier № 30 has increased by 0.033 km². There is every reason to believe that such an anomaly (not typical for Subarctic glaciers) is a consequence of the strong smoke of the atmosphere in the summer of 2019 and as a result of the minimal influx of solar radiation onto the glaciers. The catastrophic forest fires in Krasnoyarsk Krai raging in the summer of 2019 led to a strong haze and, accordingly, poor transparency of the atmosphere. According to [rp5.ru] m/s Norilsk and m/s Khatanga, cloudiness in the summer of 2019 averaged 60-70%. As a result, the ablation process on the glaciers was minimal. At the end of the snow ablation

Thus, in general, the glaciers of the Putorana plateau are degrading. The decrease in the area of glaciation is due to an increase in air temperatures, both average annual and average summer and a decrease in precipitation, and an increase in the frequency of winds of southeastern directions can lead to blowing snow out of the small glacier and, as a result, to lesser accumulation. And an increase in their area in 2019 is a consequence of the strong smoke of the atmosphere and a decrease in the direct solar radiation flux to the surface of the glaciers and, as a result, a slowdown of the melting process on the glaciers and a reduction in their area.

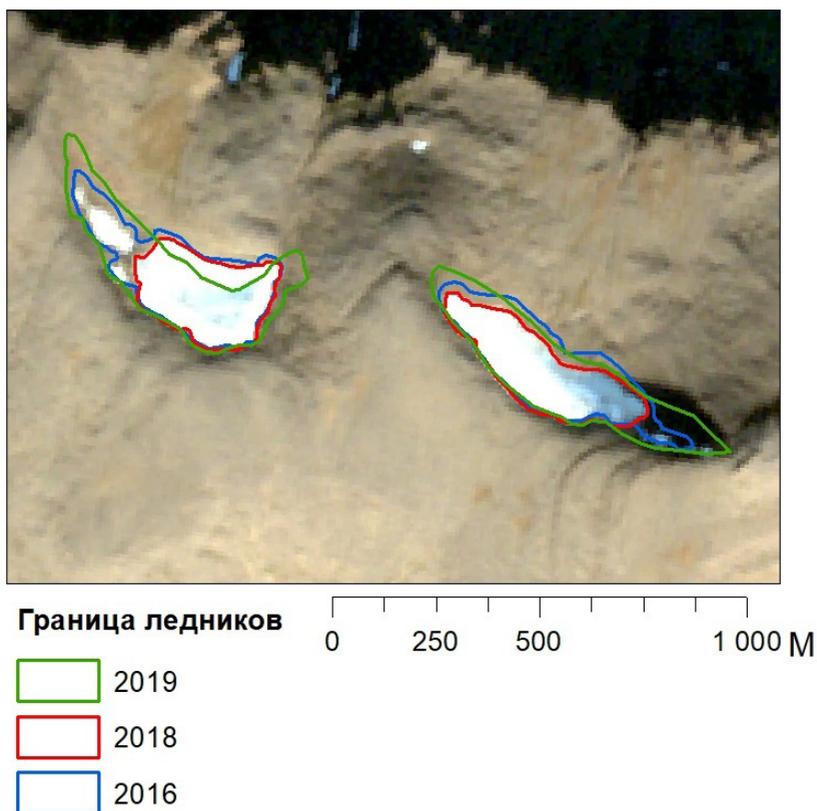


Fig. 7 Map of changes in the area of small glaciers of the Lam Mountains

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科学出版物

上合组织国家的科学研究：协同和一体化

国际科学大会的材料

2020年5月14日。中国北京

编辑A. A. Siliverstova

校正A. I. 尼古拉耶夫

2020年5月14日。中国北京。

USL。沸点：98.7。 订单253. 流通500份。

在编辑和出版中心印制
无限出版社

