ТЕОРИЯ И ПРАКТИКА СОВРЕМЕННОЙ НАУКИ: ВЗГЛЯД МОЛОДЕЖИ

МАТЕРИАЛЫ IV ВСЕРОССИЙСКОЙ НАУЧНО-ПРАКТИЧЕСКОЙ КОНФЕРЕНЦИИ НА АНГЛИЙСКОМ ЯЗЫКЕ

Научное издание
Часть I

Санкт-Петербург
2025

Министерство науки и высшего образования Российской Федерации

ФЕДЕРАЛЬНОЕ ГОСУДАРСТВЕННОЕ БЮДЖЕТНОЕ ОБРАЗОВАТЕЛЬНОЕ УЧРЕЖДЕНИЕ ВЫСШЕГО ОБРАЗОВАНИЯ

«Санкт-Петербургский государственный университет промышленных технологий и дизайна»
Высшая школа технологии и энергетики

МАТЕРИАЛЫ

IV Всероссийской научно-практической конференции на английском языке «ТЕОРИЯ И ПРАКТИКА СОВРЕМЕННОЙ НАУКИ: ВЗГЛЯД МОЛОДЕЖИ»

Научное издание

2025 ● Часть I

Под общей редакцией заведующей кафедрой иностранных языков, кандидата филологических наук, доцента
В. В. Кирилловой

Санкт-Петербург
2025

УДК 378.2.001
ББК 72
Т 338

Т 338 Теория и практика современной науки: взгляд молодежи: материалы IV Всероссийской научно-практической конференции на английском языке. В 2 ч. / Минобрнауки РФ; ФГБОУ ВО «С.-Петерб. гос. ун-т промышленных технологий и дизайна»; сост. М. А. Васильева, М. С. Липатов; под общ. ред. В. В. Кирилловой. — СПб.: ВШТЭ СПбГУПТД, 2025. — Ч. I. — 248 с.
ISBN 978-5-91646-424-5

В настоящем сборнике представлены материалы IV Всероссийской научно-практической конференции на английском языке «Теория и практика современной науки: взгляд молодежи», состоявшейся 30 ноября 2024 года в Санкт-Петербурге.

Материалы представлены в авторской редакции. Ответственность за аутентичность и точность цитат, имен, названий и иных сведений, а также за соблюдение законов об интеллектуальной собственности несут авторы публикуемых статей. Организаторы конференции не несут ответственность перед авторами и/или третьими лицами за возможный ущерб, вызванный публикацией статьи.

Материалы конференции размещены в научной электронной библиотеке elibrary.ru и зарегистрированы в наукометрической базе РИНЦ (Российский индекс научного цитирования).

УДК 378.2.001
ББК 72

ISBN 978-5-91646-424-5

Ministry of Science and Higher Education of the Russian Federation

FEDERAL STATE BUDGETARY EDUCATIONAL INSTITUTION OF HIGHER EDUCATION

“Saint Petersburg State University of Industrial Technologies and Design”
Higher School of Technology and Energy

PROCEEDINGS

of the IV All-Russian Scientific and Practical Conference in English “THEORY AND PRACTICE OF MODERN SCIENCE: THE VIEW OF YOUTH”

Scientific publication

2025 ● Part I

Under the general editorship of Head of the Department of Foreign Languages, PhD in Philology, Associate Professor
V. V. Kirillova

Saint Petersburg
2025

UDC 378.2.001
BBK 72
T 338

T 338 Proceedings of the IV All-Russian Scientific and Practical Conference in English “Theory and Practice of Modern Science: the View of Youth”. In 2 parts. / Ministry of Education and Science of the Russian Federation; FSBEI HE “Saint Petersburg State University of Industrial Technologies and Design”; compilers M. A. Vasilyeva, M. S. Lipatov; under the general editorship of V. V. Kirillova. SPb.: HSTE SPbGUITD, 2025. Part I. 248 p.
ISBN 978-5-91646-424-5

This collection presents the proceedings of the III All-Russian Scientific and Practical Conference in English "Theory and Practice of Modern Science: the View of Youth", held on November 30, 2024 in St. Petersburg.

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UDC 378.2.001
BBK 72

ISBN 978-5-91646-424-5

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УДК 004.94

3D TERRAIN MODELLING ON THE BASIS OF DIGITAL TECHNOLOGIES: FOREST EXPERIMENTAL DACHA STUDY

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Abstract. This paper examines the process of creating a terrain relief model of the Lesnaya Experimental Dacha territory. The study includes the analysis of different terrain relief modelling techniques, as well as the assessment of their strengths and weaknesses. The main attention is paid to the comparative analysis of classical and modern digital approaches to the creation of 3D terrain models, which makes it possible to identify the most effective tools for solving problems in the field of landscape architecture and environmental monitoring. The results of the work contribute to a better understanding of the features of relief and its impact on biosphere processes, which is of practical importance for further research and design in this area.

Keywords: qGis, SRTM, LOD, SketchUp, terrain modelling, Forest Experimental Dacha, ecology.

3D-МОДЕЛИРОВАНИЕ РЕЛЬЕФА ТЕРРИТОРИИ НА ОСНОВЕ ЦИФРОВЫХ ТЕХНОЛОГИЙ: ИССЛЕДОВАНИЕ ЛЕСНОЙ ОПЫТНОЙ ДАЧИ

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Аннотация. В данной статье рассматривается процесс создания модели рельефа территории Лесной опытной дачи. Исследование включает анализ различных методик моделирования рельефа местности, а также оценку их сильных и слабых сторон. Основное внимание уделяется сравнительному анализу классических и современных цифровых подходов к созданию 3D-моделей рельефа, что позволяет выявить наиболее эффективные инструменты для решения задач в области ландшафтной архитектуры и экологического мониторинга. Результаты работы способствуют улучшению понимания особенностей рельефа и его влияния на биосферные процессы, что имеет практическое значение для дальнейших исследований и проектирования в данной области.

Ключевые слова: qGis, SRTM, ЛОД, SketchUp, моделирование местности, Лесная опытная дача, экология.

Relevance: The creation of digital systems is a hot topic at the moment. This direction makes it possible to carry out complex analyses of the territory, enter a lot of data into one system and create terrain models to assess the features of the territory. The data obtained as a result of the work can be used for ecological research – assessment of the impact of relief on heavy metal pollution, assessment of vegetation condition, soil research.

Figure 1. Peak points on the object

Goal: Using digital systems to create a 3D model of the territory under study.

Objectives:

- the analysis the features of the study area;
- creation of a scheme of heights of the territory with the help of digital systems;
- comparison of manual and automatic mapping method;
- transfer of the obtained data to the platform for creation of 3D model;
- description of possible methods of 3D model creation;
- analysis of possible techniques for creating a model with the possibility of further editing.

Scientific novelty: Use of modern digital systems for modelling on the basis of available data.

Practical significance: Application of the finished model for further research of the territory.

To start the work, the necessary software for creating the terrain relief base and building the 3D model was determined. Qgis programme was chosen for map construction. Its features are openness, free of charge basis and possibility to work with relief both by means of the programme and manually adding isolines. In this programme with the help of QuickOSM module the map base was created and then the boundary of the investigated object was drawn.

The following elements are used for automatic creation of the relief map:

1. SRTM file as a substrate of the future map.

2. Tools: layer mask, isoline generator and geometry generator for working with isolines.

3. Modules: Srtm Downloader and Qgis2threejs.

To start working with automatic terrain generation, you need to obtain an SRTM file. There are many sources of these files (e.g. NASA and EarthExplorer sites), but the easiest and most convenient option is to use the Srtm Downloader module directly from the qGis programme. To work with the module, registration on the site providing the data is required [1]. It allows you to get Srtm file of the required area by coordinates.

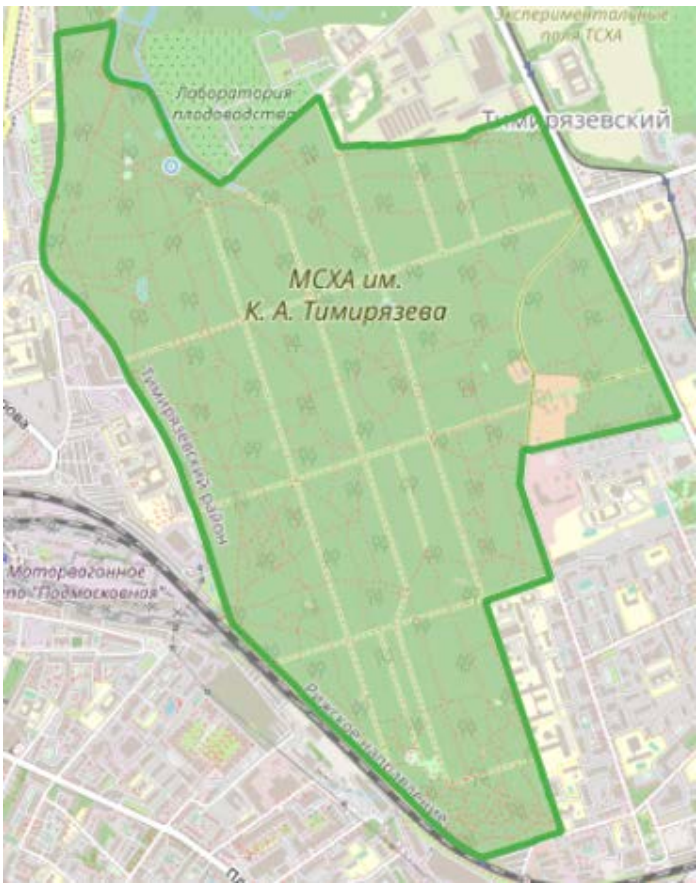

Figure 2. Forest experimental cottage

Figure 2 shows that this system is designed to work with large areas of the territory (the object of study is marked in green). Therefore, for further work it is necessary to limit the file by LOD territory. For this purpose, we use the tool that limits a layer by a mask (raster extraction) with a pre-defined territory boundary (Figure 3).

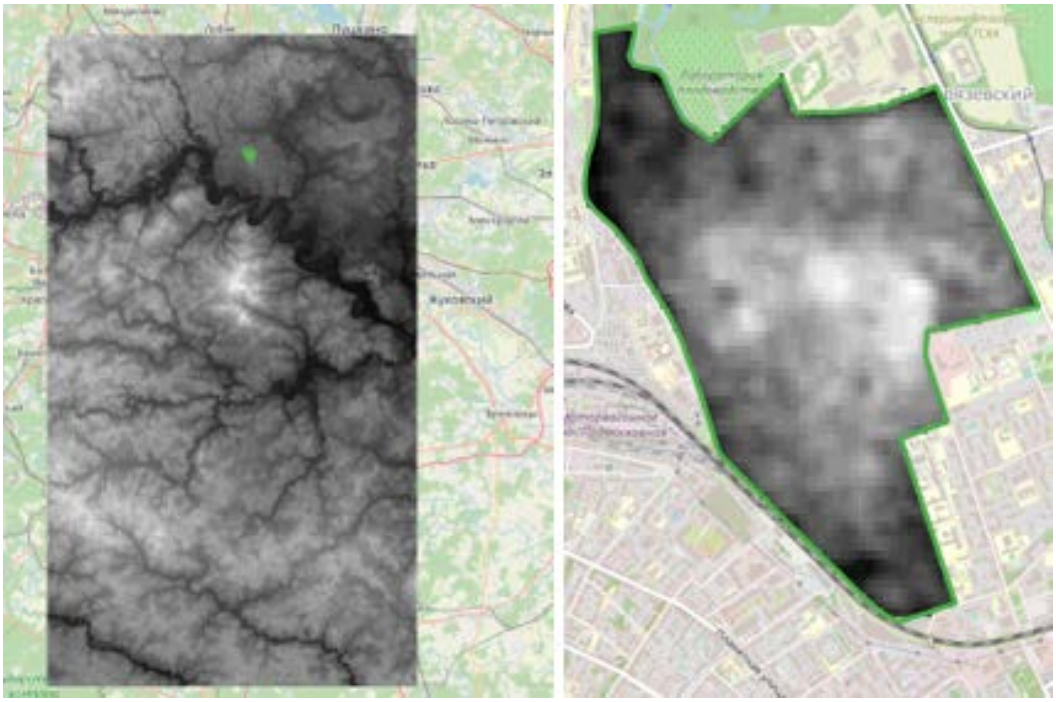

Figure 3. SRTM layer

To get isolines, you use the Create Isolines tool in the same section as the layer mask constraint. After customising and creating isolines, you may notice that some unnecessary isolines (too small, curved, not constrained) appear. To correct them and improve all isolines as a whole, you can use the geometry generator function in the layer properties and create a command to change the geometry (Figure 4).

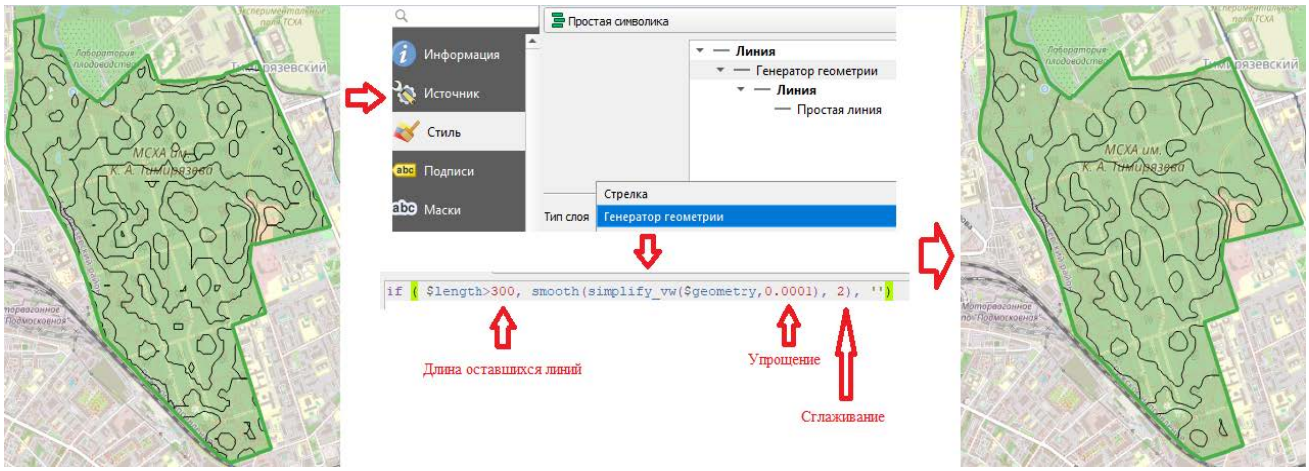

Figure 4. Working with isolines

After the completion of work with isolines on the basis of Srtm file it is possible to create a relief model of the investigated territory. First of all, it is necessary to change the colour scheme of the layer to a single-channel pseudo-colour layer (for more visual representation of heights it is recommended to use inverted RdYiGn colour series).

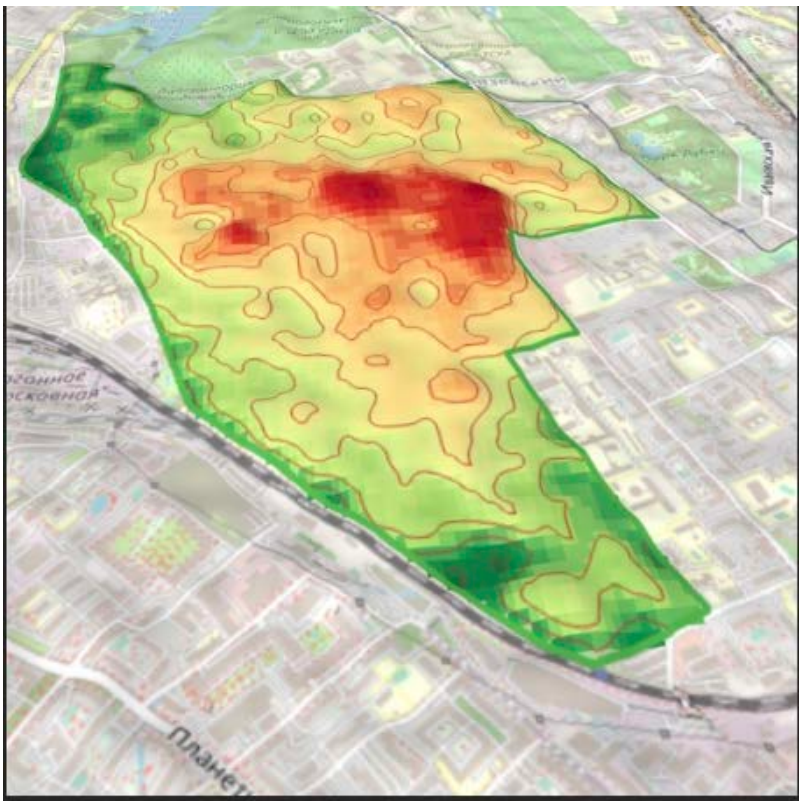

Figure 5. Territory model with automatically created isolines

Then you should install Qgis2threejs module and select the prepared layer and the layer with isolines. As a result, you can see a visual representation of the terrain relief with height isolines (Figure 5). It is necessary to note that in the presented images all elevations were equally raised several times. This change was necessary for a better visualisation of the relief due to the much greater extent of the territory relative to its altitude. Elevation differences are well visualised on the map and the steepest or gentlest slopes can be traced. However, this method has serious disadvantages. First of all, it is low accuracy of height determination when working with small objects. This peculiarity is related to high pitch of satellite images, which could be seen at the stage of SRTM file acquisition. Besides, errors may occur on automatic images due to extraneous objects on the territory. The last disadvantage is the difficulty in further editing of 3D model if necessar.

Therefore, the next option is modelling based on ready-made isolines [2]. The LOD topographic map was used as a basis. On its basis, the relief isolines were transferred to the qGis system and labelled with their corresponding heights. After that, the obtained isolines were compared with the relief obtained in the previous section (Figure 6). As a result, it can be seen that despite the general similarity of heights, there are discrepancies in some parts (the most obvious one is the displacement of the highest point on the territory).

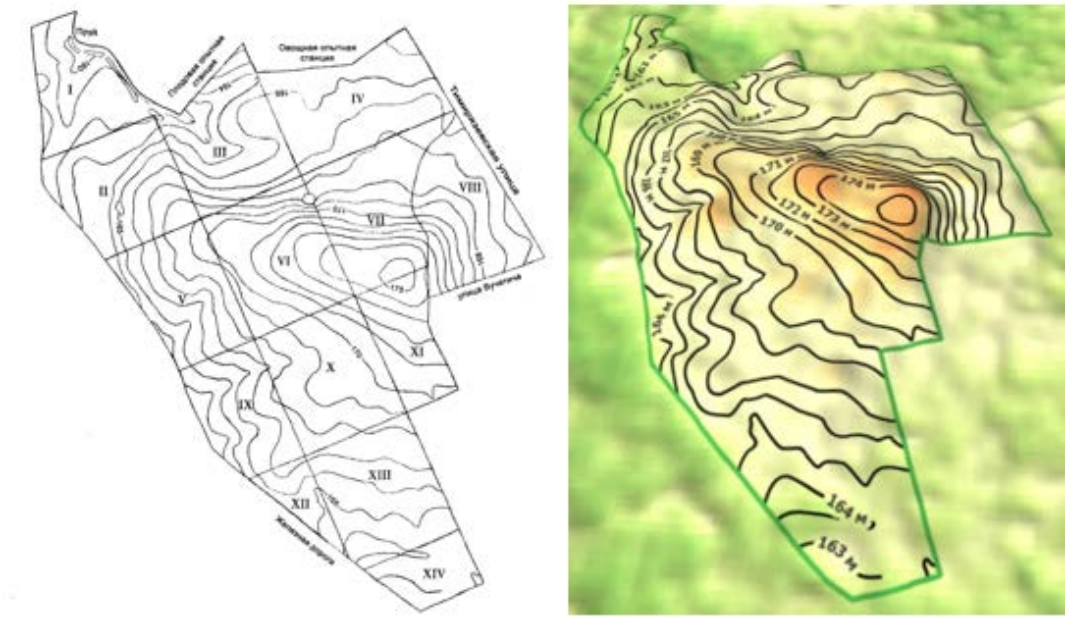

Figure 6. Basis for drawing isolines and comparing them with the automatically created relief

The last stage of the work is to use the obtained data to build a terrain model with the possibility of further editing. SketchUp programme will be used for this work. This task was set due to the need to further work with the model of the territory and its separate sections to visualise the features of the object. First of all, it should be noted that like qGis this programme allows one to automatically create a relief model on the basis of geodata of a certain area of the territory (Figure 7).

Figure 7. Automatically created relief in Sketch Up

However, it should be noted that this function has the same disadvantages as the automatic construction in qGis. In addition, the system is only able to indicate the features of relief, differentiation of certain areas by any criteria. It should also be noted that at this stage, as well as in the past, the altitudes are increased several times for better visualisation of differences in the result.

In order to create a terrain model, isolines from the previous part of the work were transferred into the programme and adjusted by height. Since the height of the relief on the object varies from 160 to 175 metres, the minimum height was taken as 0 and the maximum height was taken as 15. Further with the help of sandbox extension (sandbox tools) it is possible to create a ready relief on edges of isolines [3]. Further with the help of styles it is possible to refine the image (Figure 8).

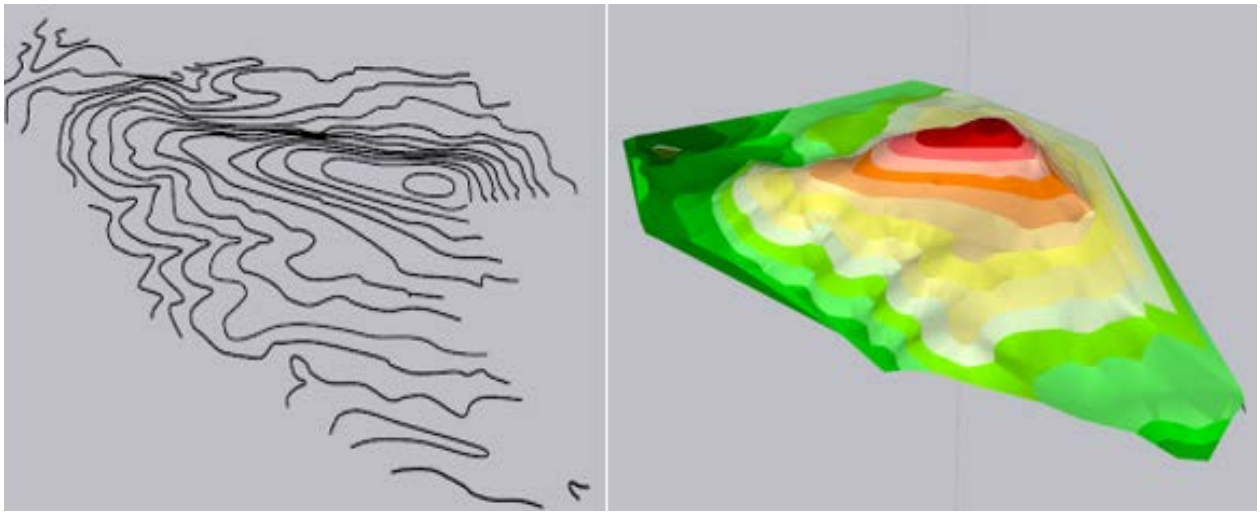
Figure 8. Terrain model by isoline edges

The main advantages and disadvantages of this model construction are as follows [4]:

– high accuracy (all elevations correspond to those on previously constructed isolines);
– possibility to build relief by points, lines and polygons;
– possibility to further edit and supplement the model (as an example, colour change of heights directly on isolines is shown);
– possibility of errors when drawing gullies and slopes (isolines are located at some distance from each other, so small features of relief are ignored);
– necessity of manual drawing of separate elements.

Conclusion

In this study we have analysed different methods of developing a 3D terrain model with the possibility of further editing. We evaluated manual and automatic methods of creation, which showed high accuracy in the first variant and high speed of creation in the second. The result was the creation of several variants of models of the territory, working both in GIS system (points on the map, routes, vegetation) and in special programmes for modelling (relief by colours, editing of parts of the model, work in section). This work can be used for further ecological studies in the territory.

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УДК 51.519.6

MATRIX MULTIPLICATION ALGORITHMS

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Abstract. Matrix multiplication algorithms are an essential topic in the field of computational mathematics. Matrix multiplication is a central operation used in many numerical algorithms, ranging from scientific computing to pattern recognition. The purpose of the article is to describe the various algorithms that were invented for matrix multiplication, as well as to justify the importance of this topic.

Keywords: computational mathematics, matrix multiplication, algebra, asymptotic complexity, Strassen algorithm, numerical stability.

АЛГОРИТМЫ УМНОЖЕНИЯ МАТРИЦ

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Аннотация. Алгоритмы умножения матриц являются неотъемлемой темой в области вычислительной математики. Умножение матриц является центральной операцией, используемой во многих численных алгоритмах, начиная от научных вычислений и заканчивая распознаванием образов. Цель статьи – описать различные алгоритмы, которые были изобретены для умножения матриц, а также обосновать важность этой темы.

Ключевые слова: вычислительная математика, умножение матриц, алгебра, асимптотическая сложность, алгоритм Штрассена, численная устойчивость.

Introduction

One of the most important things in the modern world of computational mathematics, IT and computer technology is matrix multiplication. This subject of the article is considered to be the basis and is used in many modern algorithms of cryptography, machine learning, neural networks, quantum physics, population modeling theory, computer graphics and so on.

It can be said that it is the central and simplest operation of all these algorithms, just as the process of synaptic charge transfer in the brain is the basis of its work. Using matrix multiplication, physicists can conveniently describe the complex processes of quantum physics and expand the scope of understanding our universe. Programmers

can also create neural networks that continue to amaze all of humanity with their quality.

The matrix multiplication operation has gained such popularity due to the vastness of its application. One should keep in mind that matrices, most often, are tables, but single rows or columns of data can also be called matrices. Other reasons for the popularity of matrices are rooted in linear algebra, tensor algebra, and we will not consider them.

Obviously, since matrix multiplication is used so often and everywhere, we want this process to be performed in the most optimal way possible in terms of time and memory consumption of the computing device.

It is useful to make a small remark about the further use of O-symbols. For simplicity, we will assume that the entry O(n) means that the algorithm in question performs almost certainly n operations with an accuracy of some constant. Also, such symbolism can be called the asymptotic complexity of the algorithm.

The complexity of calculating the product of matrices by definition is O(n^3), however, there are more efficient algorithms used for large matrices. The question of the limiting speed of multiplication of large matrices, as well as the question of constructing the fastest and most stable practical algorithms for multiplying large matrices, remains one of the unsolved problems of linear algebra.

Strassen algorithm

Let us start with the description of the first algorithm with a little background. In 1960, Andrei Kolmogorov, along with other pioneers of Soviet computer science, gathered at a scientific seminar and hypothesized that it was impossible to multiply two n-digit numbers faster than in an O(n^2) operation. A week later, 23-year-old graduate student Anatoly Karatsuba proposed a multiplication method with an estimate of the operating time of O($n^{log2(3)}$) and thereby refuted the hypothesis [1, p. 595]. Based on this algorithm, Volker Strassen in 1969 came up with an algorithm for fast matrix multiplication that performs less than 3 operations, namely $nlog^2(7) \approx n2.81$ operations [2, p. 169]. The disadvantage of this n method is the greater complexity of programming compared to the standard algorithm, weak numerical stability and a larger amount of memory used. A number of algorithms based on the Strassen method have been developed that improve numerical stability, constant velocity and other characteristics. Nevertheless, due to its simplicity, Strassen's algorithm remains one of the practical algorithms for multiplying large matrices.

Further algorithms

In the future, estimates of the multiplication rate of large matrices were improved many times. However, these algorithms were theoretical, mostly approximate in nature. Due to the instability of approximate multiplication algorithms, they are currently not used in practice.

Such algorithms include:

- Pan's algorithm (1978) [3];
- Bini's algorithm (1979) [4];
- Schönhage algorithm (1981) [5].

As a result, the best algorithm in terms of the number of operations performed the operation of multiplying two matrices in $O(n^{2.51})$ based on the direct sum method. Although this result is relatively smaller than the initial one, it has a number of nuances within itself – the previously mentioned problems of numerical instability, memory consumption of a computing device, and other nuances.

The following algorithm was invented in 1990 by American scientists Don Coppersmith and Shmuel Winograd. In 1990, Coppersmith and Vinograd published an algorithm with the number of operations performed being O($^{2.375}$). This algorithm uses ideas similar to Strassen's algorithm [6, p. 252]. To date, modifications n of the Coppersmith-Grape algorithm are the most asymptotically fast. In the latest modification (2024), the complexity of the algorithm is $O(n^{2.371})$. It is known that a wide class of modifications of this algorithm, in principle, cannot achieve complexity better than $O(n^{2.307})$. The Coppersmith-Grape algorithm is effective only on astronomical-sized matrices and cannot be applied in practice.

An algorithm based on neural networks

The next breakthrough algorithm appeared relatively recently, thanks to the development of neural networks, or rather the development of reinforcement learning algorithms. The development of neural networks has influenced not only the creation of smart chatbots or image generators, but also matrix multiplication algorithms.

The Google Deepmind laboratory actively conducts research in various fields of artificial intelligence applications, including matrix multiplication. In October 2022, Alhussein Fawzi, Matej Balog and some other scientists working in the Deepmind laboratory released an article highlighting the latest matrix multiplication algorithm, which showed a 10-20 % speed increase on some computing devices [7].

It is worth noting that it cannot be argued that this algorithm is guaranteed to perform fewer operations than modifications of the Coppersmith-Grape algorithm, since it is not a "classic" algorithm and has been tested only on some computing devices. It is possible that the result will be worse on other computing devices, but nevertheless this is a very promising algorithm that in the future may replace the classical algorithms currently used.

The essence of this algorithm is very interesting and unusual – scientists use a neural network that is trained to quickly multiply matrices. And to do this, they give it access not only to the matrices themselves, but also to the internal computing hardware. Thus, scientists create a kind of "professional" in matrix multiplication, who analyzes this process and finds patterns, which helps speed up the matrix multiplication process and reduce the number of operations.

Conclusion

Thus, matrix multiplication is not as simple an algorithm as it might seem at first glance. This field has attracted researchers for a very long time and to this day is one of the completely unsolved problems of computer mathematics. Its solution would significantly expand human capabilities.

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УДК 004.5

THE IMPACT OF QUANTUM COMPUTERS ON CYBERSECURITY

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Abstract. The article examines quantum computers and their role in cybersecurity. It emphasizes that with their immense computational power, these machines have the potential to break current encryption standards and compromise sensitive information. Quantum Computing companies, institutions and research groups may become targets by cybercriminals and hackativists. To protect their networks, software, hardware and data from digital attacks Quantum applications become a necessity. To address this challenge, researchers are developing quantum-resistant algorithms, with lattice-based cryptography emerging as a promising solution. By leveraging the unique properties of lattices, these algorithms provide a strong defense against quantum attacks. This research ensures the security of national defense systems, communications networks, and data storage in the quantum era.

Keywords: quantum computers, threat to cybersecurity, Shor's algorithm, quantum-resistant algorithms, lattice-based algorithms, symmetric encryption, asymmetric encryption.

ВЛИЯНИЕ КВАНТОВЫХ КОМПЬЮТЕРОВ НА КИБЕРБЕЗОПАСНОСТЬ

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Аннотация. В статье рассматриваются квантовые компьютеры и их роль в кибербезопасности. Подчеркивается, что с их огромной вычислительной мощностью эти машины обладают потенциалом для взлома текущих стандартов шифрования и компрометации конфиденциальной информации. Компании, институты и исследовательские группы, занимающиеся квантовыми вычислениями, могут стать целями киберпреступников и хакеров. Для защиты их сетей, программного обеспечения, оборудования и данных от цифровых атак квантовые приложения становятся необходимостью. Для решения этой проблемы исследователи разрабатывают квантово-устойчивые алгоритмы, а криптография на основе решеток становится перспективным решением. Используя уникальные свойства решеток, эти алгоритмы обеспечивают надежную защиту от квантовых атак. Данное направление исследований

обеспечивает безопасность национальных оборонных систем, сетей связи и хранения данных в квантовую эпоху.

Ключевые слова: квантовые компьютеры, угроза кибербезопасности, алгоритм Шора, квантово-устойчивые алгоритмы, решетчатые алгоритмы, симметричное шифрование, асимметричное шифрование.

Introduction

In the near future, quantum computing could potentially break the foundations of current cybersecurity practices, posing a significant threat. We could imagine a scenario where a sinister organization acquires a powerful quantum computer and targets a secure military communication network. Using Shor's algorithm, they could swiftly factorize encryption keys, decrypt sensitive communications, and trigger a catastrophic breach of national security. This scenario is not merely fantastical, but an oncoming reality if cryptographic systems fail to evolve alongside quantum advancements.

Quantum computing and enscryption vulnerabilities

To fully understand the implications of quantum computing for cybersecurity, let us take a step back and examine the problem from its inception. Classical computers, which rely on chains of transistors, process information using bits – either 0 or 1. In contrast, quantum computers possess two crucial properties that differentiate them from classical systems: superposition and entanglement.

To illustrate these properties, consider a coin that can be in two states – heads or tails. This coin represents traditional bits. However, in a quantum system, if you were to spin the coin, it would exist in a superposition of both heads and tails simultaneously. Moreover, if you had a pair of entangled coins, the state of one coin would instantaneously affect the state of the other, demonstrating entanglement. These properties enable a connected group of qubits (quantum bits) to possess significantly more processing power than an equivalent number of classical bits [1, p. 138].

While these unique properties hold promise, quantum computers also face several setbacks. They must be maintained at freezing temperatures or within vacuum chambers, as even slight temperature changes or vibrations can render them useless. These disturbances, known as "noises", represent one of the main limiting factors of quantum computers. They can cause decoherence, where the quantum state of a qubit is lost.

Nowadays our efforts to prevent noise are largely ineffective, as some level of noise will inevitably seep in. This renders calculations and analytical information from quantum computers susceptible to errors. To mitigate this, scientists may increase the number of regular qubits, but creating a reliable qubit with greater resistance to decoherence requires thousands of standard qubits. When compiled, these qubits form a logical qubit.

Decoherence remains the primary challenge for quantum computers, and we still have a long way to go to create a reliable and accurate quantum computer. That being said, it is important to note that quantum computers are not useless; however, having a practical, desktop quantum computer is unlikely to happen anytime soon due to their current size and demanding requirements.

Quantum speedup and the implications for cryptography

Thanks to the unique properties of qubits, quantum computers have the potential to perform large calculations far more efficiently. This efficiency is often referred to as “quantum speedup”, which implies that quantum algorithms can outperform classical ones by reducing the number of steps required for a given process. For instance, Google’s Sycamore computer solved a highly complex math problem in approximately 200 seconds, whereas a state-of-the-art supercomputer would have taken 10,000 years to solve the same problem, according to Google’s claims [2].

Now, let us consider the state of cybersecurity today. There are two primary types of digital encryption used: symmetric encryption and asymmetric (public-key) encryption. Symmetric encryption involves using identical digital keys for both the sender and receiver to encrypt and decrypt data. Current symmetric cryptographic algorithms are considered relatively secure against quantum computer-enabled attacks.

On the other hand, asymmetric encryption relies on a publicly available key to encrypt messages, which can only be deciphered by the intended recipient who possesses a private key. Public-key cryptography methods like Rivest-Shamir-Adleman method (RSA) and elliptic curve cryptography leverage algorithmic trapdoor functions to create keys that are computationally easy to compute in one direction but incredibly difficult for classical computers to reverse-engineer.

However, quantum computing has the potential to accelerate the decryption of information protected by current public-key encryption techniques. Peter Shor’s theoretical work in 1994 demonstrated that a large, fault-tolerant quantum computer could factorize the prime factors of integers much faster than classical computers. This renders many of today’s common encryption standards obsolete [3, p. 7].

Nevertheless, the development of cryptographically significant quantum computers is still out of reach. Currently, quantum computers with enough power to compromise RSA 2048 or similar public-key encryption require thousands of error-corrected quantum bits, and the largest functional quantum computers available today range from 50 to 60 qubits without error correction. However, companies like QuEra are promising the launch of a fault-tolerant quantum computer with 256 physical qubits and 10 logical qubits in 2026.

While the risk to current encryption standards may be a decade away, the implications for national security, civilian communications, and stored data are significant. This poses a massive problem for governments seeking to protect state secrets and for companies responsible for safeguarding customer and user data. Consequently, the development of quantum-resistant encryption is crucial.

Quantum-resistant algorithms and lattice-based cryptography

Researchers are currently exploring and developing several types of quantum-resistant algorithms. These include lattice-based algorithms, code-based algorithms, hash-based algorithms, multivariate polynomial-based algorithms, Isogeny-based algorithms [4].

Out of all of those algorithms the most promising ones are lattice based algorithms.

Lattices are grid-like structures made up of points arranged in a specific pattern. These structures have interesting properties that make them useful for cryptography.

In lattice-based cryptography, one of the key problems we consider is the Shortest Vector Problem (SVP). The SVP involves finding the shortest non-zero distance between any two points in a lattice. This problem becomes increasingly difficult as the number of dimensions in the lattice increases.

The hardness of the SVP is leveraged to provide security in lattice-based cryptographic systems. We assume that finding the shortest vector in a lattice is a computationally hard problem, even for powerful computers and advanced mathematical techniques.

To apply lattice-based cryptography, we use two bases: a “bad basis” and a “good basis”. The bad basis consists of vectors that are not well-structured and may have long lengths and non-orthogonal relationships. On the other hand, the good basis consists of shorter vectors that are nearly orthogonal to each other.

When encrypting a message using lattice-based cryptography, we encode the message in the lattice space using the bad basis. We then introduce a random “error vector” that represents a small deviation from the true lattice point. This error vector is added to the encoded message, resulting in an encrypted message that is not part of the lattice but is close to it.

To decrypt the message, we use the good basis, which describes the same lattice as the bad basis but with shorter vectors and orthogonal relationships. We calculate the closest lattice point to the encrypted message using the good basis. By rounding the resulting coordinates to the nearest integers, we obtain the original lattice point. With this information, we can decode the message.

The security of lattice-based cryptography relies on the hardness of problems such as the SVP and the related Closest Vector Problem (CVP). If an efficient algorithm were found to solve these problems, it would have significant implications for the security of lattice-based cryptographic systems [5].

Conclusion

To sum up, the advent of quantum computing presents both opportunities and challenges for cybersecurity. While quantum computers offer the potential for unprecedented computational power and efficiency, they also pose a significant risk to current encryption standards. The ability of quantum computers to quickly factorize encryption keys and decrypt sensitive information threatens the security of national defense systems, communications networks, and data storage.

To address this emerging threat, the development of quantum-resistant encryption algorithms is imperative. Researchers are actively exploring lattice-based algorithms, code-based algorithms, hash-based algorithms, and other approaches to ensure that our cryptographic systems can withstand the advancements of quantum computing. Among these, lattice-based cryptography appears to be the most promising option.

It is worth noting that practical, cryptographically significant quantum computers capable of breaking current encryption standards are not yet within reach. However, the potential risks underscore the importance of proactive measures. Governments, organizations, and individuals must stay vigilant, invest in research and development, and be prepared to transition to quantum-resistant encryption methods as they become available.

By staying at the forefront of technological advancements and fostering collaboration between academia, industry, and government sectors, we can adapt and fortify our cybersecurity infrastructure to protect sensitive information in the quantum era. The journey towards quantum-resistant encryption is a collective effort that requires ongoing innovation, collaboration, and a g approach to ensure the security of our digital world.

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УДК 37.013.46

THE INFLUENCE OF CLIP THINKING OF STUDENTS ON THE MODERN EDUCATIONAL PROCESS

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Abstract. The article examines key trends characteristic of the modern information society, particularly the changes in the perception of reality that manifest themselves in clip and fragmented thinking. It also emphasizes the importance of considering these factors in the educational process. Furthermore, it highlights the necessity of adapting teaching methods to new conditions in order to ensure a deeper understanding and integration of knowledge among students.

Keywords: clip thinking, information society, educational process, education, training, learner.

ВЛИЯНИЕ КЛИПОВОГО МЫШЛЕНИЯ ОБУЧАЮЩИХСЯ НА СОВРЕМЕННЫЙ ОБРАЗОВАТЕЛЬНЫЙ ПРОЦЕСС

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Аннотация. В статье рассматриваются ключевые тенденции, присущие современному информационному обществу, в частности, изменения в восприятии реальности, которые проявляются в клиповом и фрагментарном мышлении, а также подчеркивается значимость учета этих факторов в образовательном процессе. Кроме того, акцентируется внимание на необходимости адаптации методов обучения к новым условиям, чтобы обеспечить более глубокое понимание и интеграцию знаний у учащихся.

Ключевые слова: клиповое мышление, информационное общество, образовательный процесс, образование, обучение, обучающийся.

The transition from an industrial type of society to a post-industrial one and the rapid development of information technology in the second half of the 20th century had a significant impact on human cognitive abilities. The emergence and spread of television, mass media, the Internet, modern literature and art have led to a change in the nature and status of knowledge.

According to the researchers, it is the way of transmitting and receiving information that determines the features of human thought processes [1]. Modern civilization is increasingly oriented towards the perception of visual and auditory images, which reduces the role of printed text. Nowadays, almost every teenager has a social media account, where they spend a significant amount of time each day.

The content of most modern social networks can be characterized as a stream of unrelated short images (photos, images with captions, short videos lasting up to three minutes). Before an individual has time to process one topic, they switch to another. Each image is instantly perceived. The information presented is quickly imprinted in the subconscious, bypassing the barrier of conscious perception.

In other words, clips activate a non-reflective and irrational creation of information. Consuming information in such a “short film” and chaotic format over an extended period leads to changes in how modern teenagers perceive information. As a result, psychologists note the development of what is called “clip thinking” and the formation of a “clip consciousness”. The problem for its carriers is that they often do not need or are not inclined toward critical reflection on the information they receive.

Researchers L. Yu. Nesterova and S. V. Napalkov note that clip thinking is not inherent to humans from birth. It develops depending on the way information is consumed and analyzed. The specificity of modern society is the transmission of information through moving images accompanied by sound [2, p. 207]. Therefore, the term “clip thinking” refers to the habit of perceiving information through short, vivid, and highly expressive images.

According to V. Kuznetsov, one of the characteristics of clip thinking is that a person can leave the system they are observing at any moment without experiencing subsequent discomfort or a sense of incompleteness (as happens when interrupting the reading of classic works), and can also enter it at any time [3]. Due to the fragmentary nature of the presented information, the lack of context, and its dispersion over time, it becomes more challenging for the brain to comprehend the connections between events, and the clip itself turns into informational noise. At the same time, people with clip thinking are more emotional and easily influenced, especially by messages encoded in such short and vivid images.

As a result, the researchers note that the culture of perception has fundamentally changed among the modern generation of young people – they do not need linear text, and the perception of verbal text is difficult [4]. Clip thinking negatively affects an individual’s perception of information. So, it is difficult for such people to concentrate their attention, they are constantly distracted and feel a constant need to be reinforced with clip-based information; it is much more difficult for them to analyze and build logical chains, highlight important things and draw their own reasoned conclusions. It is necessary to deal with such consequences and, if possible, act ahead of the curve

The researcher T. V. Semenovskikh believes that in the context of clip thinking, it is necessary to reconsider the substantive component of educational material [5].

Since individuals with clip consciousness find it difficult to perceive linear text, it is essential for continuous thoughtful reading with full comprehension of the material to become a mandatory element of working on the topic. It is important that these are works of fiction, stories, or narratives that take no less than 10-15 minutes each week (for better effectiveness and more rational use of study time, it is advisable to assign reading as homework). To enhance understanding of the content read, pre-text and post-text exercises should be intensively used, each serving its own function: at the pre-text stage, students familiarize themselves with the issues of the text with the help

of the teacher, while at the post-text stage, they perform exercises and tasks aimed at understanding the content read.

To structure the flow of information, the content of any subject is presented thematically. This allows individuals to familiarize themselves with a specific fragment of reality and its various aspects. In particular, the theme unites and structures the characteristic language material, relevant sociocultural information, and situations of communicative interaction.

The work on writing students' own statements should become systematic. These can include both retellings (which allow for the transmission of others' thoughts) and personal reflections or reports. When considering the mental processes that are activated during writing, it is important to note that during oral communication, the transmission and reception of messages represent a brief and irreversible process in temporal terms, as spoken messages are formed at the moment of communication. In contrast, the writer and reader operate under different conditions.

During the writing process, the content of a sentence can be reviewed, refined, and rewritten until a complete thought is formulated. Furthermore, most researchers believe that writing activates the complex functioning of all components of the analytical system: speech-motor (speaking), auditory (listening), visual (reading), and motor (writing) analyzers.

The letter provides multiple repetitions of complex linguistic phenomena being studied, ensuring their accessibility, effectiveness, and the students' ability to learn them independently [6]. However, the writing of one's own statement is preceded by thorough preparation and the development of students' skills to structure their own work into meaningful blocks, using appropriate phrases, clichés, and so on.

Another productive activity is discussion. A person is an emotional being and perceives any information through the prism of his own emotions, which he wants to express. The primary didactic goal of discussion is to practice the relevant language material (lexical and grammatical) in speech, as well as the ability to express personal opinions on the issues of a specific topic defined by the curriculum.

Therefore, discussion should be based on appropriate thematic material. If students at this stage of learning are not yet ready to discuss a problem in the form of a debate, an alternative would be to organize situational speech activities for the students.

In the context of the existence of clip thinking as an objective phenomenon, fighting it with absolute "eradication" is impractical. Instead, it seems feasible to make certain adjustments to the content and process of education, taking its characteristics into account. Thus, when presenting new material to students, it is essential to focus on vivid, visual images and presentations with easily memorable formulations.

Currently, there are numerous language learning groups on social media that have accumulated a relevant base of didactic materials. Since these materials cannot be integrated into a paper textbook, the teacher's task is to select the necessary resources and present them in a measured way, considering their didactic appropriateness.

When selecting information in a clip format, it is important to remember the so-called Miller's rule, which suggests that there should be 7 ± 2 new phenomena at one

time (in our case, during a lesson). It is also important to note that the new phenomena during a lesson can include both new lexical units and grammatical aspects of the language. Therefore, the number of clips should be fewer than 7.

The clip-based approach cannot completely replace more traditional methods and forms of teaching, as the learning process would lose its systematic nature. Teachers, parents, and developers of didactic materials are not ready for such radical changes in education, and there is a lack of fundamental research in this area. However, in modern realities, it seems inappropriate to eliminate the clip format from the educational process altogether.

Thus, to address the issue of clip-based thinking, educators need to understand and consider the developmental characteristics of contemporary learners and strive to teach them to think more comprehensively.

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УДК 004.8

INTERACTION OF ARTIFICIAL INTELLIGENCE AND ARTISTS FOR IDEA DEVELOPMENT

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Abstract. The article discusses the tools of using artificial intelligence for artistic expression and promotion of visual concepts and ideas. The research is based on the following hypothesis: text-to-image models have reached a stage where they can effectively convert specific conceptual descriptions into images without the need for additional manual configuration.

Keywords: artificial intelligence, text-to-image models, prompt.

ВЗАИМОДЕЙСТВИЕ ИСКУССТВЕННОГО ИНТЕЛЛЕКТА И ХУДОЖНИКА С ЦЕЛЬЮ РАЗРАБОТКИ ХУДОЖЕСТВЕННОГО ОБРАЗА

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Аннотация. В статье рассматриваются инструменты использования искусственного интеллекта для художественного самовыражения и продвижения визуальных концепций и идей. Исследование основано на следующей гипотезе: модели преобразования текста в изображение достигли такой стадии, когда они могут эффективно преобразовывать конкретные концептуальные описания в изображения без необходимости дополнительной ручной настройки.

Ключевые слова: искусственный интеллект, модели text-to-image, текстовый запрос.

In recent years, breakthroughs in technologies such as deep learning and generative adversarial networks (GANS) have enabled AI to perform creative tasks. By training on large amounts of data and algorithms, AI can create works of art that previously could only be created by humans. Text-to-image models allow designers to quickly experiment with different styles and visual interpretations of their concepts. For the average person, AI provides an opportunity to express themselves artistically. It is certainly appropriate to explore the intersection of AI and artistic expression, so this research is undoubtedly relevant.

The primary objective of the study is to explore the potential of AI in art by investigating how AI can be utilized for artistic expression and the advancement of visual concepts and ideas. By focusing on text-to-image generation models, this project aims to enhance the creative process for artists and designers by leveraging AI to transform textual descriptions into visual representations. Through this research, the authors seek to uncover new ways in which AI can inspire, support, and extend artistic creativity, ultimately pushing the boundaries of the traditional artistic process through innovative use of technology. The study is based on the following hypothesis: text-to-image models have advanced to a stage where they can effectively transform specific conceptual descriptions into images without the need for additional manual fine-tuning.

The research process included the following steps:

1. Creating an artwork with a clear concept.
2. Formulating a concept to use in prompt for artificial intelligence.
3. Conducting experiments with different AI models to generate multiple variations or interpretations of the original image based on textual input, allowing for the exploration of different artistic styles and perspectives.
4. Making a conclusion based on the results of the experiments.

The creative impetus was given by the Latin phrase “Dies levat lucrum” that is translated as “Time eases grief”. The thematic depth of the phrase is enhanced and an artistic interpretation is conceptualized by the author’s artwork (Figure 1).

Figure 1. Initial work

The statue in the picture portrays a mythical figure with a visual motif of emanating from its head blood juxtaposed with the aged stone material. The statue depicted in the painting had initially suffered from blood oozing from its severed arms, but over time, the bleeding stopped. This artistic creation shows poignant reflection on life’s transience and the perpetual cycles inherent in the human experience and try to interpret healing over time. The foregoing text was used for creation a prompt for AI image generation.

Text-to-image models are a type of generative model that transforms textual descriptions into corresponding visual representations. These models are trained on the

content of the Internet – in the case of the figurative model, the machine finds signed images on the network and understands that a certain text correlates with a specific image and vice versa. Generative models typically consist of two components: a text encoder and an image generator trained to work in conjunction to produce realistic images based on input text. The user enters a prompt – a hint, instruction, request, on the basis of which the program produces a visual image. If we use neural networks, then our creative activity turns into the art of thinking through images and concepts. The artist does not have absolute control over the resulting work. The degree of control can be increased by introducing as many prompts as possible. However, the element of randomness cannot be completely eliminated. The final artwork is thought to depend on tools used by artists whether they use brushes and paints or a graphic tablet. Besides, the neural network learns from those works that are already in the cultural heritage of mankind and produces results based on ready-made objects, styles, and trends. However, this feature brings the neural network closer to ordinary artists, whose formation is unthinkable without the influence of others.

An interaction of art and science can not only create new forms of art and cultural expression, but also bridge the gap between cultures. AI can significantly change approaches to intercultural communication offering new tools for understanding and overcoming cultural barriers. The use of machine learning and natural language processing technologies expands the possibilities for automated analysis of cultural characteristics and adaptation of creating images to the specifics of national and regional cultures. However, despite the obvious advantages, the introduction of AI in the field of intercultural communication also involves a number of challenges and risks. Issues related to the potential loss of authenticity of cultural interaction require careful consideration and comprehensive analysis.

Several studies have analyzed the capabilities of text-to-image models as well as their strengths and weaknesses. They determined the level of the development of such models in relation to human abilities and demonstrated their efficacy [1, 2, 3].

The research by Reed et al. introduced a novel framework using GANs for generating realistic images from textual descriptions. The approach involved training the image generator to produce images that could not be distinguished from real images by a discriminator network [4].

Overall, text-to-image models leverage deep learning techniques, including GANs and attention mechanisms, to bridge the semantic gap between text and images, enabling the generation of realistic and contextually relevant visual content from textual descriptions [5]. Ongoing research in this field is focused on improving the quality, diversity, and interpretability of the generated images, thereby advancing the capabilities of text-to-image models in various applications like content generation, artistic creation, and human-computer interaction.

Neural networks such as Midjouney and aigenerator.cc. were used to assess if the advancement of text-to-image models to a level wherein an autonomous comprehension of the concept of art pieces generated without additional adjustments is achieved. By processing diverse and uniform queries with the help of artificial intelligence middleware varying results and interpretations of the artwork concept were obtained. In synthesized images based on text queries regarding the concept of “Time

Heals” some discrepancies in depiction arose. In some instances, the concept was misunderstood and depicted inadequately. Figure 2 shows a picture that was generated by Midjouney v4. It evokes emotions in the viewer but does not accurately convey the initial concept.

Figure 2. The result of generating by Midjouney v4

According to the subjective perception of the artist one image generated via artificial intelligence is aligned closely with the intended concept (Figure 3).

Figure 3. One of the results of the experiment

The picture obtained as a result of the experiments features a set of shattered clocks and a butterfly inside clocks. This particular artwork is chosen due to its profound essence in embodying the concept “Time heals all wounds”. The symbolism intertwined with the imagery of broken clocks (traditionally representing time) is juxtaposed with the graceful presence of a butterfly navigating the fragments. The juxtaposition of fragility and hope encapsulated in this artwork expresses the idea of recovery and evolution with the passage of time most accurately.

Based on the conducted research, it can be concluded that currently artificial intelligence relying solely on textual queries is often unable to accurately interpret the offered idea. However, this result should not be treated too pessimistically, it is necessary to see the potential and prospects for cooperation and complementarity between AI and humans, and not consider it as a substitute for their work and creativity.

Artists and designers can harness artificial intelligence as a tool for inspiration and idea development. The potential for collaboration between humans and artificial intelligence may lead to novel and creative ways of bringing ideas to life. Further advancement in this field could reveal opportunities for innovation and enhancement of creative processes.

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УДК 331.5

THE CONCEPT AND METHODS OF STATE EMPLOYMENT POLICY

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Abstract. In the modern world, employment issues are becoming an integral part of the socio-economic policy of each state. An effective public employment policy plays a key role in ensuring the stability of society, reducing unemployment and fighting poverty. The article examines the essence of the state employment policy and methods of state employment provision.

Keywords: employment, unemployment, employment policy, employment center, employment promotion.

ГОСУДАРСТВЕННАЯ ПОЛИТИКА ЗАНЯТОСТИ: ПОНЯТИЕ И МЕТОДЫ

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Аннотация. В условиях современного мира, вопросы занятости населения становятся неотъемлемой частью социально-экономической политики каждого государства. Эффективная государственная политика занятости играет ключевую роль в обеспечении стабильности общества, снижении уровня безработицы и борьбе с бедностью. В статье рассмотрены сущность государственной политики занятости и методы государственного обеспечения занятости.

Ключевые слова: занятость, безработица, политика занятости, центр занятости, содействие занятости.

In the modern world, employment issues are becoming an integral part of the socio-economic policy of each state. An effective state employment policy plays a key role in ensuring the stability of society, reducing unemployment and fighting poverty, and ensuring general economic equilibrium [1, p. 140].

Given globalization, technological changes, and demographic shifts, the importance of studying this topic is rapidly increasing. Finding effective approaches to

regulating the labor market, optimizing incentives for employment, and adapting to new economic conditions is becoming a priority for State institutions.

Employment of the population is the main priority for the state in the light of the aspiration to increase the level of well-being of citizens, stimulate economic development and strengthen commodity-money relations. The importance of studying the effectiveness of government measures to promote employment, adapt to changes in the labor market and create favorable conditions for the use of labor resources cannot be overemphasized.

Given the impact of economic, political and social factors on the level of employment and unemployment in Russia caused by sanctions measures, the need to adjust the existing state program is obvious. Analyzing the effectiveness of the methods and tools used in public administration in the field of employment is an urgent task to ensure the sustainability and development of the country's labor potential [2, p. 76].

Employment policy includes a set of measures and actions aimed at social and economic development, as well as at improving the labor force and ensuring employment stability for all members of society [3, p. 84].

Employment policy includes a variety of measures aimed at improving the labor force and maintaining effective employment, which contributes to the socio-economic development of society and the well-being of its members. It covers the system of relations related to attracting the population to socially useful activities that can generate income. Employment plays a key role in the economy and well-being of the nation, reflecting the level of well-being of citizens and the stability of society [4, p. 314].

There is a complex process at different levels of state employment policy: local level, macro level or regional level.

At the macro level, the key tasks of employment policy are assumed by the upper levels of state legislative and executive power:

- coordination of financial and credit, structural, investment, and foreign economic policies with the system of goals and priorities of employment policy;
- alignment of employment policy goals and priorities with economic, social, demographic and migration policies.

Regional authorities include employment support in their main priorities and implement social policies within their competence. At the regional level, various programs are being implemented to support employment, including housing, transport, and manufacturing.

For example, effective support measures for farmers and small businesses work better at the regional level than at the national level.

To solve the problems of employment at the regional level, the following state policy tools are proposed:

- professional development and retraining of the population, especially temporarily unemployed;
- improvement of information support, including the introduction of computer technologies;

– provision of specially equipped premises and qualified personnel of employment centers;
– targeted workplace support to prevent layoffs.

Assistance in employment and social protection of unemployed people, organization of public works, support for youth and adolescents, refugees and displaced persons, as well as citizens with disabilities in the labor market – all this is part of efforts to improve the efficiency of the unemployed registration system [5, p. 306].

Special events and national projects are being held in the country to help citizens find jobs and help employers find the right employees. Also, the unemployed are registered and social support payments are made to citizens who have been officially recognized as unemployed.

Depending on the targeting and level of state policy, the Government uses various methods to achieve its goals.

Methods of state regulation of employment of the population can be classified into economic, organizational and administrative-legislative methods:

– Economic methods include stimulating economic growth, developing infrastructure, investing in education and science, creating favorable conditions for business, and encouraging entrepreneurship and innovation. As an example of creating favorable conditions for business and encouraging entrepreneurship, we can cite self-employment and compensation for employment discussed in the previous paragraph.
– Organizational methods include labor market management, development of training and retraining programs, employment support, organization of employment services, development of flexible forms of employment.
– Administrative and legislative methods include setting minimum employment standards, enacting laws and regulations, monitoring and supervising compliance with labor legislation, and introducing various types of benefits and incentives for employers and employees.

Specific methods for prospective predictive justifications of employment and the labor market are as follows.

The Federal Law “On Employment of the Population in the Russian Federation” is a fundamental legislative act that defines the rights of citizens in the field of employment [6]. It establishes the principles and forms of state policy, regulates the legal and organizational status of the Federal State Employment Service as the central body in the system of bodies and institutions whose activities are aimed at solving various problems. These challenges include assessing and predicting employment development, and designing and implementing programs.

The website of the Ministry of Labor contains reports and plans of the Government of the Russian Federation, which specify the goals and objectives of the state employment policy and planned deadlines for implementation. So, with regard to unemployment, there is a specific goal of the program – not to exceed the value of the registered unemployment rate of more than 1 percent by 2030 [7, p. 36].

As an indicator reflecting the final socially significant socio-economic effect of the Program implementation, the indicator “registered unemployment rate” is provided.

Within the framework of this goal, tasks are being solved to provide citizens with opportunities to improve their skills and acquire additional knowledge and skills in order to promote their employment, to develop employment infrastructure and introduce organizational and technological innovations using digital and platform solutions to support the level of employment of the population, to digitalize the processes of providing public services, to create conditions for attracting employers of the necessary labor resources from other subjects of the Russian Federation, to develop a mechanism for independent assessment of qualifications, as well as to create and support the functioning of the basic center for professional training, retraining and advanced training of workers.

These tasks are solved in the course of implementing the activities of the federal project “Employment Promotion”, the national project “Demography” and the federal project “Digital Public Administration” of the national program “Digital Economy of the Russian Federation” [8, p. 280].

The second goal of this Program is to create conditions for the formation of a culture of safe work and increase the effectiveness of measures aimed at preserving the life and health of employees in the course of their work.

As indicators reflecting the final socially significant socio-economic effect of the Program implementation, the indicators “the number of registered group accidents at work, accidents at work with a serious and fatal outcome” and “the number of victims (insured) as a result of insured accidents at work with a fatal outcome” are provided.

To achieve this goal, it is planned to solve the following tasks: ensuring the priority of preventing occupational injuries; introducing a culture of safe work

To achieve these goals and objectives, the state develops and implements a set of measures, including legislative initiatives, social programs, economic incentives and regulation, as well as interdepartmental interaction and partnership with employers’ organizations and trade unions [9].

Thus, we can see that the state conducts an active employment policy, applying modern and relevant methods to more effectively implement the tasks set.

In accordance with the Federal Law of the Russian Federation “On Employment of the Population in the Russian Federation”, in order to promote full, productive and freely chosen employment of the population, the State provides:

- implementation of financial, credit, investment and tax policies aimed at rational allocation of productive forces, increasing the mobility of labor resources, creating new technologies, encouraging flexible working conditions and other measures that contribute to the preservation and development of the workplace system;
- legal regulation in the field of employment based on compliance with guarantees.

Separately, we would like to note the development of modern employment centers as a method of state employment provision, which previously only kept records of the unemployed and did not show special indicators, but today have become real centers of employment development. In recent years they have been actively working independently and in tandem with multifunctional centers [10, p. 90].

The Employment Service, acting in accordance with the legislation, carries out comprehensive regulation of employment of the population. Employment agencies, together with government and local self-government bodies, develop and implement the State employment policy, taking all necessary measures for its filfillment. The Ministry of Labour and Social Development is responsible for the overall management, development of employment policies and management of the employment services system.

The employment promotion program is implemented by them to protect citizens from unemployment.

Local employment organizations carry out activities provided for in the legislation of the Russian Federation on employment of the population, directly interacting with the residents of the district. The main goal of these organizations is to ensure the implementation of the state employment policy, taking into account the economic and social characteristics of a particular region.

In 2023, employment centers provided more than 2.4 million career guidance services, of which almost 940 thousand were provided to young people under 30. These services play a key role in helping citizens find work and develop their professional path. They help people discover their abilities, identify their strengths, and establish areas for development. Career guidance helps people navigate a variety of professions and choose what best suits their interests, skills, and goals.

Currently, the implementation of the State labor and employment policy faces obstacles due to the prevailing economic and political circumstances. To solve these problems, it is necessary to take measures on financial and credit policy, improve the location of production, increase labor mobility and support the entrepreneurial activity of the population. To achieve full employment of the population and improve the economic situation in the country, it is necessary to continue the active participation of the state employment service. It should provide high-quality assistance to the population in training and retraining specialists.

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УДК 681.5

MODERN PECULIARITIES OF DESIGN OF EMERGENCY CONTROL DEVICES AND SELECTION OF THEIR SETTINGS

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Abstract. The article attempts to investigate topical aspects of designing emergency automation (EA) designed for rapid detection, localization and prevention of emergency situations in an interconnected power system. Particular attention is paid to the key principles and peculiarities of setting selection for emergency control devices, the correctness of which determines the efficient and reliable operation of the latter.

Keywords: electric power industry, power system, RPA, design, setpoints.

СОВРЕМЕННЫЕ ОСОБЕННОСТИ ПРОЕКТИРОВАНИЯ УСТРОЙСТВ ПРОТИВОАВАРИЙНОЙ АВТОМАТИКИ И ВЫБОРА ИХ УСТАВОК

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Аннотация. В статье предпринимается попытка исследовать актуальные аспекты проектирования противоаварийной автоматики (ПА), предназначенной для быстрого обнаружения, локализации и предотвращения аварийных ситуаций в объединенной энергосистеме. Особое внимание уделяется ключевым принципам и особенностям выбора уставок для противоаварийных устройств, от корректности и правильности которых зависит эффективная и надежная работа последних.

Ключевые слова: электроэнергетика, энергосистема, РЗА, проектирование, уставки.

Emergency automation (EA) is a set of devices, means and methods aimed at prevention, rapid detection and localization of emergency situations in combined and isolated power systems. Effective EA design is critical to ensure the reliability and safety of electrical networks and electrical equipment, as well as to achieve the goals

of minimizing the response time of emergency shutdown systems and reducing the economic costs of implementing an automated energy infrastructure.

Proper selection of EA settings is an important step in the design and operation of power systems. Setpoints are the parameters that define the triggering conditions of automatic devices. EA setpoints can be set to different values depending on the characteristics of the power system, types of possible faults in the power grid and general protection requirements [1, p. 68].

The purpose of this paper is to investigate the actual principles and peculiarities of setting selection for modern emergency control devices operated today in the power system of our country.

Before proceeding to the consideration of key aspects of parameterization of EA devices, it is necessary to analyze the general principles of their design:

1. Analysis of potential risks and emergency scenarios. It includes: estimation of probability of occurrence of various damages in the electric power complex; investigation of their consequences for operability of the power system and technological facilities interconnected with it; determination of critical parameters and vulnerable places at power facilities, including cable and overhead power lines.

2. Selection of appropriate technologies and electrical equipment for operation, which is carried out on the basis of the above mentioned analysis. The latter are used in complex EA systems. Let us list some criteria for their selection: reliability of the equipment and stability of its operation to the disturbances of the external environment; compatibility of the implemented equipment with the involved automated systems; efficiency and speed of operation of the techno-technological base.

3. Implementation of protection algorithms. Their use is aimed at ensuring fast triggering of devices in case of various damages and abnormal operation modes of power systems. Important is the ability of the EA system to distinguish all existing levels of accidents in the electric power complex, whether they are short-term deviations from normal parameters or serious damage in the form of insulation breakdowns and long-term multiple short circuits. Adequate response of EAs to faults is also an important aspect of their operation. The key requirements for protection algorithms include: a high level of automation of tripping processes; reliability of device switching; the ability to minimize the response time of the automation; comprehensive verification of the parameters responsible for the correct start-up of EA systems.

4. Comprehensive testing of interrelated EA components. It includes:

- comprehensive modeling of emergency scenarios;
- verification of equipment performance under realistic severe conditions;
- verification of the correctness of algorithm tuning by means of successive pilot tests;
- analyzing the results obtained from the previous items [2, p. 3].

As mentioned earlier, EAs include a set of devices and algorithms used for the purpose of monitoring the state of power system parameters and automatic response to

the trends of growth of threats to the security of electric power facilities. Let us summarize the above mentioned EA tasks in the form of basic functionalities:

- detection of short circuits and overloads in the power system;
- automatic disconnection of faulty network sections;
- switching of devices to backup power and generation sources;
- restoration of normal operation mode of electric power complexes [2, p. 4].

The principles and requirements for the selection of EA settings directly depend on these functions, which can be categorized into five key points:

1. Reliability

The setpoints selected for the EA devices must guarantee high operational reliability of the systems under consideration. For this purpose, it is important not only to model emergency incidents numerically and with the help of programs, but also to carry out statistical analysis of the occurred events, including the study of previous failures of EA operation. It is necessary to take an integrated approach to the realization of tasks on redundancy of the automated system elements [3, p. 245].

2. Selectivity

The selection of EA settings to achieve the selectivity requirements of these devices implies the correct delineation of the parametric calculation. In particular, the ability of the responsible personnel to distinguish between normal and emergency parameters of the operating power system is important. The higher the selectivity of EA devices, the less susceptible they are to large tripping zones. Such an approach is necessary to minimize the number of false starts of devices and to increase the overall stability of power facilities operation [3, p. 246].

3. Response speed

The response speed of the EA should correspond to the criteria and requirements for the speed of operation of these systems in case of critical situations in the power system. Here it is important to generally optimize the time intervals of start-up of automatics to prevent damage to the interconnected electrical equipment and to reduce negative economic consequences for the fuel and energy complex enterprises [3, p. 246].

4. Sensitivity

Sensitivity means the ability of starting and measuring organs of protective devices to fix all possible conditions under which the EA should be triggered. It is the sensitivity of the EA that determines its ability to detect faults in the power system. To ensure high sensitivity of the EA, it is necessary to carefully select and adjust its parameters. Otherwise, not only ineffective operation of emergency control devices may be observed, but also failures of their triggering in case of exceeding permissible indicators of operation modes of power connections. In order to fulfill the requirements to the sensitivity of EA devices, it is important to select setpoints based on their coordination with the following factors: 1) minimum time of automation operation; 2) level of parameterization threshold values; 3) consideration of dynamic and transient

processes in the power system; 4) adaptability to external influences of apparatuses and power grid; 5) ensuring static stability [4, p. 392].

5. Cost-effectiveness

Cost-effectiveness also plays an important role in selecting the operating parameters of EA devices. It is important to set the operation settings of the emergency systems in such a way that excessive power consumption and excessive mechanical wear are avoided [4, p. 393].

Let us consider the main methods of calculation of settings of EA devices operated in the power system of our country:

1. Method of collecting initial event (historical) data

Researchers report that one of the most common methods for calculating the setpoints of emergency systems is to analyze historical data on EA operation. This approach involves collecting and analyzing information on accidents that have occurred and deviations from the normal operation of power units to select optimal setpoint thresholds. The calculation can be done by multiplying the confidence factor by the standard deviation and summing the resulting value with the average value of the setpoint parameter [5, p. 420].

2. Statistical method

The second method is called statistical method, because it allows complex consideration of probabilistic parametric characteristics of emergency incidents in the power system. With the help of subsequent statistical processing of the obtained data it is possible to determine the optimal values for EA setpoints. An example of this method is a mathematical method of general distribution of probabilities of occurrence of various events in the electric power complex for selection of settings according to the principle of minimization of threats and risks. Here the formula of the ratio of the parameter characterizing the number of events to the parameter of the total number of observations of these events is used [6, p. 71].

3. Method of expert assessments

The third method is relevant when there is no or insufficient information on the parameters required for statistical analysis. Long-term experience and knowledge of specialists working in the field of relay protection and automation of electric power systems make it possible to choose the required setpoints better and more accurately than following mathematical or program methods. This is largely due to the similarity of calculation steps for various microprocessor terminals, the practice of setting selection for which is well known in specialized circles, as well as prescribed in regulatory and technical documentation and guiding standards of energy organizations [7, p. 1378].

Within the framework of this paper, it is also important to present the classification of EA systems, which should be taken into account when designing complex emergency systems.

Depending on the purpose and functions, EA devices are divided into several main types:

1. Protection automatics

1.1 Over-parameter protection devices

This type of automation is used in conjunction with relay devices to protect equipment from unwanted overloads and short circuits. The automation is triggered when the value of the measured parameter (e.g. current or voltage) exceeds a preset threshold value. The devices are started by signals from current and voltage relays.

Advantages:

- fast response to emergency situations in the power system;
- wide range of application.

Disadvantages:

- no possibility to take into account the occurrence of potential threats [8, p. 158].

1.2. EA integrated with zero sequence current protections

This automation operates in conjunction with relay protection used to eliminate abnormal currents (e.g. leakage currents). It is used to eliminate dangerous occurrences in isolated neutral systems where the resulting zero-sequence currents are capacitive in nature.

Advantages:

- providing protection of the power system in the early stages of damage occurrence;
- avoiding serious damage to electrical equipment.

Disadvantages:

- high sensitivity to external electromagnetic interference [8, p. 159].

2. Automatics working on the principle of control action

2.1 Control automatics in abnormal modes

These EA systems control technological and other processes under conditions of transient and emergency modes. They have a wide functional capability, making it possible to change the modes of operation of power equipment depending on the current state of the parameters of the power grid.

Advantages:

- flexibility in controlling production and other critical processes;
- short response time for static and dynamic stability violations.

Disadvantages:

- complexity of setting and selection of setpoints;
- necessity to make additional corrections when parameterizing devices [8, p. 160].

2.2 Programmable Logic Controllers (PLCs)

PLCs are used for general process automation and control of electrical equipment. They can be programmed to perform various functions, including the control of abnormal situations.

Advantages:

- versatility;
- high degree of adaptability;

– ease of modification and updating.

Disadvantages:

– difficulty of integration with existing emergency systems of different manufacturers [9, p. 1017].

3. Signaling and notification EA

These EA systems are used to notify personnel of emergencies in critical parts of the power grid and other power sector facilities. The signals issued by the devices are divided into visual (light boards) and acoustic (sound signaling).

Advantages:

– promptly informing employees of power grid and power supply organizations about risks and threats to the stability of the energy system functioning;
– ease of installation and maintenance.

Disadvantages:

– lack of wide possibilities to automate response actions after the emergency signal is issued [9, p. 1018].

In the modern world, where the requirements to reliability and safety of power systems operation are very high, the design and selection of emergency control settings are key aspects of ensuring the stability of interconnected power equipment operation. Deep understanding of the peculiarities of EA systems operation allows one to improve the approach to the identification of potential emergency situations in power engineering and minimize the risks of their occurrence. The analysis has shown that in the process of EA design it is necessary take into account not only the technical characteristics of electrical equipment, but also the specific conditions of their operation, including possible external influences. The paper reveals that the correct selection of settings, based on a comprehensive data analysis and the use of modern technologies, is able to significantly improve the efficiency of EA systems in the current power sector.

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УДК 373(091)

FROM THE HISTORY OF STUDYING AND TEACHING FOREIGN LANGUAGES IN RUSSIA

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Abstract. The history of teaching and learning foreign languages in Russia and the organization of systematic language teaching in various educational institutions of the country since the eighteenth century are studied in the article. The authors consider the points of view of society and leading scientists and teachers of those centuries on the importance and significance of learning foreign languages by the younger generation.

Keywords: teaching, learning foreign languages, history, native language, teacher, learning, educational role.

ИЗ ИСТОРИИ ИЗУЧЕНИЯ И ПРЕПОДАВАНИЯ ИНОСТРАННЫХ ЯЗЫКОВ В РОССИИ

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Аннотация. В статье рассматривается история преподавания и изучения иностранных языков в России, организация системного обучения языкам в различных учебных заведениях страны, начиная с восемнадцатого века. Авторы рассматривают мнения общества, передовых ученых и педагогов тех столетий по вопросам важности и значимости изучения иностранных языков подрастающим поколением.

Ключевые слова: преподавание, изучение иностранных языков, история, родной язык, педагог, обучение, воспитательная, образовательная роль.

People began to study other languages since ancient times, when people of different cultures and nations began to communicate. The history of studying and teaching foreign languages goes back more than one century, and in the methods of

teaching different languages, you can find many interesting and useful techniques that, on the one hand, may seem a little strange, but on the other hand, can help in the acquisition of foreign languages by modern youth, give the teacher the opportunity to reflect on the methodology of modern language teaching. Having studied a number of reliable literary and historical sources, we can say with confidence that even since ancient times, Russia has accumulated the most interesting experience in studying foreign languages. From the literature published in the century before last and the last, we can refer at least to the works of M. I. Sukhomlinov "On Linguistics in Ancient Rus" [1] and V. I. Vodovozov "Ancient Languages in Gymnasiums" [2], which reveal the methodology for conducting classes on the study of foreign languages, and the role that was assigned to the study of these languages by the younger generation. The works of the most prominent Russian scientists, educators, methodologists and writers, such as M. V. Lomonosov, A. N. Radishchev, K. D. Ushinsky, V. G. Belinsky, D. I. Pisarev, N. G. Chernyshevsky, V. A. Bogoroditsky, L. V. Shcherba, reflect the most valuable legacy in the area of interesting to us – teaching foreign languages – highlight views and provide statements about the role and place of foreign languages in the upbringing and education of the younger generation.

The purpose of this article is to reveal the experience of teaching foreign languages in Russia at the turn of the 18th-20th centuries, a time of intensive cultural development and the rise of pedagogical thought in the country, when there was an unprecedented rise in the reformist activity of public forces in Russia, sciences were developing and the education system was improving.

The authors' appeal to the history of teaching foreign languages in Russia is undoubtedly relevant, since it recreates a historical retrospective of the entire Russian educational system, its traditions and developments, which have great experience and an undeniable contribution to domestic pedagogy, a contribution to the education system of Russia.

In Russia, already in the 17th-18th centuries, there was an increasingly persistent desire of progressive Russian figures to direct the study of foreign languages into the mainstream of systematic school education. The organization of a number of special educational institutions, the expansion of the course of foreign languages in existing educational institutions, the struggle for new methods of teaching foreign languages – all this indicated that the state was not satisfied with the organization of teaching foreign languages and was looking for new ways and opportunities to improve this matter. The largest center for the development and establishment of Russian science and culture was the Academy of Sciences, organized according to the project of Peter I in 1725. At the beginning of its existence, the Academy of Sciences was filled with foreign scientists who sought to subordinate the development of Russian science to foreign influence through it. Foreign languages were also widely used for these purposes. The curriculum of the university and gymnasium organized at the Academy included the teaching of foreign languages. It was no coincidence that a fierce struggle against the dominance of foreigners unfolded within the walls of the Academy of Sciences. At the head of this widespread struggle was the great Russian scientist M. V. Lomonosov. In the life of the Academy of Sciences, a turn towards weakening the influence of foreigners began only in 1747. For the first time, academicians from

Russia appeared: Lomonosov, Trediakovsky, Popov, Kafelnikov, Kozitsky, Rumovsky and others. The greatest changes in the life of the Academy of Sciences occurred when Lomonosov headed its scientific and educational department.

The dominance of foreigners in the Academy of Sciences and the acute struggle against them led Lomonosov to the idea of the need to organize his own, Russian center of science and culture in Moscow. This idea of Lomonosov was realized in 1755 by the establishment of Moscow University. In this university, in the 18th century, the teaching of foreign languages was already at a fairly high level. The teaching of foreign languages was based on the views of M. V. Lomonosov. Teaching foreign languages was based on a good knowledge of the native language, conscious assimilation of language material, reading, and analysis of relevant literature. Interesting data has come down from those times about the teaching of foreign languages in the university gymnasium. The latter was divided into schools, and the schools – into classes. The schools in the gymnasium were as follows: Russian, Latin, first basic sciences, German and French. The teaching of foreign languages in the second half of the 18th century differed significantly from the teaching of foreign languages in the classical gymnasiums of the 19th century and not at all in favor of the latter. In the university gymnasium, the study of ancient languages did not prevail over the study of native and modern languages. In the study of the latter, attention was paid to morphology, syntax, style, eloquence and reading fiction. In the study of Latin and Greek, the book of the great Slavic educator Y. A. Kamensky, "The Visible World in Pictures," was widely used. Kamensky's teaching aids were also used to facilitate the acquisition of new foreign languages [3, p. 249]. Progressive Russian educators fought for the introduction of new advanced methods of teaching foreign languages, widely using visual aids, comparisons with the native language and a whole system of well-thought-out oral and written exercises in the process of their study.

The teaching methods used in the university gymnasium are described in detail in an interesting document of that time, the so-called "Method of Teaching", compiled by a group of university professors in 1771. "Method of Teaching" is an outstanding work in the field of didactics and methodology, dating back to the second half of the 18th century. This document exhaustively sets out progressive provisions concerning the entire educational process, and particularly emphasizes the role of the teacher. Much attention in it is paid to the development of interest in learning, adherence to consistency and systematicity in teaching, and justification of the need for conscious assimilation of educational material. When teaching foreign languages, it was noted in this method of teaching, it is required that students "understand and comprehend" what they are studying [4, p. 78]. For example, the "Method of Teaching" provided detailed instructions on how to read literature. After reading, instructions were given on how to explain the meaning of words to the students, write down unknown words and phrases, and then translate the article they had read. This was followed by detailed instructions to the teacher on the grammatical analysis of the article they had read and on consolidating the grammatical material explained. The issue of teaching students correct pronunciation was also not ignored. The "Method of Teaching" set out in detail how and what had to be assigned for homework, how to question in class, how to prevent forgetting and arouse students' interest in learning. Further, it indicated the

literature, textbooks, and teaching aids that the teacher was supposed to have. The "Method of Teaching" recommended paying attention to the development of style and eloquence when studying foreign languages, using appropriate exercises for this purpose. The instructions on how to translate included an indication of the educational nature of the teaching. This document testifies to the high pedagogical culture that prevailed at Moscow University and to the great methodological achievements in teaching foreign languages and other subjects.

Prince M. M. Shcherbatov's statements on the study of foreign languages are also of interest. M. M. Shcherbatov, an ideologist of the great noble gentry and an outstanding historian of the mid-18th century, caustically criticized the educational policy of Catherine II. Shcherbatov did not limit himself to criticism alone, at the same time giving a positive program of upbringing and education. In his work, which is called "On the Method of Teaching Various Sciences", Shcherbatov outlined a program of home and school upbringing and training. He requires the implementation of a national character of upbringing and education. To this end, Shcherbatov suggests starting training with one's native language. He suggests starting to study a foreign language after young people have a sufficient understanding of the literacy of their native language. First of all, he considered it necessary to study living languages used in everyday life, since the necessary, according to him, should always precede the useful. He considered it necessary to study Latin and Greek after studying new foreign languages. When learning languages, he recommended taking a gradual approach, recommending not to learn several languages at once [5].

The ideas expressed by the leading Russian scientists and educators of the 18th century were adopted in the 19th century, where the struggle over the teaching of foreign languages also continued. The imposition of classicism in pre-revolutionary schools, the reduction in the proportion of studying new foreign languages, the presence of great formalism in the teaching of foreign languages – all this is characteristic of language teaching in the 19th century. In the 70s and 90s, formalistic classicism was especially vigorously imposed, when all attention in the study of classical languages was paid not to studying the content of ancient literature, but to the grammatical analysis of the language, which in the practice of school teaching turned into cramming [6, p. 189]. The works of the classics were only material for grammar exercises. The progressive tendencies of the 18th century in the field of studying foreign languages were taken up by the leading Russian people of the 19th century. Representatives of democracy Herzen, Belinsky, Chernyshevsky, Pisarev and Dobrolyubov expressed protest against the imposition of classicism, against the superficial study of new foreign languages. For example, V. G. Belinsky pointed out that in modern education, foreign languages are not a means of cognition and serious, in-depth study, but the main means of giving young people a secular gloss and a means of maintaining secular chatter. N. G. Chernyshevsky attached great importance to the study of foreign languages. He himself had an excellent command of many foreign languages, knew Latin, Greek, French, German and English, and mastered many of them through independent study. He considered foreign languages to be the most important way of assimilating the achievements of world culture and scientific discoveries, and saw the study of foreign languages as the most important educational

tool. And D. I. Pisarev believed that classicism has only historical significance, becoming an anachronism and only wasting the time and energy of young people. He acknowledged that the teaching of Latin and Greek is well organized, but believed that the compulsory study of these languages in school is a useless exercise [7, p. 97]. In his opinion, those who wished to study classical languages should study them with all possible diligence, but in no case should all young people be forced to do so. D. I. Pisarev attached great importance to the study of new foreign languages, but he considered one of the prejudices to recognize knowledge of French as proof of a person's education. Pisarev emphasized the educational value of foreign languages and protested against their superficial teaching. The great Russian educator K. D. Ushinsky was well aware of the great educational and pedagogical role of studying foreign languages. His deep interest in the organization of teaching foreign languages was reflected in the fact that in his pedagogical works he devoted a lot of space to this issue, examining the goals, content, and methods of teaching foreign languages. He believed that, first of all, it is necessary to lay a solid foundation for mastering native languages. Knowledge of the grammar of the native language should precede knowledge of the grammar of a foreign language. Ushinsky quite rightly raises the issue of how to devote sufficient time to a foreign language at the initial stage of learning, at least one lesson daily. He puts forward a very important principle, characteristic specifically for teaching a foreign language, the principle of intensity, the essence of which Ushinsky explains as follows: the study of a particular foreign language should proceed as quickly as possible, because in this study nothing is so important as constant reinforcement and repetition in order to avoid forgetting the material studied [8]. Ushinsky resolutely objected to the false view that had been established on foreign languages as a means of conducting salon conversations, as a sign of good manners. The study of a foreign language, according to Ushinsky, requires, above all, great, intense work. Ushinsky especially emphasizes this aspect of teaching foreign languages and sees in it an enormous educational value.

Already from this brief narrative it is clear that the issue of teaching foreign languages in pre-revolutionary Russia has its own long history and is of great scientific interest. Knowledge of foreign languages has long been considered as a sign of belonging to a special higher caste.

Starting with the grammar-translation method of teaching foreign languages, in the 19th century in Russia the formal principle of education dominated, in which the main development of thinking of the younger generation was carried out through the study of ancient languages. In the 19th century, the beginning of the 20th century, there was a change in the foundations of teaching a foreign language, teaching began to focus on the natural acquisition of a foreign language, and not only on the study of its grammar. More and more methodologists came to the conclusion that teaching foreign languages can be carried out during listening and perceiving the text itself without direct translation, without the help of their native language. The leading Russian educators and methodologists V. G. Belinsky, N. G. Chernyshevsky, D. I. Pirogov, K. D. Ushinsky attached great educational significance to the study of foreign languages, rightly believing that a foreign language is the most important means of

cultural development of a person. We need to collect and carefully study the experience of these prominent educators and methodologists.

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УДК 378.14

POSSIBILITIES, PROBLEMS AND PROSPECTS OF USING ICT IN TEACHING A FOREIGN LANGUAGE

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Abstract. The article examines the possibilities of using information and communication technologies (ICT) in the process of teaching a foreign language, identifies the possibilities of using ICT that contribute to the effective acquisition of aspects of the language being studied. It also describes the problems and prospects for the further use of ICT in this area.

Keywords: information and communication technologies (ICT), foreign language, education, competence development, motivation.

ВОЗМОЖНОСТИ, ПРОБЛЕМЫ И ПЕРСПЕКТИВЫ ИСПОЛЬЗОВАНИЯ ИКТ ПРИ ОБУЧЕНИИ ИНОСТРАННОМУ ЯЗЫКУ

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Аннотация. В статье рассмотрены возможности использования информационно-коммуникационных технологий (ИКТ) в процессе обучения иностранному языку, обозначены возможности применения ИКТ, способствующие эффективному усвоению аспектов изучаемого языка. Также описаны проблемы и перспективы дальнейшего использования ИКТ в данной сфере.

Ключевые слова: информационно-коммуникационные технологии (ИКТ), иностранный язык, образование, развитие компетенции, мотивация.

Today, information and communication technologies (ICT) are becoming an integral part of the educational process in the world, especially in the field of learning foreign languages. They open up new horizons for learning, allowing you to create interactive and exciting learning materials, as well as provide access to resources that were previously unavailable. However, despite the obvious advantages, the use of ICT in teaching foreign languages is also associated with a number of problems, such as a lack of teacher training, technical limitations and problems with student motivation. In

this article, we will consider both the existing difficulties and prospects associated with the integration of ICT into the process of teaching foreign languages, as well as offer recommendations for more effective use of them.

An important quality of modern information and communication technologies is their universality. They can be the basis for organizing any activity related to information exchange; the basis for creating a common information space. Information and communication technologies are a set of technologies that ensure the fixation of information, its processing and information exchanges (transmission, dissemination, disclosure). ICTs include computers, software, and electronic communications. ICT is often also referred to as management consulting technologies and the design of business processes and administrative processes, since the design results usually involve the use of computers and electronic communications. Information technologies arise as a means of resolving the contradiction between the ever-increasing amount of knowledge, on the one hand, and the possibilities and scale of their social use, on the other. Hence the dual role of ICT: as a means of transforming knowledge into an information resource of society and as a means of implementing social technologies and their transformation into socio-information technologies that can be directly used in public administration and public self-government systems [1].

The use of information technology plays an important role in the process of teaching foreign languages. Today, the use of various multimedia technologies makes the process of learning foreign languages interesting and accessible to the student, allowing him to adequately understand the subject being transmitted. The use of computer technology helps to remove the psychological barrier of the student, which is a way of using a foreign language as a means of communication. One of the manifestations of this obstacle is the fear of making a mistake. When students use the computer, they do not feel uncomfortable, they receive instructions on how to deal with the mistakes they make [2].

The use of ICT in teaching foreign languages provides a number of advantages.

One of the main advantages of using ICT in learning foreign languages is access to an unlimited number of materials. Previously, students were limited to textbooks, teachers and classroom activities, but today they can use various online resources such as video lectures, audio podcasts, e-books and articles, as well as language forums. This allows students to develop all aspects of language proficiency (listening, reading, speaking and writing) and to learn the material in the most convenient way for the student.

In addition, ICTs contribute to the individualization of the learning process. Many digital platforms offer adaptive programs that take into account the student’s level of preparation, pace and needs. For example, applications such as Duolingo and Babbel offer tasks of varying difficulty depending on the level of language proficiency. This allows students to study at a pace that is comfortable for them, repeating materials as needed.

Multimedia technologies also have a significant impact on student motivation. Interactive tasks, the ability to communicate with native speakers through video conferences or chats, as well as participation in virtual language clubs make the learning process more exciting and dynamic.

ICTs also provide many opportunities to assess knowledge and monitor student progress. Online tests, assignments and automated verification systems (for example, on the Kahoot and Socrative platforms) allow teachers to evaluate students' knowledge in real time. This simplifies the process of testing and analyzing academic performance, making it possible to track the progress of each student.

Platforms such as Google Classroom and Moodle also allow teachers to create online courses, post assignments, and students can submit papers electronically. This facilitates the process of organizing the educational process and makes it more transparent.

However, it is important to keep in mind that automated assessment systems have their limitations, as they cannot always take into account the subjective aspects of language proficiency, such as intonation, pronunciation and creative use of language. Therefore, teachers should combine the use of ICT with traditional assessment methods to gain a complete understanding of students' skills [3].

Despite the obvious advantages of introducing information and communication technologies (ICT) into the process of teaching foreign languages, there are certain problems that may hinder their effective use. Let's look at the main ones.

1. Insufficient teacher training. One of the main problems is the lack of qualified specialists who are able to effectively integrate ICT into the educational process. Many teachers do not have sufficient experience with digital tools and do not know how to adapt traditional teaching methods to new technologies.

2. Technical limitations. Some educational institutions lack the necessary equipment or stable Internet access, which limits the use of ICT. This can lead to uneven access to educational resources and a decrease in the quality of education.

3. The quality of the content. Not all available online resources and applications meet high educational standards. Teachers should carefully select materials to avoid using irrelevant or ineffective content, which requires additional effort and time.

4. Problems with student motivation. ICTs can make learning more fun, because the banal memorization of vocabulary without context has exhausted itself. Therefore, there is an urgent need to define a new teaching methodology aimed at the formation and development of the student's communicative function. Students need to explain how knowledge will be useful to them in life. Therefore, the teacher must prove to the student that his subject is important for their future profession and activity. Students should be motivated not by getting the desired grade, but by the result that can be achieved. The inclusion of a more familiar and human-friendly environment, namely ICT, can definitely help in this [4].

The use of the latest technologies opens up unique opportunities to improve the quality and effectiveness of learning foreign languages. Let's look at the most promising areas of ICT in this area:

1. Artificial intelligence. Artificial intelligence (AI) and virtual reality are two advanced technologies that significantly transform the process of learning foreign languages. AI can analyze the student's level of knowledge and provide individualized content, as well as provide instant feedback on exercises and tests, which will certainly simplify the task of an individual approach to the student. AI-based programs are able

to adapt the complexity of tasks depending on the student's academic performance, which makes learning more dynamic and effective.

2. Virtual reality. Virtual reality allows you to create a complete immersion in the language environment. With the help of virtual reality glasses and specialized applications, students can find themselves in virtual cities and countries where all communication takes place in the language they are learning. This not only improves the understanding of language in real contexts, but also contributes to the development of communication skills.

3. Personalized learning. Personalized learning is an approach in which the learning process adapts to the individual needs, goals and learning rates of each student. ICTs provide tools for creating personalized curricula, including adaptive language learning platforms and applications that track progress and offer materials according to the level achieved. This approach allows students to effectively work on their weaknesses and develop their strengths, which contributes to faster and more sustainable learning progress.

4. Gamification. Gamification is the use of game elements in a conventional environment, such as education, to increase motivation and improve student engagement. The application of gamification in learning foreign languages can include achievements, rewards, competitions, and progressive difficulty levels. These elements make the learning process more interesting and exciting, thereby increasing the motivation of students. Language learning game applications such as Duolingo or Babbel use gamification to create a dynamic and fun learning process that maintains constant interest and desire to continue learning, i.e., increases motivation.

In general, the use of ICT in teaching foreign languages opens up new horizons for the educational sphere, making the learning process more individualized, interactive and motivating. These technologies are able to provide deeper immersion in the language environment and make learning foreign languages accessible and effective for a wide range of students around the world [5].

To date, there are a number of recommendations that will help create a more effective and exciting educational environment for learning English using ICT.

1. Selection of suitable tools and resources:

- Online platforms: use platforms such as Duolingo, Quizlet and Kahoot for interactive learning and knowledge testing.
- Multimedia resources: include videos, podcasts and audiobooks to improve listening comprehension and expand vocabulary.
- Simulations and games: apply gamification through educational games and simulations to make the learning process more fun.
- Virtual classrooms: use Zoom, Microsoft Teams, or Google Meet to organize remote lessons and group discussions.

2. Training teachers to work with ICT:

- Advanced training courses: organize regular trainings and courses for teachers on the use of ICT in education.
- Exchange of experience: create internal groups to discuss successful practices and share resources among teachers.

- Support from IT specialists: provide access to technical support to solve problems that arise.

3. Integration of ICT into curricula:

- Development of flexible curricula: include ICT as an integral part of the educational process, adapting programs to new technologies.
- Project activities: encourage students to create projects using ICT, such as presentations, blogs or videos.
- Assessment and Feedback: implement digital tools to assess knowledge and receive feedback from students.

4. Creating support and resources for students:

- Online resources: provide access to libraries, video tutorials and interactive assignments through educational platforms.
- Forums and communities: create online forums or chat rooms for students where they can ask questions and share experiences.
- Additional assistance: arrange additional classes or consultations on the use of ICT for students experiencing difficulties [6].

It is important to remember that technology should complement traditional teaching methods, not replace them.

In conclusion, it can be said that the use of information and communication technologies in teaching foreign languages opens up many opportunities to improve the effectiveness of the educational process. However, despite significant advantages such as access to a variety of resources and interactive learning methods, there are also serious challenges that require attention. The problems associated with insufficient teacher training, technical limitations and student motivation require an integrated approach and innovative solutions.

The prospects for integrating ICT into language learning look promising, especially the introduction of neural networks, given the rapid development of technology and the emergence of new educational platforms. To achieve maximum effect, it is necessary to create conditions for improving the skills of teachers, introduce modern technologies into the educational process and actively involve students in the use of digital resources.

Thus, the right combination of traditional teaching methods and modern technologies can significantly speed up and improve the process of learning foreign languages, making it more accessible, interesting and effective.

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УДК 81'25, 347.78.034

THE STRATEGIES OF TRANSLATING TOPONYMS INTO THE TEXT (BASED ON VERONICA ROTH'S NOVEL "DIVERGENT")

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Abstract. This paper discusses the strategies of translating toponyms into the text. The research is based on Veronica Roth's novel "Divergent". Toponyms, or place names, play a crucial role in establishing the setting and cultural context of a narrative. In "Divergent" the author employs a variety of fictional and real-world locations that contribute to the world-building and thematic depth of the story. Translating these toponyms requires careful consideration of several factors, including cultural significance, phonetic appeal, and the intended audience's familiarity with the original terms.

Keywords: strategies, translation, toponyms, cultural context, Veronica Roth.

СПОСОБЫ ТРАНСЛЯЦИИ ТОПОНИМОВ В ТЕКСТ ПЕРЕВОДА (НА МАТЕРИАЛЕ РОМАНА ВЕРОНИКИ РОТ «ДИВЕРГЕНТ»)

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Аннотация. В данной статье рассматриваются стратегии перевода топонимов в текст. Исследование основано на романе Вероники Рот «Дивергент». Топонимы, или названия мест, играют ключевую роль в создании обстановки и культурного контекста нарратива. В «Дивергенте» автор использует разнообразные вымышленные и реальные локации, которые способствуют построению мира и тематической глубине истории. Перевод этих топонимов требует тщательного учета нескольких факторов, включая культурную значимость, фонетическую привлекательность и степень знакомства целевой аудитории с оригинальными терминами.

Ключевые слова: стратегии, перевод, топонимы, культурный контекст, Вероника Рот.

A proper name is an individual designation that introduces us to an object or subject, as well as their language category [1, p. 88].

The main distinguishing features of a proper name:

1) it is given to a specific object, and not to a group of objects that have a common feature that is similar for all units included in it;

2) an object named with a proper name is always precisely defined and isolated;

3) the name is not directly related to the concept and does not have a clear and unambiguous connotation at the language level.

In the modern approach to the study of language and culture, as well as language and people, the images of the latter are interpreted as fragments of specific linguistic images of the world. The study of proper names is also relevant within the framework of linguistic and cultural methods. It is one of the most modern and successful areas of linguistics and allows us to consider onomastic material in a new way.

In recent years, psycholinguistic approaches to language and speech have become relevant, especially to phenomena such as onomastics.

Proper names play an important role in the identification process. The onomasticon, uniting organs into the structure of human society, has the ability to define and create it, acting as a means of separating one culture from another.

The linguistic theory of translation was accompanied by a noticeable break from the literary theory of translation. As well as linguistic theory, unlike literary theory, it is characterized by high accuracy and scientific validity.

A combination of transcription and transliteration techniques can be identified as the most commonly used strategies to translate proper names.

Science fiction is a literary genre represented in various fields of art. It is one of the subspecies of fiction. The genre of science fiction is based on fantastic plots that preserve the scientific vision of the world, without going beyond the possibilities of the humanities and natural sciences [2, p. 221].

Proper names in science fiction works have the following functions:

1) identifying (naming);

2) stylistic (including informative, emotive, expressive and pictorial) [3].

It can also be noted that:

1) the authors of science fiction texts create the names of characters according to existing national nominal models to achieve the illusion of reality;

2) if it is necessary to create an unusual, new name, the authors semanticize it in the text of the work;

3) the differences between the onomasticon of various science fiction works are due to their plots.

The storyline of Roth's work unfolds on the ruins of the former Chicago, Illinois. The new city, or rather, the reservation where the survivors live, does not have its own name, but at its core it is a large-scale study known as the Chicago Experiment.

I've been spending a lot of time here, he says. It's the record room. They keep some of the ***Chicago Experiment*** *data in here* [4].

– Я провел здесь много времени, — сказал он. Это комната записей. Здесь хранятся некоторые данные ***Чикагского Эксперимента*** [5].

But not everyone knows about this "official" name. The vast majority of residents of the Chicago Experiment have no idea what really happened. They do not remember their past and live in the present, completely controlled by a medical center called the Bureau of Genetic Welfare. A. Kilanova uses a loan translation.

Another famous building abandoned after the Purity War is John Hancock Tower. A dilapidated building in gray tones, painted with graffiti, is located on the territory of the Dauntless and used by it as a training area.

As soon as I lift my eyes to scan the buildings, I know where we're going: the empty ***Hancock Building****, a black pillar with crisscrossed girders, the tallest building north of the bridge* [4].

Подняв глаза, чтобы осмотреть здания, я сразу поняла, куда мы направляемся: в ***небоскреб Джона Хэнкока****, черную колонну с перекрещенными балками, самое высокое здание на север от моста* [5].

In the above example, the author uses the toponym *the Hancock building*, but the full and official name of this one-hundred-story skyscraper is North Michigan Avenue. When translating this toponym into Russian, A. Kilanova applied concretization for the English word 'building', as well as a combination of techniques: lexical addition («небоскреб») and transcription for the Hancock lexeme («Хэнкок»), obtaining the version «небоскреб Джона Хэнкока».

Now it's the headquarters of ***the Bureau of Genetic Welfare*** *— or just the Bureau, as we call it around here* [4].

Теперь это штаб-квартира ***Бюро Генетического Благополучия*** *— или просто Бюро, как мы его здесь называем* [5].

This organization arose after a large-scale and devastating civil war in the territory of the former United States. The so-called War for Purity was caused by an attempt to eliminate cruelty and crime in society through biological experiments on the population. Some people were willing to become part of the experiment, while others were massively displeased. Later it turned out that biological mutations did not lead to the reduction of "vicious" genes, but to their development. Those who were initially against the experiment overthrew the current government and staged a mass genocide against the population with damaged genes. This resulted in a full-scale conflict with the use of conventional, and later biological and nuclear weapons. When translating into Russian, a loan translation was used again.

The entire population of the Chicago Experiment was exposed to Memory Serum. People were deprived of all vivid memories, except those that are responsible for the normal functioning of the body. They are unaware of the war and its consequences, living on the ruins of a city unknown to them. But despite this, they use the former names of streets, buildings and objects of a once-existing culture. For example, the novel mentions such place names of the former Chicago as Michigan Avenue and Lake Shore Drive.

South of the bridge, ***Michigan Avenue*** *is a busy street, crawling with people, but here it is bare* [4].

К югу от моста находится ***Мичиган-Авеню*** *– оживленная улица, обычно переполненная людьми, но сейчас она пуста* [5].

The toponym *Michigan Avenue* is the name of one of Chicago's streets. Alexandra Kilanova used transcription to convey this toponym – Мичиган-авеню.

I follow the cable down, over the cluster of buildings and along ***Lake Shore Drive*** [4].

Я спускаюсь вниз по кабелю над скоплением зданий, вдоль ***Лейк-Шор-Драйв*** [5].

The toponym *Lake Shore Drive* denotes a highway that is also located in Chicago. When translating this name, a transcription was used – Лэйк-Шор-драйв.

The next toponym *Hub* (*Sears Tower*) is the name of a hundred and eight-story Chicago skyscraper. It currently has the name Willis Tower and until 2009 it was called Sears Tower. The previously mentioned Ceremony of Choosing and meeting representatives of the heads of the five factions also takes place here. Alexandra Kilanova translated this toponym into Russian using a transcription technique – Сирс-тауэр, and the slang version of the toponym the Hub was translated using a semantic translation – Втулка:

The building that was once called ***the Sears Tower*** *– we call it* ***the Hub*** *– emerges from the fog, a black pillar in the skyline* [4].

Здание, которое когда-то носило название ***Сирс-тауэр*** *– мы называем его «****Втулкой****», – выплывает из тумана, черный столб на горизонте* [5].

The goal of the Bureau of Genetic Welfare was to combat demographic damage and create genetically pure Divergent people. Along the way, they conducted experiments in such areas as medicine, genetic and chemical engineering, mechanical engineering and agriculture. The Bureau's headquarters were located outside the Wall, in the former building of Chicago's O'Hare International Airport.

Welcome to the compound, says Zoe. This building used to be ***O'Hare International Airport****, one of the busiest airports in the country* [4].

– Добро пожаловать в комплекс, – сказала Зои. В этом здании раньше располагался ***Международный Аэропорт О'Хара****, один из самых загруженных аэропортов в стране* [5].

When translating the toponym *O'Hare International Airport*, the translator used a loan translation in combination with transliteration (О'Хара), while the word order of the loan components was changed. It helped to preserve their partial meaning: Международный Аэропорт О'Хара.

Along with real toponyms, fictional ones are used. They were created specifically for this literary work. Among them is the toponym The Choosing Room, denoting the room where the Faction Selection Ceremony is held. A loan translation was used in the official translation of the book, so this room was named the Choosing room:

Blue lanterns dangle at random intervals above the stone paths, similar to the ones that lit the ***Choosing room*** [4].

Голубоватые фонари, такие же как в ***Зале выбора****, с неравными промежутками висят над каменными тропинками* [5].

As mentioned earlier, the Chicago Experiment was surrounded by the Wall. Its purpose was to keep its participants away from the truth and dangers of the outside world. In the novel, the Wall looked like a Soviet radar missile launch detection system – Duga-1.

I ask Christina, What do you think is out there? I nod to the doorway. I mean, beyond ***The Fence*** [4].

Я спросила Кристину, кивнув в сторону выхода: «Как ты думаешь, что там снаружи? Я имею в виду, за ***Стеной****»* [5].

From the original language the toponym *The Fence* can be literally translated as "Забор" or "Изгородь", but for adequate translation, A. Kilanova used the word "Стена". It is more suitable for the Russian-speaking population. This decision is

justified by the peculiarity of our culture. In our understanding, a fence is a low structure that is more often used to fence local objects inside the city. Walls did not only surround entire cities, but also protected them from external threats. In this case, the translator used a functional substitution technique.

The "talking" toponym the Pit stands for one of the premises of the Dauntless and is a small underground city with an extensive tunnel system and infrastructure built around the perimeter of the pit, connected by narrow, unsafe ascents and paths. This toponym was translated by semantic translation:

In less than a week, the Dauntless-born initiates will find their families on the ***Pit*** *floor, or in the glass building above the compound, and do whatever it is the Dauntless do when they reunite* [4].

Меньше чем через неделю неофиты-лихачи увидят свои семьи на дне ***Ямы*** *или в стеклянном здании над лагерем и будут делать то, что делают лихачи, воссоединившись* [5].

The choice of this method can be explained as follows: to get to the headquarters of the faction, it was necessary to jump from the roof into a deep crevice, at its bottom there is a network.

An equally significant place in the novel "Divergent" by V. Roth is the Merciless Mart, also known as the headquarters of the Candor. At least eighteen floors high, consisting of half-empty rooms without windows, connected by corridors of black marble, with the symbols of the faction in the form of white scales, personifying candor and justice. It includes the largest prison block. In reality, it is a huge architectural object that doubles as a wholesale and shopping center – Merchandize Mart. During the War for Cleanliness, the building was also damaged, only the letters remained from the name Merc...is ... Mart. A lot of people began to call the building the Merciless Mart because of the ruthless interrogations taking place within the walls of the Candor.

My legs ache by the time we reach the bridge, but then I see ***the Merciless Mart*** *across the marshy river, abandoned and unlit, and I smile through the pain* [4].

Мои ноги болели к тому времени, как мы добрались до моста, но увидев ***Беспощадный Март*** *по ту сторону болотистой реки, заброшенный и неосвещенный, я улыбнулась сквозь боль* [5].

Analyzing the translation of this fragment, it can be noted that, despite the peculiarity of the cultural perception of the eponym *Mart*, associated with one of the twelve months, the translator decided to convey it as a choronym. In the original language, in this context, Mart is part of the name of the former shopping center. The translator decided to preserve the meaning laid down by the author and translate the choronym with the help of a half-loan.

Thus, Veronica Roth used already existing toponyms to better imagine the world for the reader where the plot of the book unfolds, so the recipient has associations with a city resembling Chicago. The names of real buildings and streets were translated by transcription, and the translator used a loan and semantic translation to transfer fictional toponyms. This approach helped to fully reflect the specifics of the science fiction genre, as in the post-apocalyptic world that Veronica Roth describes in her novel, in addition to new buildings and urban facilities, pre-war buildings were preserved. The translation of toponyms in a work of fiction causes certain difficulties for the translator,

however, the reader’s idea of the chronotope of the work depends on the choice of the translation method.

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УДК 005.8

SOCIAL ASPECTS OF PROJECT MANAGEMENT: THEORY AND PRACTICE

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Abstract. The article is devoted to the study and application of social aspects in project management. It considers key aspects such as the role of leadership, team interaction, conflict and stress management, and the use of social technologies and platforms to improve interaction within the team. Particular attention is paid to the issues of motivation, communication and leadership.

Keywords: projects, social factors, communication, risks, leadership.

СОЦИАЛЬНЫЕ АСПЕКТЫ УПРАВЛЕНИЯ ПРОЕКТАМИ: ТЕОРИЯ И ПРАКТИКА

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Аннотация. Статья посвящена исследованию и применению социальных аспектов в управлении проектами. В ней рассматриваются ключевые аспекты, такие как роль лидерства, командное взаимодействие, управление конфликтами и стрессами, а также использование социальных технологий и платформ для улучшения взаимодействия внутри команды. Особое внимание уделяется вопросам мотивации, коммуникации и лидерства.

Ключевые слова: проекты, социальные факторы, коммуникация, риски, лидерство.

In the modern world, project activities are becoming an integral part of most organizations, whether they are commercial companies, government agencies or non-profit organizations. However, the success of any project depends not only on technical and economic indicators, but also on social factors that often remain out of sight of managers. Social aspects play a key role in the project management process, as they

determine the interaction between project participants, their motivation, the level of trust and the general atmosphere of cooperation.

The study of the social aspects of project management is relevant for several reasons. Firstly, projects are implemented in a dynamically changing external and internal environment, which requires flexibility and the ability to adapt to new conditions. Secondly, modern projects often bring together specialists from different cultures, professions and age groups, which creates unique challenges for management. Finally, the effectiveness of project management is directly related to the level of satisfaction of the participants in the process, their involvement and ability to work in a team.

In order to better understand the impact of social factors on project management, it is necessary to identify the key concepts underlying this topic. The term “project” refers to a temporary enterprise aimed at creating a unique product, service or result. The “social environment” includes a set of attitudes, norms, values and expectations that exist among the project participants. “Management” refers to the process of coordinating resources and actions to achieve set goals [1].

The purpose of this article is to analyze the theoretical foundations and practical aspects of taking into account social factors in the project management process. The objectives of the research are to study the main social aspects affecting the implementation of projects, to describe the methods of sociological analysis used in project activities, as well as to consider examples of successful integration of social factors into project management practice. In addition, special attention will be paid to identifying typical errors and problems that arise when the social context is not sufficiently taken into account.

Thus, this work is aimed at raising awareness of project managers about the importance of social aspects and offers practical tools for their effective use in daily work.

Social aspects in project management are a set of factors that affect the interaction between people involved in the implementation of the project. These factors include culture, communication processes, motivation, leadership, as well as the socio-psychological climate of the team. Taking into account social aspects allows for a better understanding and management of human resources, which, in turn, contributes to improving the effectiveness of the project. Traditional project management methodologies, such as Waterfall or Agile, focus primarily on the technical and administrative aspects of the project. However, the successful implementation of these methodologies is impossible without taking into account social factors. For example, teamwork and flexibility play an important role in the Agile methodology, which requires project participants to have a high degree of trust, open communication and willingness to change. Ignoring social aspects can lead to a decrease in motivation, deterioration of communication and, as a result, delays and failures in the project.

Communications play a key role in project management, as they ensure the transfer of information between participants and the coordination of their actions. There are several models and theories that help to understand and improve

communication processes in projects. One of these models is the Shannon-Weaver model (Figure 1), which describes the process of transmitting information from the sender to the recipient through a communication channel. According to this model, interference (noise) is possible at each stage of transmission, which can distort the message. Therefore, it is important to use communication channels that ensure maximum accuracy and reliability of information transmission [2].

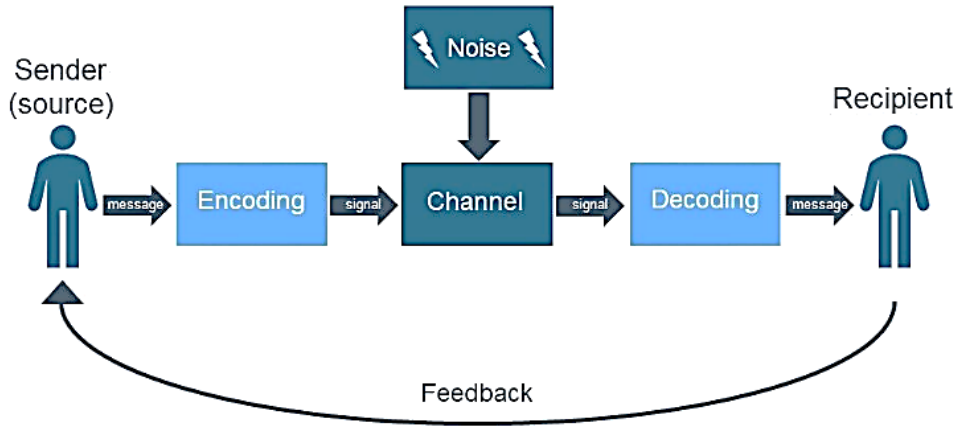

Figure 1. Shannon-Weaver model

Another important concept is the theory of two-stage communication proposed by Paul Lazarsfeld (Figure 2). It assumes that information first goes to opinion leaders, who then pass it on to other members of the group. In the context of project management, this theory emphasizes the importance of informal leaders and their role in spreading information and shaping public opinion.

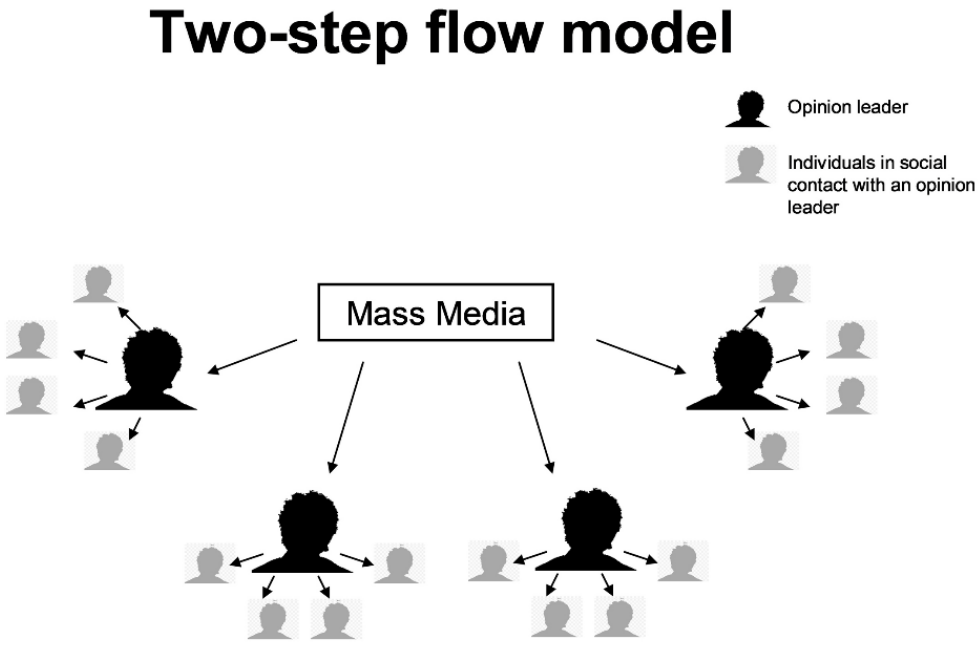

Figure 2. Lazarsfeld's two-step flow of communication model

In addition, there are theories explaining the influence of cultural context on communication. For example, Edward Hall's theory distinguishes two types of cultures: high-context and low-context ones. In high-context cultures, information is transmitted indirectly through non-verbal signals and context, while in low-context cultures it is transmitted through direct and explicit messages. Understanding these differences helps to adapt communication strategies to the specific culture of the project.

The social environment of the project is also a complex interweaving of interpersonal and organizational interactions that influence the process of project implementation. This is not just a set of people engaged in one business, but an integrated system consisting of various levels and elements, ranging from the individual characteristics of the participants to the cultural characteristics of the team. The social environment forms the atmosphere in which the project is carried out and has a direct impact on its effectiveness and efficiency [3].

Social factors play a crucial role in the success or failure of a project. They cover a wide range of aspects that need to be considered when managing a project. One of the key factors is communication. Effective communication of information between project participants is necessary to achieve consistency of actions and minimize the risk of misunderstandings. Unclear or insufficient communication can lead to delays, errors and conflicts, which negatively affects the overall result.

Equally important is the motivation of the project participants. People working on the same task may have different internal incentives and reasons to participate in the project. A successful project manager should be able to recognize these individual motivations and find ways to enhance them in order to maintain high productivity and team engagement. Finally, conflicts should be mentioned. Any group of people working together will sooner or later face contradictions. The ability to anticipate possible sources of conflict and respond promptly to them using constructive dispute resolution methods will help prevent negative consequences and maintain a positive attitude in the team.

Each participant of the project occupies a certain place in the project structure and performs its own unique functions. The coordination of actions and the effectiveness of the entire team depends on how clearly the roles are defined and responsibilities are distributed. The project manager assumes primary responsibility for managing the process. He develops a strategy, coordinates the actions of the team, monitors compliance with the schedule and budget, and makes important decisions regarding the progress of the project. The project team consists of specialists, each of whom is responsible for a specific area of work. Team members must work closely with each other to ensure that a common goal is achieved. The customer is the party that initiated the project and finances its implementation. He formulates the requirements for the final result and actively participates in the process of making key decisions. Contractors and suppliers provide the necessary resources and services to ensure that specific tasks are completed. Their collaboration with the core project team plays an important role in meeting deadlines and budgets [4, 5].

In order to successfully integrate social aspects into the project management process, it is necessary to use a variety of methods of sociological research. These methods help to identify hidden problems, assess the mood in the team and predict possible difficulties related to human factors. Let's look at some of them in more detail.

Sociological research methods such as surveys, interviews, and observations are widely used in project management to collect data on the behavior and perceptions of project participants. This data allows managers to better understand the current situation and make informed decisions. For example, questionnaires can help to identify the level of employee satisfaction, and interviews can reveal the underlying causes of dissatisfaction or difficulties.

Assessment of the risks associated with the human factor. The human factor is one of the main sources of risk in any project. The assessment of these risks includes an analysis of the skill level of employees, their motivation, the presence of conflicts and potential communication problems. Such an analysis helps to identify weaknesses in the team and develop measures to eliminate or mitigate them. For example, if low levels of motivation are identified, incentive or training programs can be offered to improve the situation.

Communication processes are the basis for the successful implementation of any project. To create an effective work environment, a variety of tools are used to strengthen the bonds between team members and increase their productivity.

Holding regular meetings and discussions is one of the most important elements of interaction within the team. Daily brief meetings (stand-ups) or longer strategic sessions help to synchronize the actions of all project participants, discuss current tasks, share successes and problems. At the same time, it is important to follow the structure of such meetings, setting a clear agenda and controlling time so as not to delay the process. This approach ensures timely identification and elimination of emerging difficulties.

The modern world allows the use of digital platforms to optimize work processes. Platforms like Trello, Jira, Slack, Microsoft Teams and others allow you to visually present tasks, track progress, communicate in real time and provide quick access to important information. These tools are especially relevant in remote work environments, helping to maintain a high level of interaction regardless of the physical location of team members [5].

Conflict and stressful moments are inevitable in any project, but proper management of them can minimize their negative impact and even turn them into points of growth.

Conflict and stress management are important aspects of a successful project. The involvement of employees in conflict resolution, the development of crisis management mechanisms and the formation of a favorable climate in the team contribute to achieving high performance and sustainability of the project.

Conflict management helps to avoid devastating consequences, and creating a favorable climate in the team helps to improve interaction and increase productivity.

It is important to pay attention to social aspects, both in the process of work and when planning a project. The use of modern technologies and conflict management methods can significantly improve the efficiency and quality of tasks.

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УДК 338.24.021.8

THE 2025 TAX REFORM OF THE RUSSIAN FEDERATION. CHANGES IN THE FIELD OF ENTREPRENEURSHIP

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Abstract. This paper examines the history of tax reforms in the Russian Federation, focusing on the 2025 tax reform and its impact on entrepreneurship. Key stages of tax reforms, from the Soviet era to present, are discussed, with emphasis on progressive personal income tax, corporate profit tax, and changes to the simplified tax system. The paper analyzes how these reforms affect small and medium-sized enterprises and offers insights into business adaptation strategies.

Keywords: tax reform, STS, entrepreneurship, tax amnesty, VAT, PIT.

НАЛОГОВАЯ РЕФОРМА 2025 ГОДА В РОССИЙСКОЙ ФЕДЕРАЦИИ. ИЗМЕНЕНИЯ В СФЕРЕ ПРЕДПРИНИМАТЕЛЬСТВА

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Аннотация. В данной статье рассматривается история налоговых реформ в Российской Федерации, особое внимание уделяется налоговой реформе 2025 года и ее влиянию на предпринимательство. Обсуждаются ключевые этапы налоговых реформ, начиная с советских времен и по настоящее время, с акцентом на прогрессивный налог на доходы физических лиц, налог на прибыль корпораций и изменения в упрощенной системе налогообложения. В статье анализируется, как эти реформы влияют на малые и средние предприятия, и предлагаются стратегии адаптации бизнеса.

Ключевые слова: налоговая реформа, УСН, предпринимательство, налоговая амнистия, НДС, НДФЛ.

In the context of an ever-changing economic situation and the development of technology, the tax system must be flexible and efficient in order to ensure the stable development of the state and business. In this regard, the Government of the Russian Federation regularly conducts tax reforms aimed at improving the tax system and

supporting entrepreneurs. One of these reforms is the tax reform of 2025, which provides for a number of changes in the field of taxation of small and medium-sized businesses.

The relevance of the study is due to the need to study the upcoming changes in tax legislation, their impact on business activities and develop recommendations for adaptation to new conditions. The scientific novelty lies in a comprehensive analysis of the planned changes and identification of possible consequences for entrepreneurs.

The object of the study is the tax reform of 2025 and its impact on the business sector.

From January 1, 2025, Federal Laws No. 176-FZ dated 07/12/2024 and No. 259-FZ dated 08/08/2024 will enter into force, which make significant changes to the first and second parts of the Tax Code of the Russian Federation. The latest innovations of this scale were carried out during the tax reform of 2000-2002, which was a key element in creating a favorable environment for entrepreneurship and investment [1].

The tax system in the Soviet Union was primarily built on state-controlled mechanisms. Key components included a turnover tax (налог с оборота) and enterprise profit contributions (платежи из прибыли), which played a pivotal role in funding the state's planned economy [2]. By the late 1980s, however, the system faced severe strain. The introduction of reforms like the self-financing model (хозяйственный расчет) aimed to give enterprises more autonomy while retaining central control. Despite this, the inefficiencies of centralized planning and declining oil revenues contributed to the fiscal crisis of the 1990s, with tax revenues dropping from 152 % of GDP in 1980 to 117 % by 1990 [3].

After the dissolution of the Soviet Union in 1991, Russia undertook rapid tax reforms to adapt to its transition to a market economy [4]. One of the most significant early changes was the introduction of the Tax Code of the Russian Federation, with the first part enacted in 1998 and the second part in 2000. These reforms aimed to simplify the tax structure, improve transparency, and stabilize government revenues. Key features included the introduction of corporate profit taxes, value-added tax (VAT), and a flat-rate personal income tax (PIT) of 13 % – one of the lowest in Europe.

The 2000s saw continued efforts to stabilize Russia's tax system, with the 2001 reform of PIT being particularly successful. This flat rate of 13 % for all citizens significantly reduced tax evasion and boosted compliance, contributing to sustained GDP growth throughout the decade. During this period, the corporate tax rate was also lowered from 35 % to 24 %, and VAT rates were adjusted, demonstrating the state's focus on encouraging investment and simplifying tax procedures [5].

With the advent of digital technologies, the Russian government modernized its tax system, introducing online reporting requirements and automated tax audits. Additionally, reforms targeted tax avoidance by implementing measures such as controlled foreign company (CFC) rules in 2014 to prevent offshore tax evasion [6]. The government also extended tax incentives for specific sectors, such as IT, offering 0 % corporate profit tax to stimulate the growth of the digital economy.

In 2021, the Russian government introduced a progressive personal income tax, increasing the rate to 15 % for annual incomes exceeding 5 million RUB. This marked a significant departure from the long-standing flat tax system and was part of broader

efforts to generate more revenue from high earners. Additionally, the government introduced regional investment incentives and expanded VAT exemptions for small businesses.

The 2025 tax reform in the Russian Federation represents one of the most significant changes in tax legislation in recent years. Its primary goal is to strengthen tax control and increase budget revenues, including through higher tax burdens on businesses and high-income individuals. Key changes affected the progressive personal income tax scale, an increase in the corporate profit tax rate, and adjustments to the simplified tax system (STS). These measures are aimed at balancing the budget, but experts warn they may increase tax risks for entrepreneurs and lead to higher administrative costs [7].

One of the key innovations of the 2025 reform was the introduction of a five-tier progressive PIT scale. Previously, Russia had a two-tier system: 13 % on incomes up to RUB 5 million per year and 15 % on incomes exceeding this threshold. As of January 1, 2025, a new progressive PIT scale comes into force with the following rates:

- up to RUB 2 million – 13 %;
- RUB 2 million to RUB 5 million – 15 %;
- RUB 5 million to RUB 10 million – 18 %;
- RUB 10 million to RUB 20 million – 20 %;
- above RUB 20 million – 22 %.

This system is designed to increase the tax burden on high-income individuals, thereby ensuring additional budget revenues. According to preliminary estimates by the Ministry of Finance of the Russian Federation, the introduction of the progressive PIT scale is expected to generate about RUB 450 billion in additional annual tax revenues. However, this measure raises concerns among investors and entrepreneurs whose incomes fall under the higher tax brackets. It may incentivise capital outflow abroad and the creation of tax optimization schemes, which could negatively affect the country's long-term investment climate.

The reform is characterised by numerous changes for small and medium-sized businesses. The corporate profit tax rate, which was 20 % before the reform, has been increased to 25 % from 2025. This measure is aimed at increasing tax revenues from enterprises, particularly large and medium-sized companies, which are the main taxpayers under this tax. The new profit tax rate is distributed as follows: 3% is allocated to the federal budget, and 22 % to the budgets of Russia's constituent entities.

According to expert estimates, raising the corporate profit tax rate is expected to generate an additional RUB 1,6 trillion in annual budget revenues [8]. However, this measure creates additional financial risks for businesses, especially for companies with high profitability. The increased tax burden will force companies to reassess their tax and cost management strategies. Large enterprises operating in capital-intensive industries, such as the oil, gas, and metallurgy sectors, will have to raise product prices to offset higher tax expenses.

One of the most significant aspects of the reform is the change in the conditions for the simplified tax system (STS). Before the reform, the STS was a popular regime among small and medium-sized businesses due to its simplified tax reporting procedures and lower tax rates. However, starting in 2025, companies using the STS

with annual revenues exceeding RUB 60 million will be required to pay value-added tax (VAT).

New VAT rates have been introduced for such companies:

– 5 % for companies with revenues from RUB 60 to RUB 250 million;

– 7 % for companies with revenues from RUB 250 to RUB 450 million.

Companies with annual revenues exceeding RUB 450 million will lose the right to use the STS and will be required to switch to the general tax system. These changes primarily affect businesses in the services and retail sectors, which previously benefited from the STS and were exempt from paying VAT. According to estimates from the Federal Tax Service (FTS), these changes will force approximately 200,000 business entities to reconsider their tax strategies.

The 2025 tax reform includes a tax amnesty aimed at legalizing the activities of entrepreneurs who previously used business splitting schemes to reduce their tax burden. The amnesty allows companies that voluntarily abandon such practices and switch to the general tax system by the end of 2024 to avoid penalties and fines for the 2022-2024 periods.

According to the FTS, about 15 % of companies using the STS engaged in business splitting schemes to avoid paying taxes. The introduction of the amnesty is intended to encourage voluntary abandonment of these practices and increase tax revenues to the budget [9].

The amnesty program is designed to promote greater tax transparency and compliance among businesses, particularly those that have relied on aggressive tax minimization strategies. It aims to bring companies back into full compliance with tax laws without the threat of punitive measures for past tax avoidance. However, some experts express concern that while the amnesty offers short-term incentives for compliance, it may not address the underlying causes of tax evasion, such as the high tax burden and administrative complexities.

The 2025 tax reform is expected to have a profound impact on small and medium-sized enterprises (SMEs), particularly those that have been using the STS. Before the reform, the STS provided a simplified taxation regime with fewer reporting requirements and lower tax rates, making it an attractive option for SMEs. However, the new obligation to pay VAT, combined with the tiered rates based on revenue, will significantly increase both the tax and administrative burdens for many businesses.

For example, companies with revenues between RUB 60 million and RUB 250 million will now face a 5 % VAT, while those with revenues between RUB 250 million and RUB 450 million will be subject to a 7 % VAT. These additional taxes may force SMEs to increase the prices of their goods and services to compensate for the higher tax costs, which could reduce their competitiveness in the market.

Moreover, SMEs that exceed the RUB 450 million revenue threshold will be required to transition to the general tax system, which involves a more complex set of tax regulations and higher reporting requirements. This transition could lead to higher administrative costs, as businesses may need to hire additional tax professionals or invest in new accounting software to comply with the more stringent tax rules.

The introduction of VAT for STS users is expected to generate approximately RUB 300 billion in additional annual tax revenue. However, it may also push some

businesses to operate in the informal economy to avoid the higher tax burden, especially in sectors where competition is fierce and profit margins are thin.

While the immediate goal of the 2025 tax reform is to increase tax revenues and reduce budget deficits, the long-term consequences for the business environment in Russia are still uncertain. On the one hand, the reform is expected to improve tax compliance and reduce the use of tax avoidance schemes, particularly in relation to business splitting. On the other hand, the higher tax burden on businesses and high-income individuals could discourage investment and entrepreneurship, leading to slower economic growth.

One of the key challenges that businesses may face is adapting to the new tax regime without sacrificing profitability. The increased tax rates and the introduction of new reporting requirements will require businesses to reevaluate their operational strategies and find ways to optimize their tax obligations. Larger companies may be able to absorb these costs, but SMEs are likely to struggle with the additional administrative and financial burdens.

Furthermore, the reform's impact on the investment climate remains a significant concern. The increase in corporate profit tax and the progressive PIT scale could make Russia a less attractive destination for both domestic and foreign investors. This is particularly relevant for sectors such as technology and manufacturing, where profit margins can be narrow and the tax burden plays a critical role in determining investment decisions.

In the long run, the success of the reform will depend on how well businesses can adapt to the new tax environment and whether the government provides sufficient support to mitigate the negative effects on SMEs and investors. While the tax amnesty offers a short-term solution for businesses that have engaged in tax avoidance, it is essential that the government continues to address the broader issues of tax complexity and the administrative burden on businesses to foster a more competitive and sustainable economy.

The 2025 tax reform in the Russian Federation marks a significant shift in the country's tax policy, with major changes affecting both individuals and businesses. The introduction of a progressive PIT scale, an increase in the corporate profit tax rate, and new VAT requirements for STS users are all aimed at increasing tax revenues and ensuring greater tax compliance. However, these measures also raise important questions about the potential impact on investment, entrepreneurship, and the overall competitiveness of the Russian economy.

While the reform is expected to bring in additional tax revenues – estimated at over RUB 1 trillion annually – it also poses challenges for businesses, particularly SMEs, which will need to navigate the new tax landscape. The introduction of tax amnesty provides a temporary reprieve for businesses engaged in tax avoidance, but long-term success will depend on how well the government addresses the structural issues in the tax system and supports businesses in complying with the new regulations.

In conclusion, the 2025 tax reform represents both an opportunity and a challenge for the Russian economy. If implemented effectively, it could lead to more sustainable public finances and a more transparent business environment. However, if the burden on businesses and high-income individuals becomes too great, it may lead

to unintended consequences, such as reduced investment and slower economic growth. As the reform takes effect, it will be crucial to monitor its impact and make adjustments as necessary to ensure that it achieves its intended goals without stifling economic development.

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УДК 621.378

OPTICAL TONER REMOVAL FROM PAPER USING IPL TECHNOLOGY

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Abstract. This paper presents a method for removing toner from coated paper using intense pulsed light (IPL) technology. The process ensures complete removal of toner without damaging the paper. The method offers an environmentally friendly alternative to traditional recycling methods, reducing chemical use, energy, and emissions.

Keywords: toner removal, intense pulsed light, coated paper, eco-recycling, paper recycling.

ОПТИЧЕСКОЕ УДАЛЕНИЕ ТОНЕРА С БУМАГИ С ИСПОЛЬЗОВАНИЕМ ТЕХНОЛОГИИ IPL

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Аннотация. В статье представлен метод удаления тонера с мелованной бумаги с помощью технологии интенсивного импульсного света (IPL). Процесс обеспечивает полное удаление тонера без повреждения бумаги. Метод предлагает экологически чистую альтернативу традиционным способам переработки, сокращая использование химических веществ, энергию и выбросы.

Ключевые слова: удаление тонера, интенсивный импульсный свет, мелованная бумага, экологическая переработка, повторное использование бумаги.

The production of pulp, paper, paperboard and wood products is a major contributor to emissions related to climate change, chemical pollution and energy consumption. For example, the total carbon emissions of this industry are estimated to be equivalent to 12 $GtCO_2$, and paper and pulp production accounts for the lion's share (~42 %) of global industrial wastewater. Traditional paper recycling primarily aims to reduce the impact of paper use on forests and involves the decomposition and recovery of paper through the following steps. In the first step, recycled paper is moved from the point of use to the point of recycling, where it is classified according to paper type

and type of contamination (ink or toner). This step involves the energy used to transport the paper, but makes a relatively small contribution to energy consumption and pollution. The paper is repulped; pulping is performed using mechanical, chemical or thermomechanical processes to form a slurry and separate the toner particles from the fibres. This step requires large amounts of energy and water and is the dirtiest in terms of climate change emissions of the recycling step. The separated dye and toner are removed from the pulp by washing, flotation, screening or centrifugal separation (deinking step), followed by bleaching to improve appearance. This step is typically the largest contributor to chemical pollution of wastewater. The paper pulp is dried and processed into sheets of paper suitable for printing, along with any necessary coatings. This recycling step is the second largest energy consumer after the defibration step and the largest source of climate change emissions compared to the above steps.

Thus, the traditional approach to paper recycling is still a major contributor to energy consumption, emissions of gases and toxic chemicals into the environment. Approaches to improving efficiency and reduce the environmental impact of the above life cycle include modifications to the defibration and deinking process and valorization of papermaking by-products. However, this approach does not reduce the number of recycling steps and therefore its impact is relatively small. The next approach that will be presented in this paper is toner ablation, which is an approach to paper recycling that removes toner directly from the paper without damaging it in any way. De-inking is conceptually different from removing ink or toner during traditional recycling because it does not require prior shredding of the paper, can be accomplished with simple tools that are easily integrated with modern printers, and uses a minimal amount of chemicals. When implemented in this form, de-inking technology can reduce or eliminate all of the above life cycle steps in conventional paper recycling and enable a new level of recycling and reuse at the point of use. Given the above potential, various approaches to implementing de-inking technology have been explored.

1. Adhesive de-inking technology

Adhesive de-inking technology is based on the use of a material that forms a stronger bond with the toner than the bond between the toner and the paper. This material is pressed onto the paper and then scraped off to remove the toner. This method often requires extensive chemical pre-treatment to weaken the bond between the toner and the paper, followed by physical removal of the toner, both of which can damage the structure of the paper [1].

2. Abrasion-based method

Abrasion-based methods use abrasive particles as well as the application of oscillating mechanical energy to remove toner, but the potential for mechanical damage to the paper itself is high.

3. Solvent-based removal

Solvent-based removal exposes the paper to organic chemicals that selectively dissolve the toner but not the paper itself. The need for significant amounts of these chemicals, which are often harmful to the environment, places additional stress on the environment.

4. Bleaching

Bleaching involves printing with a special toner that changes color and becomes transparent to the eye when exposed to heat or UV light. This process requires special expensive paper and toner, and places limitations on the printing process and the toner used [2].

5. Laser ablation

Laser ablation has been demonstrated to remove toner imprints, and significant advances have recently been made in the understanding and feasibility of the technology. The advantages of this approach are the low use of chemicals, the absence of the need for special toner or paper, and the elimination of mechanical damage to the paper. The ease of integration of lasers with existing printers also allows the full benefits of print removal to be realized. Optimum laser parameters for successful toner removal from uncoated paper printed on various laser printers were determined, with prints characterized by analyzing micromorphology, chemical composition, and optical appearance. However, laser light invariably damaged the coating layer during print removal from coated paper, making it difficult to reuse. In typical coated printing paper, the main cellulose fibers are surrounded by a protective layer consisting of a combination of polymer resins and other silica-based minerals (such as kaolin). This gives the paper a glossy appearance, makes it smoother, and provides greater opacity for improved print quality in advertising, packaging, books, photographs, and drinking glasses. With coated paper accounting for nearly 40 % of the current global printing paper production, an optical deinking method with minimal chemical use and high scalability could have a significant impact on the recycling efficiency of such paper.

In this paper, we investigate a new laser-free optical deinking process for coated paper. This process uses broad-spectrum pulsed visible light (IPL) from a large-area xenon lamp incident on the paper, followed by a small amount of environmentally friendly ethanol-based alcohol to remove the toner [3]. The dry toner removal process is more similar in nature to adhesion-based toner removal technology than laser removal. The pulsed light weakens the bond between the paper and the toner so much that a simple wipe soaked in alcohol can be used to gently remove the toner. In the past, IPL technology was used to fuse conductive nanomaterials onto substrates such as paper, polymers, and fabrics for flexible and rigid electronics applications. Although IPL technology is known to be scalable due to its large-area processing capability and minimal damage to the underlying substrate, there has been no research to date on its use in removing toner residue from paper. The technology was first described in the Journal of Cleaner Production. In the paper, a group of scientists experimentally evaluated the capabilities of IPL technology for removing toner from coated paper. The sample used was a 270 gsm semi-gloss coated paper printed on an ECOSYS M2540dn multi-color digital printing press (Figure 1).

Figure 1. ECOSYS M2540dn

The test samples consisted of stripes of black, blue, red and green colors printed with the supplied KYOCERA dry toner (Figure 2). In this paper, the samples of the pure black color were considered.

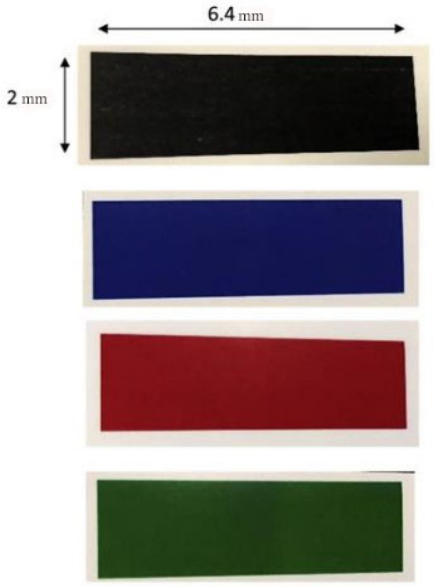

Figure 2. Test samples

The samples were exposed to pulsed light from a Sinteron 3000 xenon flash lamp, manufactured by Xenon. The sheets were positioned 38 mm from the lamp, so that the optical trace on the sample plane was approximately 305 mm by 38 mm (Figure 3) [4].

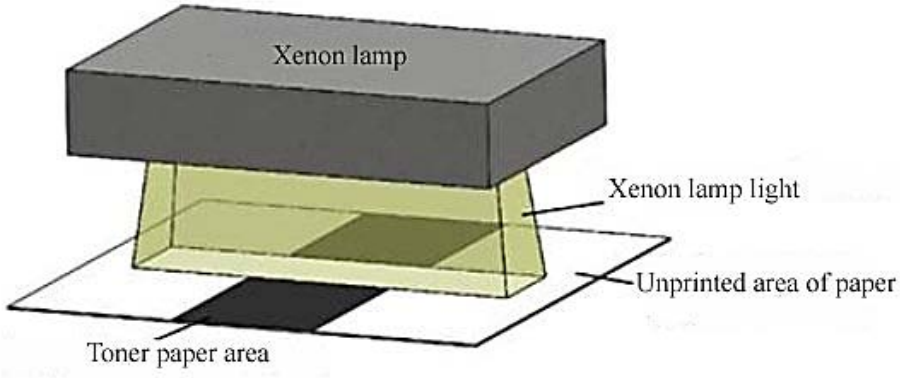

Figure 3. Toner removal process diagram

The power spectrum of this lamp is in the range from 350 to 800 nm, with most of the energy concentrated in the region from 400 to 700 nm (Figure 4).

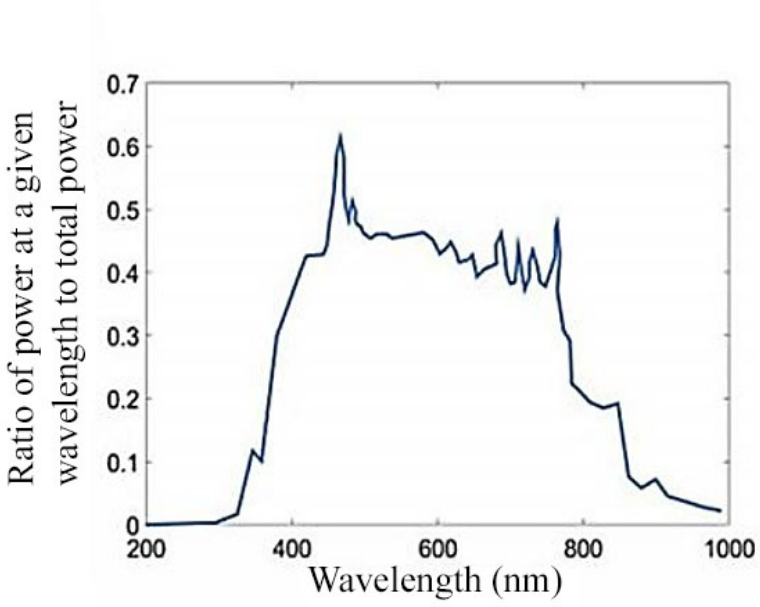

Figure 4. Lamp power spectrum Sinteron3000

This power spectrum avoids UV and IR light, which damages paper as observed in laser fingerprint removal work. The light output was controlled by changing the pulse duration in microseconds. After the pulse, the paper surface was lightly wiped with an ethanol-soaked wipe to remove the toner, thereby changing the appearance and exposing the underlying paper coating. Using pulsed light without wiping with a wipe does not affect the color and structure of the paper and toner surface, as does using an ethanol-soaked wipe without exposure to pulsed light. The surface morphology of the samples was examined using a Zeiss Sigma Field Emission 8100 scanning electron microscope [5]. The optical reflectance of the samples was examined using a Jasco UV-Vis spectrophotometer. The measured reflectance spectra show the intensity of light at different wavelengths perceived by the human eye when viewing paper and were used as an optical measure of the degree of fingerprint removal. For example,

unprinted paper has very high and uniform reflectance across the visible spectrum, whereas paper printed with black toner exhibits significantly lower reflectance across the spectrum. The closer the spectrum of the paper with the print removed (cleaned) to the spectrum of the clean paper, the greater the degree of print removal. Human perception of reflectance is often measured at a wavelength of 550 nm because it corresponds to the maximum light intensity perceived by the cones of the human eye. Sheets cleaned with the optimal processing mode were reprinted with the same toners on the same digital printing press to study the change in their reflectance. This study was conducted to quantify the cleaning cycles of the paper before reprinting was impossible due to surface damage.

For black toner removal at a fluence of 7.5 J/cm², a single pulse of light does not cause sufficient toner removal (Figure 5). Increasing the flux density to 10 J/cm² shows a gradual improvement in toner removal, with the paper surface partially exposed but still in the partial removal mode. Using pulses of 12 and 13.5 J/cm² provides a good degree of toner removal, with the paper color after cleaning not differing from the color of unprinted paper.

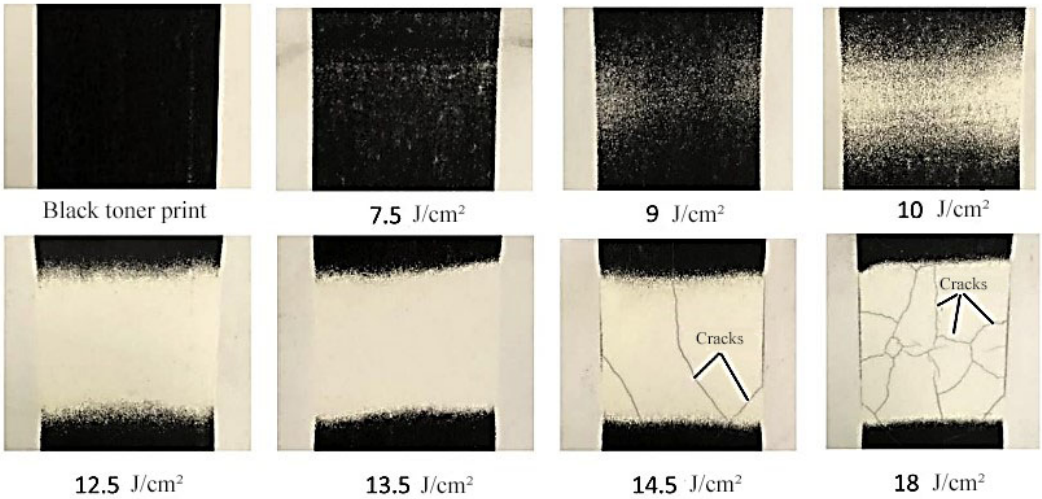

Figure 5. Samples with black imprint in partial removal, full removal, removal with cracking modes

Increasing the energy density to 14.5 J/cm² and higher results in toner removal and cracking of the paper coating. The corresponding reflection spectra in the visible range are shown in (Figure 6).

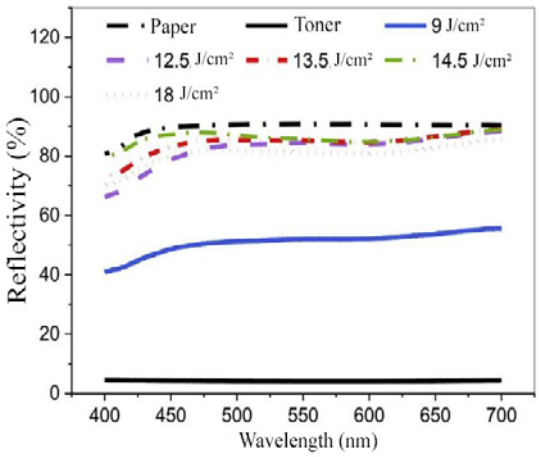

Figure 6. Reflectance spectra in the visible range

The reflectivity of the bare paper is very high and fairly uniform in the visible region, while the paper with the black toner imprint has a uniformly low reflectivity throughout the visible spectrum due to significantly higher optical absorption by the toner. In the partial removal mode (9 J/cm²), the reflectivity is higher than that of the black toner imprint, but almost 40 % lower than that of the bare paper at 550 nm. With complete removal (12.5 and 13.5 J/cm²), the reflectivity increases significantly and is within 5–6 % of the bare paper values at 550 nm [6]. Further increase in energy and transition to the complete toner removal and cracking mode (14.5 J/cm²) causes a slight increase in the reflectivity, which is especially noticeable at a wavelength of 500 nm and less. And this is despite the appearance of cracks on the cleaned paper (Fig. 5). Increasing the energy to 18 J/cm², which leads to an even greater increase in the number of cracks, as well as their area, causes a decrease in reflectivity up to 11 % of the values for clean paper. These observations show that reflectivity measurement can be used as an assessment of efficiency and determination of the cleaning mode, but the appearance of cracks causing a noticeable decrease in reflectivity occurs with significant accumulation of them. To scale the process to the entire sheet and remove the entire black toner imprint, an overlap of the optical spot area by the value OL was used (Figure 7).

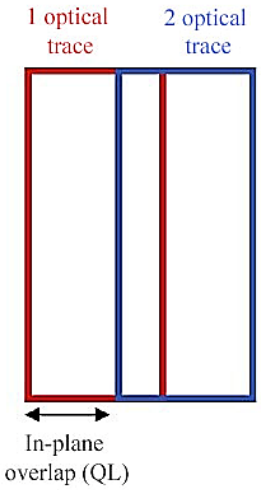

Figure 7. Schematic representation of the overlap in the plane

An alcohol wipe was used after the entire toner removal process was completed. Complete toner removal without cracking was achieved with an energy density of 12.5 J/cm² and an in-plane overlap of OL = 10 mm. Using a smaller in-plane overlap of 5 mm at the same energy density causes paper cracking due to excessive energy falling on the paper in the area between successive optical traces. A larger overlap of 15 mm causes only partial toner removal because parts of the paper do not receive enough energy for uniform removal.

In summary, this work has presented a new method for removing toner marks from coated paper based on pulsed visible light (IPL) technology, which can achieve significant results in the field of paper recycling. The obtained data showed that effective toner removal without damaging the paper structure is possible. This confirms that IPL technology can significantly reduce the number of traditional recycling steps, reducing carbon emissions and energy consumption. Not only does the IPL method minimise the use of chemicals, it also integrates with modern printers, making it easier to reuse paper at the point of use. This approach has significant potential to reduce environmental impacts, including reducing the volumes of toxic wastewater generated during the deinking and bleaching stages of traditional recycling. The study shows that the use of pulsed light could be a key element in the transition to more sustainable waste management practices in the paper industry. It is important to continue working in this area to further optimise the process, which will allow the technology to be as efficient and reliable as possible.

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УДК 004.925

OVERVIEW OF EXISTING 3D GRAPHICS COMPRESSION AND OPTIMIZATION TECHNOLOGIES

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Abstract. At the current stage of development of modeling tools, it has become quite easy to create detailed 3D models for use in various applications. However, performance issues arise. This paper examines the main methods for optimizing 3D model rendering. The analysis compares two types of compression – 3D mesh compression and texture compression.

Keywords: 3D model, virtual space, rendering, polygon, normal map, texture, mesh, performance.

ОБЗОР СУЩЕСТВУЮЩИХ ТЕХНОЛОГИЙ СЖАТИЯ И ОПТИМИЗАЦИИ 3D-ГРАФИКИ

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Аннотация. На современном этапе развития средств моделирования стало достаточно легко создавать детализированные 3d-модели для использования в различных приложениях. Однако возникают проблемы производительности. В данной работе рассматриваются основные методы оптимизации рендеринга 3d-моделей. В результате анализа сравниваются два типа сжатия – сжатие трехмерной сетки и сжатие текстур.

Ключевые слова: 3d-модель, виртуальное пространство, рендеринг, полигон, карта нормалей, текстура, трехмерная сетка, производительность.

Introduction to 3D Model Rendering Optimization

Optimizing 3D model rendering is an important aspect of development that allows you to improve performance and visual quality. Regardless of whether it is a game, animation or virtual reality, optimizing rendering will help you achieve better performance results. This article will cover the main methods and recommendations for optimizing 3D model rendering, which will help you create high-quality projects with minimal resource costs.

Geometry and mesh optimization

One of the most effective ways to optimize rendering is to reduce the number of polygons in a model [1]. The fewer polygons, the fewer computing resources are required for rendering. You can use polygon reduction tools such as Decimate in Blender or ProOptimizer in 3ds Max. These tools allow you to automatically reduce the number of polygons while maintaining the overall shape and details of the model. It is important to find a balance between the number of polygons and the quality of the rendering so that the model remains attractive and detailed.

Removing invisible polygons, such as interior parts of a model that will never be visible to the user, can significantly reduce the load on the system. This is especially important for complex models with a lot of detail. For example, if you have a model of a building, you can remove all the interior walls and objects that will not be visible from the outside. This will reduce the number of polygons and improve rendering performance.

A normal map allows you to create the illusion of a highly detailed surface without increasing the polygon count [2]. This is achieved by using textures that simulate surface details. This way, you can maintain high rendering quality with fewer polygons. Normal maps are especially useful for creating fine details such as cracks, scratches, and other textured elements.

Effective use of textures and 3D meshes

Let’s look at two types of compression: 3D mesh compression (Draco) and texture compression (KTX 2.0). Let’s compare the results of using these algorithms separately and together.

Draco is a compression library developed by Google that allows for efficient compression and decompression of 3D meshes. The main goal is to reduce the amount of data required to store and transmit 3D models while maintaining high visual quality. This method focuses on compressing vertex data, normals, texture coordinates, and other attributes while maintaining geometric accuracy. The library uses various compression algorithms such as value prediction, compression via encoding, and other optimizations. Users can choose the compression level depending on their needs, which allows them to find a balance between model quality and file size. This technology also supports streaming decompression, which allows loading 3D models in parts, improving performance when loading large objects.

Texture size directly affects rendering performance. It is necessary to use textures with a resolution that matches your project. For example, for mobile applications, it is better to use textures with a lower resolution to reduce the load on the GPU. It is important to find a balance between texture quality and their size to maintain high rendering quality with minimal resource costs.

Texture compression reduces the amount of data that needs to be loaded into memory, helping to reduce loading times and improve rendering performance [3]. It is important to choose the right compression format for each texture type to maintain image quality and reduce data volume.

KTX 2.0 (Khronos Texture 2) is a texture storage format developed by the Khronos consortium. It is an extension of the original KTX format and supports more modern requirements for compression and storage of textures in graphics applications.

This format supports several types of texture compression, including various formats such as BC1, BC3, BC7, and ASTC (Adaptive Scalable Texture Compression) [4]. This allows you to choose the optimal format depending on the quality requirements and the loading performance. KTX2 also allows you to store textures as separate detail levels (mipmap), which improves rendering quality at different distances to objects. You can use both lossy compression (which is especially important for games and applications where performance is important) and lossless compression when quality is of paramount importance.

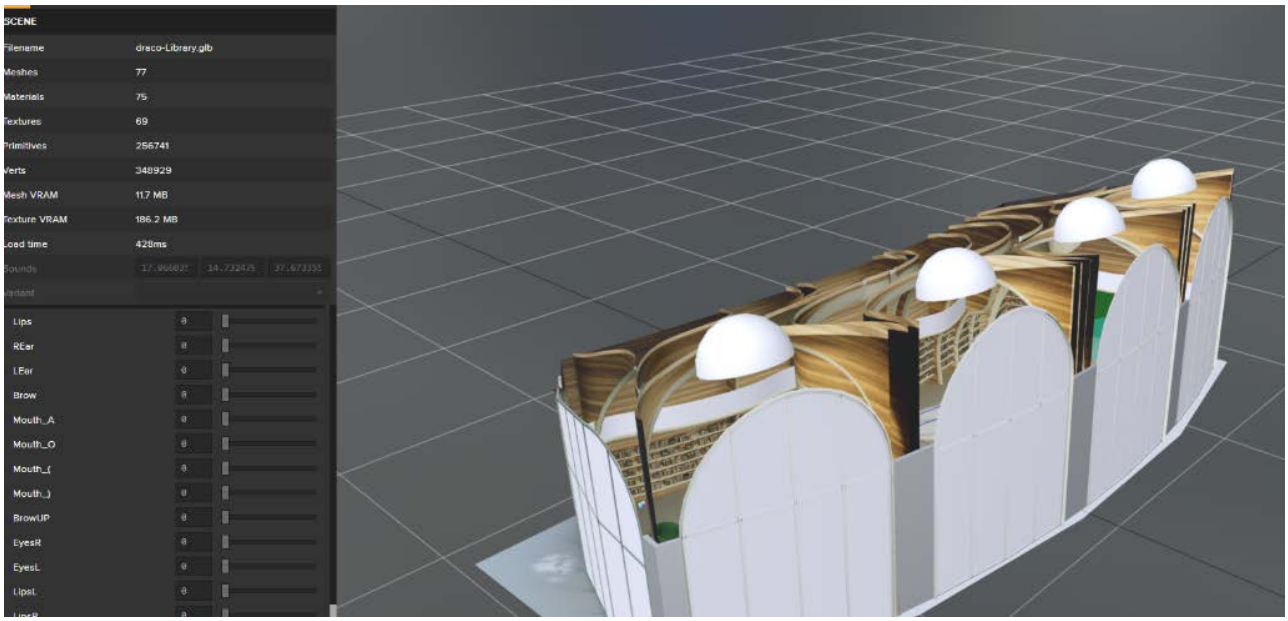

Figure 1. 3D model

Figure 1 shows a scene of a small location for a level in a video game. This location contains many furniture objects: sofas, armchairs, chairs, bookshelves, and 5 large panoramic windows. The initial size of the GLB file is 30 MB and occupies 186 MB of video memory (VRAM).

Table – Comparison of compression types (Draco + KTX 2.0)

Compression type	File size, MB	VRAM, MB
Original size	30 MB	186 MB
Draco	15.5 MB	209 MB
KTX 2.0	20.3 MB	40 MB
Draco + KTX 2.0	11.4 MB	38 MB

Using the texture compression algorithm (KTX 2.0) and 3D geometric mesh compression (Draco). The results of using the compression algorithms are presented in Table.

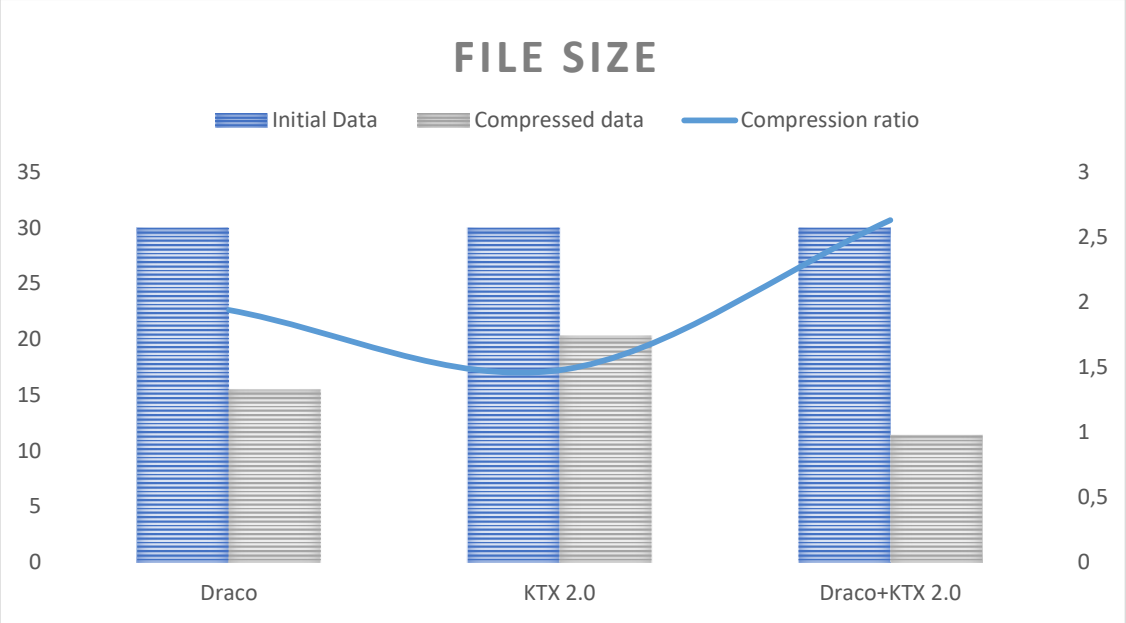

Figure 2. The impact of compression algorithms on the original file size

Figure 2 shows the impact of compression algorithms on the original file size. The analysis showed that the combined use of compression types provides the greatest efficiency. Compression ratios for file size were also calculated when using the algorithms separately, for example, for KTX 2.0 this ratio is 1.48.

Using LOD

Another method for optimizing the rendering of 3D models is the use of LODs (levels of detail) [5]. This technique allows for the use of different versions of the model with different levels of detail depending on the distance to the camera.

Figure 3 shows an example of using this technique. This helps reduce the load on the system, since models with fewer polygons are used at greater distances.

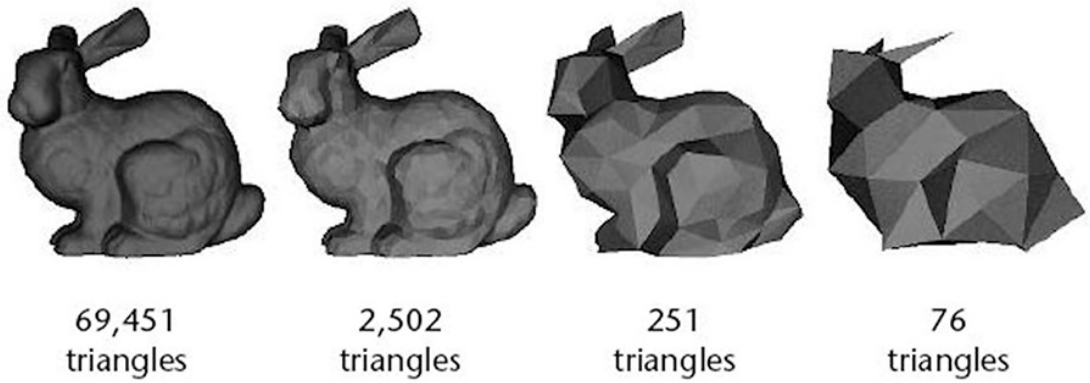

Figure 3. Levels of detail for a 3D rabbit model

For example, for objects that are far from the camera, you can use simplified versions of the model with fewer polygons. This will reduce the number of calculations and improve rendering performance.

In addition to LOD, there are other optimization techniques such as culling (cutting off invisible objects) and instancing (using one copy of a model for many objects). These techniques can significantly speed up the rendering of virtual space.

For example, culling allows you to automatically remove objects that are outside the camera's visibility, which reduces the number of calculations. Instancing allows you to use a single copy of a model for many objects, which reduces the number of draw calls and improves performance.

Conclusion

Based on the above, we can conclude that 3D model rendering optimization is a complex process that includes many different techniques and methods. Geometry and polygon mesh optimization, the use of 3D mesh and texture compression algorithms, and the use of LOD will allow you to achieve better results and improve the performance of your project. It is important to remember that optimization is a continuous process that requires constant analysis and improvement.

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УДК 378.016

CHALLENGES AND STRATEGIES IN TRANSLATING IT DOCUMENTATION: A STUDY AMONG TECHNICAL UNIVERSITY STUDENTS

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Abstract. This study surveys the difficulties faced by students of technical universities when translating English technical literature into the Russian language, points out the main ones and offers the ways and decisions for mastering translation skills. A survey of 206 students revealed that the majority struggle with the accurate translation of technical terms, with many relying on machine translation. The study highlights the need for advanced training in technical translation to meet the demands of a global IT industry.

Keywords: foreign language challenges, translation strategy, machine translation, IT terminology.

ПРОБЛЕМЫ И СТРАТЕГИИ ПЕРЕВОДА ИТ-ДОКУМЕНТАЦИИ: ИССЛЕДОВАНИЕ, ПРОВЕДЕННОЕ СРЕДИ СТУДЕНТОВ ТЕХНИЧЕСКИХ УНИВЕРСИТЕТОВ

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Аннотация. В данном исследовании рассматриваются проблемы и трудности, с которыми сталкиваются студенты технических вузов при переводе английских информационных текстов на русский язык, предлагаются стратегии совершенствования навыков перевода. Опрос 206 студентов показал, что большинство из них испытывают трудности с точным переводом технических терминов, и многие полагаются на машинный перевод. В исследовании подчеркивается необходимость повышения квалификации в области технического перевода, чтобы соответствовать требованиям ИТ-индустрии в современном мире.

Ключевые слова: проблемы изучения иностранного языка, стратегия перевода, машинный перевод, IT-терминология.

The English language is the key to achieving the efficiency in communication in the IT-sector due to the fact that it is the most widespread language starting from

business to science dealing with all kinds of technologies. Students in technical universities specializing in IT need solid English language proficiency due to the rapid advancements and innovations in the IT industry. For non-native speakers, particularly Russian-speaking students, translating technical documentation poses unique challenges. These challenges include interpreting complex terminology, understanding technical jargon, and accurately translating multi-word expressions. To fully utilize these innovations, students frequently encounter technical documentation in English, which can present translation challenges. For effective understanding of technical documentation, user's manuals, system requirements, coding standards, etc. foreign language skills and awareness of translation strategies is crucial for IT-specialists.

As Figure 1 demonstrates, over 64.4 % of scientific articles and technical documentation are published in English, highlighting the importance of English proficiency for IT professionals. These reliable results are presented by PLOS (Public Library of Science) [1].

The relevance of this study stems from both industry demands for qualified translators and the academic need to prepare students for a globalized workforce where English is the standard language in business, science, and technology.

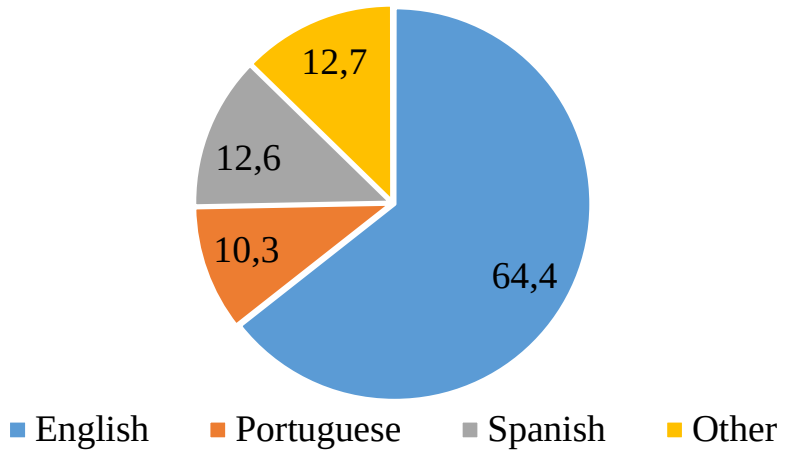

Figure 1. The review of papers published in different languages

The study aimed to identify the challenges technical students encounter in translating IT documentation and to propose solutions. The following objectives were set [2]:

- Analyze existing literature on the translation of technical documentation and terminology.
- Survey students to assess their translation challenges.
- Assess translation training techniques suitable to students of technical universties.

A mixed-methods approach was employed, including theoretical research methods (e.g., analysis and synthesis), survey methodology, and comparative analysis. A survey was conducted among 206 students from St. Petersburg State University of Telecommunications (SPbSUT), and data were analyzed through both quantitative and

graphical methods. In general, technical literature contains a lot of technical terms and professional jargons whose translation may lead to either the partial loss of the sense of them or even appearance of troubles caused by the lack of equivalents in a translator's native language. Russian students and IT-specialists may have the need to transliterate them in some cases, which may cause difficulties for translators, because, obviously, the Russian alphabet differs from the Latin alphabet.

In the framework of the survey the following findings were revealed: 82.1 % of students experienced difficulties in translating technical terminology (Figure 2).

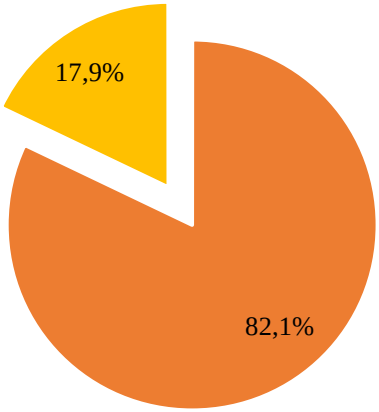

Figure 2. Students' experience & difficulties in translating

Ther percentage of common problems faced by students translating IT literature is shown in Figure 3.

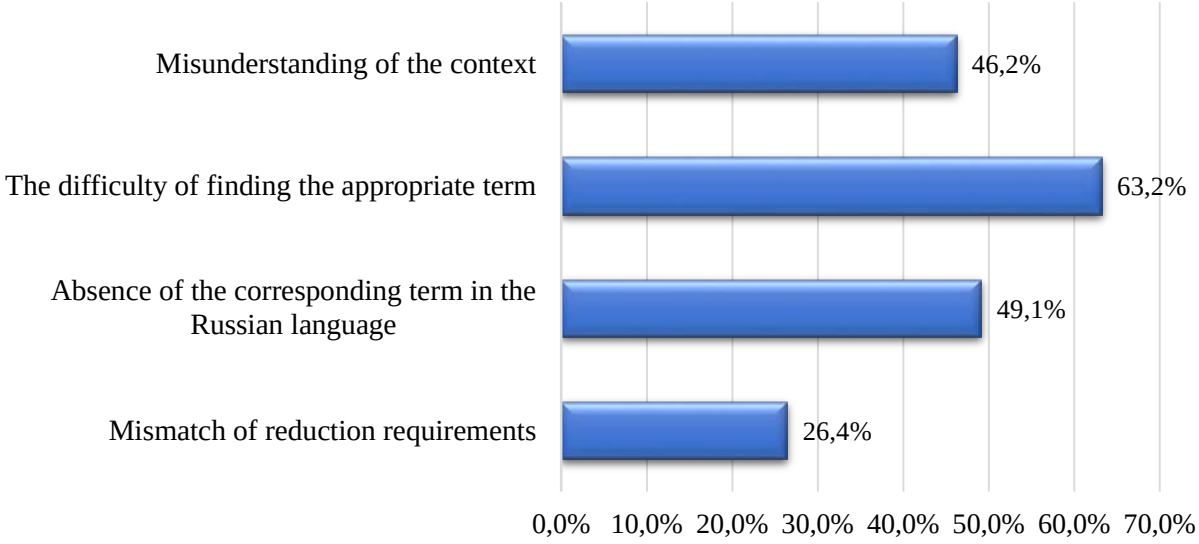

Figure 3. Language aspects difficulties

Students use different approaches when translating technical literature. Machine translation is most often used (73.6 % of respondents), while 50 % of respondents turn

to specialized professional dictionaries. In addition, 57.5 % of students prefer to translate independently, using the knowledge and skills they gained while reading professional texts in a foreign language (Figure 4).

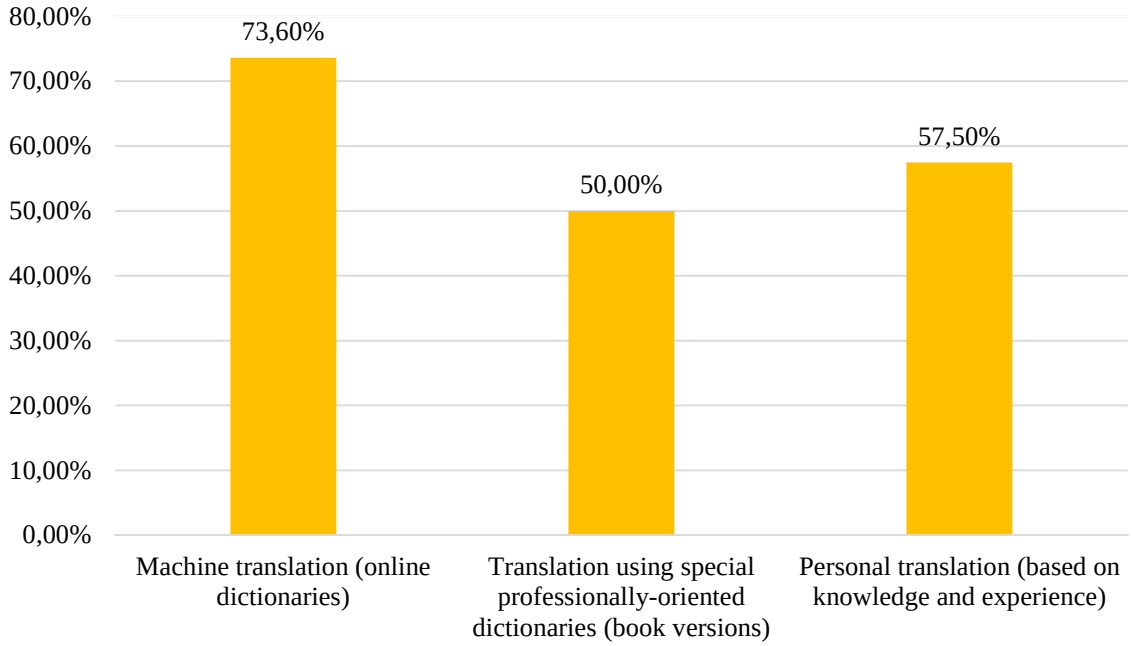

Figure 4. Students' translation strategies

The complexity of translating IT terminology is heightened by the prevalence of multi-word terms and idiomatic expressions that often lack direct Russian translations [3, 4]. Additionally, the Russian language alphabet and grammatical structure add complexity. The abundance of technical terms and jargon poses a substantial barrier for students, as many terms do not have exact Russian counterparts and require familiarity with technical language structures in both languages. The common difficulties in IT terminology translation are terms consisting of several words, they are also called multicomponent (multi-word) technical terms. Table provides examples of multi-word technical terms and their corresponding translations, illustrating the linguistic challenges students face [5].

Table – Example of IT multi-words

Initial term	*Translation*
object relational mapping	объектно-реляционное преобразование
fault tolerance	отказоустойчивость
step voltage	ступенчатое напряжение
correction for displacement	коррекция на смещение

Additionally, phrasal verbs sometimes found in business communication, present another challenge. Machine translation, although widely used by students, often fails to deliver a relevant translation, emphasizing the need for more comprehensive translation training.

According to the survey among the students of SPbSUT, 1/3 expressed interest in improving their translation skills and acquiring strategies and extra knowledge on specific translation techniques, including post-editing of machine translations (PEMT).

Rapid technological progress in the IT industry determined the necessity of studying technical translation in universities, and especially in the field of the information technology. Therefore, methodical approach is required for the translation of IT terminology in each text, as well as auxiliary materials (Russian analogue texts and reference literature, translation dictionaries, etc.).

As a consequence, students' curiosity in the practice of scientific communication in IT field should lead them to use practical recommendations and algorithms for high-quality translations of technical literature and to be able to establish the multi-words, emphasizing multicomponent words of a professional orientation. Foreign language tutors are supposed to teach interested students these translation technologies at vocabulary, grammar and syntax levels. Along with that, tutors have to pay attention to the stage of development of their post-editing machine translation (PEMT) skills and critical thinking in order to maintain the accuracy of the translation.

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УДК 37

FORMATION OF THE ABILITY OF YOUNGER SCHOOLCHILDREN TO UNDERSTAND MUSICAL WORKS IN THE PROCESS OF DEVELOPING THEIR MUSICAL AND CREATIVE ABILITIES BY MEANS OF SAND ANIMATION

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Abstract. This scientific article examines the formation of the ability of younger schoolchildren to understand musical works in the process of developing musical-creative abilities of younger schoolchildren using sand animation. The ability to understand and appreciate musical works is important for comprehensive development, and the use of sand animation can improve students' understanding of music and their involvement in it. The influence of sand animation on the musical development of children is also considered, key factors contributing to the formation of their ability to interpret musical works and establish a connection with them are identified. By integrating sand animation into music education curricula, educators can create a dynamic, creative and interactive learning environment that stimulates students' creativity and promotes a deeper understanding of music.

Keywords: primary school children, sand animation, music, musical-creative abilities, skills, understanding of a musical composition, hermeneutics.

ФОРМИРОВАНИЕ УМЕНИЯ МЛАДШИМИ ШКОЛЬНИКАМИ ПОНИМАТЬ МУЗЫКАЛЬНЫЕ ПРОИЗВЕДЕНИЯ В ПРОЦЕССЕ РАЗВИТИЯ ИХ МУЗЫКАЛЬНО-ТВОРЧЕСКИХ СПОСОБНОСТЕЙ СРЕДСТВАМИ ПЕСОЧНОЙ АНИМАЦИИ

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Аннотация. В этой научной статье исследуется формирование умения младшими школьниками понимать музыкальные произведения в процессе развития их музыкально-творческих способностей с помощью песочной анимации. Умение понимать и ценить музыкальные произведения имеет важное значение для всестороннего развития, а использование песочной анимации может улучшить понимание музыки учащимися и их вовлеченность в нее. Также рассматривается влияние песочной анимации на музыкальное развитие детей, выявляются ключевые факторы, способствующие формированию у них способности интерпретировать музыкальные произведения и устанавливать связь с ними. Интегрируя песочную анимацию в учебные программы музыкального образования, педагоги могут создать динамичную, творческую и

интерактивную среду обучения, которая стимулирует творческие способности учащихся и способствует более глубокому пониманию музыки.

Ключевые слова: младшие школьники, песочная анимация, музыка, музыкально-творческие способности, умения, понимание музыкального произведения, герменевтика.

Today, the education system pays special attention to the upbringing of individuals with creative abilities, striving for self-improvement and self-realization. Therefore, it is important to find ways to help younger students develop their creative qualities. As children grow and develop, so does their desire for creativity. Cultural and spiritual activities begin to play a significant role in their lives. This process helps to shape their personal and psychological qualities, allowing them to unleash their creative potential.

Subjects such as music, fine arts, and needlework play a crucial role in developing the creative abilities of younger students. It is important to take into account age-related changes in children's development. For example, while role-playing games may be the predominant activity among preschoolers, primary school children give priority to educational activities.

Art provides people with an opportunity to demonstrate their creative potential. Artists express themselves through paintings, architectural designs and other visual projects. Those who are engaged in theater bring their creative potential to life through acting and stage productions. Writers express their creativity in poems, short stories and novels, and musicians create and perform songs, symphonies and operas.

Our creative abilities allow us to explore and interpret the world around us. It is important to develop these abilities from an early age. Children begin their creative path in music from kindergarten and continue to explore and expand their creative potential as they enter school.

The ability to understand musical works by younger schoolchildren is important for a high-quality and competent musical (vocal and instrumental) work. The performance of the vocal part by different children, provided that all the notes are correctly performed, often differs because someone does not have an understanding of the meaning and plot of the vocal and instrumental work at all, and someone has a distant one. Understanding the meaning and plot of a vocal and instrumental work is necessary not for the sake of simple curiosity, but for the transmission and reproduction of the emotional, semantic and figurative component, as well as living the plot of the work itself. The musical-artistic components are combined by sand animation.

"Sand animation is an art form that contains the creation of a film with a storyline on a special light (light-animation) table using special sand in front of the viewer, and transmitting the image to various screens using computer and video equipment" [1, p. 38], and accompanied by a vocal and instrumental work or instrumental music [1].

In the context of the development of musical-creative abilities of younger schoolchildren, the use of sand animation as a means has great potential to enrich their understanding of musical works. All of this interweaves artistic expression with

musical education, offering a multi-sensory experience that can greatly enhance children's engagement and understanding of musical works.

The use of sand animation is a dynamic and innovative method of immersing children in the world of music. With this tactile tool, children can visually interpret and represent the essence of musical works, thereby strengthening the connection with the music they are learning. By engaging in the process of creating visual narratives that reflect the emotions and themes of musical works, children get the opportunity to explore the deep meanings and subtleties of the compositions they encounter.

In addition, the interactive nature of sand animation allows young listeners to actively participate in the interpretation and expression of music, developing their creative self-expression and critical thinking skills. By translating musical elements into visual storytelling using sand, children receive a unique platform for mastering the nuances of musical works, thereby honing their ability to understand and interpret music on a deeper level.

In order to perform sand animation by younger schoolchildren, preliminary preparation takes place, at which a storyboard is performed based on the content of a vocal-instrumental or instrumental work. To create a plot in a composition of sand animation based on a vocal and instrumental work (children's song), the child needs not only to draw the content of the text, but also to correctly compose, create a plot development, convey meaning and mood. As a result, the composition of the sand animation should become an addition to the vocal and instrumental work and look as a result as a single work. Understanding the content of the song allows children not only to correctly perform it and perform a composition of sand animation, but also to sit on the stage, create a single image, as one performs the artistic part, and the other the vocal part.

As a result of the formation of the ability of younger schoolchildren to understand musical works in the process of developing their musical-creative abilities by means of sand animation, they are faced with a hermeneutic approach. Hermeneutics primarily studies the understanding and interpretation of various texts. In our case, the text is a vocal and instrumental piece, an instrumental piece and the result of a sand animation.

The hermeneutical approach allows younger students not only to understand the literal meaning of a piece of music, but also to penetrate deeper into its emotional and symbolic content. By joining music with the help of sand animation, children get the opportunity to creatively interpret the work. The process of creating a sand animation based on a piece of music requires careful attention to detail, as the child must visually represent the themes, moods and emotions conveyed in the music.

In addition, through the practice of creating sand animation, younger students develop their artistic and creative abilities, as they learn to express themselves visually and interpret music in a unique and personal way. This process helps them to better understand and appreciate music as an art form. By combining the visual and auditory elements of music, children can create multidimensional and immersive experiences for themselves and their audience.

B. L. Yavorsky played an important role in improving the music education system, advocating the integration of music with artistic activities. He believed that

creative subjects such as music were ideal for developing students' creative abilities. Various methods can be used in music lessons to help students unlock their creative potential. For example, listening to music plays a crucial role because it allows children not only to appreciate the composer's idea, but also stimulates their imagination, forcing them to create their own interpretations and associations with the melodies they hear. Encouraging students to express their impressions through drawing or storytelling after listening to music can further contribute to their creative development. Singing is another fundamental activity in music education that promotes the creative growth of students by honing their vocal skills, increasing attention and memory, since mastering a song requires an understanding of the text, melody and nuances set by the composer. During extracurricular hours, it becomes possible in a general education organization to conduct classes on sand animation, which will allow developing the musical and creative abilities of younger schoolchildren. Of course, such classes require 18 hours a week, since sand animation includes musical-artistic activities.

Educators such as V. A. Sukhomlinsky [2] emphasized the importance of surrounding children with beauty, games, stories, music, drawing, imagination and creativity in order to create a favorable environment for mastering fundamental skills such as reading and writing. The emotions and experiences that children encounter in such an environment significantly affect their learning process.

In addition, S. M. Flor presented a method of using illustrations in music education. This approach involves encouraging children to create visual images of music that, in their opinion, convey the mood and essence of the work. S. M. Flor also believes that for instrumental pieces without text (for example, sketches, preludes) or other instrumental music, students can compose images or mental representation reflecting the essence of the musical work, which further stimulates their imagination and understanding of music. The issues of perception of musical works were also considered by V. V. Medushevsky [3, 4], E. V. Nazaikinsky, A. N. Sokhor [5], B. M. Teplov [6] and others.

N. L. Grodzenskaya [7] emphasizes that evaluation is the most important aspect of musical perception, arguing that understanding music presupposes conscious perception of it, awareness of its content and, to a certain extent, an understanding of its form. This point of view is shared by V. K. Beloborodova [8, 9], who describes musical perception as a process of reflection leading to the formation of a musical image in human consciousness. This mental creativity is based on an evaluative approach to the perceived work.

The essence of the perception of a new musical work lies in the listener's desire to empathize and understand the composer's point of view, to reveal the concept of the work and to give a cultural and artistic assessment of the work within the framework of the development of modern musical culture. Well-known music theorists such as L. A. Mazel, A. N. Sokhor, Yu. N. Tyulin, along with music educators such as O. A. Apraksina [10], N. L. Grodzenskaya, M. A. Rumer, V. N. Shatskaya [11] and others, emphasize the importance of experiencing, understanding and assessment as fundamental elements of musical perception. V. K. Beloborodova argues that musical perception is a reflexive process that leads to the creation of a distinct musical image in the mind of an individual. This mental construction is based on an evaluative

approach to the perceived work, which indicates that the formation of a meaningful understanding of a musical work involves a critical assessment and interpretation of its artistic elements.

In this context, the sequence of experience, understanding and evaluation is considered as the key basis of the process of musical perception, as stated by the mentioned scientists and practitioners in the field of music education and theory.

The use of sand animation as a means of teaching younger students musical compositions offers a unique multi-sensory approach to music and art education. By visually presenting musical concepts and elements through dynamic and smooth movements in the sand, students can establish connections between the auditory and visual aspects of music, enriching their overall understanding and appreciation of musical compositions. This interactive and hands-on method not only engages children in a more active learning process, but also allows them to express themselves better and interpret the music they are learning.

Sand animation can help develop children's creativity and imagination by encouraging them to think outside the box in terms of how they perceive and react to music. Observing the intricate patterns and shapes created in the sand to accompany musical compositions, younger students are inspired to explore different ways of interpreting and expressing emotions through art and music. This can lead to greater self-confidence and empowerment of their musical abilities, as well as a deeper connection with the emotional and expressive qualities of music.

Incorporating sand animation into music education can also foster a sense of collaboration and teamwork in younger students as they work together to create stunning visual images of the music they are learning. This aspect of collaboration not only develops their social skills and ability to communicate effectively with others, but also promotes a sense of community and shared achievements in the classroom. By creating a supportive environment for creativity, the development of musical-creativity and self-expression, teachers can help students develop a lifelong passion for music and art.

The use of sand animation in music education can also improve students' critical thinking and analytical abilities. Visually presenting complex musical concepts such as rhythm, melody and harmony using sand animation, students have the opportunity to critically comprehend the interaction between these elements and how they affect the overall structure and emotionality of a musical work. This hands-on approach encourages children to actively work with the material and develop a deeper understanding of the musical composition they are studying.

Sand animation can serve as a powerful tool to improve students' memory and memorization of musical compositions. The combination of visual, auditory and kinesthetic stimuli in sand animation provides students with a variety of reference points to consolidate their knowledge and deepen their understanding of key musical concepts. By repeatedly watching sand animations in combination with specific pieces of music, students can strengthen their musical memory and better understand its nuances and subtleties.

The experimental nature of sand animation can help students gain a holistic and sensory-rich perception of music that goes beyond traditional methods of music

education. By involving different senses in the learning process, students can establish brighter and stronger connections with the music they are learning. Such an immersive approach can deepen their emotional involvement in music and instill a lifelong love and appreciation for art.

Sand animation in music education can also help students develop their creativity and imagination. By allowing students to visually represent music with sand, we encourage them to think outside the box and explore different ways of interpreting and expressing musical concepts. This creative process can stimulate children's artistic needs and inspire them to think creatively about music in new and innovative ways.

Incorporating sand animation into music education can also help students develop fine motor skills and hand-eye coordination. When students manipulate sand to create intricate patterns and shapes that match the music they are learning, they gain a tactile and kinesthetic learning experience that can improve their dexterity and coordination. This physical aspect of sand animation not only develops students' motor skills, but also gives them a rich sensory learning experience that can deepen their connection to music on a physical level.

Scientific research has shown that the ability of younger schoolchildren to understand musical works can be significantly improved by using sand animation as a tool for developing their musical-creative abilities. Sand animation is a unique and fascinating method that allows children to visually interpret and express the emotions and themes present in musical compositions. By incorporating this technique into music education programs, educators can effectively stimulate children's imagination, creativity, and emotional intelligence. Through hands-on participation in creating visual images of music through sand animation, children can deepen their understanding and appreciation of musical works, which allows them to form a strong connection with music at an early age. This innovative approach not only develops children's musical abilities, but also contributes to their overall cognitive and artistic development. Ultimately, the integration of sand animation into the musical education of younger students can significantly contribute to their comprehensive development and understanding of art.

The use of sand animation in music education can help students better appreciate the visual arts and form a more holistic understanding of the creative process. By exploring the intersection of music and visual art through sand animation, children get to know new forms of artistic expression and get the opportunity to look at music in a more multifaceted way. Such an interdisciplinary approach to music education can broaden the artistic horizons of students and contribute to a deeper understanding of the interrelationship of various types of art.

Thus, the inclusion of sand animation in music education can enrich the artistic experience of students and contribute to their overall personal and artistic growth. The formation of the ability of younger schoolchildren to understand musical works with the help of sand animation not only enriches their musical and creative skills, but also contributes to a deeper connection with the music itself. By combining visual arts with music, children can explore the complexities and nuances of musical expression in a tangible and engaging way. This approach not only develops their artistic abilities, but also opens up new opportunities for them to perceive music more deeply. It is also

worth noting that the use of sand animation in music education offers teachers a versatile and exciting tool to enhance students' musical knowledge, develop creativity, collaboration and overall enjoyment of music. The inclusion of sand animation in the curriculum of primary school students opens up a creative and exciting way to improve their understanding of musical works. This innovative approach not only develops children's musical abilities, but also develops their creativity, imagination and intelligence through a harmonious combination of visual arts and music education.

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УДК 628.5:004.896

ROBOTIC SYSTEMS FOR CLEANING UP MICROPLASTICS IN THE OCEANS

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Abstract. The article deals with the current environmental problem of microplastic pollution of the oceans. An overview of robotic systems developed to combat this phenomenon is presented, analyzing their technologies, operating principles and efficiency. Special attention is given to the impact of these systems on the marine ecosystem and their potential to improve the situation. In the conclusion prospects for the development and improvement of robotic technologies for cleaning microplastics from the oceans are discussed.

Keywords: microplastics, oceans, robotic systems, cleaning, ecosystem, technology, development prospects.

РОБОТИЗИРОВАННЫЕ СИСТЕМЫ ДЛЯ УБОРКИ МИКРОПЛАСТИКА В ОКЕАНАХ

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Аннотация. В статье рассматривается актуальная экологическая проблема − загрязнение океанов микропластиком. Представлен обзор роботизированных систем, разработанных для борьбы с этим явлением, анализируются их технологии, принципы работы и эффективность. Особое внимание уделяется воздействию этих систем на морскую экосистему и их потенциалу в улучшении ситуации. В заключении обсуждаются перспективы развития и усовершенствования роботизированных технологий для очистки океанов от микропластика.

Ключевые слова: микропластик, океаны, роботизированные системы, очистка, экосистема, технологии, перспективы развития.

Microplastics represent one of the most pressing and fastest growing environmental problems of our time. These tiny plastic particles, less than five millimeters in size, have become persistent pollutants in marine and freshwater ecosystems around the world. The sources of microplastics are diverse: they can be the result of fragmentation of large plastic objects that disintegrate when exposed to ultraviolet radiation, mechanical abrasion and biodegradation, as well as direct ingestion of microplastics that are used in cosmetics, household chemicals and even textiles.

The problem of microplastics in the oceans is gaining momentum every year, not only due to the increasing production of plastic products, but also due to inadequate waste management systems. Plastic waste released into the environment enters river streams and eventually reaches the oceans, where it accumulates and breaks down into microparticles. These microparticles pose a threat to marine animals that may ingest them as food. The consequences of such ingestion can be fatal, including physical injury, digestive disorders, and even chemical poisoning, which can lead to declining populations and disrupted food chains. Microplastics are capable of absorbing various toxic substances such as pesticides, heavy metals and other contaminants on their surface, which can then be transported to and accumulate in the bodies of marine animals. This not only jeopardizes the health of marine life, but can also lead to bioaccumulation of toxins in food chains, which can result in harmful substances being ingested by humans.

The scientific community and international organizations have made considerable efforts to study the extent and consequences of microplastic pollution. The importance of this problem is emphasized by the fact that microplastics are found not only on the water surface and in coastal areas, but also in deep-sea sediments and in Arctic and Antarctic ice, indicating their global distribution.

Taking all of the above into account, robotic systems for removing microplastics from the oceans represent one of the most promising avenues for combating this environmental threat. These systems can help to reduce the concentration of microplastic particles in the aquatic environment, thereby reducing their impact on marine life and, more broadly, on the health of the ecosystem as a whole. In the following sections, we review existing technologies, their operating principles, and assess the potential of robotic systems to address this global problem.

In recent years, the development of robotic systems for cleaning microplastics has become an important area of environmental technology. These systems are being developed to reduce the amount of microplastics in the oceans, their efficiency and ability to adapt to different environmental conditions are key factors for successful application. Currently, there are several types of robotic systems, each with its own characteristics and operating principles [1].

One example is The Ocean Cleanup project, which has developed floating barriers equipped with collection systems that can concentrate and recover plastic from the water (Figure 1). These systems use natural ocean currents to collect plastic, making them energy efficient and allowing them to cover large areas.

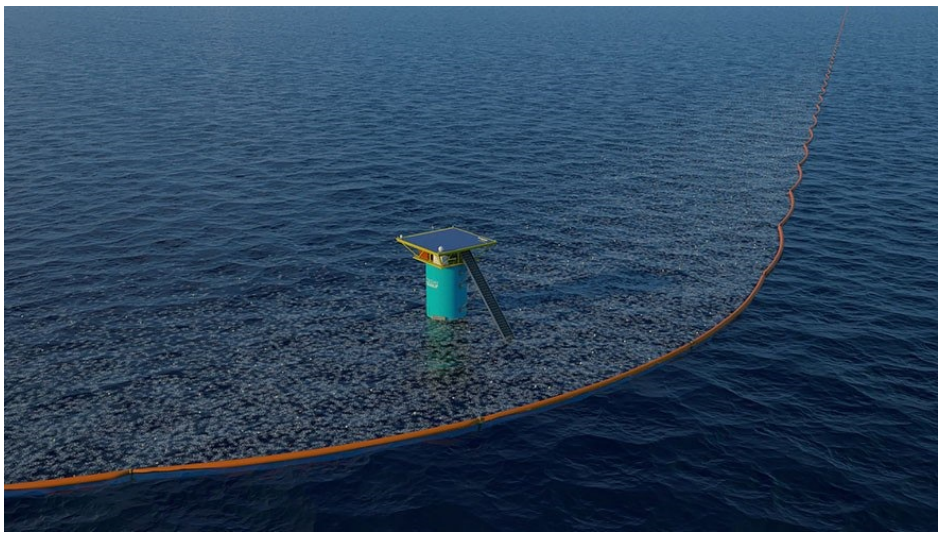

Figure 1. The Ocean Cleanup floating barriers

Another innovative approach is the use of autonomous underwater vehicles (AUVs) that can patrol the marine interior and collect microplastics using specialized filtration systems. These robots can operate in deep water and in hard-to-reach areas where traditional cleaning methods are ineffective (Figure 2).

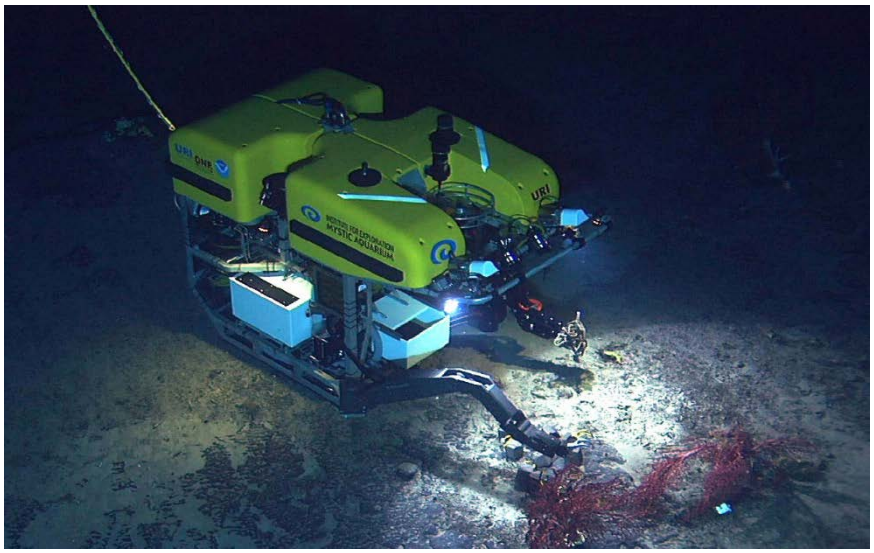

Figure 2. Autonomous underwater vehicles (AUVs)

There are also platforms that use drone technology to monitor and map microplastic pollution. They are equipped with sensors and cameras that collect data on the distribution of microplastics on the water surface. This information is needed to plan cleanup operations and evaluate their effectiveness. Biorobots are being developed that can mimic the behavior of marine animals to collect microplastics without harming the environment, for example, manta ray robots that “graze” on the water surface, filtering microplastics like real manta rays.

The performance of these systems is evaluated according to various criteria, including the volume of microplastics collected, cost of operation, impact on the marine environment and durability. An important aspect is their ability to work in synergy with other cleaning methods and their adaptation to changing conditions in the

marine environment. Nevertheless, despite the innovative nature and potential of robotic systems, there are certain challenges and limitations. These include high development and maintenance costs, difficulties in controlling and navigating changing marine conditions, and the need to ensure safety for marine life while the devices are in operation.

Robotic systems for cleaning microplastics in the oceans use a variety of technologies and operating principles aimed at maximizing the efficiency of microplastic collection while minimizing the impact on the marine environment. In this section, we review the key technological aspects and principles underlying the operation of these systems.

Many robotic systems are equipped with autonomous features that allow them to autonomously navigate through the aquatic environment, avoid obstacles and determine optimal routes for collecting microplastics. The use of GPS, sonar, lidar and complex data processing algorithms allows these robots to effectively adapt to changing conditions.

Various filtration technologies are used to extract microplastics from water. These can range from simple fine mesh screens to complex multi-stage systems capable of separating particles of different sizes and preserving marine life. Robotic systems often use renewable energy sources such as solar panels or algal biofuel cells to minimize their dependence on conventional sources and reduce their ecological footprint [2].

Some systems are designed in such a way that they can be easily modified or combined into larger networks to increase the cleaning area. This flexibility allows the process to be optimized depending on the scale of contamination. The application of AI and machine learning allows systems to analyze collected data, optimize collection processes and adapt to new circumstances, such as changing weather conditions or the discovery of new microplastic accumulations.

Robots must be able to withstand harsh marine conditions, including strong currents, salt water and wave impacts. Strength of materials and robustness of construction are important factors for long-term operation. Some robots are designed so that their operation does not disturb marine animals. An example is systems that mimic the behavior of marine animals to collect microplastics without attracting the attention or frightening real ocean creatures.

Current science and technology are developing different approaches to clean up microplastics in the oceans. Magnetic nanorobots use magnetic fields to collect and concentrate microplastic particles, while biohybridized MAR microrobots combine living microorganisms with inorganic materials to capture and recycle them. Ocean Cleanup floating systems, on the other hand, are passive systems that collect debris using natural marine currents. We will conduct a comparative analysis between magnetic nanorobots, biohybridized MAR microrobots and Ocean Cleanup floating systems (Table). This analysis will be based on general characteristics and perceived performance, as accurate data can only be obtained through real experiments and observations [3].

Table – Comparative analysis of treatment systems

Parameter/System	Magnetic nanorobots	MAR biohybrid microrobots	Ocean Cleanup floating systems
Purification method	Magnetic filtration	Biomimetics	Passive barriers
Selectivity	High	Medium	Low
Scalability	Low	Medium	High
Power consumption	Low	Low	Medium to high
Manageability	High	High	Low
Ecosystem Impact	Potentially low	Potentially low	Medium to high
Development stage	Research	Experimental	Implemented and operated

Magnetic nanorobots and MAR biohybrid microrobots are in the early stages of development and are showing promise in the laboratory, but their effectiveness in real marine environments has yet to be evaluated. Floating Ocean Cleanup systems have already been implemented and are operating in the ocean, but their ecosystem impacts and long-term effectiveness require additional monitoring and optimization. Furthermore, it is important to consider that selectivity and scalability are key factors for the success of any cleaning system. An integrated approach, possibly combining different technologies, may prove to be the most effective solution to the problem of microplastics in the oceans.

In the field of ocean cleanup of microplastics, it is expected that future technologies will seek to integrate with artificial intelligence, allowing systems to autonomously adapt to changing conditions and optimize cleanup processes. Such systems will be able to autonomously identify areas with high concentrations of pollution and efficiently allocate resources to remediate them. Energy efficiency will remain a key aspect, as increasing the autonomy of robotic systems is directly related to their ability to function for long periods of time without external intervention. The use of renewable energy sources, such as solar panels or hydrogen cells, can significantly expand the capabilities and applications of such systems, making them more resilient to variations in operating conditions [4].

Given the need for multifunctionality, robotic systems can be equipped with additional tools for monitoring the marine environment, which will not only enable them to clean water from microplastics, but also to collect data for scientific research and contribute to the restoration of damaged ecosystems. Modularity and scalability will be important features that allow systems to be flexible and adaptable to different tasks and conditions. The ability to coordinate between different devices will enhance the effects of their operation, as collaborative efforts can significantly increase the overall cleaning capacity and coverage of areas. Innovations in biomimetics and the creation of bio-hybrid systems that can work effectively in harmony with marine fauna and flora will minimize negative impacts on ecosystems and increase cleaning efficiency.

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УДК 005.4

GAMIFICATION IN HUMAN RESOURCE MANAGEMENT: CASE STUDY ANALYSIS

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Abstract. This paper examines the theoretical aspects of gamification and its practical application, particularly its impact on the motivation and productivity of millennials and zoomers employees in the workplace. A retrospective analysis of gamification, including its definitions, types, and implementation principles, is conducted. Case studies of companies applying gamification strategies in business environment are also analyzed to assess its effects on employees' engagement and performance to avoid business stagnation.

Keywords: management challenges, business strategy, employee motivation, workforce efficiency, employee engagement.

ГЕЙМИФИКАЦИЯ В УПРАВЛЕНИИ ЧЕЛОВЕЧЕСКИМИ РЕСУРСАМИ: АНАЛИЗ КЕЙСОВ И ПРАКТИК

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Аннотация. В данной статье рассматриваются теоретические аспекты геймификации и ее практическое применение, в частности, ее влияние на мотивацию и продуктивность сотрудников миллениалов и зумеров на рабочем месте. Проводится ретроспективный анализ геймификации, включая ее определения, типы и принципы реализации. Также анализируются примеры компаний, применяющих стратегии геймификации в бизнес-среде, чтобы оценить их влияние на вовлеченность и производительность сотрудников во избежание стагнации бизнеса из-за непрофессионального внедрения данной технологии.

Ключевые слова: проблемы управления, бизнес-стратегия, мотивация сотрудников, эффективность персонала, вовлеченность сотрудников.

In current competitive environment, companies are increasingly prioritizing employees' multi-tasking, stress-resistance, creativity, commitment to lifelong learning and high-performance. Expectations of the latter make organizations seek

innovative ways to increase workforce productivity, motivate employees and retain talent. One of the emerging digital human resource (HR) strategies is gamification, which applies game design elements in non-game contexts to increase engagement and job satisfaction [1, 2]. This technology is considered to be effective in motivating employees, especially the younger generation, and improving business performance [3, 4].

The purpose of the study is to analyze the theoretical aspects and existing practices of gamification in the context of HR-management to identify the impact on the motivation and efficiency of the employees. It is assumed that competent implementation of gamification allows increasing staff motivation and teamwork, improving their performance and readiness for result-orientation and life-long learning in professional sphere. The following tasks are defined for its realization:

– retrospective analysis of gamification (terms, types, gamification principles, peculiarities of gamification implementation);

– case studies of modern companies to assess the impact of gamification on employee performance.

Object of the study: specific cases of gamification, their impact on employee motivation, training effectiveness, level of participation in corporate programs and other aspects of HR-management that can be improved or changed using gamification. **Subject of the study:** concepts and methods of gamification applied in human resource management. **Research methodology:** a combination of theoretical and statistical methods such as comparative analysis and data synthesis, generalization and hypothesis formulation are used to evaluate the results.

The relevance of the study is predetermined by external and internal factors of modern society and business, i.e., the changing demographics of employees, for whom traditional methods of motivation and involvement of personnel are becoming increasingly ineffective to ensure the competitive advantage of business.

The analysis of various generations' needs and motivation for labor activity shows that people of the previous generation have conservative views and value stability and simplicity, and prefer working in one company for a long time. In contrast, Millennials (Y) and Gen Z are more flexible and career-oriented, striving for personal growth and diversity in the workplace, so they are ready to change jobs if they lose interest in it or if the conditions do not meet their needs.

According to the Rosstat data, more than 56 % of employed population is made up of people of generations Y and Z [5], who are accustomed to digital interactions and value intrinsic rewards. So, the gamified elements in routine work and training tasks enable to generate interest among millennials and zoomers. Traditional methods of motivation systems used for generation X are less effective for Y and Z due to their needs requiring new tangible types, but especially intangible ones.

The first mention of the term "gamification" appeared in the 1980s, and was defined as 'turning something that is not a game into a game' [6]. The author, Richard Bartle, a professor at the University of Essex and one of the creators of the first multiplayer MUD game, trying to understand the motivation of players, identified an area of interest, which had 2 scales: action – interaction and player – world. Based on their preferences, all players are divided into 4 psychotypes: achievers, prioritizing the

accumulation of various resources such as money, experience, artifacts; killers with their main motivation being superiority and dominance over others; explorers, who enjoy exploring the game world and discovering its secrets, not caring about ranking, strength, battles and wealth; socializers, who play games for socialization and social interaction. This division gave an idea of the basic gamers' needs, and also allows one to make an approximate ratio of representatives of different groups to fulfill the set goals.

In 2002, Nick Pelling, a British game developer and programmer, introduced a new definition of gamification as the process of using game thinking and game dynamics to engage audiences and solve problems [6]. However, the term was not widely used because of Pelling's target focus on hardware. Not until 2010 did Taiwanese-American entrepreneur Yu-kai Chou reintroduce the term "gamification" to the mainstream again, having developed the Octalysis model, which describes eight core drives that motivate human behavior (epic meaning, accomplishment, empowerment of creativity, ownership, social influence, scarcity, unpredictability and loss) [7], pushing a person to activity (Figure).

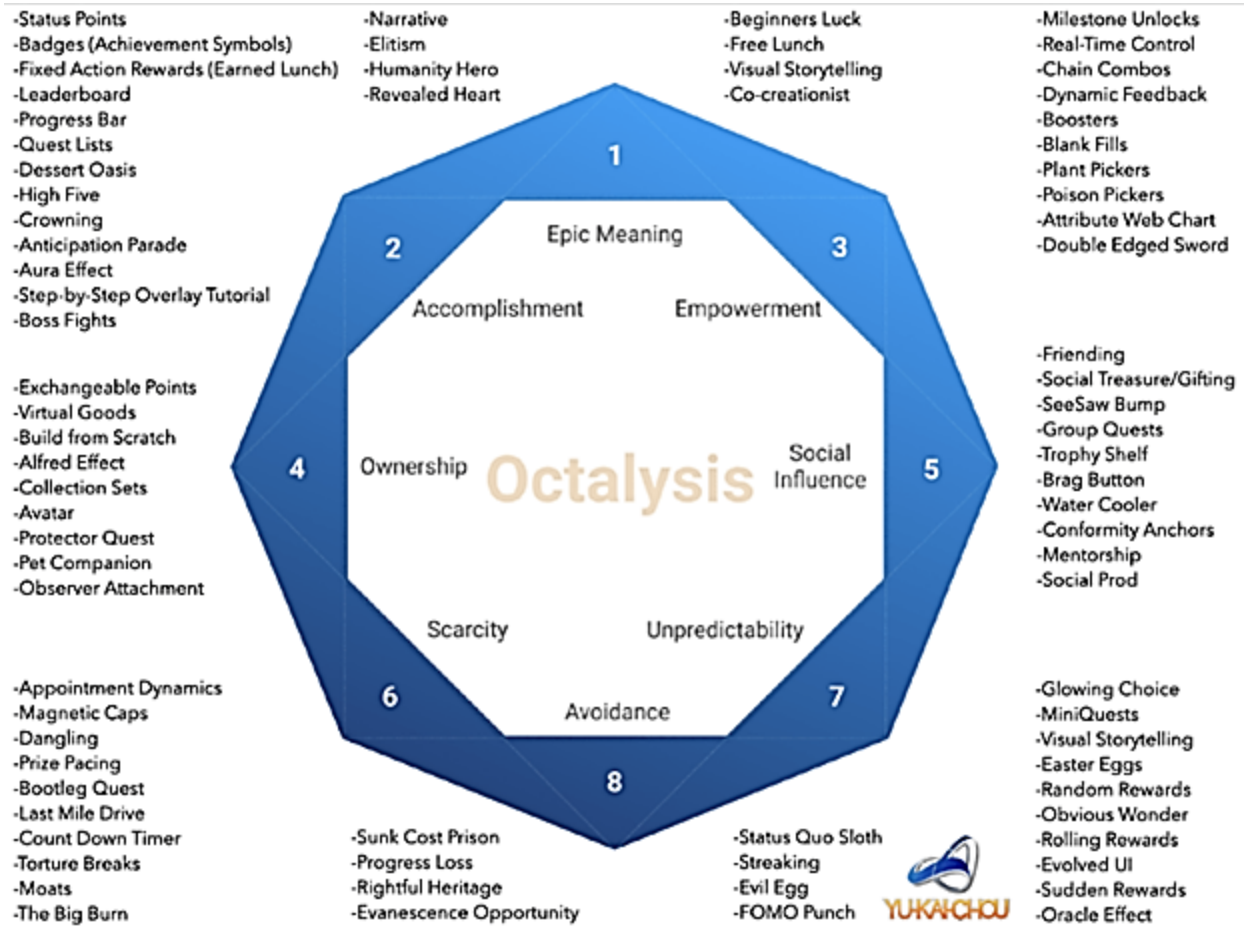

Figure. The Octalysis model [8]

Achievement, possession and scarcity are referred to extrinsic motivation, they reflect the desire to get a result from the activity. Creativity, social influence and unpredictability are intrinsic motivators, from which a person enjoys the process of his activity. In addition, two other groups are distinguished as 'white' and 'black' stimuli.

This model has been widely applied in both consumer engagement and employee motivation contexts and requires sufficient competency of stimuli that help to solve a particular problem.

Since the 2010s the spheres of a gamified tool application has become quite diverse: education, management and HR, marketing, social sphere, mass media, tax collection; charity, healthcare. Gamification has become an integral part of some business processes in Russian companies and some research have been done in this area, proving its efficacy for developing and improving the key competencies of employees (hard and soft skills), increase employee productivity, and creation of a new corporate culture [4].

So, the retrospective analysis has shown that gamified elements were used even by our ancestors to solve problems that faced the state. As a full-scale tool of non-material motivation gamification began to be recognized in the late XXth century, but it became widespread only after 2010.

There are different classifications of gamification proposed by different authors [1-3, 9] and the objective of all types is to increase the employee's interest in work processes. According to some researchers, gamification is divided into internal gamification (improving team performance), external gamification (attracting customers) and behavior modification (forming new habits) [9]. Others suggest division into gamification for marketing tasks and in personnel management [1]. Structural, content, digital and analog gamifications are also distinguished [2]. Most benefits of gamification are considered as follows:

- boosting employee motivation and increasing engagement and labor efficiency;
- promoting teamwork and creating a favorable atmosphere in the team;
- stimulating healthy competition and professional growth, enhancing performance;
- allowing one to track the personnel progress and achievements;
- simplifying feedback, adaptation and training processes.

Along with advantages, some disadvantages are stressed depending on a proper design, strategies and organization of gamification (Table).

Table – Challenges of gamification

№	*Drawbacks*	*Reasons & recovery techniques*
1	Incorrect implementation of gamification	important to focus on increasing interest, not only on results
2	Negative staff reaction	occurs if the employees perceive games at workplace skeptically
3	Transition from healthy competition to hostility and unhealthy team rivalry	possible due to improper strategy implementation, game mechanics, rewards and employee preferences need to be considered so that gamification contributes to a positive and productive work environment

4	Short-term effect	important to generate interest due to the fact that people quickly get used to rewards and may lose motivation
5	Insufficient staff retention strategy	important to cater to the preferences of younger generations in the workplce, e.g. provide personalized work plans
6	Employees' dissatisfaction and even damage of company reputation	the need for skilled HR-managers able to consider both strategic approach, careful planning and psychological aspects

Thus, to maximize the benefits of this technology, managers need to carefully consider all strategies and aspects of the application of its main elements in practice (contests, games, mobile simulation game, etc.).

The following case studies from domestic and foreign companies that have implemented gamification provide qualitative data on the influence of gamification on employee performance, motivation, and teamwork.

Considering the impact of the main elements of gamification on staff motivation and commitment, indicators denoting some difference before and after the application of this tool are stressed. In addition, both successful and unsuccessful practices, some advantages and limitations of using gamification in professional HR activities for increasing the productivity level of employee are highlighted:

1. Successful cases of gamification implementation in the work team, e.g. Yota, Tele2, Walmart:

Yota Star Wars

Before the release of the seventh installment of Star Wars, Yota launched a contest [10]. It involved point of sale and sales plan employees, the former were on the light side, the latter were on the dark side. The winner was the side whose military strength was greater. The goal of this gamification was to fulfill the sales plan, improve service quality and train employees. Points of military force were awarded for selling the company's products (modems and SIM-cards) and training (courses, tests, checklists). Olga Alexeeva, PR-director of Yota, spoke about the results of gamification as follows: "As a result, we managed to increase the level of customer service by 87 % and increase the number of trained employees to 98 %, which had a positive impact on the growth of retail sales. An anonymous survey among the employees involved in the game showed that 88 % of them positively evaluated the idea of the project and were happy to take part in it. In some regions, employees even bought costumes of the movie characters at their own expense" [10]. Sergey Zhurikhin, Head of Training and Personnel Development at Yota, noted that the duration of one game should not be more than 1.5-2 months and after it employees need a break.

Tele2's struggle with aliens

Tele2 set itself the goal of improving the customer experience [11], the essence of which was to search for problems before they were discovered by subscribers. Managers were tasked with motivating employees to voluntarily search for problems. The principle of the case is somewhat reminiscent of Yota's competition, i.e. space wars, getting military power for accomplishing tasks, only employees compete not

among themselves, but together fight a common enemy. For this purpose, they created a special application and interface on the internal portal, where the errors found were entered. After that, the system automatically addressed them to the right department, where the problem was solved, and then it was checked again. Each of the three people responsible had a personal profile showing what role they played in solving the problem.

Finding problems was the only way to earn experience, so employees actively looked for bugs to pump themselves up. For each problem solved, participants were awarded experience (if the problem is not solved, the enemy becomes stronger), and then the five most "high-level" employees were sent to fight with the aliens. If the sum of the five people's points was greater than the opponent's strength, the team won. After the battle with the monsters, the points of the five players were reset, giving the other five people a chance to fight for the honor of the team. For defeating enemies, team members received in-game currency that could be redeemed at the prize shop such as limited edition products, tutorials and professional training courses.

The results in the first year after the implementation of gamification were quite positive, i.e. more than 5,000 employees of the company participated in the game. According to the company statistics, more than 5.5 thousand problems were registered, of which more than five thousand were solved at the time of data collection. The rate of problem solutions is over 90 %. The average time to solve a problem is 3 days. The interest to the game even after a year remained at a high level.

Spark City

Walmart developed a mobile supermarket simulation game where you need to serve customers, restock shelves with products, adjust prices and perform other tasks [12]. At the end of each day, the player is presented with a report on the day's work. This simulator evaluates employee's actions during routine tasks and emergencies on three characteristics: inventory, customer satisfaction, and sales.

The company objectives were to create a system for staff training; to create a positive brand image among the company employees; to conduct safety training for 5,000 employees in 8 company branches; to demonstrate career paths and teach employees to become leaders. Players are accompanied throughout their training by a virtual mentor, Cynthia, who helps them internalize important information and provides feedback on their performance.

The results of gamification were as follows:

Pilot participants rated the game apps with an average of 9.6 out of 10 points scale; productivity of teams playing the game improved by 22 % over pre- and post-assessment scores; workplace safety performance improved with a 54 % reduction in incidents across the company's 8 centers; the increase of employees' performance, priority setting and team management skills could be observed. The game has been downloaded more than 500,000 times [12] and the project itself has won the Brandon Hall Gold Award.

However, this method does not accompany all companies, the analysis of mistakes on a proper goal setting and failed attempts to implement gamification is given below.

2. Unsuccessful practices of gamification implementation:

Electronic whip

One Disneyland's laundry tried to implement gamification to optimize and speed up the laundry performance, the essence of which included the introduction of a rating system among the laundresses [13]. Workers call the system the 'electronic whip' and they say that it had the intended effect of speeding up their work. A leaderboard was installed in a form of a spreadsheet where leaders who were meeting the plan were marked in green, those who were working slowly were marked in yellow, and those who were lagging behind were marked in red. This resulted in overwork and lack of breaks for employees, which included pregnant women. This was followed by an article in the press that severely damaged the reputation of the hotel. The main mistake was that managers in an attempt to achieve high performance forgot about the main goal of gamification, i.e. to inspire interest, not fear.

MyMarriottHotel

Marriott created its own game about the hospitality industry, where players could try their hand at all areas of the hospitality business [14]. Gamification was introduced to attract new employees by playing a simulation game that would reflect the job intricacies. However, the functionality was limited to working in the kitchen, and the technology of the game did not generate interest. The benefits for employees were practically non-existent, as well as motivation to play the game. As a result, there was a loss of resources (costs for the development and implementation of gamification failed to recover); the company's mistake was that the goals and elements were poorly developed, and thus the game did not make sense; the interests of employees and a detailed gamification plan were not taken into account. In this way, the company risked losing not only profits, but also employees and reputation.

The research reveals that gamification has become a widely adopted tool for improving employee motivation and business efficiency. Successful examples include Yota, Tele2, and Walmart, which have implemented gamification strategies to improve sales, customer service, and employee training, etc. These cases demonstrate how game-like elements, such as competitions, role-playing, and simulations, enhance employee engagement and skill development. Conversely, poorly designed gamification, such as the leaderboard in Disneyland's laundry, led to employee dissatisfaction and overwork, highlighting the need to align gamification goals with employee welfare and motivation. Poorly implemented gamification strategies can lead to a decrease in employee morale and even to a bad company reputation.

With ongoing advancements in digital technology and changing workforce demographics, gamification is likely to become a core component of HR-management. New digital methods should be implemented to motivate and retain young staff providing with work and life balance initiatives, wellness programs relevant in today's society, new formats to encourage employee loyalty and active participation. In this contest, preparing gamification is a very serious and time consuming process which requires highly qualified managers with a high level of competencies, analytical and strategic skills as well as knowledge of psychology and methodology.

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УДК 314.15

ANALYSIS OF SOCIO-ECONOMIC MEASURES AGAINST DEMOGRAPHIC CHALLENGES IN THE CITY OF SEVASTOPOL

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Abstract. This article examines the measures taken by federal and regional authorities in the city of Sevastopol to struggle against demographic challenges in the region. The development of education and healthcare sectors, improvement of housing conditions and provision of financial support to families with children are the main aspects of demographic policy studied when conducting the situation analysis in the region. As a result, prospects were outlined and new approaches to counteract negative demographic trends were suggested.

Keywords: demography, population dynamics, education, healthcare, housing conditions, financial support, benefits, demographic crisis.

АНАЛИЗ СОЦИАЛЬНО-ЭКОНОМИЧЕСКИХ МЕР ПО БОРЬБЕ С ДЕМОГРАФИЧЕСКИМИ ПРОБЛЕМАМИ В ГОРОДЕ СЕВАСТОПОЛЕ

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Аннотация. В данной статье рассматриваются основные меры, которые принимаются органами федеральной и региональной власти в городе Севастополе для борьбы с демографическими проблемами в регионе. Развитие сфер образования и здравоохранения, улучшение жилищного фонда и оказание материальной поддержки семьям с детьми – основные аспекты демографической политики, которые были изучены в ходе анализа общей ситуации в регионе. В результате были отражены перспективы и предложены новые подходы к противостоянию негативным демографическим тенденциям.

Ключевые слова: демография, динамика численности населения, образование, здравоохранение, жилищный фонд, материальная поддержка, пособия, демографическая яма.

The demographic problem has become one of the central issues for the Russian Federation under global political and economic instability. The Russian government's efforts are primarily aimed at stimulating birth rates, improving living conditions for families with children and developing education and healthcare systems [1].

The city of Sevastopol is a region that has been experiencing natural population decline, so it has become the subject to a number of measures implemented by government to counteract this challenge. Efforts to increase birth rates and improve the quality of life for families with children are supported by various national and regional projects in education and healthcare, assistance in providing housing for needy families, and the implementation of the regional project "Financial support for families at the birth of children".

Sevastopol has been one of the leading regions in overall population growth in recent years. According to the Federal State Statistics Service, since reunification of Crimea with Russia in 2014, the region's population has grown by more than 40 %. Significant increases were noted in 2020 (an increase of 60.8 thousand people) and in 2022 (an increase of 36.2 thousand people) [2].

However, this constant population growth is solely due to migration, which over the past nine years amounted to more than 175 thousand people [2]. Simultaneously, the region is experiencing a natural population decline. Analysing the data, presented in Table 1, we can emphasise that the mortality rate in the region remains relatively stable, except for 2020 and 2021 when an excess was recorded due to the Covid-19 pandemic [2]. It should be noted that the birth rate situation was gradually worsening in 2014 when 13.3 children were born per 1000 people on average, while in 2022 this figure dropped to 8.9 [2]. Is this a local manifestation of a demographic crisis or a nationwide trend?

As shown in Table 1, the overall natural population growth rate in Sevastopol has aligned with national figures over the past three years. On average, the country's natural population decline is 4.0 people per 1000 [3], and it is 4.1 in 2022 in Sevastopol [2]. However, it is important to note several unique features:

– lower overall mortality rates in Sevastopol compared to an average across Russia (1.7 % lower in 2022, despite being higher by an average of 1 % up to the pandemic);

– the exact opposite birth rate situation – equality of indicators until 2017, shifting to a difference of 1.8 % by the end of 2022 [2, 3].

Table 1 – Population movement indicators in the city of Sevastopol [2, 3]

Year	2014	2015	2016	2017	2018	2019	2020	2021	2022
Population as of the beginning of the year, thousands of people	393.3	399.0	416.3	428.8	436.7	443.2	449.1	510.0	522.1
Migration growth, people	6325	17883	13020	8733	7739	7429	62986	15390	38483
Natural increase, people	-656	-593	-530	-816	-1197	-1503	-2132	-3325	-2267

Average crude birth rate across Russia (in Sevastopol), %	13.3 (12.6)	13.3 (13.5)	12.9 (12.7)	11.5 (11.2)	10.9 (10.1)	10.1 (9.6)	9.8 (8.7)	9.6 (8.2)	8.9 (7.1)
Average crude death rate across Russia (in Sevastopol), %	13.1 (14.3)	13.0 (14.9)	12.9 (13.9)	12.4 (13.1)	12.5 (12.8)	12.3 (13.0)	14.6 (13.2)	16.7 (14.7)	12.9 (11.2)

The assessment of the demographic situation in Sevastopol indicates the need for a range of measures to maintain demographic stability. This need is fully observed by the Sevastopol government, which implements a multifaceted policy to support a decent quality of life for families and stimulate birth rate growth.

A crucial aspect of improving the demographic situation in the region is the development of accessible preschool education. A well-developed system can provide young mothers with time free from childcare, which can be devoted to work or rest. The availability of such an institution as accessible preschool education is a key tool for improving the quality of life for families with children and stimulating birth rates.

One of the key outcomes of the regional government's efforts in this area is that from the time of Crimea and Sevastopol's reunification with Russia in 2014 up to 2022, the proportion of children aged 1-6 receiving preschool education services in the region increased by 9.4 % – from 54.1 % to 63.5 % [2].

Regional government actively pursues policies to increase the number of places in preschool educational institutions. As part of the national program "Demography", regional authorities have built 18 new kindergartens since 2014 [4]. Additionally, many kindergartens have undergone modernization, major repairs, and reconstruction [4]. The number of places in institutions has increased by 64 % in nine years – from 12.8 thousands to 20.1 thousand places by the beginning of 2023 [2].

As a result of the authorities' efforts in this area, in 2014 there were 116 children per 100 places, but by the end of 2022 this number dropped to 104, indicating that the actual demand for preschool educational institutions is almost fully met [2].

Another significant aspect that receives considerable attention in the region is the development of the healthcare system, particularly maternal and child health services. The region faces several challenges: according to official data, the level of provision with medical personnel and hospital beds does not even reach the national average (Table 2).

Table 2 – Dynamics of healthcare organization resources in the city of Sevastopol (compared to nationwide indicators) from 2014 to 2022 [3]

Год	2014	2015	2016	2017	2018	2019	2020	2021	2022
Doctors per 10 000 population, nationwide	48.5	45.9	46.4	47.5	47.9	48.7	50.4	51.0	50,8
Doctors per 10 000 population, Sevastopol	41.1	41.6	40.2	46.8	47.3	45.4	44.6	47.6	45,4
Mid-level medical personnel per 10 000 population, nationwide	104.3	105.8	104.8	103.8	101.6	101.6	102.0	100.8	98,3

Mid-level medical personnel per 10 000 population, Sevastopol	-		78.3	93.4	90.1	80.6	76.0	74.9	72.2
Hospital beds per 10 000 population, nationwide	87.0	83.0	81.6	80.5	79.9	80.0	81.3	79.8	78,0
Hospital beds per 10 000 population, Sevastopol	71.0	65.0	60.2	82.6	80.1	77.8	80.5	68.2	60,3
Hospitals	-		13	13	13	11	10	12	13
Outpatient clinics			54	51	50	49	49	61	65

Based on 2022 data, there are 50.8 doctors and 98.3 mid-level medical personnel per 10 000 people on average across Russia. In Sevastopol, however, the level of provision is low (45.4 doctors and 72.2 mid-level medical personnel per 10 thousand people) [3].

A similar situation is observed regarding the availability of hospital beds. The sharp decline in availability seen in 2021 and 2022 can be attributed mainly to the increase of migration to the region during this period, as well as the significant reduction in the number of infectious disease beds following the successful battle against the pandemic [5]. From 2020 to 2022, Sevastopol showed a positive trend in increasing the number of hospital and outpatient clinics. The opening of 3 hospital organizations and 16 new outpatient clinics and polyclinics will enhance the readiness of the region healthcare system to meet the need for a wide range of medical services.

However, the lack of skilled specialists and hospital beds remains vulnerable. In this context, significant attention should be paid to the implementation of Sevastopol regional projects such as “Providing healthcare medical organizations with personnel” and “Development of children’s healthcare, including the creation of modern medical care infrastructure for children” within the national project “Healthcare” [5].

Improving the living standards of families with children is a primary goal set by the Sevastopol government. One of the most significant forms of support provided to families is the program for obtaining housing or improving living conditions for large families. On average, 2 % of registered families receive new housing annually. Thus, for six years (from the introduction of the program in 2017 up to 2022), 695 families benefited from this program [2].

In 2022 114 families received housing and improved their living conditions. Of these, 67.5 % were orphans and children left without parental care, 13.2 % were large families, 9.6 % were young families, 1.8 % were families of combat veterans, and 1.8 % were families with disabled children [2].

Another significant method of support in the region is the provision of subsidies for housing and utility payments. According to the official data of the Federal State Statistics Service for the Republic of Crimea and Sevastopol, over the eight years of the program’s existence, the number of families receiving subsidies annually has increased multiple times. In 2015 only 17 families received subsidies, whereas the number of recipients exceeded 485 families in 2022 [2].

Urban infrastructure development, creating better living conditions for families in need and providing social support to families for housing and utility payments indicate an active policy of regional authorities in this area.

However, the main tool for ensuring a decent standard of living and stimulating birth rate growth is the provision of financial support: payments and benefits.

At the national level, there is a wide range of various forms of financial support for families with children, most of which are implemented within the framework of the national project “Demography”. However, regional authorities in Russia often adopt additional forms of support for families with children. The regional project “Financial support for families at the birth of children” in Sevastopol operates as part of the national project “Demography”. It is aimed at developing mechanisms for financial support for families upon the birth of children, creating favourable conditions for family life and minimizing the impact of changes in citizens’ financial situations due to childbirth. There are five main directions for the regional project to be implemented:

– monthly payments upon the birth/adoption of the first child (4483 recipient families in 2022);

– monthly financial payments to families upon the birth of the third or subsequent child up to the age of 3 years (481 recipient families in 2022);

– monthly payments to families upon the birth of the third or subsequent child born after December 31, 2019 (1401 recipient families in 2023);

– financial support in the form of regional maternity capital payments (1235 recipient families in 2023), currently amounting to 128,066 rubles;

– accessibility of medical services for families suffering from infertility (2019–2024) [6].

Additionally, active support is provided to low-income large families. Besides there is a one-time financial aid of 1834 rubles at the beginning of the school year, each minor child receives an additional social benefit of 25 % of the regional subsistence minimum for families with three or four children, and 50 % for families with five or more children, respectively [7]. In addition to all the above forms of support, additional allowances are provided to single mothers and children whose parent does not pay alimony.

Value orientations of the citizens of our country play a significant role in solving the demographic problem. At the end of 2023, the All-Russian Center for the Study of Public Opinion published the results of its statistical survey conducted among 1 600 citizens. More than 80 % of respondents noted that it is important for them to see Russia in the future as a country that has preserved traditional moral and national values. The most important goals in the lives of Russians named were creating a happy family, raising children (56 %), and maintaining health (58 %). It is important to note that three out of four young people (aged 18-24) in the country considered creating a family as the highest priority [8].

Analysing the above information, we can conclude that social values and beliefs as well as combination of measures taken at both the state and regional levels to ensure a decent standard of living for families and to modernize healthcare and education sectors demonstrate the comprehensive state policy in this area.

We can notice that after the relevant measures were taken, only one of the two main goals was achieved. Undoubtedly, the state effectively supports families with children by developing social infrastructure and providing various forms of financial

support. However, since these measures were implemented, including the national project “Demography”, the birth rate in the country has not increased. In 2014 there were 13.3 births per 1000 people per year in the country, while this figure was only 8.9 in 2022 (Table 1) [3].

Despite an active policy to stimulate the birth rate, a decline can be seen for eight consecutive years. The state is trying best to maintain the demographic situation. The range of opportunities provided to young families such as financial support and the development of social infrastructure is a vital condition for keeping the situation from reaching a critical level.

In the current demographic situation with the ageing population, one additional method to stimulate birth rates considered is the introduction of maternity capital payments for the third child, and in the long term, for subsequent children on common grounds. This is primarily because the dominant age group in the population is currently 30-39 years old [3]. It is important to note that the state needs not only to do everything to support birth rates by encouraging young people to become young parents but also to focus on supporting women who want to become mothers of many children.

Well, the family institution is now facing a number of challenges, so strengthening family values and improving the demographic situation requires a comprehensive approach that includes various forms of support from the state and society as a whole [9].

First and foremost, the state and regional authorities need to continue implementing family policies actively aimed at providing such support measures as financial assistance, child subsidies, and guaranteed parental leave. An important aspect is also the accessibility of healthcare, as ensuring access to quality medical care for children and their parents, as well as providing quality reproductive health services, including consultations and pregnancy management, that has a positive effect on young people’s readiness to have children [10].

A necessary aspect of stimulating birth rates is creating conditions suitable for balancing work and family life. This implies not only the development of preschool education but also ensuring the availability of flexible schedules, remote work formats, and long-term parental leave.

These approaches can be adjusted to fit the specific conditions of the demographic situation in the country or region. However, it is important to remember that long-term changes require time and coordinated efforts at all levels. This is a task not only for the government but for society as a whole.

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УДК 130.2

THE TRICKSTER AS A COMPANION TO THE CULTURAL HERO IN MODERN CINEMATOGRAPHY: “FIGHT CLUB” BY DAVID FINCHER

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Abstract. Trickster is an archetype who acts as a cultural hero or his companion, challenging the hero’s claims to power and mocking his beliefs. The diversity of the trickster and its complexity in modern culture opens up new avenues for scientific research. This study analyses the trickster hero (Tyler Durden) in the homonymous adaptation of Chuck Palahniuk’s novel “Fight Club” (1999, directed by David Fincher). The purpose of the study is to consider the characteristics of a trickster as a cultural hero’s companion and to determine the specificity of the influence of the mentor-trickster on the concept of a separate artistic work of modern culture.

Keywords: Trickster, Tyler Durden, cultural hero, Fight Club, Chuck Palahniuk, post-modernism, modern culture, archetypes.

ТРИКСТЕР КАК СПУТНИК КУЛЬТУРНОГО ГЕРОЯ В СОВРЕМЕННОМ КИНЕМАТОГРАФЕ: “БОЙЦОВСКИЙ КЛУБ” Д. ФИНЧЕРА

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Аннотация. Трикстер – архетип, выступающий как культурный герой или его спутник, бросая вызов претензиям героя на власть и насмехаясь над его убеждениями. Многообразие трикстера и сложность его интерпретации в современной культуре открывают новые направления для научных изысканий. В настоящем исследовании анализируется герой-трикстер (Тайлер Дерден) в одноименной экранизации романа Чака Паланика “Бойцовский клуб” (1999, режиссер Дэвид Финчер). Цель исследования – рассмотреть особенности трикстера как спутника культурного героя и определить специфику влияния трикстера-наставника на концепцию отдельного художественного произведения современной культуры.

Ключевые слова: Трикстер, Тайлер Дерден, культурный герой, Бойцовский клуб, Чак Паланик, постмодернизм, современная культура, архетипы.

The trickster as an archetype can be a cultural hero or his companion. He also provokes the hero, challenges his views, giving his beliefs in return, or simply mocking him [1, p. 74]. With the advent of interpretations of the trickster as a mentor in artistic culture, researchers have asked about the specifics and significance of this quality of the trickster archetype – one of the most controversial, interesting and demanded in the modern cultural space [2, p. 15]. This work presents an analysis of the trickster as a companion of the cultural hero in the thriller "Fight Club" (1999, directed by David Fincher), an adaptation of the self-titled cult novel written by Chuck Palahniuk.

The trickster, one of the archetypes of the theory of Carl Gustav Jung, the founder of analytical psychology, is capable of being a cultural hero or his guide [3, p. 105]. Anthropologists who have addressed the myths of ancient peoples disagree on which of these characteristics of the trickster deserves more attention while studying [4, p. 48]. Some researchers, particularly Mariam West and Franz Rattig believe that from the very beginning of myths, the trickster was a full-fledged cultural hero, a demigod, he had his own value system, made independent decisions and could lead the characters of myths (e.g. Scandinavian Thor or South American Br'er Rabbit) [5, p. 24]. Maria Louise von Franz and Donald Holway believe that the trickster always accompanied the hero, helping him make the right decision, or vice versa, stumble and interrupt his path [5, p. 30]. This is how the trickster exposed the fragility and vulnerability of human nature (e.g. North American Coyote, ancient Greek Hermes, Scandinavian Loki). There are also several approaches to understanding the role of the trickster in the context of "companionship". Some researchers, such as Victor Turner, consider the trickster as a symbol of liminality – a figure existing on the border between the old and the new, the known and the unknown [4, p. 54]. Other ones, such as Mikhail Bakhtin, emphasize the carnival beginning of the trickster, his ability to overturn and distort social norms in order to emphasize their conventionality and temporality [6, p. 67]. Through these processes, the trickster is able to question the cultural hero's views on his own daily life and build a different value system in the future.

Let us define the meaning of the trickster as an archetype in modern cultural studies. The trickster is one of the key figures in mythological and artistic narrative, its nature is characterized by ambivalence and inconsistency [3, p. 126]. Traditionally, a trickster is a cunning person who skillfully changes images and makes the hero to have the illusion that he can be trusted [7, p. 153]. The desire to disrupt the order makes them especially significant in the context of cultural transformations, because it is the trickster, which researcher Lewis Hyde also claims, who can serve as an indication of socio-cultural crisis and the dynamics of changes in this process [8, p. 95].

A trickster can be a mentor to a cultural hero – a character who embodies moral values of society, or who is an average image of an individual in a certain age [8, p. 101]. The relationship between the trickster and the hero not only forms the problematics of the narrative, but also determines the character of the cultural hero and

his role in the plot [9, p. 54]. The duality of the trickster, which manifests itself, including in mentoring, helps to identify the inner contradictions of the hero and allows the viewer to understand the complexity of human nature, represented in the literary text as a socio-cultural pattern of society [9, p. 132].

Let us turn to the specifics of the trickster as a companion of the hero within the artistic space. The trickster's duality is pivotal; he can serve both as an ally and an adversary to the hero, embodying the roles of both destroyer and creator [7, p. 112]. This dualism, in the context of his relationship with the cultural hero, renders the trickster an indispensable element of the narrative. His presence not only allows for a more nuanced examination of the protagonist but also helps to sustain tension, develop conflict, and ultimately lead to a climax [8, p. 24].

This study will analyze the trickster character and elucidate the specifics of his influence on the main character and the thematic issues at play. The thriller "Fight Club" (1999), directed by David Fincher, is an adaptation of Chuck Palahniuk's novel of the same name, published in 1996. This cult film has become emblematic of the late 1990s and is frequently regarded as a manifesto for Generation X [10, p. 45]. The film explores themes of alienation, consumerism, existential emptiness, and male identity crises through the story of an unnamed narrator who channels his repressed aggression and frustration into participation in an underground fight club orchestrated by his alter ego, Tyler Durden [10, p. 191].

Fight Club has maintained its relevance over the decades due to its audacious critique of contemporary society and its in-depth exploration of human nature. As sociologist Professor Michael Bernstein notes in his analysis of Palahniuk's Fight Club, the themes of alienation, consumerism, and identity crises resonate across generations, particularly against the backdrop of increasing digital technology and globalization [10, p. 192].

The film is distinguished by its nonlinear and fragmented narrative, mirroring the protagonist's mental chaos and internal conflicts [11, p. 128]. Its multilevel structure employs flashbacks, violations of the fourth wall, and metanarrative elements, allowing the viewer to engage deeply with the complexities of the hero's psyche [11, p. 107]. This narrative architecture enhances the impact of the surprising denouement, revealing that Tyler Durden is merely a projection of the narrator's unconscious. Such cinematic techniques are designed, among other purposes, to reflect the nature of the spaces – both "internal" and "external" – in which the trickster (a figure characterized by gloom, hopelessness, and chthonic qualities) manifests himself [10, p. 131].

Moreover, we must consider Carl Gustav Jung's thesis regarding archetypes, which posits that the trickster functions as a compensatory figure, supporting individuals burdened by societal pressures and strict norms [3, p. 154]. In this context, consumer society is represented, and the critique of its morals and values has been examined by various scholars, most notably Jean Baudrillard in his seminal work Simulacra and Simulation [11, p. 38].

This section presents the perspectives of both the director of the film and the author of the novel regarding the narrative. Chuck Palahniuk, the author of Fight Club, describes the work as a metaphor for confronting social conventions and inner

demons [12, p. 200]. For Palahniuk, Tyler Durden symbolizes liberation from socially imposed standards and the search for genuine identity – an alternative path, a belief system for those seeking to break free from traditional constraints and discover themselves [12, p. 50].

David Fincher, on the other hand, interprets Fight Club primarily as a satire of modern society, where individuals have lost their core values and replaced them with superficial consumer goals [7, p. 21]. He argues that the film illustrates the "deconstruction of male identity," showcasing how an internal identity crisis can manifest in destructive ways.

Overall, the viewpoints of the writer and the director align closely; Palahniuk himself called the film adaptation the best and most faithful to his original work. However, it is essential to note that in the original text, as observed by scholars of contemporary prose, Palahniuk places greater emphasis on the protagonist's inner world and psychological complexities, rather than solely on the darker, hidden aspects of his consciousness [10, p. 67]. Consequently, when analyzing Tyler Durden within the novel, it may be more appropriate to consider the archetype of the Shadow rather than the Trickster, as the trickster's more villainous and buffoonish traits are more prominently featured in Fincher's film than in Palahniuk's novel.

Tyler Durden is a central figure in the narrative; he embodies freedom, but also anarchy and destruction [6, p. 119]. As a charismatic yet dangerous leader, Tyler draws the protagonist and other participants into the fight club – a space where young people gather for unregulated fights, through which they supposedly find themselves and release pent-up aggression and pain [1, p. 132]. Tyler serves as the antithesis to the restrained, intimidated, and depressed narrator, representing the shadowy aspects of the narrator's psyche that he has long repressed [1, p. 135].

Tyler Durden actively challenges social and moral norms, promoting beliefs that contradict established traditions – such as detaching oneself from material possessions and rejecting the consumerist society that depersonalizes individuals [11, p. 96]. As a trickster, he instigates both internal and external conflicts within the protagonist, provoking him to reevaluate his values.

Tyler acts as a catalyst for change, creating situations that compel the narrator to transcend his mundane existence. The trickster's presence is crucial for the hero's transformation, confirming the trickster's role as a mentor, which shapes the dynamics and scale of the protagonist's evolution [5, p. 100]. The trickster can influence at both macro levels – societal or national – and within the individual psyche, particularly within the narrator's consciousness [7, p. 141].

We can delineate the significance of Tyler Durden's role as a companion and mentor to the main character by identifying the ways in which the trickster influences the protagonist and shapes the narrative:

1. Incentive for change

Tyler provokes the protagonist, stirring internal conflicts and compelling him to reevaluate his beliefs and cultivate new conditions for personal growth. Through Tyler, the hero undergoes an internal transformation, realizing his hidden desires and internal unresolved conflicts (for example, the lack of a father figure during adulthood, etc.) [3, p. 201];

2. Mentor in the search for identity

Amid the protagonist's identity crisis, Tyler offers an alternative life philosophy, rejecting materialism and societal conventions. Other characters in the narrative also view Tyler as a guide in their search for meaning in an increasingly irrelevant traditional value system [3, p. 205];

3. The philosophy of "liberation"

Tyler advocates for radical liberation through destruction and the renunciation of social norms [3, p. 208]. This philosophy resonates with youths who feel constrained by contemporary society;

4. The idealization of anarchism

Many young individuals perceive Tyler as an archetype of rebellion against a depersonalizing mass society devoid of promising prospects [11, p. 97]. He symbolizes strength and independence, appealing to those in search of their path.

Modern scholars such as Michael Bernstein and Michael Danahei highlight Tyler Durden's significance as a figure reflecting contemporary societal crises. Fischer, in his cultural critique, regards Tyler as a symbol of postmodern nihilism and alienation resonant with the conditions of late capitalism. Meanwhile, Jenkins examines the trickster's role in popular culture, asserting that characters like Tyler help articulate and comprehend social contradictions and internal conflicts in a rapidly evolving world [2, p. 124].

Evaluations of Tyler Durden's role as a mentor are polarized. Some view him positively, as he liberates the narrator from societal constraints and helps him discover inner strength. Others argue that Tyler is a negative influence, as his methods and ideology lead to chaos and destruction without providing a viable alternative to the existing social order [4, p. 191]. Tyler remains a complex and ambiguous figure, simultaneously exerting both positive and negative influences. Nevertheless, he prompts the protagonist, those around him, and modern viewers to reflect on the meaning of existence and reassess the societal foundations that shape individual identity, thereby preserving their uniqueness [2, p. 231].

Building on the analysis of Tyler Durden as a trickster companion, we can identify several ways in which the trickster can influence a cultural hero:

1. Incentive for change

The trickster generates and amplifies the protagonist's internal conflicts, challenging him to reassess his beliefs and fostering conditions for personal growth.

2. Reflection of hidden aspects of personality

The trickster often embodies the suppressed or unconscious dimensions of the protagonist's personality that he is reluctant to acknowledge.

3. A testing for the hero

During the protagonist's transformation, the trickster tests his resolve, questioning his ideals and beliefs, thus contributing to the hero's personal and spiritual growth.

4. Ambivalence and ambiguity

The trickster may serve as both an ally and adversary, challenging the hero's values and prompting ongoing self-doubt, leading him to explore new perspectives.

The trickster plays a crucial role in the protagonist's development, guiding him through both internal and external conflicts toward maturity and self-discovery. This expands our understanding of the trickster's role as a mentor within literary texts. In one interpretation, Tyler Durden exists as the protagonist's alter ego solely to facilitate self-discovery and resolution of his grievances [7, p. 97]. This suggests that Tyler does not need to provide a consistent plan of action or a stable value system throughout the narrative. Instead, Tyler serves as a temporary mentor, enabling the protagonist to achieve self-realization and resolve internal conflicts. Once this is accomplished, the trickster mentor fades away, symbolizing the hero's maturation and newfound inner freedom [11, p. 217]. Thus, it is appropriate to characterize the trickster as a magical assistant – a role often employed by folklorists, medieval novelists, and authors of children's literature [5, p. 73].

Tyler Durden remains a significant figure in modern culture, encapsulating the core contradictions and challenges faced by youth amid globalization and cultural evolution. Often, young individuals – especially those lacking fully formed parental figures – require a mentor who embodies not only absent parental qualities but also friendship and guidance that reflect the attributes they aspire to possess [5, p. 113]. Like the narrator, Tyler Durden, despite his distinctive identity and striking appearance, represents a collective image of the alter ego or ideal figures sought by youth navigating the search for meaning – a crucial aspect of personality formation [5, p. 31]. The selection of traits associated with the trickster archetype in this case aligns with the notion that the ideal young man embodies characteristics typical of the trickster (assertive masculinity, sarcasm, self-confidence, unpredictability, physical and moral strength, independence, etc.) [9, p. 152]. Both Chuck Palahniuk in his novel and David Fincher in his film adaptation effectively convey the intensity and drama of the journey toward inner freedom and self-assertion for young men.

Returning to the question of the trickster's significance as a cultural hero or companion, it is crucial to recognize that the film synthesizes these two roles. Tyler Durden, as a product of the protagonist's psyche and entirely dependent on his consciousness, gradually evolves into a cultural hero, embodying the collective image of the contemporary masculine ideal [10, с. 348].

Fight Club transcends a mere narrative of personal crisis; it delves into profound changes in human identity and the surrounding culture. Examining Tyler Durden as a trickster companion reveals how modern artistic film texts utilize archetypes to analyze contemporary societal issues. The trickster, acting as the cultural hero's companion, exposes the hero's identity, compelling him to confront and resolve internal conflicts. Consequently, the trickster's mentorship decisively influences the protagonist, shaping the narrative dynamics and addressing enduring problems that remain relevant and open to new interpretations in today's artistic space.

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УДК 800.92:519.682

ADVERTISING AND MARKETING AS A TOOL OF MANIPULATION OF SOCIETY

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Abstract. The authors of the article investigate how companies manipulate society through advertising and intermediaries, focusing on their role in shaping artificial needs and stimulating consumption. The paper analyzes strategies employed by marketers, including cultural and social pressure through advertising, as well as the use of intermediaries to influence consumers. Special attention is given to the analysis of Vercors' "Quota, or 'Supporters of Abundance'", the research also includes studies on Nestlé, based on articles that examine their marketing practices and advertising strategies aimed at manipulating public consciousness.

Keywords: manipulating society, companies' marketing and advertising, public consciousness, artificial societal needs.

РЕКЛАМА И МАРКЕТИНГ КАК ИНСТРУМЕНТ МАНИПУЛЯЦИИ ОБЩЕСТВОМ

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Аннотация. Авторы статьи исследуют, как компании манипулируют обществом с помощью рекламы и посредников, отдельно отмечается их роль в формировании искусственных потребностей и стимулировании потребления. В работе анализируются стратегии, применяемые маркетологами, включая культурное и социальное давление через рекламу, а также использование посредников для влияния на потребителей. Особое внимание уделяется произведению Веркора «Квота, или "Сторонники изобилия"», включены также исследования компании Nestlé, основанные на статьях, где подробно рассматриваются их маркетинговые практики и рекламные стратегии, нацеленные на манипуляцию общественным сознанием.

Ключевые слова: манипуляция обществом, маркетинг и реклама компаний, общественное сознание, искусственные потребности общества.

Relevance

We decided to raise a problem that the world's population usually does not think about. How do people make a choice between competing varieties of the same product, how are they manipulated by companies? There are monopolies and oligopolies that control all production, cooperating with each other and sometimes with the state. They dictate exactly what to produce, where, who will make a profit and in what amount, as well as what people will buy. Becoming a victim of manipulation and marketing, people do not think about such things as: Are the products offered by manufacturers safe and reliable? Do manufacturers accurately describe their products in advertisements and on packaging? Is there competition within the market, due to which there is a sufficient choice of goods in terms of quality and prices? Are retailers and service workers treating consumers fairly? Does the activity related to the production and packaging of goods harm the environment?

The purpose of this work is to understand and identify the methods of societal manipulation through advertising and marketing, drawing on various sources.

Susceptible people

We are being deliberately manipulated. Our preferences are shaped not only by the environment, but often by deliberate manipulation by those who seek to ensure that we think and act the way they would like. All aspects of human life – political propaganda, education, religion, the media – partially manipulate us.

The most famous example is advertising. Most economists believe that advertising is not just information about various products and prices. They agree with the fundamental idea of John Galbraith's book, "The Society of Abundance", that most of the advertising is aimed precisely at the desire of customers to get the advertised product stronger or even something that they had never considered necessary before. Advertising often uses memory triggers acting in the subconscious mind. It can be broadcast during the period when people are more receptive (around 9-10 p. m.) [1].

Advertising and its impact

First, we need to figure out how the company's funds are used for manipulation. Advertising is the process of conveying information from the advertiser to the target audience through media channels or other means.

Advertising tasks are as follows:

1. Informing consumers about the advertised product: new products, promotions, benefits, cost changes and everything related to it.

2. Convincing people of the need to perform any actions (for example, to buy a product or use a service).

3. A reminder of the need to purchase the advertised product. For example, you constantly forget to buy a spare light bulb, but when you enter the store, you see an advertisement for this product. It is possible to say with great confidence that you will remember about a spare light bulb and buy it.

4. Formation of the brand image.

The main purpose of advertising is to increase the volume of sales of goods and services. There are several types of advertising:

– Commercial advertising is the advertising of goods, services and other commodity and non-commodity offers with the ultimate goal of making a profit;

– Political advertising is a type of advertising aimed at changing the political behavior of a society or part of it in the context of political choice; it is a set of measures and methods for representing and promoting political associations, forces, ideas and practices that are aimed at changing political attitudes in society and at achieving individual goals related to politics;
– Social advertising is a type of non-commercial advertising aimed at changing patterns of social behavior and drawing attention to the problems of society [2, 3].

There is also marketing, which is a market analysis, consumer choice.

Marketing

Philip Kotler's book "Fundamentals of Marketing" examines various aspects of how marketing influences consumer behavior and manipulates their purchasing decisions. Here are a few key points:

1. Understanding the needs: Kotler emphasizes that marketing begins with understanding the needs and desires of consumers. He argues that "successful marketing is not only about offering a product, but also creating value for the consumer" [4]. This means that companies are researching exactly what their target audience wants and adapting their offerings.

2. Emotional connection: marketers use emotional triggers to create a connection with consumers. Kotler notes that "emotions play a key role in the decision-making process" [4]. For example, advertising can evoke feelings of joy, nostalgia, or even fear, which can encourage a person to buy.

3. Social influence: an important aspect is the influence of others. Kotler says that "consumers are often guided by the opinions and behavior of other people" [4]. This explains why social evidence (reviews, ratings) so important for marketing.

4. The art of positioning: Kotler argues that "positioning a product in the minds of consumers helps to distinguish it from competitors" [4]. This means that companies strive to create a unique image of their product so that it is associated with certain qualities or lifestyle.

5. Pricing strategies: prices also play an important role in the purchase decision. Kotler notes that "consumers often perceive a high price as a sign of quality" [4]. This can manipulate the perception of the product and encourage you to buy it.

These aspects show how marketing can influence consumer behavior and use various psychological techniques to stimulate purchases.

We also suggest considering this topic based on Nestle.

Nestle's manipulations

Most of the world's brands are owned by one Swiss company, Nestlé. This corporation is the largest monopolist, owning 2,000 brands in 188 countries around the world. Nestlé is the most expensive grocery brand on Earth, featuring popular people and stars in its ads. Millions of people around the world are involved in the production of products, from top CEOs in expensive suits to children who harvest cocoa beans in African countries.

We studied how the company achieved such success and how entire countries became victims of aggressive marketing. How do such huge corporations go to all lengths for profit?

Just 200 years ago, there was a problem with the mortality of children, the reason was the industrial revolution. People moved en masse to cities where they lived in slums, without clean water and sewerage. They used to work in villages, but now they worked in factories, even women who hardly paid attention to babies. In these unsanitary conditions, many children did not receive enough breast milk, which is critically important for the first year of life.

During the war, while men were at the front, women worked in the rear. After that, the trend persisted: more and more women moved away from the traditional domestic role and chose a job.

After the war, in the 1950s, Nestlé refined the formulation of its infant formula. In advertising, its product began to be equated with breast milk. Now, if women had less time to take care of children because of work, they could just buy a ready-made mixture. Mass advertising produced excellent results: studies show how the number of children who were fed artificial formula increased every year.

When Nestlé realized that sales were going well in Europe and the United States, it began to look for new markets in countries with high fertility – Africa, Latin America and Asia. After all, it is there that the largest part of the world's population lives, and the demand for baby products was huge.

Africa is famous for its clean drinking water, but on the continent, the most people in the world die because of dirty water. In poor countries, children were fed not with an original formula, which even in ideal conditions cannot replace breast milk, but with an incomprehensible substance.

Success in African countries would have continued if, in 1974, a British charity organization had not published an article that exposed the company. It detailed how Nestle promoted at the expense of breast feeding, used nurses to advertise and hooked mothers on its product through free samples. In 2018, Cambridge scientists estimated that as a result of Nestle's actions in poor and developing countries, approximately 11 million children died in 55 years.

When the article was published, it was picked up by journalists, translated into other languages, and mass boycotts of the company's products began in developed countries. The scandal reached the point that in 1981, at the World Health Assembly, an international code was adopted prohibiting the distribution of samples of mixtures and talking about the advantages of using them over breastfeeding. Nestle has formally incorporated this code into its strategy. But less than four years later, Nestle was noticed distributing samples in Asian countries, and the boycott resumed.

Today, like other baby food companies, Nestle continues to advertise its products in various ways [5-9].

The work "Quota, or 'Supporters of abundance'"

In order to consider how society is manipulated to buy goods, one can turn to the dystopia, the work of Vercors, "Supporters of Abundance" (the original title is "Les Chemins de la Liberté"), as well as to the image of Colonel Quota. This work depicts a consumer society rather satirically and raises issues of economic and social manipulation of people. Important elements of this work, such as the imposition of artificial needs, the use of propaganda and advertising, as well as the creation of

economic dependence, clearly reflect the mechanisms by which society is manipulated in the field of sales.

Colonel Quota is a central figure symbolizing power and control, which are used to impose consumer values. One of the key points of the work is how economic and social forces manipulate public consciousness, creating demand for unnecessary goods. In this, parallels can be drawn with modern marketing methods.

An example of such manipulation can be seen in the chapter describing a policy based on the desire for abundance. Let us consider in more detail the psychological techniques that are used here.

C*reation of artificial needs*. In the text, you can find examples of how manipulators make people believe in the need for constant consumption, regardless of the real needs of a person. This echoes the idea of marketing strategies where products are presented as essential for a happy life: “People are starting to want things they never thought about before. They believe that only through the possession of these things will they be able to achieve prosperity and happiness” [10].

Also, the main line of manipulation in the book is based on the idea that the abundance of goods is a measure of happiness and success. Colonel Quota’s dialogue with representatives of the elite discusses how society can be controlled through the suggestion of the need for constant consumption.

In one of the key episodes (Chapter 3), Colonel Quota states: “If we don’t make people want something all the time, we will lose control over them. Let them strive for abundance, even if it is just an empty shell. The main thing is for them to believe that the more they have, the happier they will become” [10]. This fragment describes a strategy for the formation of needs that have no real meaning for a person, but play an important role in maintaining the economy.

The description is very similar to modern advertising campaigns, where companies manipulate emotions, forcing people to believe that their happiness directly depends on buying a new product. Consumption is becoming not just a part of life, but its most important goal.

Advertising as a tool of pressure and manipulation. Vercors emphasizes that advertising strategies play a key role in shaping consumer mentality. Advertising here is presented as a powerful tool for manipulating consciousness, when people begin to believe that they need more and more material things, even if they are not needed: “The world is filled with slogans that shout: “You have to have it, otherwise you won’t be a part of this world.” Advertising doesn’t just sell products, it sells a way of life” [10].

Chapter 5 describes how city streets are filled with advertising slogans, and the media actively broadcast messages about new products that supposedly should change lives for the better. Here, Quota discusses the impact of advertising: “You have to make them dream. If they don’t see a new product on every corner, they’ll forget they need more. Advertising is not selling goods, it;s selling a dream that they didn’t know they wanted’ [10].

This passage illustrates how advertising instills the idea that without a new product they will not be able to live a full life. Moreover, this reflects modern marketing practices.

Social pressure and conformity. An important role in the book is played by social pressure, which imposes the idea that everyone should follow the same pattern of consumption. Those who refuse or cannot afford to participate in the race for abundance are considered losers and outcasts: “Man has been turned into a machine for consumption, where his desires and needs are no longer his own, but imposed from the outside” [10].

In one of the dialogues, Colonel Quota explains to his subordinates: “We will create a society where those who don’t buy will be outsiders. They will be ashamed that they don’t have the latest stuff. Let everyone feel that without abundance they are nobody” [10].

This clearly demonstrates the mechanism of manipulation through social pressure, when the refusal to consume is placed outside the norm. Such methods are actively used in the modern world, where advertising and marketing often create the feeling that people who do not follow trends are left behind and lose their social status. This leads to the loss of personal freedom and spiritual values, because a person’s life begins to revolve around things.

Refusal to participate in the consumption system is perceived as a threat to public order. Those who oppose abundance and choose a simple life are portrayed as antisocial elements.

In a conversation between a Quota and one of his subordinates, it is said: “People who don’t want to buy are a threat. They are undermining everything we have built. If everyone is content with little, how will we be able to maintain our standard of living? Let them understand: if you don’t consume, you don't live” [6].

Economic slavery. Colonel Quota and his supporters strive to create a society where people will depend on consumption. This is reminiscent of modern models of economic pressure through lending and other financial instruments. “You think you’re free, but in fact you’re just a cog in the mechanism that makes you buy, pay, and buy again” [10].

In Chapter 9, Colonel Quota talks about the need to keep people in financial slavery through consumption: “They have to buy more than they can afford. Loans will make them dependent on us. The more debt they have, the more we can control them” [10]. This episode highlights the strategy of using debt obligations as a tool of manipulation. In the modern world, this can be easily traced through the example of credit cards, installments and other financial products that encourage people to buy things without having the means to do so.

Even the church was used in the work: “My father, I want people to catch any word you say. May all the people of Tagualpa see and hear you on television every evening at the hour of prayer. Every evening you will remind them of their duty, not only to God, but also to Caesar. About their religious and their civic duty. In terms of religion, this means honoring the creator, and in civil terms, it means buying goods. Thus, the economy will cease to be something basely mundane, we will clothe it in sacred veils. That’s what I expect from you, my father. In addition, do not forget that when your sect, – Quota continued, as if everything had already been decided, – grows with my help, it will build new temples, acquire thousands of religious objects, it will need bricks, cement, wood, tiles, glass, copper, candles, incense, stained glass,

breviaries, organs and much more, much more – in short, everything that an inventive mind is able to replenish rituals and divine services. What a rich market!" [10].

"Following the instructions of Quota, the holy father kept repeating that there is no better way for a Christian to honor God on our earth, how to prove himself a good citizen, a good father of a family and a good, that is, submissive and disciplined, buyer, so that over time, as expected, his sermons were brought into the minds. There was a necessary confusion among the listeners for the benefit of the cause, and the believers in their hearts really believed that they were buying a lot of things not out of necessity, not out of compulsion, not out of personal desire, but fulfilling their duty as a citizen and a Christian. Only a few people committed fraudulent frauds, and even then they were all condemned. For the most part, people were happy and proud that every three months they had a new car, every month a new refrigerator. Their conscience was pure not only in relation to the state, but also to God, and the consciousness that they were fulfilling the will of the Lord awakened in them a desire to attend church, which they had recently neglected. The ranks of the sacred cohorts have been replenished, and the sect, as predicted by Quota, has embarked on a path of prosperity, which has forever made Esposito his most loyal ally" [10].

Parallels with modern marketing manipulations

Modern marketing strategies use the same manipulation mechanisms that Vercors describes. These include:

- creating a desire to buy new versions of products (for example, new smartphone models that offer small changes, but create the illusion of necessity);
- using the psychology of color, emotions and stereotypes to increase sales;
- the formation of social competition – "all this has already been bought, you also have to" [10].

In Vercors' work, one can see vivid examples of how the government and the economy manipulate people's minds, creating artificial demand and instilling a culture of consumption. These ideas echo well with modern realities, where advertising and marketing play a leading role in people's lives, managing their needs and desires.

Conclusion

Advertising and marketing are integral elements of modern business aimed at promoting products and services. They help to create brand awareness, attract new customers and retain existing ones. Using the example of Nestlé, you can see how the use of marketing strategies allows the company to take a leading position in the market, offering products that meet the needs of consumers.

The work "Quota, or 'Supporters of Abundance'" touches on key social and economic aspects that shape the understanding of consumer culture and society as a whole. The author raises important questions about how the abundance of goods and services created through marketing efforts shape our understanding of well-being and consumption. The study of advertising and marketing strategies, as well as the analysis of companies such as Nestlé, allow for a deeper understanding of their impact on society and the economy, emphasizing the importance of a balanced approach to product promotion and their social responsibility.

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УДК 7.05

SUSTAINABLE DESIGN: ENVIRONMENTALLY FRIENDLY MATERIALS AND TECHNOLOGIES IN INTERIOR DESIGN

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Abstract. The article focuses on exploring the concept of sustainable design, emphasizing the use of eco-friendly materials and technologies in contemporary interiors. The aim of the study is to identify the specificities of material integration and their impact on both aesthetics and functionality. The research hypothesis posits that the utilization of sustainable materials enhances environmental conditions and enriches design solutions. The study employs stylistic analysis methods, examines examples of successful projects by various designers, and analyzes the historical context of using natural materials.

Keywords: sustainable design, environmental friendliness, interior design, design, safe environment.

УСТОЙЧИВЫЙ ДИЗАЙН: ЭКОЛОГИЧЕСКИ ЧИСТЫЕ МАТЕРИАЛЫ И ТЕХНОЛОГИИ В ИНТЕРЬЕРЕ

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Аннотация. Статья посвящена исследованию концепции устойчивого дизайна, особое внимание уделяется использованию экологически чистых материалов и технологий в современном интерьере. Цель исследования заключается в выявлении особенностей интеграции материалов и в их влиянии на эстетичность и функциональность. Гипотеза исследования заключается в том, что использование устойчивых материалов улучшает экологическую ситуацию и обогащает дизайнерские решения. В работе применяются методы стилистического анализа, рассматриваются примеры успешных проектов различных дизайнеров и проводится анализ исторического контекста использования натуральных материалов.

Ключевые слова: устойчивый дизайн, экологичность, интерьерный дизайн, проектирование, безопасная среда.

Sustainable design is a field of design that focuses on the equitable combination of economic, socio-cultural, environmental and technological aspects. This approach can be applied both to the creation of physical objects from interiors to clothing, and to the development of digital products and services [1, p. 126].

Sustainable design originated in the 1960s, highlighting the need to protect natural resources. This approach prioritizes eco-friendly materials, energy and water conservation, improved usability, product longevity, and waste reuse and recycling. A key figure in this field is German designer Dieter Rams, who outlined ten principles of good design that encompass aesthetics as well as environmental, economic, and social factors. Rams stressed the importance of creating durable and functional products that can withstand changing trends and technologies [2, p. 808]. In the 1980s, interest in eco-friendly products grew, but eco-design was seen more as an experimental trend than a standard practice. The real shift toward sustainable design happened in the 1990s when the International Council on Design began to promote it. A key moment was the adoption of Agenda 21 at the 1992 UN conference in Rio de Janeiro, highlighting sustainable design's role in overall sustainable development. Traditionally, design focused on productivity and cost-efficiency, often neglecting environmental and social factors. Over time, it became evident that a product's entire life cycle should be considered, not just its price and functionality. The foundations of sustainable design emerged in the 1970s with organizations like The Society for Environmental Graphic Design and The Green Building Council, which aimed to address environmental issues through design. One of the first significant sustainable design projects was Victor Papani's Aerodynamic Car model in 1942, which featured innovative design for reduced aerodynamic resistance. In the early 1990s, there was a strong movement for sustainable design in Europe and the U.S., leading to the creation of various organizations and standards. Since then, sustainable design principles have been applied across many sectors, from home appliances to urban landscaping. Currently, there are various methodologies in sustainable design, but three fundamental principles are crucial for the creation of environmentally responsible products and systems.

1. *Environmental Responsibility.* This principle highlights the necessity of selecting materials and resources that do not harm the ecosystem. The aim of sustainable design is to minimize negative impacts on nature while enhancing resource efficiency. Achieving this requires a comprehensive evaluation of a product's entire life cycle, from the extraction of raw materials to its eventual disposal or recycling.

2. *Economic Viability.* This principle emphasizes the importance of ensuring that a product remains economically sustainable over time. Sustainable design should strive to develop products that are financially feasible throughout their entire lifespan. This can be achieved by incorporating recyclable and reusable materials, as well as reducing energy consumption and resource costs.

3. *Social Equity.* This aspect focuses on meeting the needs and enhancing the well-being of users and the broader community. Sustainable design must take into account social considerations such as accessibility, safety, and the overall impact on health and quality of life. It is essential that products are designed to be inclusive and do not contribute to existing social disparities [3].

These three principles are interconnected and mutually reliant: effective design must address user needs while considering both economic and ecological factors to produce items that are advantageous and promote a longer life cycle.

A notable illustration of a project grounded in sustainable design principles is the Second Nature Furniture Series by Steelcase. This collection incorporates environmentally friendly materials that have a minimal ecological footprint. Furthermore, the furniture is designed for ease of repair and reuse, which contributes to prolonging the lifespan of the products and minimizing waste. This initiative not only underscores the company's dedication to sustainability but also encourages users to adopt a more responsible approach towards resource consumption and environmental stewardship (Figure 1).

Figure 1. Second Nature Furniture Series by Steelcase

Herman Miller exemplifies sustainable design in furniture by actively using recycled materials like aluminum, reducing its environmental impact. Moreover, the company's products are designed to be recyclable, which helps in reducing waste. Herman Miller also introduces innovative mechanisms that allow users to customize their chairs and tables according to their personal preferences and needs. This not only enhances comfort, but also significantly increases the life of the products, as users can customize the furniture, which reduces the likelihood of premature replacement. In this way, the company demonstrates an integrated approach to sustainable design, combining environmental, economic and social aspects in its products (Figure 2).

Figure 2. A series of chairs from Herman Miller

Another example of a sustainable design project is the “Print Your City!” initiative launched by Rotterdam-based studio The New Raw. Using 3D printing technology, they create comfortable and multifunctional furniture of unusual shapes from recycled plastic. The studio sees its mission as transforming plastic waste into elements of public space, involving citizens in the process of creating their products and motivating them to recycle local trash. Moreover, the company has developed an online platform where users can become creators, giving new shapes to their waste and creating a comfortable design of the surrounding space (Figure 3).

Figure 3. A sustainable design project from The New Raw studio

Eco-friendly trends are also becoming increasingly popular in Russia. The St. Petersburg brand 99Recycle produces eco-friendly interior items made from recycled plastic and offers a wide range of products, including tables and decorative panels for checkout areas, as well as curtains for fitting rooms made from plastic bags. What makes the products unique is that the products are almost 100 % recycled – the main material for the furniture is recycled HDPE-labeled lids. 99Recycle’s products are already available in some showrooms, which testifies to the growing demand for eco-friendly products and society’s interest in sustainable development (Figure 4).

Figure 4. Eco-friendly interior items from the brand “99Recycle”

A survey was conducted to understand consumer attitudes towards sustainable design, gauge their interest and preferences, and the barriers stopping them from choosing more eco-friendly products. According to this survey, over 60 % of respondents aged 18-25 stated an interest in eco-friendly materials when renovating. This indicates that the new generation is increasingly aware of the importance of sustainability and is ready to integrate its principles into their lives. However, despite the high level of interest, there is a significant gap between intentions and actions. Some 35.6 % of those surveyed do not pay attention to sustainable materials, highlighting the need for educational initiatives and awareness campaigns. Understanding the benefits of sustainable design can help change this situation and increase consumer awareness. Women made up the majority of respondents, which may indicate that they are actively involved in renovation decisions. It may also be related to the fact that women are more likely to be sensitive to environmental issues. Nevertheless, even among those interested in eco-friendly solutions, more than 42 % are already adopting such approaches in other areas of life, opening the door to growing interest in sustainable design in renovation. However, price remains a major barrier to choosing sustainable materials. Most respondents are willing to consider overpaying, but only within 5-10 %. This suggests that in order to successfully promote sustainable solutions, it is necessary to work on reducing prices and improving the availability of such materials. Thus, in order to achieve sustainable design in the renovation industry, it is necessary not only to offer quality and affordable eco-friendly solutions, but also to actively inform consumers about their benefits. Diversity of offerings and price reductions can be key factors in popularizing sustainable design and integrating it into everyday life.

Sustainable design is becoming more and more relevant in today's world, where there is a growing awareness of the importance of environmental responsibility. In this context, it is important to consider the strengths, weaknesses, opportunities and threats associated with the use of environmentally friendly materials and technologies, to conduct a SWOT analysis (Figure 5).

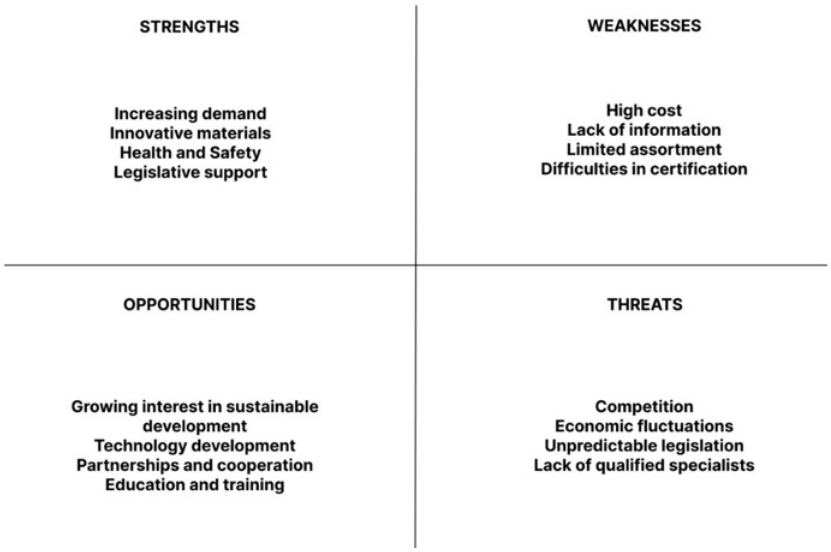

Figure 5. SWOT analysis for the field of sustainability in interior design

The strengths of sustainable design include the increasing demand for environmentally friendly products. In recent years, there has been a significant increase in sustainability awareness among consumers, who are increasingly choosing products that are environmentally responsible. The rise of innovative materials like recycled components and low-emission paints is paving the way for designers and architects to develop more sustainable solutions. Utilizing eco-friendly materials not only fosters a healthier living environment but also appeals to consumers looking to enhance their quality of life. Additionally, growing government initiatives and subsidies aimed at promoting green practices offer further motivation for adopting sustainable approaches. However, there are also weaknesses. Green materials and technologies often cost more, which can deter some customers, especially when budgets are tight. Not all consumers are aware of the benefits of sustainable design and renovation, which can limit demand. In some regions, there is a lack of available eco-friendly materials and services, which makes it difficult to realize sustainable projects. In addition, certification processes for sustainable materials and services can be complex and costly, creating additional barriers to market entry.

Nevertheless, the opportunities for sustainable design are also significant. Increased awareness of environmental issues is creating new niches in the market. The emergence of new technologies can make sustainable design more affordable and effective, lowering production and implementation costs. Opportunities to collaborate with other companies and organizations to promote green initiatives can create synergies and expand the market. Organizing seminars and courses on sustainable design can attract new customers and increase the skills of professionals in the field. Threats include increasing competition. An increase in the number of companies offering eco-friendly solutions can lead to market saturation, making it more difficult to stand out from competitors. Economic instability may also force consumers to abandon expensive green solutions in favor of cheaper alternatives. Legislative changes can create market uncertainty for sustainable materials and services, while a lack of skilled professionals in sustainable design may hinder industry growth. Utilizing eco-friendly materials and technologies is crucial for minimizing environmental impact. Implementing these solutions helps conserve natural resources and meets the increasing consumer demand for responsible and ethical products. To succeed in this field, it is necessary to continue research, develop innovative technologies and raise public awareness of the benefits of sustainable design. Various modern approaches to solving problems in the field of design are regularly considered in the works of Rovinskaya O. V., Vekovtseva T. A. [4, 5]. Their works present intelligent technologies such as “smart house”, “smart parking”, “smart car” or “smart glasses”. Such systems can also include the environmental agenda, which is a key point in the field of sustainable design.

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УДК 004.05

INFLUENCE OF NATIVE LANGUAGE ON THE SYNTAX STRUCTURE OF PROGRAMMING LANGUAGES

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Abstract. This article covers key aspects of syntax of Python, C++ and PascalABC programming languages. Basic structures such as variables, conditional statements, loops and functions are described in detail. The ways programmers can set syntax rules based on their native language structures, such as the use of commas, parentheses, and other symbols are analyzed.

Keywords: syntax, development, programming language, native language, Python, C++, PascalABC.

ВЛИЯНИЕ РОДНОГО ЯЗЫКА НА СТРУКТУРУ СИНТАКСИСА ЯЗЫКОВ ПРОГРАММИРОВАНИЯ

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Аннотация. В статье рассмотрены ключевые аспекты синтаксиса языков программирования Python, C++ и PascalABC. Подробно описаны основные структуры, такие как переменные, условные операторы, циклы и функции. Анализируются способы, с помощью которых программисты могут устанавливать синтаксические правила, основанные на структурах их родного языка, такие как использование запятых, круглых скобок и других символов.

Ключевые слова: синтаксис, разработка, язык программирования, родной язык, Python, C++, PascalABC.

Programming languages are an important tool in the world of technology, allowing us to develop software, manage data, and interact with computers. An important factor that influences the perception and use of programming languages is the native language of the developers. This paper examines how the native language can influence the syntax and structure of programming languages.

Syntax represents the laws of word order and sentence construction [1, p. 7].

The syntax of programming languages is formed on the basis of usability and logic, but the native language of developers can influence its structure. Let us consider several aspects of this influence on the example of languages C++, Python and PascalABC. Each of these languages has its own peculiarities, and the way we interpret their syntax may depend on our linguistic background.

Python is an interpreted programming language with implicit dynamic typing. The author of the language is Dutch programmer Guido van Rossum [2, p. 13].

In 2003, enthusiasts of the Southern Federal University (SFU, Rostov-on-Don) created an educational programming environment Pascal ABC [3, p. 27]. Syntactically PascalABC.NET language is close to Delphi language (compatibility is 90-95 %), but includes many languages constructs C# [3, p. 5].

C++ was created by Bjarne Stroustrup in 1979 at Bell Laboratories (Murray Hill, NJ) [4, p. 10]. This structured language supports the concept of subroutines and local variables.

Programming languages can borrow terms and concepts from your native language. Developers who speak languages with a certain structure (for example, fixed word order) can adapt the syntax to patterns they know. For example, the use of commas, parentheses, and other symbols may be interpreted differently in different languages. This can affect the way they create or perceive conditional expressions, loops, and other constructs. For example, encapsulation and strict typing (e.g., C++) may be more understandable to people who speak languages in which logic is expressed more strictly.

Let us break down the syntax of each language separately.

Python

Python is a high-level programming language known for its simple and readable structure.

1. Indents:

Python uses indentation to mark blocks of code (for example, within functions, loops, and conditional statements). This makes the code more readable.

It is recommended to use spaces (4 spaces) instead of tabs for indentation.

2. Comments:

Single-line comments begin with #.

Multi-line comments can be created with triple quotes: """ or “””.

3. Variables:

Declaring a variable does not require an explicit type statement, Python uses dynamic typing:

```
x = 10      name = "Alice"
```

4. Data Types:

Basic data types: int, float, str, list, tuple, dict, set, и bool.

5. Conditional operators:

Conditional constructs use if, elif, и else:

```
if x > 10:
    print("x more 10")
elif x == 10:
    print("x equally 10")
```

```
    else:
        print("x less 10")
```

6. Loops:

- for is used to iterate over sequences:

```
 for i in range(5):
     print(i)
```

- while executes the loop as long as the condition is true:

```
 while x < 10:
     x += 1
```

7. Functions:

A function declaration starts with def:

```
def my_function(parameter):
     return parameter * 2
```

8. Lists and other collections:

Lists are defined by square brackets:

```
my_list = [1, 2, 3, 4]
```

Tuples are immutable sequences defined by parentheses:

```
my_tuple = (1, 2, 3)
```

Dictionaries are defined by curly brackets:

```
my_dict = {'key': 'value', 'another_key': 10}
```

9. Display output:

The following function is used to output information print():

```
print("Hello, World!")
```

10. Importing libraries:

To use external libraries use the command import:

```
import math
```

This syntax makes Python suitable for both novice and experienced programmers, allowing you to focus on solving problems rather than the complexity of the language design itself.

C++

C++ is a programming language that combines both high-level and low-level concepts. It is known for its powerful functionality and strict syntax.

1. Program structure:

A C++ program usually starts with an #include directive that loads the necessary libraries:

```
 #include <iostream>
```

2. The main() function:

The main function is main(), which starts the execution of the program:

```
int main() {
     // Code
    return 0;
}
```

3. Variables and data types:

C++ requires explicit declaration of variable type:

```
int x = 10;
```

```
double y = 5.5;
std::string name = "Alice";
```

4. Conditional operators:

Conditional constructs use if, else if и else:

```
if (x > 10) {
std::cout << "x more 10" << std::endl;
}
else if (x == 10) {
std::cout << "x equally 10" << std::endl;
}
else {
std::cout << "x less 10" << std::endl;
}
```

5. Loops:

- The for loop is used to iterate:

```
for (int i = 0; i < 5; i++) {  std::cout << i << std::endl;  }
```

- The while loop:

```
while (x < 10) {  x++;  }
```

6. Functions:

A function declaration includes specifying the type of the return value:

```
int myFunction(int parameter) {  return parameter * 2;  }
```

7. Classes and objects:

C++ supports object-oriented programming using classes:

```
class MyClass {
 public:  void myMethod() {
    std::cout << "Hello, C++!" << std::endl;
  }
};
```

8. Errors and exceptions:

Errors are handled using try and catch:

```
try {  // Code that can raise an exception  }
catch (const std::exception& e) {
std::cout << "error: " << e.what() << std::endl;
}
```

9. Libraries and namespace:

In order to use functions from the C++ standard library, a namespace is often plugged in std:

```
using namespace std;
```

10. Input and output:

Std::cout is used for output and std::cin is used for input:

```
int number;
std::cout << " Enter a number: ";
std::cin >> number;
```

C++ syntax requires careful attention to data types and code structure. While it can be more difficult to learn than languages like Python, this rigor allows you to create powerful and efficient programs.

PascalABC

PascalABC is a modern version of the Pascal language, which is designed to teach programming and includes additional features that simplify development.

1. Program Structure:

The program begins with an announcement:

```
program HelloWorld;
```

2. Code blocks:

All blocks are terminated with the keyword begin and end. Each block may contain multiple operators:

```
begin        // Code      end.
```

3. Variables:

Variables are declared in the var section with the types. The types are strict:

```
var         x: Integer;         name: String;
```

4. Constants:

Constants are declared using the const keyword:

```
const         PI = 3.14;
```

5. Conditional statements:

Uses if, else if и else with cleanly syntaxed:

```
if x > 10 then          WriteLn('x more 10')
else if x = 10 then          WriteLn('x equally 10')
else          WriteLn('x less 10');
```

6. Loops:

- The for loop:

```
for i := 1 to 5 do          WriteLn(i);
```

- The while loop:

```
while x < 10 do          x := x + 1
```

7. Functions and procedures:

Defined using the keywords function and procedure:

```
function Square(n: Integer): Integer;
begin
   Square := n * n;
end;
procedure PrintHello;
begin
   WriteLn('Hello, PascalABC!');
end;
```

8. Arrays:

Arrays can be declared with bounds specified:

```
var         numbers: array[1..10] of Integer;
```

9. Exception handling:

Exceptions are handled using try and except blocks:

```
try         // Code that can raise an exception
```

```
except on E: Exception do WriteLn('error: ', E.Message);
end;
```

10. Input and output:

Write or WriteLn is used for output and Read or ReadLn is used for input:

```
var number: Integer;
begin
Write('Enter a number: ');
ReadLn(number);
end;
```

PascalABC emphasizes clarity and simplicity of code, making it an excellent choice for novice programmers. Strict typing and clear syntax make it easy to learn the basics of programming..

English follows strict syntactic rules of sentence construction, which can also be seen in C++. Strict typing of variables, function return values, and constant references to certain libraries, such as "std:". There is a need to constantly keep track of proper punctuation and curly brackets in order for the code to work correctly. This language is designed for strict adherence to the rules of writing and is intended for large and feature-rich programs. Python, on the other hand, focuses on code readability. The syntax of the language is simple and intuitive, such as the use of functions with explicitly named parameters, just as Dutch has rules and norms to ensure clarity and consistency in communication, such as the use of articles and the agreement of nouns with adjectives. There are many compound words and phrases that can be broken down into parts. For example, “afspraak” (meeting) can be split into “af” and “spraak”. Functions and classes are compound elements in Python as well. For example, def my_function(): can contain sub-functions and defined blocks, defining their structure according to the “component behavior” scheme. While Russian language often omits the order of words in a sentence, it does not reduce clarity, it is necessary to observe the mapping of tenses, cases, declensions and conjugations, which also correlates with PascalABC, its syntax is similar to C++, but at the same time it is easier to read, it has strict variable typing, but the structure of the language is much simpler, because it was designed as a learning platform for programming languages, it combines both the ease of writing and readability of Python and the ability to write complex programs as in the languages of C.

Different programming languages implement different paradigms such as procedural, object-oriented, and functional programming. Native language proficiency can affect how developers understand and apply these paradigms. For example, native speakers of languages that emphasize logic and abstractions may perceive functional programming more easily.

Some programming languages are designed with structure and rules specific to certain cultures or language groups in mind. For example, languages such as Python are known for their readability and simplicity of syntax, which differs from languages that are more rigorous and formalized, such as C++. These differences can make some languages more accessible to speakers of certain languages.

The structure of sentences in a programming language is also important. Languages can have different word orders, which may be closer or further away from

the developer's native language. For example, if your native language has a fixed word order, you may find it easier to understand and work with languages that follow the same logic. At the same time, the R language, for example, has the ability to execute code in the order the user wants because it implements the ability to execute code line by line.

Although programming languages are usually designed with universal principles in mind, the influence of the developers' native language contributes to the perception, understanding, and practical use of these languages. Exploring this influence can help create more intuitive and accessible programming languages, especially for novice programmers.

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УДК 316.42

THE SOCIAL IMPACT OF GRANT SUPPORT: ASSESSMENT OF THE IMPACT ON SOCIETY

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Abstract. The article analyzes the social consequences of grant support, assessing its impact on various aspects of public life, including education, science, innovation and economic development. Both the positive and possible negative effects of grants are considered, and recommendations for optimizing the social impact of grants are proposed.

Keywords: social impact, grants, society, potential, risks.

СОЦИАЛЬНОЕ ВЛИЯНИЕ ГРАНТОВОЙ ПОДДЕРЖКИ: ОЦЕНКА ВОЗДЕЙСТВИЯ НА ОБЩЕСТВО

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Аннотация. В статье анализируются социальные последствия грантовой поддержки, оценивается ее воздействие на различные аспекты общественной жизни, включая образование, науку, инновации и экономическое развитие. Рассматриваются как положительные, так и возможные отрицательные эффекты грантов, а также предлагаются рекомендации по оптимизации социального воздействия грантов.

Ключевые слова: социальное воздействие, гранты, общество, потенциал, риски.

Grant support is one of the key mechanisms for financing socially significant projects, research and initiatives around the world. Grants are provided by government agencies, international organizations, non-profit foundations and private companies.

The social impact of grants can be assessed through a wide range of indicators, including improving the quality of life, access to education, community development and strengthening social capital (Figure 1). Grants can serve as a catalyst for social

change by providing resources for the implementation of innovative projects and programs that might otherwise remain unfulfilled due to lack of funding.

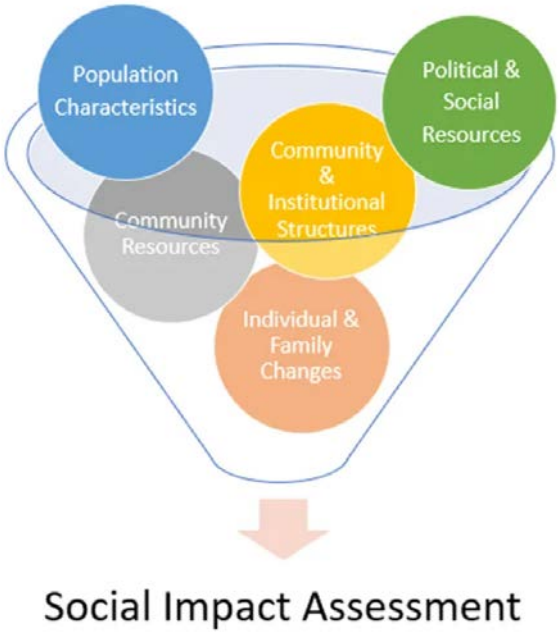

Figure 1. Categories of social impact

Social capital theories are central to assessing how financial support can contribute to social development and strengthen public relations (Figure 2). Social capital, according to scholars such as Pierre Bourdieu and Robert Putnam, includes social networks, norms of mutual assistance and trust that can be mobilized for collective action. In the context of grant activities, social capital theories are applied to develop programs that purposefully seek to strengthen these aspects of public life. Grants can be used to support educational programs, community initiatives and projects that stimulate cooperation and knowledge exchange between different groups of the population, thereby strengthening social ties.

Figure 2. Theories of social capital

The application of social capital theories in grant activities also includes the development of strategies to measure and increase the impact of grants on social well-

being. For example, grants can be aimed at supporting communities suffering from high unemployment and low levels of education in order to create new jobs and improve educational standards. Thus, grant support can contribute not only to the direct improvement of economic indicators, but also to the strengthening of social capital through improved social integration and cooperation [1, pp. 20-21].

Social impact assessment models serve as a tool for analyzing and understanding the impact of grants on society. These models range from quantitative methods of data collection and analysis, such as surveys and statistical analysis, to more sophisticated qualitative methods, including in-depth interviews, focus groups and case studies. Quantitative methods can measure, for example, the number of jobs created.

As for the criteria for assessing social impact, they should be defined in advance and coordinated with the objectives of the grant program. These may include: the level of improvement in the quality of life of program participants; the degree of improvement in access to educational and labor resources; changes in social capital, including the level of trust within the community and strengthening social ties; the level of community participation in grant initiatives and projects; economic impact, including job creation and stimulating the local economy; sustainability of social change after the end of the project financing [2. pp. 39-40].

To assess these criteria, various indicators can be used, such as income level, employment statistics, data from educational institutions, as well as sociological surveys reflecting changes in the perception and satisfaction with the life of participants.

It is important to emphasize that social impact assessment is an iterative process that requires regular review and adaptation of criteria and methods of data collection in accordance with changing conditions and results. Effective impact assessment requires transparency, stakeholder engagement, and willingness to adjust programs based on the data obtained.

Grants play a key role in financing educational initiatives and research. They provide resources for developing new curricula, updating teaching materials and equipment, and provide scholarships for students and researchers. For example, thanks to grants, teacher training programs can be implemented, which directly affects the quality of education. In the field of science, grants allow for fundamental and applied research that can lead to scientific discoveries and technological innovations. Grant support also promotes international scientific cooperation, knowledge and experience sharing, which strengthens the scientific community and contributes to global progress.

Grants can be a powerful tool for economic incentives, as they provide financing for startups, small and medium-sized businesses, as well as large innovative projects. This financing helps companies develop new products and services, increase competitiveness and create jobs. Grants can also contribute to regional development by supporting projects aimed at improving infrastructure or developing key sectors of the economy. In the long term, such investments can lead to sustainable economic growth, an improved business environment and an increase in the general standard of living of the population [3, pp. 64-67].

Grant programs are often aimed at supporting vulnerable segments of the population, such as poor families, people with disabilities, migrants and ethnic

minorities. Grants can fund social services, educational programs, medical care, and housing construction. They can also support projects aimed at social integration and combating discrimination. The contribution of grants to improving the quality of life of vulnerable groups is manifested in increasing the availability of social services, strengthening social protection and creating opportunities for self-realization. This, in turn, contributes to reducing social inequality and strengthening social justice.

Examples of successful grant projects may include programs aimed at supporting education in underprivileged regions, anti-poverty initiatives, or projects that promote sustainable development. Such case studies often demonstrate how grants help to implement innovative approaches to solving social problems, for example, the introduction of new educational technologies in schools or the creation of social entrepreneurship offering jobs and support to marginalized groups. These projects can serve as an example of how grant funds turn into real social changes, improving the quality of life and providing new opportunities for development [4].

Despite the positive potential, grant activity is not without risks. Among them is the possibility of improper allocation of funds when grants do not reach their target groups due to bureaucracy or corruption. In addition, there is a risk of becoming dependent on external financing when organizations or communities adapt to life on grants and lose the incentive to develop independently. Another risk is the possibility of “project thinking”, when initiatives are developed for the sake of obtaining a grant, and not to solve real social problems.

Public policy plays an important role in setting rules and criteria for granting grants, as well as in controlling their distribution and use. The state can direct grants to solve the most pressing social problems, thereby ensuring the strategic development of society. At the same time, the private sector, including foundations and corporations, can offer more flexible and innovative approaches to grant support, as well as promote the development of partnerships between various participants in social projects. Joint efforts of the state and the private sector can ensure more effective and targeted use of grants, minimizing risks and increasing the social impact of their implementation.

Grant support has a significant impact on social development, it can contribute to innovation, improvement of education, healthcare and other socially significant areas. However, the success of grant activities depends on many factors, including the clarity of goals, the correctness of the choice of recipients, and the adequacy of management and control over the expenditure of funds. Research shows that grants can have both a direct impact on target groups and an indirect one, through stimulating economic growth and social development.

To increase the social effectiveness of grants, it is necessary to improve the mechanisms for selecting projects, ensuring transparency and fairness of the process. It is also important to establish a system for monitoring and evaluating results, which will allow for rapid adjustment of programs and more appropriate allocation of resources. Partnerships between government agencies, the private sector and non-governmental organizations should be developed to share experiences and resources. In addition, it is important to train and develop personnel capable of effectively managing grant projects.

Future research should focus on analyzing the long-term impact of grants on social development and identifying factors contributing to a sustainable outcome. It is necessary to study the interaction of various types of support (public, private, international) and their cumulative impact on social change. An important area is also the study of mechanisms for minimizing risks and negative consequences of grant activities. In addition, an analysis of the impact of grants on the development of social entrepreneurship and the discovery of new models of social impact through grant support will be required [5].

Thus, grant activity is a powerful tool of social influence, but in order to achieve maximum effectiveness, an integrated approach is required, including continuous improvement of mechanisms for allocating and controlling the use of funds, as well as a deep understanding of the social processes that it intends to stimulate.

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УДК 004.93

APPLICATION OF MACHINE LEARNING AND DEEP LEARNING FOR NATURE CONSERVATION

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Abstract. The article discusses the use of machine learning and deep learning technologies to identify wild animals in nature. Various modern methods of collecting data on rare animal species are described, particularly, the types of stationary and portable sensors. Advantages and disadvantages of using artificial intelligence technologies to protect nature and the environment are analyzed.

Keywords: machine and deep learning, ecology, camera traps, environmental monitoring, annotated datasets.

ПРИМЕНЕНИЕ МАШИННОГО И ГЛУБОКОГО ОБУЧЕНИЯ ДЛЯ ОХРАНЫ ПРИРОДЫ

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Аннотация. В статье рассматриваются вопросы использования технологий машинного и глубокого обучения для идентификации диких животных в природе. Описываются различные современные методы сбора данных о редких видах животных: виды стационарных и переносных датчиков. Анализируются достоинства и недостатки применений технологий искусственного интеллекта для охраны природы и окружающей среды.

Ключевые слова: машинное и глубокое обучение, экология, фотоловушки, экологический мониторинг, аннотированные наборы данных.

The popularity of artificial intelligence technologies (machine learning and deep learning) has been constantly growing in recent years. Nevertheless, people who are not familiar with these technologies still do not understand the possible applications of artificial intelligence algorithms to solve the surrounding life and professional problems.

First of all, machine learning and deep learning tools are used to analyze various data and provide options for modeling and predicting the development of events based

on the results obtained [1]. Artificial intelligence (AI) methods offer an alternative to classical statistical methods, while having the following advantages: they have the ability to efficiently process large arrays of multidimensional data, allowing them to automatically identify hidden patterns and key features of the processed data, and can easily adapt to changes in the source data.

Environmental problems and research can be considered one of the promising areas of application of AI methods. Environmental and environmental management specialists are often forced to make difficult decisions in a rapidly changing conditions. Such problems include climate change, biodiversity or wildlife of the planet, the state of forest and water resources, urban sprawl and agriculture, energy and energy consumption.

Modern advances in technology allow the ecologist to no longer collect data manually, but to use the available opportunities, such as the ability to collect data using satellites and navigation systems, the use of geographic information systems, the availability of data via the Internet and the digitization of historical datasets. All this leads to the formation of very large volumes of various data arrays. Data can rarely be structured, and most often it is messy and difficult to understand and evaluate. It is for working with this type of data that the basic machine/deep learning algorithms are designed.

Machine learning and deep learning capabilities allow you to analyze samples of environmental indicators, recognizing patterns hidden in them; systematize data, allowing you to put forward new hypotheses; predict the development of hypotheses in the future. AI methods, in addition to the classical methods used, can help to understand the processes of ensuring the rational use and reproduction of natural resources, explore complex ecosystems, and restore a favorable state of the environment.

One of the most difficult tasks facing nature conservationists in protecting the planet’s fragile ecosystems and biodiversity is monitoring and tracking wildlife populations. AI capabilities allow us to create tools for rapid assessment of wildlife diversity and population dynamics on a large scale with high spatial and temporal resolution.

Traditionally, the collection of data on the population and behavior of animals is carried out by employees working on the ground in nature reserves [2]. This is associated with a number of disadvantages and errors based on the human factor, and leads to limited results. Recent advances in the digitalization of data collection, the development of digital devices – sensor and acoustic sensors, various types of recording devices, remote sensing methods – increase the possibilities of covering the studied territories. The use of bioregistrators on animals allows you to track individuals for a long time, taking into account the possibilities of movement and migration of animals.

Sensors used by ecologists in animal monitoring can be classified depending on the type of data accumulated, by type of interaction with an animal, stationarity or mobility.

Stationary sensors carry out constant monitoring in the wild. Such sensors can detect the presence of animals in their area of action, identify the species, gender, age and health of animals, monitor the behavior of individuals, and the interaction of predator and prey. The disadvantages of such sensors include repeated fixation of the

same individuals at different time intervals, which leads to a correlation of the data obtained. Stationary sensors include sensors based on image recording (camera traps) and sound (bioacoustic sensors).

Camera traps are cameras that capture high-resolution images. This type of sensor is inexpensive and easy to install. However, the resulting array of images requires subsequent processing, which can be perfectly implemented using machine learning (ML) tools. Current indicators of animal recognition by means of ML are about 80 %, which significantly accelerates environmental research [3].

Acoustic sensors are various types of microphones used to record the sounds of animals and their environment. This type of sensor is used for passive acoustic monitoring. The use of information obtained through bioacoustics for processing by AI methods is fraught with some difficulties: the enormous amount of information received, the need to isolate and identify the necessary animal sounds when processing the information received, distinguishing them from ambient noise, the absence, at the moment, of a large number of already labeled datasets for training neural networks. Nevertheless, the results of using deep learning methods in processing acoustic monitoring networks are already emerging.

Mobile sensors are sensors of various types related to remote sensing. Such sensors can be fixed on mobile platforms: unmanned aerial vehicles (UAVs), airplanes, satellites, and also attached directly to the animals themselves. This type of sensor allows you to track the free movement of animals in the space of large territories over time.

The most common of the mobile sensor devices are sensors mounted on animals. This type of device can record the movement of animals, for example, using a GPS system. In parallel, video cameras, accelerometers, microphones, etc. can be mounted on the animal. From here, ecologists receive information about the environment, physiological and behavioral characteristics of the studied mammals and birds. The biomonitoring devices used are selected taking into account the limitations associated with power supply, storage and data transfer from the devices. Data collection and preprocessing protocols should be optimized to save resources and extend the life of devices. ML methods have shown a good potential for processing data arrays obtained from such devices when using learning algorithms with a teacher.

Copters and drones are a promising environmental monitoring technology. They allow you to collect information at a low altitude with the ability to bypass vegetation that interferes with the view, and have a relatively low cost. Together with the use of deep learning systems, they are an effective means of tracking and identifying individuals. The disadvantages are reduced coverage of the studied area (devices run on batteries) and restrictions on UAVs by local legislation. It is worth adding that the use of this type of device can cause concern in wild animals by changing their behavior.

The use of satellites helps to expand the coverage area of animal surveillance in the absence of direct interaction with the animal world. There are special government programs that allow you to receive free information from satellites sufficient to study the habitats of wild animals. Satellite photo data is suitable for further processing by machine learning and deep learning algorithms. The result can be direct detection of large animals, such as elephants, when using high-resolution images.

The use of aerial photography allows you to increase the resolution and detect smaller animals or not the animals themselves, but their places of activity. This allows you to indirectly determine the locations of animal colonies.

All the data that can be collected through the above new methods can significantly increase the scale of assessment of the environmental situation in the world compared to the classical methods used before. An important condition for the application of the results obtained is the need to convert the data obtained to the forms of presentation of the results familiar to ecologists, for example, drawing up maps that display the absolute values of the number of animals in individual territorial units, reserves. When forming results that are easy to understand in ecology, all the same methods are used as in machine learning, such as detection, localization, identification, etc.

The ever-growing volume of images, audio and video recordings obtained as a result of environmental research requires the use of automatic analysis methods. For example, in 2021, the Dutch camera trap image processing and storage platform Agouti posted 31 million images, of which only 1.5 million received an annotation. This was directly related to the fact that manual processing was used to annotate the image.

An alternative is to involve volunteers who process wildlife data and create the necessary annotations and labels needed to train ML models. The trained models obtained in the future can already be used to recognize images of the animal world. Recognition of popular animal species can be performed by volunteers without additional training. A more complex systematization is the difference between animal species in detail, with small differences, a “subtle classification” can be made by already trained experts.

The problem of repeated identification of the same animals in the camera trap lens can lead to the unreliability of all the results accumulated over a long time. DNA testing is considered a classic in the identification of species and individual animals, which causes great difficulties with large animal populations and the distribution of species over a large area. An alternative to tracking specific individuals is the manual marking of animals, which also cannot be a solution to the problem on a global scale. A modern method of solving the problem using AI technologies to obtain deep learning models can be the identification of specific individuals from images, which is an order of magnitude more difficult task than identifying an animal species from a photo.

Repeated identification of the same individual is realized based on the analysis of the smallest nuances of the appearance of the animal presented in the image. The signs that uniquely determine the personality of an individual are investigated, such as individual signs: a unique pattern (spots, stripes, scars) on the surface of the animal’s body, the size ratio of key points. The difficulty is the lack of lighting, the distinctive outlines of the animal may be poorly distinguishable or partially blocked by the surrounding environment, the change in the appearance of the animal over time (growth, wounds), the blurring of images when an individual moves or the camera moves when using movable photo sensors negatively affects the results. Separately, it should be borne in mind that new previously unfixed individuals (born or migrated) may enter the camera field, which adds such an aspect as working with an open data set. The deep learning model should be able to work with classes that were not

encountered in the process of its (model) learning. It also requires constant adjustment of compliance with past conclusions, comparing the evolution of certain species of individuals, in terms of the biological stage of the animal.

As an excellent example of attracting a lot of ordinary users to benefit environmentalists with the participation of AI, the Wildbook website can be cited. The Wildbook website is a non-profit project promoted by Wild Me. It is an open source software platform. The platform uses machine learning and computer vision techniques to analyze images received from any user. These can be both professional photos of scientists from camera traps, copters, etc., and photos of ordinary people unexpectedly caught in the frame of wild animals in their natural habitat. AI technologies allow you to find an animal of the same species in different photos. The platform combines the capabilities of artificial intelligence with wildlife research, tracks individuals, analyzes populations, and, importantly, engages the community in science.

The MegaDetector project, developed by Microsoft as part of the Al for Earth environmental initiative can be considered as another successful environmental project. The company launched this project as part of the conservation of biodiversity and natural ecosystems of the planet. MegaDetector uses open source tools and a publicly available programming API. The launched software platform, based on AI technology, uses machine learning methods to analyze large amounts of data from various sources. The computational model [4] will allow scientists from all over the world, including specialists in environmental protection, environmental management, ecologists, non-profit organizations and government agencies to download and receive data on the state of the Earth. The data obtained by the project is used to train neural networks in order to search and identify animals in the wild based on the results obtained, for example, from camera traps, initially, allowing you to separate an empty frame from the image of an animal, and further identifying its (animal) appearance. When working, the MegaDetector platform demonstrates high resistance to various factors, such as the geography of filming, the technical characteristics of the equipment used and various features of the footage. The result of the project, set by the creators, is the emergence of a large database for the ability to identify any animal species existing in the world.

Artificial intelligence technologies, including machine learning and deep learning, solve the task of automating many routine processes necessary for environmentalists, thereby saving time for wildlife researchers. Of course, it is worth paying attention to a number of problems that have yet to be solved at the moment.

The reference annotated data sets were obtained only for certain animal species. For further development of this area and solving environmental problems, a variety of large datasets on various species with good annotation, which are in the public domain, will be required.

Information technology professionals should understand the ethical and environmental risks of open access to animal datasets in the wild. Access will be available not only to scientists, but also to poachers who can use it with malicious intent. Also, errors in existing models can lead to erroneous results, which can negatively affect the ecology and population of certain rare species, leading to catastrophic consequences.

However, the above provides a better understanding of the possibilities of using the presented technologies to preserve and protect the environment. Improving AI tools opens up a number of prospects and new approaches for environmental scientists, allowing the integration of relevant activities, implementing an interdisciplinary approach and leading to cooperation between environmentalists and artificial intelligence specialists for the benefit of the planet and the conservation of wildlife.

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УДК 662.614.44

INNOVATIVE APPROACHES TO PIPELINE INSULATION IN HEAT SUPPLY SYSTEMS: MATERIALS AND TECHNOLOGIES

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Abstract. Modern heat supply systems are faced with the need to improve energy efficiency and reduce heat losses. One of the key factors affecting the efficiency of these systems is the quality of pipeline insulation. This article discusses innovative materials and technologies used for insulation of pipelines in heat supply systems, as well as their advantages and prospects for use.

Keywords: pipeline insulation, heat supply systems, heat losses, energy efficiency, nanomaterials, nanoaerogels, polymer composites, phase-change materials (PCM), injection insulation, thermographic control methods.

ИННОВАЦИОННЫЕ ПОДХОДЫ К ИЗОЛЯЦИИ ТРУБОПРОВОДОВ В СИСТЕМАХ ТЕПЛОСНАБЖЕНИЯ: МАТЕРИАЛЫ И ТЕХНОЛОГИИ

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Аннотация. Современные системы теплоснабжения сталкиваются с необходимостью повышения энергоэффективности и снижения теплопотерь. Одним из ключевых факторов, влияющих на эффективность этих систем, является качество изоляции трубопроводов. В данной статье рассматриваются инновационные материалы и технологии, применяемые для изоляции трубопроводов в системах теплоснабжения, а также их преимущества и перспективы использования.

Ключевые слова: изоляция трубопроводов, системы теплоснабжения, теплопотери, энергоэффективность, наноматериалы, наноаэрогели, полимерные композиты, материалы с фазовым переходом (PCM), инжекционная изоляция, термографические методы контроля.

Heat supply systems play an important role in ensuring comfortable living conditions and functioning of industrial facilities. The efficiency of these systems largely depends on the correct choice and application of insulation materials. Heat losses through pipelines can reach significant values, which leads to increased costs for

energy resources and negative impact on the environment. Therefore, the development and implementation of innovative approaches to pipeline insulation are becoming urgent tasks [1].

Pipeline insulation has several key values and functions that are important for both energy efficiency and safety. Insulation helps reduce heat loss in heating systems, which saves energy and reduces heating costs. It also ensures that the temperature of transported liquids or gases is stable, which is especially important for processes that require a specific temperature regime. Insulation materials can protect pipelines from the environment, which reduces the risk of corrosion and extends the life of the pipes, and some have sound absorbing properties, which helps to reduce the noise created by the movement of liquid or gas through the pipes. Insulation can prevent piping from overheating and reduce the risk of burns from contact with hot surfaces and helps to lower carbon emissions by reducing the energy required for heating or cooling, which has a positive environmental impact [2].

Humid conditions can lead to condensation forming on cold pipes. Insulation helps prevent this, which can reduce the risk of mold and other moisture problems.

Traditional pipe insulation materials include several categories, each with its own characteristics and applications.

The materials currently used in the heating industry include mineral wool, which is made from fiberglass or rock wool, has good thermal insulation properties and fire resistance, and is used to insulate hot water and steam piping; expanded polystyrene (EPS), which is a lightweight and inexpensive material with good thermal insulation properties and is often used to insulate pipes in heating and water systems; and polyurethane foam, which provides high thermal insulation at a low thickness Asbestos insulation can still be found in some older buildings.

Variable density polyurethane foam can adapt to temperature changes, providing better thermal insulation under different conditions. Superinsulating materials such as vacuum insulation panels (VIP) have extremely low thermal conductivity and can be used in confined spaces. Modern high-insulation elastomers can provide excellent thermal insulation properties and flexibility, making them ideal for complex pipeline shapes. Biomaterials that are developed from natural fibers (e. g., flax, hemp) can be used for environmentally friendly thermal insulation. Smart materials can change their properties in response to external influences (e. g., changes in temperature or humidity), and ceramic coatings can significantly improve their thermal resistance and corrosion protection [3].

Innovative materials for insulation of pipelines and other engineering systems are constantly evolving and improving. Nanomaterials, such as nanoaerogels, represent a promising trend in thermal insulation. They have unique properties. Due to their porous structure, nanoaerogels provide excellent thermal insulation characteristics, the light weight of the materials simplifies their transportation and installation, and nanoaerogels do not absorb moisture, which prevents the formation of mold and rot. Polymer composites with additives that improve thermal insulation properties are becoming increasingly popular. These materials have high strength, resistance to chemical attack and durability. Phase-change materials are capable of storing and releasing heat as the temperature changes. This makes it possible to smooth out temperature fluctuations in heating systems and increase their efficiency (Figure).

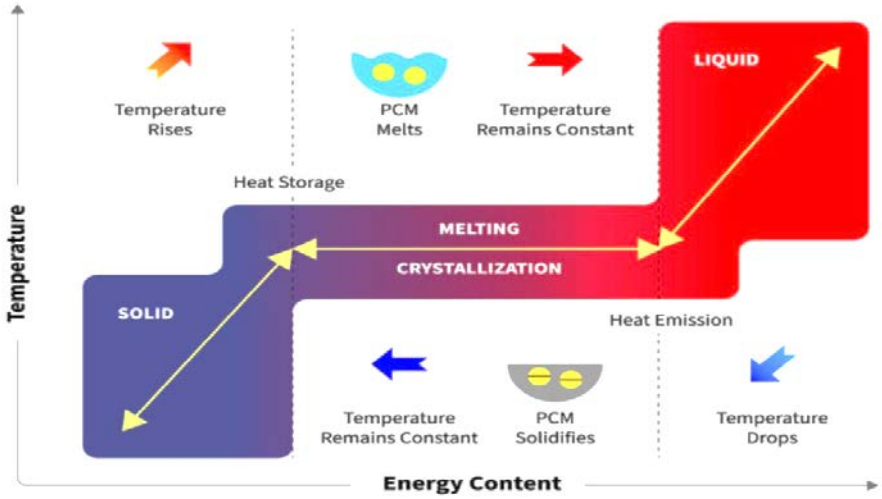

Figure. Phase-change materials work cycle

Installation of insulation of pipelines and other engineering systems involves various technologies and methods, which depend on the type of insulation material, operating conditions and specifics of the object. Roll insulation materials (e. g., mineral wool or glass wool) are glued or placed on the surface of pipelines. Installation may involve the use of adhesives, tape, or mechanical fasteners. Insulating sheathing or panels are pre-manufactured and then installed on the pipes. This reduces installation time and improves the quality of the insulation. Liquid insulation materials (e. g., polyurethane foam) are applied to the surface of pipelines using sprayers. This technology provides uniform coverage and the ability to fill hard-to-reach places.

Vacuum panels are used, which are installed around the pipelines. This technology requires a precise fit and can be more difficult to install, but provides excellent insulating properties. In some cases, special electrical systems (e. g. electric heating) are used to protect against condensation and corrosion, which can be integrated into the insulation. Special adhesives and sealants that can withstand high temperatures are used to provide airtightness and moisture protection. Large industrial facilities often use automated systems to install insulation, which can improve the speed and quality of work. Some types of insulation may use specialized machines and tools, such as polyurethane foam extruders or liquid insulation application devices [4].

Each of these technologies has advantages and disadvantages, and the choice of installation method depends on the specific application, insulation requirements and project budget. Injection technology creates seamless insulation envelopes around pipelines, which minimizes the potential for cold bridges and improves overall system efficiency. The use of thermographic methods to monitor insulation quality allows for timely identification of defects and necessary maintenance. Integration of temperature and humidity sensors into the insulation system allows for real-time monitoring of pipeline condition and prevention of emergencies. Environmental aspects of installing insulation for pipelines and other engineering systems are an important part of the process, as they can have a significant impact on the environment.

Environmentally friendly and safe insulation materials (e.g., natural fibers such as cellulose or sheep’s wool) should be used to help reduce environmental impact.

Insulation materials should be certified to environmental standards (e. g., LEED, ISO 14001). The process of manufacturing insulation materials can include carbon dioxide and other pollutants. Choosing materials with a low carbon footprint can help minimize this impact. It is important to consider the energy intensity of the production and transportation of insulation materials. Good insulation reduces the energy used to heat and cool buildings, which in turn reduces greenhouse gas emissions. Energy efficient buildings contribute to a more sustainable use of resources. Some insulation materials can emit volatile organic compounds (VOCs) that can negatively affect indoor air quality. Choosing low-VOC materials can help improve the indoor atmosphere. It is important to consider the ability to dispose of or recycle insulation materials at the end of their life cycle. Some materials can be recycled, while others may pose a problem for disposal. Some insulation materials also provide sound insulation, which can help to improve quality of life and reduce noise levels in living and working areas. By taking these aspects into account, the negative environmental impact can be significantly reduced [5].

Innovative approaches to pipe insulation in heating systems open new horizons for energy efficiency and sustainable development. The use of modern materials and technologies not only reduces heat losses, but also contributes to improving the environmental situation. The future of the heating industry lies in the integration of advanced solutions that will help meet the challenges of the present.

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УДК 004.93'1

AUTOMATION OF QUALITY CONTROL PROCESSES IN INDUSTRY USING COMPUTER VISION

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Abstract. This article deals with the application of computer vision technologies for automation of quality control processes at industrial enterprises. Approaches, algorithms and systems used for visual analysis of products are described. A comparative analysis of various methods of image processing and artificial intelligence is carried out, and the prospects and limitations of these technologies for improving the efficiency and accuracy of quality control in industry are discussed.

Keywords: deep learning, computer vision, convolutional neural networks, quality control, defect detection.

АВТОМАТИЗАЦИЯ ПРОЦЕССОВ КОНТРОЛЯ КАЧЕСТВА В ПРОМЫШЛЕННОСТИ С ИСПОЛЬЗОВАНИЕМ КОМПЬЮТЕРНОГО ЗРЕНИЯ

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Аннотация. В данной статье рассматривается применение технологий компьютерного зрения для автоматизации процессов контроля качества на промышленных предприятиях. Описываются подходы, алгоритмы и системы, используемые для визуального анализа продукции. Проводится сравнительный анализ различных методов обработки изображений и искусственного интеллекта, а также обсуждаются перспективы и ограничения применения данных технологий для повышения эффективности и точности контроля качества в промышленности.

Ключевые слова: глубокое обучение, компьютерное зрение, сверточные нейронные сети, контроль качества, выявление дефектов.

Modern industry is faced with increasing requirements to product quality, which is due to both high competition in the global market and increased consumer expectations. In such conditions, product quality control becomes one of the most important tasks, on which the company's reputation, level of competitiveness and financial results directly depend. Traditional methods of quality control, such as visual inspection by operators or mechanical measurement methods, have a number of disadvantages: they are labor-intensive, time-consuming and costly, and depend on the human factor, which increases the risk of errors and reduces efficiency. Thus, there is a need for automation of the quality control process that can provide consistent, accurate and fast results.

Visual inspection by an operator, being the traditional method of quality control, often fails to provide adequate accuracy, especially with high production volumes and high quality standards. Human error, fatigue, and the eyes' limited ability to perceive small defects and color differences result in defective products that may pass inspection and reach the customer. In addition, the significant amount of work required to perform visual inspection in large plants results in increased personnel costs and time for inspection operations. These disadvantages of traditional methods are particularly relevant to highly automated, high-volume manufacturing facilities, where even small increases in inspection accuracy can significantly impact product quality and reduce costs.

The advantages of quality control in industry using computer vision are as follows:

1. *High accuracy and objectivity of inspection.* The computer vision system eliminates the influence of human error, which reduces the likelihood of errors due to fatigue, loss of concentration or subjective judgment. The automated system is able to detect the smallest defects that may not be visible to the operator, especially during long shifts or high work rates. The result is objective and consistent quality control throughout the production process.

2. *Processing speed.* The use of computer vision enables real-time quality inspection. The system is able to process images and detect defects in a fraction of a second, which significantly reduces the time it takes to inspect each product. This speed is especially important on high throughput production lines where traditional inspection methods (visual inspection or mechanical inspections) can slow down the process. Automating inspection also allows human resources to be reallocated to more complex tasks that require an analytical approach.

3. *Cost-effectiveness.* Automating quality control processes reduces the need for personnel, resulting in lower operating costs. Also, the use of computer vision contributes to a significant reduction in the output of defective products, which reduces the cost of product returns and additional inspections. In the long run, the implementation of such a system can improve the economic sustainability and competitiveness of the company.

4. *Flexibility and scalability.* Computer vision systems are highly adaptive, as their algorithms and models can be reconfigured to detect different types of defects or to handle different types of products. By utilizing flexible convolutional neural network

architectures, the model can be trained to handle new products or changing parameters with minimal change to the existing infrastructure [1].

Comparison with traditional quality control methods

Traditional inspection methods, such as visual inspection or the use of mechanical measuring devices, are widely used in industry but have several drawbacks.

Accuracy. Operator-guided visual inspection has limitations in recognizing small defects, especially if the inspection is manual at high production rates. Computer vision, on the other hand, is able to capture even minor defects and operate at a high level of detail.

Speed. Traditional methods take longer than automated systems because they require human involvement. For example, an operator not only needs to scrutinize each object, but also make a decision about its quality. Computer vision accomplishes these tasks in milliseconds.

Human Factors. In traditional inspection, the operator is subject to fatigue, emotional state and other subjective factors that affect inspection results. An automated system provides a consistent level of accuracy and stability [2].

However, traditional inspection methods can be useful in the case of non-standard defects or unique production situations that are still difficult to identify with algorithms. In such cases, the operator can also assess the context of the situation, not just the specific defects.

Limitations and challenges of using computer vision in industry

Despite the high results, the application of computer vision in industrial quality control also has a number of limitations that need to be considered when implementing such systems.

1. *Data quality and quantity requirement.* To train a deep learning model, a large amount of data representing possible defects and their variations is required. At the same time, the images should be of high quality and variety. With limited time and budget for data collection, this can be a major obstacle for rapid system integration. In such cases, additional funding may be required to create high quality training datasets and to use synthetically generated images or data augmentation techniques.

2. *Sensitivity to lighting conditions and image quality.* Computer vision often depends on stable lighting conditions, image clarity and resolution. Changes in illumination can lead to errors in defect recognition, as the system may misinterpret visual data. The solution may be to install additional lighting fixtures on the production line or to use adaptive image correction techniques.

3. *High cost of implementation.* At the initial stage, the integration of computer vision system requires significant costs. It is necessary to purchase equipment (cameras, servers for data processing), train the model and conduct testing. In the long run, these costs are offset by savings in personnel and reduced scrap rates, but in some cases the initial investment can be significant.

4. *Model limitations in a changing product mix.* When the product mix changes or new products are introduced, the model may need to be reconfigured or retrained, which requires additional time and resources. In a dynamic market, this can be a challenge for businesses that frequently launch new products. A solution to this problem may be to regularly update models and use self-learning systems.

Opportunities for improvement and prospects for development

Algorithm and model development. Computer vision technologies continue to evolve, and new approaches such as transformers and self-tuning neural networks offer additional opportunities to improve the accuracy and adaptability of inspection systems. Improvements in algorithms may allow for better defect identification and reduced reliance on training data.

Integration with other systems and platforms. In the future, it is possible to integrate computer vision with other enterprise information systems such as Manufacturing Execution Systems (MES) [3] or Warehouse Management Systems (WMS). This will improve quality control at all stages of the production cycle, optimize processes and increase overall production efficiency.

Use of the Internet of Things (IoT). The use of sensors and transducers combined with computer vision technology will improve monitoring of equipment condition and product quality. For example, sensors can detect vibrations or temperature changes that are associated with defects, and computer vision will supplement this data with visual information, creating a more complete picture of potential problems.

Applying hybrid models and methods. Combined approaches, such as combining machine learning and classical image analysis techniques, can achieve greater resilience in the face of changing manufacturing parameters. Such hybrid systems can cope with variations in lighting, noise, and other changes that interfere with standard algorithms.

In today's high quality standards and competitive marketplace, automation of product quality control is becoming an important element of efficient manufacturing. Application of computer vision technologies allows to increase accuracy, speed and stability of control, providing enterprises with competitive advantages and economic benefits [4].

The use of computer vision eliminates the human factor, which is one of the main causes of errors in visual inspection, and provides a high level of defect detection even at high production volumes [5]. In addition, the system is much faster than traditional methods and can operate around the clock without reducing efficiency, which is especially valuable for large production facilities.

Nevertheless, implementing such systems requires significant resources: quality equipment, stable lighting conditions and, most importantly, a large amount of data for model training. Costs at the initial stage can be high, which may limit the application of this technology in small and medium-sized enterprises.

To address these limitations, a promising direction is to further develop algorithms that are robust to changing lighting conditions and other environmental parameters, as well as integrating computer vision systems with other production control systems and using synthetic data for training. These improvements will not only improve the accuracy and speed of the system, but also reduce the cost of implementation and operation.

Thus, automation of quality control using computer vision is a promising area for improving the efficiency and competitiveness of enterprises, and it is expected that with the further development of technology, this area will play an increasingly important role in industry.

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УДК 621.3.051

PROSPECTS AND PROBLEMS OF USING DC POWER LINES

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Abstract. The article deals with the usage of direct current transmission lines for electric power transmission. An analysis of the impact of DC transmission lines on the energetic characteristics of transmission lines and on the environment is given. As a result, possible ways of solving the existing challenges to achieve sustainable development in this area are proposed.

Keywords: power transmission line, DC power lines, AC power lines, comparison of DC and AC power lines, development prospects.

ПЕРСПЕКТИВЫ И ПРОБЛЕМЫ ИСПОЛЬЗОВАНИЯ ЛЭП ПОСТОЯННОГО ТОКА

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Аннотация. В данной статье рассматривается использование линий электропередачи постоянного тока для передачи электроэнергии. Приводится анализ влияния линий электропередачи постоянного тока на энергетические характеристики линий электропередачи и на окружающую среду. В результате предложены возможные пути решения существующих проблем для достижения устойчивого развития в этой области.

Ключевые слова: линия электропередачи, ЛЭП постоянного тока, ЛЭП переменного тока, сравнение ЛЭП постоянного и переменного тока, перспективы развития.

DC power transmission lines are becoming more and more relevant in modern energy, offering new opportunities for long-distance transmission of electricity with minimal losses. Given the growing interest in renewable energy sources and the need to integrate various energy systems, DC power lines represent a key element for creating an efficient and sustainable energy infrastructure.

A direct current line is a set of electrical installations, devices and wires used to convert alternating current into direct current for its further transmission over a long

distance, followed by its conversion to alternating current. They are most often used to connect independent power systems operating in non-synchronous mode 2, in underground and underwater versions with a length of more than 50 km and in land connections with a length of more than 800 km [1].

The technical features of DC power lines are as follows:

1. The limit of the transmitted power along the line does not depend on its length and is significantly greater than that of AC power lines.

2. The concept of a limit on static stability, characteristic of overhead AC power lines, is removed.

3. Power systems connected by overhead DC power lines can operate asynchronously or with different frequencies.

4. Only two wires are required instead of three, or even one if earth is used as the second [2].

Today, the importance of DC power lines in modern power engineering lies in the following aspects:

– *Cost-effectiveness.* DC power lines allow you to transfer large amounts of electricity over long distances with less losses than AC power lines. Depending on the line voltage and the method of current conversion, losses can be reduced to 3 % per 1000 km.

– *Efficient use of electricity sources remote from the load power nodes.* The transmission of energy via a high-voltage DC power line allows direct transmission from the power plant to the consumer, for example, to remote areas.

– *Increasing the capacity of the existing power system in cases where it is difficult or too expensive to install additional AC power lines.*

– *Transmission of electricity between unsynchronized AC power systems.* This helps to increase reliability by preventing cascading failures due to phase out-of-sync between individual parts of a large power system.

– *Transmission of electricity between AC power systems operating at different frequencies.* This method of transmission increases the stability of power systems, since, if necessary, they can use energy reserves from incompatible power systems.

When considering the technical features and importance of DC power lines in modern electric power industry, it is important to pay attention to the comparative advantages and disadvantages with traditional AC power lines. Despite the fact that both technologies play a key role in the transmission of electricity, they have different characteristics that affect their application depending on specific conditions and requirements.

The main advantage of direct current over alternating current is the absence of frequency and phase parameters and, therefore, easier control of the transmission system – when using direct current transmission, there is no need to keep all sources in the system synchronously. But there are also a number of other advantages:

– Increased stability of the transmission system – in the case of widely used 2-pole circuits, the line can operate with half the capacity in case of failure of one of the conductors.

– Lower transmission losses over long distances – approximately 3 % loss per 1000 km of HVDC transmission.

– When a certain transmission distance is exceeded, HVDC has lower acquisition costs compared to the AC option.

– Taking into account the growing environmental requirements, which often complicate the construction of new overhead lines, it is possible to use extended underground cable lines, despite their many times higher purchase cost.

– Compared to 3-phase alternating current systems, only 2 conductors are sufficient for direct current transmission, or 1 in the case of a return current through the ground.

– Shorter insulation distances than with alternating current at the same effective voltage value – there is no need to increase the maximum value as with alternating current.

– The ability to convert existing AC lines to DC – the third wire can serve as a backup, which will increase the reliability of transmission.

– The ability to control the direction and magnitude of the transmitted power.

– There is no need for reactive power compensation stations, unlike AC lines [3].

Areas of application of DC power lines are as follows:

– transmission of high power over long distances via overhead power lines;

– transmission of electricity via cable lines over 30-50 km long, including through water barriers via underwater cables over long distances (over 500 km);

– deep power inputs in megacities;

– connection of generation based on renewable energy sources to existing electrical systems;

– power supply to islands and remote regions with weak electrical systems or without their own power sources;

– intersystem connections;

– limitation of short-circuit currents in high-power power systems and megacities by separating individual parts of the power system through DC power lines.

The efficiency of DC power lines lies in the ability to transfer large amounts of electricity over long distances with less losses than AC power lines. Depending on the line voltage and the method of current conversion, losses can be reduced to 3% per 1000 km.

The efficiency of AC transmission lines is due to the simplicity and cheapness of electricity transformation, which reduces transmission losses over a distance. However, the disadvantages of such lines include large voltage losses over a distance compared to DC lines.

Thus, the choice between DC and AC power lines depends on the specific conditions and tasks of power transmission: for long lines it is more profitable to use DC power lines, and for small and medium-sized ones AC would be more suitable [4].

Despite the many advantages that DC power lines offer, their implementation faces a number of serious problems and challenges. Let us consider them in more detail.

1. High capital costs for construction

One of the main obstacles to the widespread distribution of DC power lines is the high capital costs for the construction and installation of such systems. Unlike traditional AC lines, which already have a well-developed infrastructure, DC transmission lines require significant investments in new equipment and technologies.

This includes:

– Converters: high-voltage converters, which are necessary to convert alternating current to direct current and vice versa, are expensive and require a high degree of precision in production.

– Cables and insulation materials: special cables designed for direct current transmission also have a high cost, especially when it comes to underwater or underground lines.

– Infrastructure: the construction of new lines requires significant land costs, permits and the construction of auxiliary facilities.

These high initial investments can be a deterrent for many energy companies and governments, especially in a tight budget environment.

2. Technical difficulties and the need for new technologies

The introduction of DC transmission lines is associated with a number of technical difficulties that require the development and application of new technologies.

The main challenges include:

– Compatibility with existing systems: the integration of DC power lines with existing AC networks requires complex solutions to ensure compatibility and reliability of both systems.

– The need for highly qualified personnel: the development, installation and maintenance of DC transmission lines require highly qualified specialists, which can become a problem in the context of a shortage of personnel in the energy industry.

– Development of new standards: the emergence of new technologies requires the creation of new standards and norms, which can take a lot of time and resources.

3. Environmental and social aspects

When designing and building DC power lines, it is necessary to take into account environmental and social aspects that can cause public discontent and protests.

The main problems include:

– Ecosystem impacts: the construction of new lines can lead to the destruction of natural ecosystems, changes in animal migration routes and environmental degradation.

– Social conflicts: DC power transmission line projects can affect the lands of local communities, which can cause social conflicts and resistance from the population. Public participation and transparency of the decision-making process are becoming key factors for successful implementation.

– Problems with land use: the need for large areas for the construction of power lines can lead to conflicts with other types of land use, such as agriculture or nature conservation.

Therefore, it is important to take into account that this technology requires an integrated approach that takes into account both economic and technical,

environmental and social aspects. Overcoming these problems will be the key to the successful integration of new technologies into the energy infrastructure.

The future of DC power transmission lines

1. Technology development prospects

Direct current transmission lines (DC transmission lines) are becoming increasingly relevant in the context of growing demands for long-range transmission of electricity and the integration of renewable energy sources. Technological advances in high-voltage direct transmission (HVDC) are opening up new horizons for energy infrastructure.

Modern HVDC systems have a number of advantages, including lower transmission energy losses, the ability to connect remote renewable energy sources and improved network stability. Further development of technologies is expected in the coming years, such as:

– Multiple conversion systems: advanced inverters and converters that provide more efficient conversion of alternating current to direct current and vice versa.

– Integration with smart networks: increasing the interaction of DC power lines with intelligent networks, which will optimize energy distribution and increase the reliability of the system.

– Sustainable materials and technologies: development of new conductors and insulation materials that can cope with high loads and extreme conditions.

These technological advances will help create a more sustainable and efficient energy infrastructure capable of meeting the challenges of climate change and increasing electricity demands.

2. Recommendations for energy companies

For the successful implementation and development of DC power lines, it is necessary to consider a number of strategies and recommendations:

– Investment in research and development: public and private organizations should actively invest in R&D aimed at HVDC innovation in order to accelerate the introduction of new technologies and improve their commercial viability.

– Creation of a regulatory framework: it is necessary to develop a clear regulatory and legal framework that will facilitate the integration of power lines into existing energy systems and ensure the protection of the interests of all market participants.

– Stimulating cooperation: energy companies, government agencies and scientific institutions should actively cooperate to share knowledge and experience, which will accelerate the introduction of new technologies and practices.

– Education and training: It is important to organize training and advanced training programs for HVDC specialists to ensure that they have the necessary knowledge and skills to work with new technologies.

– Integration with renewable sources: Energy companies should actively develop strategies for integrating power lines with renewable energy projects, which will help create a more sustainable and environmentally friendly energy system [5].

Thus, the use of direct current transmission lines represents a significant step forward in the development of energy infrastructure, offering many prospects such as

efficient transmission of electricity over long distances, integration of renewable energy sources and reduction of transportation losses. However, despite the obvious advantages, the introduction of DC power lines faces a number of serious problems and challenges.

High capital costs for construction, technical difficulties and the need for new technologies, as well as environmental and social aspects require a careful approach from energy companies and government agencies. For the successful implementation of projects, it is necessary to create favorable conditions, including investments in research and development, the formation of a regulatory framework and active involvement of the public in the decision-making process. The future of DC power lines depends on the ability of stakeholders to overcome existing obstacles and effectively integrate new technologies into the existing energy system.

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УДК 72.012

CULTURAL ASPECTS OF INDUSTRIAL DESIGN

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Abstract. The article examines the cultural aspects of industrial design as a key element influencing the creation and perception of products. It analyzes how cultural traditions, social norms and historical context shape design decisions and consumer preferences. An assessment of different cultural approaches to design reveals their impact on the functionality, aesthetic perception and sustainability of products. The article highlights the importance of incorporating cultural factors into the development and marketing process, and offers guidance for designers seeking to create products that are universally appealing and culturally relevant.

Keywords: industrial design, cultural aspects, design solutions, aesthetics, social norms, historical context, consumer preferences, product sustainability, cultural diversity, cross-cultural design.

КУЛЬТУРНЫЕ АСПЕКТЫ ПРОМЫШЛЕННОГО ДИЗАЙНА

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Аннотация. В статье рассматриваются культурные аспекты промышленного дизайна как ключевой элемент, влияющий на создание и восприятие продуктов. Анализируются, как культурные традиции, социальные нормы и исторический контекст формируют дизайнерские решения и потребительские предпочтения. Оценка различных культурных подходов к дизайну позволяет выявить их влияние на функциональность, эстетическое восприятие и устойчивость продуктов. Статья подчеркивает важность учета культурных факторов в процессе разработки и маркетинга, а также предлагает рекомендации для дизайнеров, стремящихся создать универсально привлекательные и культурно значимые изделия.

Ключевые слова: промышленный дизайн, культурные аспекты, дизайнерские решения, эстетика, социальные нормы, исторический контекст,

потребительские предпочтения, устойчивость продуктов, многообразие культур, кросс-культурный дизайн.

The relevance of the research topic is explained by globalization and the expansion of markets, where products must be adapted to diverse cultural and social contexts. Industrial design cannot ignore cultural differences as they affect consumer preferences and product acceptance. With this in mind, successful companies continue to rethink their design approach to meet local requirements. Examples include adapting packaging, design style and functionality to specific cultural practices.

The purpose of this study is to analyze in detail the influence of cultural factors on industrial design, as well as to develop practical recommendations for creating universal and localized design solutions. Achieving this goal will help designers and companies better understand their markets and effectively engage with their target audiences.

To achieve this goal, it is necessary to solve the following tasks: to study the cultural factors that influence industrial design, such as symbolism, color preferences and formal styles; to determine the typology of cultural differences by researching how different cultures perceive the same objects; to analyze the ethnic and national features of design, for example, preferences in materials and shapes that may reflect the uniqueness of cultures; to explore the concept of design localization and to find successful examples of adaptation in different markets; to consider problems and challenges related to localization, such as necessary changes in production processes; to describe the principles of universal design and analyze how they can be reconciled with unique cultural elements.

It is necessary to apply such research methods as:

- comparative analysis: research of products adapted to different cultures to identify specifics and differences,
- interviews with designers: obtaining insights from practitioners working in an international environment,
- case stages: analysis of successful examples of adaptation, such as IKEA, Apple and Coca-Cola.

In addition to the objective world, we also live in a world of man-made protocols – fashions, social habits and conventions – and encountering this world, especially at high speed, is often as painful as the objective world [1]. Therefore, it is necessary to study all aspects that influence the development of design. Cultural factors such as traditions, customs and symbolism affect the perception and functionality of design.

1. **Color preferences**. In China, red symbolizes good luck and wealth, whereas in Western countries, white is often associated with purity and simplicity. Brands like Coca-Cola adapt their marketing materials to different cultural color associations.

2. **Traditional shapes**. Japanese design mainly uses minimalist and natural shapes, as is the case with Muji furniture design (Figure 1), which embodies the philosophy of “less is more”.

3. **Functionality of products**. In the Nordic countries, the need for thermal insulation and compactness dominates due to the limited space, which can be seen in the design of compact houses and furniture.

Figure 1. Muji Chair

The typology of cultural differences helps to understand how different cultures perceive and interpret the same objects or design solutions [2]. The key aspects of the typology include:

1. **Perception of aesthetics.** In Western countries, such as the United States and Western European countries, there is an emphasis on individuality and originality. For example, furniture design often uses bright colors, unusual shapes and asymmetrical lines, reflecting the current state of art and design. In contrast, in Eastern cultures such as Japan and China, aesthetics are often based on the principles of minimalism and symmetry. For example, the Japanese "wabi-sabi" style values imperfection and naturalness, which is manifested in the use of simple shapes and natural materials such as wood and stone. In some countries in Africa and South America, the choice of bright, saturated colors and bold patterns is the norm, reflecting their cultural identities and traditions (Figure 2).

2. **Functional requirements**. In the Nordic countries, the emphasis on functionality is also accompanied by simplicity and conciseness of forms. For example, furniture from brands such as IKEA is becoming popular due to convenience and multifunctionality, which is especially important when space is limited. In some Asian countries, such as India, products may be multi-functional, which implies the need to use a single product for multiple purposes, such as traditional decoration elements that serve both storage and decorative purposes. Additionally, many cultures have traditional shapes and designs that continue to be used. For example, Arabic architecture has arched structures and carved elements that reflect the unique visual codes of this region.

3. **Social contexts**. In countries with collectivist cultures, such as Japan and China, the focus on group consent is often reflected in design, where products such as shared furniture are created with shared spaces in mind [2]. In contrast, in individualistic cultures such as the United States, the emphasis may be placed on the uniqueness of individuals, which makes it possible to create personalized and customized products. Furthermore, designers must consider religious practices that may influence the perception of the product. For example, in Muslim countries, some furniture design must take into account specific needs in accordance with the traditions of prayer and purification. Moreover, different levels of education and historical contexts can also affect the perception of design. For example, in countries with rich

cultural heritage there may be a heightened focus on traditional elements and materials that are taken into account in the design process of new products.

Figure 2. African ornament

Ethnic and national characteristics influence the choice of materials and visual elements.

1. **Use of local materials**. African design often uses natural materials such as wood and straw, as seen in traditional wicker baskets.

2. **Symbolism**. Native American design contains symbols based on local myths and legends, such as textiles and interior design.

3. **Formal styles**. Architecture in Arab countries often includes domes and arches, while in Europe straight lines and angles are widely used, as in modern Scandinavian design.

By identifying the factors that influence design adaptation, it is possible to define the principles of design localization. Design localization is the process of adapting products and solutions to the specific needs and cultural characteristics of the target audience. This concept covers several key aspects, let us cinsider them in more detail.

1. **Adaptation of visual and functional elements**. It is important to consider language aspects when making localization decisions. For example, app interfaces should be translated and adapted to cultural contexts to avoid misunderstandings and provide a comfortable user experience. Complex texts can be simplified or replaced with visual elements in cases where it is necessary for better understanding. Logos and visual identities may need to be adapted for different markets. For example, VEGETA, when entering the Chinese market, replaced the packaging using traditional Chinese symbols, which made the product more attractive to consumers. In some cultures, it may be necessary to rethink the functional elements of products. For example, large cars may be preferable in countries with wide roads and low population density, while in countries with dense urban areas and narrow streets, such as Japan, compact cars are more popular.

2. **Taking into account cultural preferences and consumption patterns**. Some products may require variations based on taste and texture preferences in different cultures. For example, Starbucks adapts its drinks for different markets by

offering special flavor series, such as matcha green tea in Japan, to match local tastes. Brands can use local materials and technologies in the production process. For example, in Morocco, traditional clay pots called “tajines” are often used in the design of kitchen utensils, reflecting local traditions and preferences (Figure 3). Brands can also create special versions of products for national holidays. For example, Coca-Cola produces themed packaging for Christmas, but takes into account various holidays, such as Diwali in India.

3. **Localization challenges**. To some extent, too careful localization can cause the product to lose its original identity, which can ultimately negatively affect brand perception. For example, if a world-famous clothing brand merges with local fashion and loses unique features, this can lead to a loss of interest from consumers who previously valued exclusivity. In addition, localization may require a change in manufacturing approaches and technologies, which can cause additional costs and increase the time to launch the product. For example, redesigning may require rethinking the supply chain and logistics. It should be emphasized that misinterpretation of cultural characteristics can lead to a negative perception of the brand. For example, the inappropriate use of local symbols can cause insult or dissatisfaction among the target audience. As a result, successful localization requires a deep understanding of cultural aspects, product adaptation actions and consideration of possible challenges that may arise in the process of integration into a new market [3].

Figure 3. Moroccan tagine

Certain challenges arise when adapting design to new cultural contexts, e. g. risk of losing brand identity (too much localization can lead to a loss of brand uniqueness and value in international markets); difficulties in production processes (adaptation may require changes in production technologies, which can increase time and costs); biased perceptions (cultural barriers and misunderstandings can lead to a designer’s choice not being understood or accepted by the local audience).

In connection with the above-mentioned problems, designers are coming to create universal products. Universal design involves creating products that are suitable for all users regardless of their cultural context [3]. Principles of universal design may include:

1. Safety and convenience: products should be safe and convenient for all users, such as adaptive technologies in furniture.

2. Ease of use: interfaces and products should be intuitive (for example, smartphones with universal designs that use gestures instead of text).

3. Flexibility: products should adapt to different user needs without significant changes (for example, folding chairs and tables suitable for various events).

Creating a balance between universal and unique design is crucial. For example:

1. Functionality: universal design can be adapted for many, but in order to remain attractive in different cultures, local preferences must be taken into account.

2. Emotional response: unique elements such as local patterns or colors can make a product more appealing without losing its functionality.

3. Adaptability: a successful product may have standard elements, but must also consider cultural textures and elements to ensure that the culture is reflected.

In order to develop universal design solutions, it is necessary to conduct preliminary research: it is important to study the cultural characteristics of the target audience through surveys and market analysis, to hire local designers: their knowledge and understanding of local traditions and preferences will help to create a more appropriate product, to create adaptive models: to work out the possibility of modifying products at the place of use, for example, depending on preferences in color, materials or sizes.

As a result of the study, it was revealed that attention to cultural aspects in industrial design significantly affects the success of products. Given the diversity of cultural factors, companies can develop more attractive and functional designs.

Modern design, based on respect for cultural heritage, contributes not only to the preservation of historical elements, but also to their adaptation to new living conditions [4]. Understanding cultural aspects allows companies to create products that not only meet consumer needs, but also take into account local traditions and preferences. This contributes to the company’s growth in the global market.

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УДК 725.4

INDUSTRIAL ARCHITECTURE IN THE AGE OF AUTOMATION AND ROBOTIZATION

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Abstract. The article discusses the impact of automation and robotization on industrial architecture. Modern technologies are changing the layout and design of industrial spaces, making them more flexible and adaptive to changing conditions. The focus is on designing areas to integrate robotic systems and smart technologies. Safety measures, ergonomics and environmental aspects of sustainable construction are discussed. Special attention is given to modular design, intelligent control systems and green technologies to improve the efficiency and sustainability of manufacturing facilities.

Keywords: production zones, ergonomics, flexible spaces, modular technologies, green technologies.

ПРОМЫШЛЕННАЯ АРХИТЕКТУРА В ЭПОХУ АВТОМАТИЗАЦИИ И РОБОТИЗАЦИИ

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Аннотация. В статье рассматривается влияние автоматизации и роботизации на промышленную архитектуру. Современные технологии меняют планировку и дизайн производственных помещений, делая их более гибкими и адаптивными к изменяющимся условиям. Основное внимание уделяется проектированию зон для интеграции роботизированных систем и интеллектуальных технологий. Обсуждаются меры по безопасности, эргономике и экологические аспекты устойчивого строительства. Особое внимание уделено модульному проектированию, интеллектуальным системам управления и зеленым технологиям для повышения эффективности и устойчивости производственных объектов.

Ключевые слова: производственные зоны, эргономика, гибкие пространства, модульные технологии, зеленые технологии.

Modern industrial architecture is undergoing a revolution thanks to the introduction of automation and robotization. The impact of these technologies on production processes is changing not only the internal layout and design of buildings, but also the general approaches to the design, operation and flexibility of production facilities. New trends and needs require the adaptation of existing designs and the creation of fundamentally new solutions that will ensure efficiency, environmental friendliness and safety in the context of modern manufacturing processes [1].

The impact of automation and robotization on the layout and design of manufacturing facilities

Manufacturing facilities have traditionally been designed with a focus on fixed flow lines, minimizing human involvement in hazardous operations and optimizing resources. However, with the introduction of automated systems and robotics, the design of such spaces is changing at several key levels:

– Flexibility and adaptability of spaces. The automation of manufacturing has led to the need for more flexible manufacturing spaces that can quickly adapt to changes in technology and market demand. Modern manufacturing spaces are designed to allow for the relocation of equipment, reconfiguration of production lines, and integration of new components without the need for complete building renovations. Flexibility is achieved through the use of modular designs that allow for zoning and equipment changes at minimal cost. These solutions allow the production process to be optimized and adapted to new challenges, whether it is the production of small batches or the transition to new products.

– Considering the needs of robotic systems. Robotic systems require certain spatial conditions. Firstly, robotic arms often have large dimensions and ranges of motion, which require enlarged working areas. To achieve this, ceiling heights are increased and space is organized to minimize obstacles and create optimal routes for equipment movement. In addition, automated systems require specialized engineering solutions to support them. This can include a reinforced power supply, cooling and ventilation systems, and robust communication networks for robot control and data exchange. Ergonomics in the design of production facilities should allow easy access to these systems for regular maintenance.

– Safety and ergonomics. The introduction of robots and automated systems also affects safety and ergonomics aspects. Production areas must be equipped with special barriers and safety systems, such as light barriers and laser sensors, to avoid collisions between people and machines. The architecture should include shared-use areas where operators and robots can work together safely, minimizing the risk of accidents [2].

Designing flexible spaces to integrate robots and intelligent systems

Flexibility in industrial spaces is becoming a key requirement with evolving automation technologies. The integration of robots and intelligent systems requires spaces that can adapt to new tasks and technologies. Let’s take a look at how this flexibility can be achieved:

– Modular design and scalability. A core element of flexible manufacturing spaces is modular design. Facilities and equipment are organized in such a way that they can be easily changed or scaled. An important aspect becomes the ability to move production modules – for example, mobile platforms for machines and work areas that can be adapted to new tasks with minimal effort. This approach also helps to save money and time on building renovations, as modules can be upgraded or replaced without having to demolish and erect new structures.

– Integration of intelligent control systems. Modern industrial facilities are being equipped with intelligent control systems that allow automatic regulation of equipment operation and coordination of different elements of the production process. For this purpose, production facilities are equipped with sophisticated systems of sensors and controllers that provide real-time communication. Integrating these systems requires designers to consider many factors, such as providing a reliable signal for wireless communication, minimizing potential interference and creating redundant data paths. Intelligent systems help improve productivity, optimize energy and resource use, and minimize the impact of human error on process efficiency.

– Compatibility with green technologies. Green technology covers many areas, including the design and construction of industrial buildings and their operation, eliminating negative impacts on the climate and the environment. Sustainability preserves nature and improves the quality of life [3].

Industrial architecture in the age of automation must also take environmental requirements and sustainability into account. This means using solutions to reduce energy costs, integrate renewable energy sources and reduce emissions. Robots and automated systems can consume significant amounts of energy, so it is important to incorporate energy-efficient technologies such as intelligent lighting, recycling and heat recovery systems. For example, façade glazing lets in 90 % of light and reduces energy consumption (Figure 1).

Figure 1. Example of facade glazing

To reduce heating and ventilation costs in buildings it is necessary to use modern building materials for the construction of facades The use of aerated concrete, which has environmentally friendly materials in its composition, in terms of strength

corresponds to conventional wall materials, but has high thermal insulation properties, which solves the problem of reducing energy costs (Figure 2).

Figure 2. Modern building materials

In the design of the upper building envelopes, operable roof structures have been developed, which preserves nature and improves the quality of life (Figure 3).

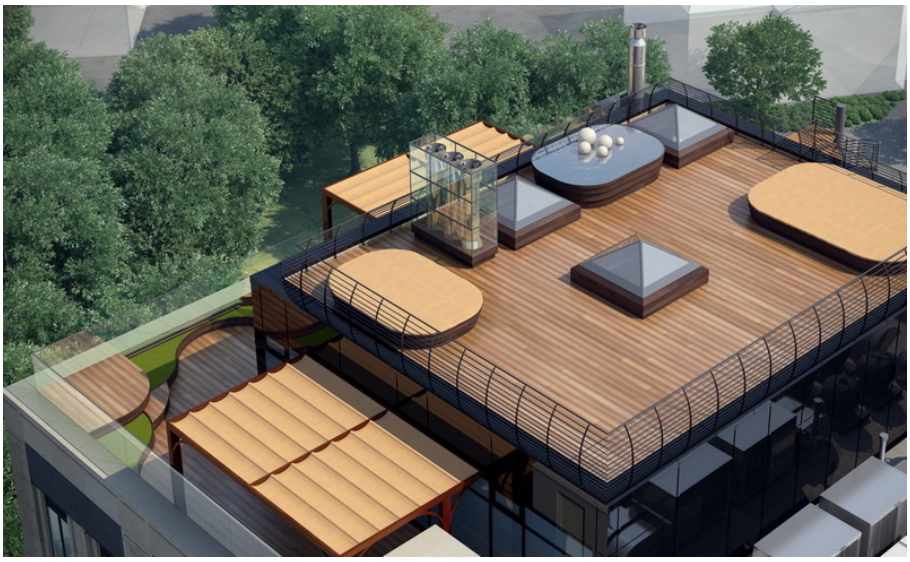

Figure 3. Example of a building with a maintained roof

– Creating areas for sharing and safe interaction with humans. Integrating robots with humans requires designing special areas where operators and robots can work together without risk. These could be workstations where employees perform more subtle operations while robots do major assembly or transportation. Such areas need to ensure both physical safety (through fencing or an automatic robot stop system) and operator comfort, which involves positioning equipment ergonomically and providing comfort [4].

Automation and robotization of production processes are radically changing industrial architecture, influencing design, space utilization and engineering solutions. Flexibility and adaptability are becoming key elements of modern industrial

construction, enabling companies to remain competitive in the face of rapidly changing technologies and market demands.

Modular design, intelligent control systems, sustainability and safety all need to be considered when designing manufacturing facilities in the age of automation. Such approaches help create efficient, environmentally friendly and safe manufacturing facilities that can adapt to new challenges and ensure sustainable industrial development without conflicting with green technology objectives [5].

Automation and robotization are not only changing industrial processes, but also transforming the facilities themselves, making them high-tech and ready for future challenges. Engineers, architects and automation specialists must work together to create facilities that will ensure the future of manufacturing at a new level.

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УДК 338.1

BUILDING ESG-STRATEGY AS A FACTOR OF INCREASING THE COMPETITIVENESS OF THE ENTERPRISE

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Abstract. This article analyses the influence of ESG-factors on the investment attractiveness of a company and brand reputation. The experience of application of sustainable development tools in the practice of Russian entrepreneurs is described. The peculiarities of definition of each component of ESG-factors are specified.

Keywords: sustainable development, ESG factors, sustainable development strategy, green investment, ecology, social sphere, corporate governance.

ПОСТРОЕНИЕ ESG-СТРАТЕГИИ КАК ФАКТОР ПОВЫШЕНИЯ КОНКУРЕНТОСПОСОБНОСТИ ПРЕДПРИЯТИЯ

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Аннотация. В данной статье представлен анализ влияния ESG-факторов на инвестиционную привлекательность компании, репутацию бренда. Уточняются особенности дефиниции каждой составляющей ESG-факторов. Описаны современные проблемы устойчивого развития и пути их разрешения.

Ключевые слова: устойчивое развитие, ESG-факторы, стратегия устойчивого развития, зеленое инвестирование, цели устойчивого развития, экология, социальная сфера, корпоративное управление.

The significance of sustainability and ESG in the modern world is undeniable. An increasing number of people are becoming conscious consumers, participating in environmental initiatives and supporting inclusive programs. ESG factors, which include environmental sustainability, social responsibility and corporate governance, are becoming critical criteria for both consumers and socially responsible investors seeking to invest in companies that are committed to making a positive impact on the

environment. Consequently, more and more real-world businesses are establishing dedicated sustainability divisions and departments and developing ESG strategies in response to evolving trends. Furthermore, the focus on sustainability extends beyond consumers and business leaders. In 2015, the United Nations adopted 17 Sustainable Development Goals (SDGs) that serve as a global framework for achieving a more equitable and sustainable future by 2030. These goals cover a wide range of social, economic and environmental aspects, as well as measurable quantitative indicators that reflect the progress of countries, industries or individual businesses in this area.

In this article the authors aim to show the significance and importance of having an ESG strategy for an enterprise. The development and implementation of ESG-policy provides large organizations and medium and small businesses with an opportunity not only to comply with legal requirements, but also to increase their competitiveness in the market due to a well-built marketing strategy with a focus on the values of sustainable development [1].

Let us conduct a detailed analysis of each component factor. ESG factors comprise three key components:

1. Environmental aspects

This component covers the impact of business on the environment. Modern businesses can demonstrate their commitment to the environment by reducing their carbon footprint, optimizing the use of resources, implementing renewable energy sources and managing waste. Adopting environmentally friendly technologies and practices such as recycling and sustainable farming also play an important role. Companies that invest in environmental sustainability often gain a competitive advantage and a better reputation among consumers. Here are some examples of usage: “Norilsk Nickel” – Mineralization of waste steam – absorption of greenhouse gases by tailings ponds, “Four Paws” pet shop chain – Eco-dog walking area made of recycled dry food packaging [2].

2. Social aspects

The social component of ESG emphasizes a company’s interactions with its employees, customers, suppliers, and the broader community. This encompasses transparency in hiring practices, equitable opportunities for employees, respect for human rights, and active engagement in local communities. Contemporary enterprises are encouraged to cultivate an inclusive corporate culture and uphold elevated standards of safety and health in the workplace. Engagement with stakeholders and the advancement of social initiatives further enhance the company’s positive image. Here are some examples of usage: “Technopolis” in Moscow – “Dobropolis” Corporate Volunteering Program, “SBER” – “SberKot” – Influencer of good deeds [2].

3. Governance aspects

This area concerns the internal organization and management of the company. Sustainable corporate governance implies the presence of effective strategies that ensure impartiality, transparency, and accountability. Modern enterprises must have clear mechanisms to prevent corruption, comply with legal norms, and uphold ethical standards. The issue of diversity in leadership is also important, as it contributes to more balanced and inclusive decisions. This point is manifested in the existence of

documents regulating the sustainable development of the company, aimed at preventing conflicts of interest and corruption.

One of the primary advantages of implementing ESG is the enhancement of the company's image. Organizations engaged in sustainable development attract the attention of customers, investors, and partners, which fosters trust and strengthens their reputation. This can subsequently result in increased sales and customer loyalty. Large enterprises such as "Gazprom", "Severstal" and "LUKOIL" are actively developing their environmental and social programs, which contribute to the growth of their investment attractiveness. "Gazprom", for example, is implementing projects to modernize the gas transportation system, aimed at reducing methane emissions. "Severstal" is pursuing an active policy on waste and water resource management, and "LUKOIL" supports social responsibility programs in the regions where it operates.

Improving the efficiency of a modern company is also possible through the implementation of ESG. Energy efficiency and waste reduction, for example, lead to cost reduction, which has a direct positive impact on the company's financial performance. Investing in sustainable technologies and innovations creates new opportunities for business growth and development [3].

In addition, ESG implementation is becoming a factor in attracting investment. Investors are increasingly focusing on sustainability factors when making investment decisions. Companies with high ESG scores can expect lower costs of capital as well as access to new sources of financing. International agencies compile ESG ratings to allow investors to compare companies. ESG ratings range from leader (AAA, AA), average (A, BBB, BB) to laggard (B, CCC). The level of a company's rating determines the attractiveness of its shares for responsible investors [4].

To summarize, the implementation of ESG in a modern enterprise not only meets the requirements of the time, but also creates significant advantages in the form of image enhancement, risk reduction, increased efficiency and attractiveness for investors. It is a strategic step that can ensure sustainable development and competitive advantages in the future.

"ESG business transformation is the process of changing and adapting a company to integrate ESG principles into all areas of its activities. This transformation is aimed at creating a sustainable and responsible business that considers the impact of its actions on the environment, society and management of internal processes" [5].

The stability of businesses adhering to ESG principles promotes long-term stability and risk control, which can improve financial performance. ESG-oriented companies can attract additional funding from investors who make business investment decisions based on the company's contribution to society. The application of ESG can also help improve operational efficiency, reduce costs and improve governance.

Research shows that companies with a high degree of ESG maturity can have higher shareholder value, better return on capital and attractiveness to investors.

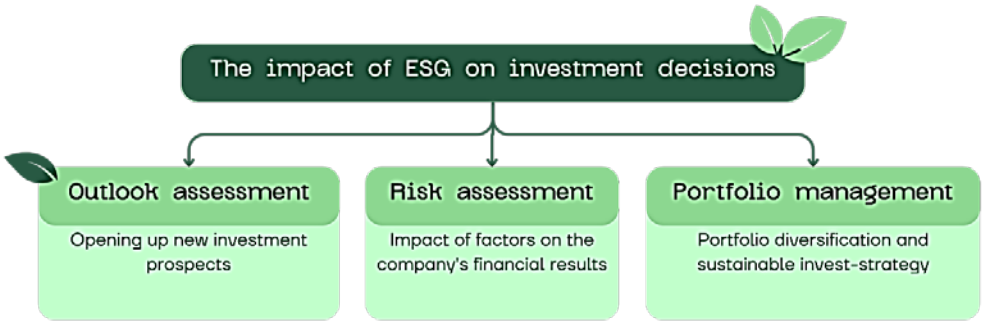

Figure. Influence of sustainable development factors on investment decision making

Next, we will consider the concept of ESG investing. This term most often refers to an investment strategy that considers environmental, social and corporate governance factors when selecting investment sites.

Investors believe that companies that follow ESG principles are more sustainable and profitable in the long term. Figure summarizes the opportunities and prospects that are gained by adhering to the concept of socially responsible investing.

Table – ESG features of investment funds

ESG Fund type	Characteristic
Index funds	Track indices consisting of companies with high ESG ratings
Active funds	Operated by managers who select companies with ESG factors in mind and actively influence their performance
Thematic funds	Invest in companies operating in a specific industry with high ESG potential, e.g. renewable energy, sustainable agriculture, biotechnology
Integrated funds	Consider ESG factors in their investment strategy along with financial performance. Impact of ESG on investment decisions
Excluded funds	Exclude from their portfolio companies engaged in activities that are ethically harmful, such as weapons, tobacco, fossil fuel production

Table presents a typology of ESG investing funds and the strategies followed by investors to make green investments.

The implementation of ESG principles is becoming an important factor in the sustainable development of companies and increasing their competitiveness. However, certain problems arise on the way to successful implementation of ESG principles. Businesses, in pursuit of newfangled trends, can make value-oriented mistakes. Here are some examples:

1. “Green PR”

It is ethically unacceptable for a business to launch environmental initiatives that the business does not believe in and to broadcast values that it does not really share. Such behavior deceives consumer trust and has a separate name, “green camouflage”

or “green PR”. The terms emerged in the 80s in the US when some hotels started encouraging guests to reuse towels rather than handing them in to the laundry. Customers did not appreciate this way of saving money on laundry under the guise of caring for nature.

2. Manipulations

This applies to social advertising, which should evoke a desire to help the environment rather than a feeling of guilt. For example, in 2020, the Russian branch of Greenpeace blamed women for polluting the planet with disposable hygiene products. Women’s organisations sharply criticised this position.

3. False statements

It is not worthwhile to claim green initiatives that business is not going to implement, or the environmental friendliness of a product if it does not possess such. In most regions, there are environmental activists who are keen to follow business statements closely. And if a company publicly promises to help the environment and fails to fulfil it, they are bound to notice it. A scandal cannot be avoided if the advertised environmental benefits of a product turn out to be false [6].

Also, one of the main problems is the lack of unified standards and methodologies for assessing ESG indicators. This makes it difficult to compare the results of different companies and regions. The Central Bank of the Russian Federation is actively working to resolve this problem, annually issuing recommendations for expert agencies to assess the ESG indicators of enterprises and organisations [7].

In addition, ESG implementation requires significant resources, including financial, human and technological resources. Many companies face a shortage of skilled staff and a lack of understanding of the benefits of ESG. There is also a risk of loss of revenue due to the additional costs of complying with ESG standards.

Another challenge is the resistance to change on the part of some companies and industries. They may fear a loss of competitive advantage or may not see the direct benefits of ESG implementation. As a result, the process of ESG implementation may slow down or even stop.

Despite the existing challenges, the prospects for ESG development look promising. Growing interest in sustainable development and social responsibility favors the spread of ESG practices. Governments and international organisations are actively developing standards and guidelines for ESG implementation, which contributes to the formation of a unified system of evaluation and comparison of results.

In addition, advances in technology are opening new opportunities for collecting and analyzing ESG data. Artificial intelligence (AI) and blockchain can help automate data collection processes, analyze risks and increase transparency of information.

In conclusion, the article demonstrates the growing importance of ESG factors in today’s world, reflecting profound changes in societal and economic priorities.

ESG has become not a minute trend, but a long-term strategy that is shaping new standards of responsibility and sustainability for business and investing.

The study proves the impact of ESG factors on the marketing attractiveness of companies, their investment reputation and brand image. The implementation of ESG practices helps to attract investors, improve competitiveness, reduce risks and increase

customer confidence. However, there are also problems with ESG implementation: lack of unified standards, lack of information, risks of ‘greenwashing’.

Despite these obstacles, ESG continues to evolve and its role in business and investing will only continue to grow. Technology plays a key role in ESG, enabling the collection of data, analyzing risk and increasing the transparency of ESG information.

In the future, we expect to see increased regulatory pressure on ESG, increased ESG investment practices and wider application of ESG across sectors. Companies that incorporate ESG factors into their operations in a timely manner will gain a competitive advantage and contribute to creating a more sustainable future.

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УДК 004.896

THE ROLE OF CHATBOTS IN CUSTOMER INTERACTION IN THE AGE OF DIGITALIZATION

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Abstract. The article analyzes the impact of digitalization on customer service, with particular attention being paid to the role of chatbots in transforming customer interactions. The benefits chatbots provide to companies are discussed, including instant responses to queries, 24/7 availability, and personalized service. The importance of integrating automated solutions and face-to-face interactions to achieve high levels of customer service in a rapidly changing digital world is emphasized.

Keywords: customer service, digitalization, chatbots, customer interaction, automation, human factor.

РОЛЬ ЧАТ-БОТОВ ВО ВЗАИМОДЕЙСТВИИ С КЛИЕНТАМИ В ЭПОХУ ЦИФРОВИЗАЦИИ

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Аннотация. В статье анализируется влияние цифровизации на клиентский сервис, при этом особое внимание уделяется роли чат-ботов в трансформации взаимодействия с клиентами. Исследуются преимущества, которые чат-боты предоставляют компаниям, включая мгновенные ответы на запросы, круглосуточную доступность и возможность персонализации обслуживания. Подчеркивается важность интеграции автоматизированных решений и личного общения для достижения высокого уровня клиентского сервиса в условиях быстро меняющегося цифрового мира.

Ключевые слова: клиентский сервис, цифровизация, чат-боты, взаимодействие с клиентами, автоматизация, человеческий фактор.

The first contact centers appeared simultaneously with the widespread use of telephony. They called customers (current or potential) and received incoming calls. With the spread of the Internet, there were operators working in chat rooms – windows

added to a company's website for exchanging messages or specially created dialogs in messengers where users could solve their problems.

Call center employees were divided into several lines. The operators of the first line, as a rule, worked strictly according to prescribed scripts for typical situations. In case of a complicated problem, the subscriber was switched to the second line with more qualified operators [1].

Maintaining a call center was quite costly. It was necessary to rent an office of sufficient area, hire the required number of people, conduct initial training, equip workplaces, and provide soundproofing so that operators did not interfere with each other. In addition, a specialist could be incompetent, rude to the client, or perform the work poorly. It was also required to maintain a quality control department that listened to calls and took action against violators. With the widespread transition to remote work, some of the problems have disappeared, but the human factor has not gone anywhere.

An alternative to maintaining a call center in-house was outsourcing companies specializing in telephone communication. This option is simpler and cheaper, but it has a number of disadvantages: it is more difficult for the operators to immerse themselves in the specifics of the work, and for the company to control its quality.

The development of technology has made it possible to automate part of the work of call centers. Answering machines have significantly reduced the load on operators. A person who called the line could select the problem he/she was interested in by pressing a button in the tone mode. This made it possible to automate the distribution of calls to operators of the required profile.

Nevertheless, the real revolution in communicating with customers occurred due to chatbots. This tool made it possible to free people from routine tasks. Currently live operators solve only really non-standard problems, and all tasks that can be solved by algorithms are transferred to bots. Let us consider this technology in detail.

A chatbot is a program that imitates a conversation with a live person. It can be created on the basis of scripts (scenarios that reproduce typical situations) or artificial intelligence (Figure).

Figure. Visualization of communication with a chatbot

A bot can communicate by voice or by correspondence. The subscriber in these two cases perceives the communication process differently, but from the technical point of view the program works in the same way. It analyzes the interlocutor's phrase, extracts key words from it and searches the database for the most appropriate answer. If necessary, the bot will ask to formulate the request differently or offer to transfer the communication to the operator [2].

In this article, we will look at how chatbots are changing customer service and what benefits they bring to companies and their customers.

One of the main benefits of chatbots is their convenience and accessibility 24/7. This means that customers can get answers to their questions at any time without waiting for an operator to respond. This approach greatly improves service quality and customer satisfaction. Chatbots can quickly process requests, providing information about products and services, as well as helping with ordering. This is especially relevant for e-commerce companies, where speed and convenience are crucial.

Another advantage is the ability of chatbots to personalize communication. They are able to remember user preferences, purchase histories, and previous interactions. This allows them to create a more targeted and relevant experience for each customer. For example, if a customer has previously been interested in a certain product category, a chatbot can provide up-to-date offers or discounts on those products. A personalized approach fosters customer loyalty and increases the likelihood of repeat purchases.

Chatbots can efficiently handle routine inquiries and frequently asked questions, reducing the employee workload. This allows them to focus on more complex queries and tasks that require human intervention. In this way, companies can increase overall team productivity and improve service quality. Furthermore, automating routine processes helps reduce customer service costs, which is an important factor for many businesses.

Chatbots not only interact with customers, but also collect data about their preferences and behavior, which provides for better analytics and feedback. The acquired information can be used to analyze service performance and identify areas for improvement. For example, if many customers are asking the same question, this may indicate a need to improve information on the website or app. Additionally, chatbots can solicit feedback from customers after interactions, which helps companies better understand their customers' needs and tailor their services to meet those needs.

Modern chatbots can be integrated with various platforms and messengers such as WhatsApp, Telegram and others. This allows customers to interact with the company through their familiar channels, which increases the convenience of communication. Integration with customer relationship management (CMR) systems also allows chatbots to provide more accurate information about customers and their queries, which makes communication more effective and significantly expands the number of available scenarios: for example, the bot will be able to offer additional services based on previous orders. All stages of communication are saved in the client's card. This makes it easier to analyze user behavior and simplifies the conversation with a live operator if the customer switches to it [3].

There are different types of bots, but most of them can be categorized into three big groups:

1. Autoresponders with advanced functionality have been in use for a very long time. They do not understand voice commands, i.e. the user interacts with the program by pressing buttons on the phone. Such bots can provide background information or connect to the right specialist.

2. Scripted bots can analyze the subscriber's messages – both written and verbal. Based on embedded scripts, they can conduct quite complex dialogs – sometimes users do not even realize that a non-human is talking to them. Such bots can solve a wide range of user problems, from providing reference information to booking a table in a restaurant.

3. Bots based on artificial intelligence are able not only to reproduce scripts embedded in them, but also to learn from their experience. The development of such programs is expensive, only large companies can afford them. However, due to their scale, these software solutions help save huge amounts of money.

Chatbots find application in a wide range of spheres, and their capabilities are really impressive. Here are a few examples where they are particularly useful:

- Customer support. Chatbots have become an integral part of customer support. They can answer frequently asked questions, provide information about products and services, and help users solve simple problems. This allows companies to reduce wait times and improve service quality.
- E-commerce. In online stores, chatbots can help users with product selection, provide recommendations based on preferences, and even process orders. They can notify customers about delivery status and offer special promotions.
- Banking and finance. Chatbots in banking help customers check balances, make transfers, get credit and account information. This facilitates access to financial services and makes them more convenient for users.
- Education. In educational institutions, chatbots can be used to answer student questions, provide information about courses and schedules, and help with the learning process. This can be especially useful for online courses and platforms.
- Healthcare. In healthcare, chatbots can help patients make doctor's appointments, remind them to take medications, and provide information about symptoms. This facilitates interaction between patients and healthcare providers [4].

The scope of application of chatbots is immense and with time the number and variety of bots will constantly increase. Let us demonstrate, on the examples of well-known companies, that this technology can increase the efficiency of almost any organization, the main thing being to find its application.

Chatbots can be set up in messengers and social networks (Telegram, Vkontakte, WhatsApp and others), on websites, in mobile applications, control systems (Siri), voice assistants (Alice) and so on.

The Aviasales service has developed a bot for abnormal prices in Viber, Facebook* (prohibited on the territory of the Russian Federation) and Telegram messengers. It monitors tickets for specified destinations. As soon as the price of a flight starts to decrease, the chatbot notifies the user.

Car manufacturer Škoda has developed a learnable chatbot called Lucy. With Lucy you can discuss your needs, the purposes for which you need a car and your

budget. The learning chatbot analyzes your answers and recommends the most suitable car from the eight Škoda models. Lucy can also discuss purchase details with you and schedule a test drive.

Alfa-Bank has developed a chatbot with artificial intelligence that understands human speech. To train the chatbot, the developers analyzed several thousand records of conversations of call center operators. The bot understands the names of promo cards, promotions and services, and is able to recognize different formulations of the same requests. For example, a trained chatbot will understand if you ask it both “how much money is left” and “account balance”. Thanks to the capabilities of the chatbot, Alfa-Bank plans to reduce its annual operating costs by 100 million rubles [5].

Although chatbots offer many advantages, their implementation is also associated with certain disadvantages. Let us consider them in more detail.

One of the downsides lies in the fact that chatbots may not always interpret user requests correctly due to limited comprehension capabilities, especially if they are not formulated clearly or contain complex constructions. This can lead to misunderstandings and frustrated customers.

Many customers prefer to interact with a live person, especially in complex or emotionally charged situations. Chatbots may not provide the necessary empathy and support, which can negatively impact the customer experience.

Chatbots require regular updates and training to keep information current and improve the customer experience. This can call for additional resources and time. Additionally, chatbots ts may be limited in their capabilities and may not be able to perform more complex tasks such as handling specific requests or performing transactions.

Like any other technology, chatbots can encounter technical issues such as glitches or bugs in the code. This can lead to unavailability of service and loss of customers.

Furthermore, the use of chatbots can raise concerns about protecting customers’ personal data. If chatbots do not handle or store information properly, it can lead to data leaks and privacy breaches.

In conclusion, it can be said that customer service in the age of digitalization is undergoing significant changes due to the introduction of chatbots. These innovative tools not only optimize customer interaction processes, but also create new opportunities to enhance customer service. However, it is important to remember that technology cannot completely replace the human element. An effective combination of automation and face-to-face interaction remains a key element of successful customer service. The future of customer interaction will lie in the harmonious coexistence of human-centered approaches and high technology, which will allow companies to not only meet customer needs, but also exceed their expectations. Thus, chatbots are becoming an important tool in the arsenal of modern businesses, helping to create more efficient, convenient and enjoyable interactions with customers.

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УДК 629.78

THE ELECTRIC REVOLUTION: NASA'S H71M ENGINE AND ITS IMPACT ON SPACE MISSIONS

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Abstract. The development of the NASA H71M electric propulsion system represents a significant step forward in space technology. This experimental electric rocket engine powered by the Hall effect is capable of generating up to 1 kW of power and provides record efficiency. In this article, we will look at the key features and benefits of the new engine, as well as its potential impact on the future of space exploration.

Keywords: space, rocket engines, space missions, spacecraft.

ЭЛЕКТРИЧЕСКАЯ РЕВОЛЮЦИЯ: ДВИГАТЕЛЬ NASA H71M И ЕГО ВЛИЯНИЕ НА КОСМИЧЕСКИЕ МИССИИ

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Аннотация. Разработка электрической двигательной установки NASA H71M представляет собой значительный шаг вперед в области космических технологий. Этот экспериментальный электрический ракетный двигатель, работающий на эффекте Холла, способен генерировать мощность до 1 кВт и обеспечивать рекордную эффективность. В статье мы рассмотрим ключевые особенности и преимущества нового двигателя, а также его потенциальное влияние на будущее космических исследований.

Ключевые слова: космос, ракетные двигатели, космические миссии, космические аппараты.

In ancient times, people could only dream of flying into space, watching the stars and thinking about what is hidden beyond our planet. With the development of science and technology, dreams have become reality: the first human flight into space was a turning point in the history of mankind. Since then, science has not stood still, and today we are witnessing a new breakthrough – the creation of the NASA H71M electric

propulsion system. This Hall effect-based engine represents a significant achievement in space technology, providing record-breaking efficiency and maneuverability for small spacecraft. Designed with the needs of future missions in mind, the H71M is able to recycle up to 30 % of the mass of the device during 15,000 hours of operation, which opens up new horizons for planetary exploration and satellite maintenance.

In 2024, NASA unveiled a new experimental electric rocket engine called the H71M (Figure 1). which has record efficiency and power up to 1 kW. This engine is designed for use in small spacecraft and promises to significantly change the approach to space missions, including satellite maintenance and interplanetary exploration.

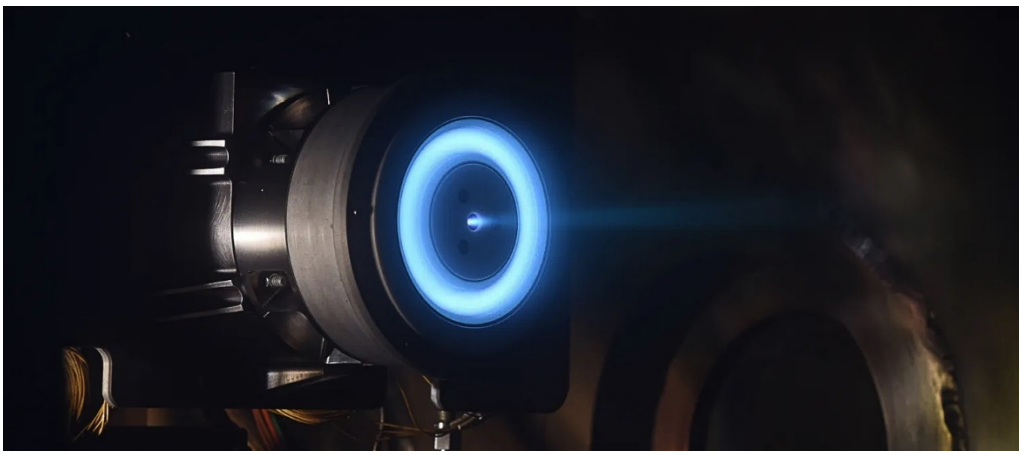

Figure 1. NASA H71M Electric Propulsion System

The main characteristics of the H71M engine are as follows:

– Efficiency: the H71M engine is capable of converting up to 30 % of the mass of the device into fuel, which is three times more than that of modern analogues. This allows him to work up to 15,000 hours.

– Maneuverability: the new engine increases the maneuverability of small satellites, allowing them to independently ascend to the desired orbits and make long flights to other planets.

– Technology: the H71M is based on the Hall effect ion thruster technology that has been used in space for over 50 years. NASA was able to create a more compact and efficient version of this engine [1].

NASA does not plan to independently develop the field of electric rocket engines, but instead will license the technology to commercial companies. The first license for the H71M engine was used by Northrop Grumman, which is developing its own version called NGHT-1X. This engine will be used in the Mission Extension Pod (MEP) service satellite, which will be able to extend the life of existing satellites in orbit.

The development of the H71M engine opens up new horizons for small spacecraft and scientific missions. It is expected that with its help it will be possible to significantly increase the range and maneuverability of satellites, as well as expand opportunities for scientific research within the framework of the Lunar Gateway and Deep Space Transport programs.

The NASA-H71M engine is a modern solution in the field of electric rocket engines, based on ion engine technology, in particular, on the Hall effect. This engine has been designed with high efficiency and durability requirements in mind for use in small spacecraft. Here are its main technologies and characteristics:

– Hall effect: the H71M engine uses a Hall effect-based operating principle that allows for high thrust with relatively low energy consumption. This makes it more efficient compared to traditional chemical engines.

– Miniaturization and high throughput: the development of the engine includes significant miniaturization of components, which allows it to operate at less than 1 kW, while maintaining high performance. This is especially important for maneuvers required to perform tasks in outer space.

– Fuel efficiency: according to NASA calculations, the H71M engine is capable of converting up to 30 % of the mass of the device into fuel for a service life of up to 15,000 hours. This significantly exceeds the performance of modern analogues, which usually process about 10 % of the weight.

– Durability: the extended service life of the engine allows it to be used in long-term space missions, including exploring distant planets and extending the life of existing satellites [2].

As mentioned earlier, the Hall effect is used, so what is it. The Hall effect is a physical phenomenon that is observed in conductors and semiconductors when they are affected by a magnetic field perpendicular to the direction of the current. In the context of rocket engines, especially Hall-type ion engines, this effect is used to create thrust. Here are its main components and processes:

– Working fluid: xenon is usually used, which is supplied to the engine.

– Electric and magnetic fields: an electric field (using the anode and cathode) and a magnetic field (using magnets) are created in the motor, which interact with each other.

– Ionization: xenon gas is ionized in the combustion chamber by the electron flux generated by the cathode. This leads to the formation of positive ions and free electrons.

– Electron drift: electrons moving from the cathode to the anode, under the influence of a magnetic field, begin to drift in a direction perpendicular to both electric and magnetic fields. This drift is called the Hall effect.

– Ion acceleration: positive ions are accelerated by an electric field and ejected through the nozzle of the engine, creating reactive thrust [3].

Hall effect engines are actively used in modern spacecraft. For example, NASA's Psyche probe, which was launched in 2023 to explore the metallic asteroid Psyche, uses a Hall effect engine to achieve high speed (200,000 km/h) and maneuver in space. This allows the probe to move efficiently along complex trajectories without the need for large amounts of fuel.

Thus, the new electric motor has a number of significant advantages over traditional rocket engines, especially chemical ones. Here are the main ones:

– Fuel economy: the H71M engine is able to recycle up to 30 % of the weight of the device into fuel, which is three times higher than modern analogues, which can

recycle only about 10 %. This allows one to significantly reduce fuel consumption during long-term space missions.

– Long service life: the H71M is expected to be able to operate for up to 15,000 hours, which is significantly longer than the service life of traditional chemical engines. This makes it more suitable for long-term interplanetary exploration and operations in orbit.

– Increased maneuverability: the engine allows small satellites to independently ascend to the desired orbits and perform complex maneuvers such as braking and trajectory changes. This opens up new opportunities for exploration missions, including the possibility of sending to Mars and other planets.

– Miniaturization: the H71M is a more compact version of traditional Hall effect ion engines, which allows it to be used in small spacecraft without losing power. This makes it ideal for commercial satellites and service missions.

– Less emissions: unlike chemical engines, electric motors do not emit emissions during operation, which makes them more environmentally friendly.

Thus, the H71M engine developed by NASA opens up new possibilities for various space missions due to its high efficiency and durability. Here are some of the future missions that can be completed using this electric motor:

– Interplanetary missions: the H71M will be used to send small spacecraft to planets such as Mars, as well as to asteroids and moons. Due to its high maneuverability and the possibility of long flights, the devices will not only be able to fly past objects, but also carry out detailed studies of their surface and atmosphere [4].

– Manned missions to the Moon and Mars: the H71M engine will be part of larger programs such as Lunar Gateway, which involves the creation of an orbital station around the Moon, as well as Deep Space Transport for manned flights to Mars by 2040. These programs require highly efficient propulsion systems to ensure maneuverability and the ability to change the trajectory.

– Mission Extension Pod (MEP): the engine will be actively used in commercial projects such as the Mission Extension Pod from Northrop Grumman. These devices will extend the service life of active satellites in geostationary orbit, allowing them to adjust their orbits and perform the necessary maneuvers to prolong active operation.

– Expansion of scientific goals: with the help of the H71M, it will be possible to launch additional scientific vehicles as payloads on existing missions, which will expand the range of objects under study and increase the time for detailed study of celestial bodies.

To sum up, the H71M engine opens up new possibilities for small spacecraft, allowing them to independently perform complex maneuvers and expand their missions. It is expected that with its help it will be possible to significantly increase the range of satellites and their maneuverability, which will be especially important for future interplanetary research and commercial projects in space.

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УДК 004.8

USING ARTIFICIAL INTELLIGENCE FOR PERSONALIZED MEDICINE

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Abstract. In the era of digitalization of medicine, artificial intelligence (AI) is becoming a key tool in the development of personalized medicine, offering advanced technologies for the diagnosis, treatment and prediction of disease outcomes. This article offers a review of the current state of artificial intelligence in medicine, discussing its applications for the collection and analysis of medical data, the development of personalized diagnostic and therapeutic approaches, as well as predictive analytics. In conclusion, the prospects for the development of personalized medicine using AI and possible directions for future research in this area are presented.

Keywords: artificial intelligence, personalized medicine, medical data, diagnostics, healthcare, neural network, photoplethysmography, genetic markers.

ИСПОЛЬЗОВАНИЕ ИСКУССТВЕННОГО ИНТЕЛЛЕКТА ДЛЯ ПЕРСОНАЛИЗИРОВАННОЙ МЕДИЦИНЫ

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Аннотация. В эпоху цифровизации медицины искусственный интеллект (ИИ) становится ключевым инструментом в развитии персонализированной медицины, предлагая передовые технологии для диагностики, лечения и прогнозирования исходов заболеваний. В статье представлен обзор текущего состояния искусственного интеллекта в медицине, обсуждается его применение для сбора и анализа медицинских данных, разработки персонализированных диагностических и лечебных подходов, а также прогностической аналитики. В заключение представлены перспективы развития персонализированной медицины с помощью ИИ и возможные направления будущих исследований в этой области.

Ключевые слова: искусственный интеллект, персонализированная медицина, медицинские данные, диагностика, здравоохранение, нейросеть, фотоплетизмография, генетические маркеры.

Nowadays, artificial intelligence (AI) is becoming an essential tool for the development of personalized medicine, providing advanced capabilities for the

diagnosis, treatment and prediction of disease outcomes. Machine learning algorithms can analyze huge amounts of medical data, creating detailed patient profiles that take into account their unique clinical characteristics and treatment needs. AI can identify patterns that help in the diagnosis of diseases at an early stage, and develop personalized treatment plans adapted to the biological characteristics and lifestyle of the patient. In addition, AI can predict the risks of future diseases, allowing doctors to develop preventive measures and intervene before the disease develops.

In Russia, work is underway in several areas from the field of medical artificial intelligence. In 2017, the Voice2Med project was launched, designed to reduce the time for filling out paperwork. It has been successfully tested at the Republican Hospital of Tatarstan in Kazan. Another application of AI is called TeleMD, which specializes in oncological diseases [1].

The Skolkovo Institute of Science and Technology has discovered one of the most interesting inventions of the Skoltech neural network. Scientists from Skoltech have developed a neural network capable of detecting and describing pathologies on lung X-rays, thereby reducing the analysis time for doctors from a few minutes to about 30 seconds (Figure 1).

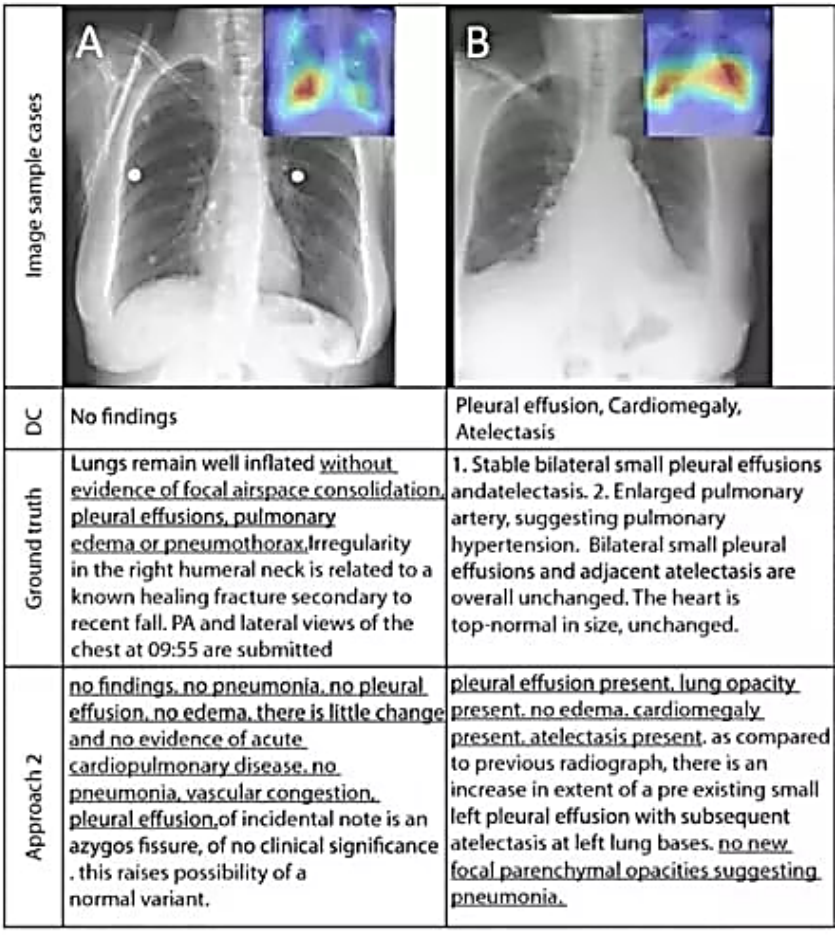

Figure 1. The results of an experimental study of the Skoltech neural network

The researchers used modern models of machine vision and computational linguistics, including GPT-3 small, the predecessor of the popular GPT-3.5 and GPT-4. Unlike conventional models, Skoltech's neural network automatically

describes X-rays, which allows doctors to confirm or reject diagnoses such as fibrosis, an enlarged heart or suspected cancer. To train the neural network, a large database of X-ray images and a special radiological dictionary were created to increase the accuracy in the use of radiological terms. It is reported that the system can also be adapted to work with MRI and CT scans, as well as use active training, allowing the model to be improved based on adjustments made by doctors [2].

To accelerate the implementation of AI in medicine, standardization of algorithms is necessary, including the establishment of transparent and reproducible standards for the development and validation of algorithms, the creation of algorithm repositories to facilitate access to them and evaluate their effectiveness, as well as the development of consistent terminology and ontologies to improve interdisciplinary communication. The future of personalized medicine with AI support is promising. Research continues on new AI algorithms, the integration of AI with other advanced technologies, and the expansion of AI adoption beyond large medical centers. These developments promise to revolutionize healthcare by improving treatment outcomes and improving patients' quality of life [3].

One such example is a medical bracelet that works as a neurotracker, tracking a person's overall health. It measures a set of psychophysiological indicators, including motor activity, body temperature, pulse, respiratory rate, changes in blood glucose levels, ECG, heart rate variability, blood oxygenation and others. Photoplethysmography is the technology that makes the heart rate monitor work. It involves the use of green LEDs that emit light and detectors that register the level of its reflection (Figure 2). When the heart contracts, blood pressure increases and capillary blood flow increases. As a result, more light emitted by the LED is absorbed, which is what the detector registers. Based on the information received, the pulse is determined.

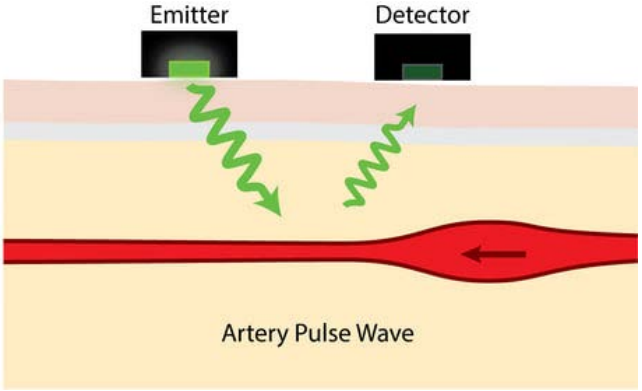

Figure 2. Photoplethysmography technology

The bracelet can warn of an impending attack, if the device detects a harbinger, it sends a vibration signal to the person. The bracelet is also able to have a therapeutic effect, thanks to the built-in electrodes, it is possible to control the psychoemotional state of a person. Through a special application, data is transferred to the cloud for calculations, forecasting changes in health, as well as convenient visualization of health status and issuing recommendations. In addition, medical bracelets can be used to

identify patients. They include full name and age, diagnosis, contraindications and allergies, blood type, prescribed medications and recommendations [4].

In the field of diagnostics, technology has expanded the possibilities of detecting a wide range of diseases at early stages. High-resolution microscopes and automated analyzers increase the accuracy of pathological studies, speeding up diagnosis. In addition, the miniaturization of medical devices such as wearable sensors and implantable monitors allows patients to self-diagnose and monitor their health in real time.

Technology has also transformed healthcare systems. Electronic Healthcare Records (EHRs) simplify the exchange of patient information between healthcare providers, making available more consistent and timely care. Telemedicine provides remote access to medical services, especially for patients living in remote areas or with limited mobility. Adaptive technologies such as smartphone apps and wearable devices give patients and caregivers more control over their health and increase treatment adherence [5].

It can be concluded that technology has provided doctors with powerful new tools. Robotic surgery has improved the accuracy and reduced the invasiveness of operations, reducing recovery time and improving results. Individualized therapies such as targeted therapies and immunotherapy use the patient's genetic information to develop tailored treatments, improving their effectiveness and reducing side effects. Advances in pharmacology have led to the development of more effective and less toxic drugs, expanding therapeutic options and improving the quality of life of patients. Artificial intelligence has had a profound impact on the healthcare sector, expanding diagnostic and therapeutic capabilities, and transforming patient care systems. As technology evolves in the future, we can expect even greater advances in healthcare, leading to improved patient outcomes and revolutionizing the way healthcare is delivered.

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УДК 681.5

INTEGRATION OF MANAGEMENT SYSTEMS IN AUTOMATED MANUFACTURING PROCESSES: A PATH TO INNOVATION AND EFFICIENCY

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Abstract. Modern manufacturing enterprises face the need to enhance the efficiency, flexibility, and innovativeness of their processes. The integration of management systems in automated manufacturing processes represents a key step toward achieving these goals. This article examines the methods and approaches to integrating management systems, their impact on productivity and competitiveness of enterprises, as well as the main challenges organizations face during the integration process.

Keywords: modular approach, systemic approach, standards, centralized management, data security, technical aspects, manufacturing environment.

ИНТЕГРАЦИЯ СИСТЕМ УПРАВЛЕНИЯ В АВТОМАТИЗИРОВАННЫХ ПРОИЗВОДСТВЕННЫХ ПРОЦЕССАХ: ПУТЬ К ИННОВАЦИЯМ И ЭФФЕКТИВНОСТИ

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Аннотация. Современные производственные предприятия сталкиваются с необходимостью повышения эффективности, гибкости и инновационности своих процессов. Интеграция систем управления в автоматизированных производственных процессах представляет собой ключевой шаг к достижению этих целей. В данной статье рассматриваются методы и подходы к интеграции систем управления, их влияние на производительность и конкурентоспособность предприятий, а также основные вызовы, с которыми сталкиваются организации в процессе интеграции.

Ключевые слова: модульный подход, системный подход, стандарты, централизованное управление, безопасность данных, технические аспекты, производственная среда.

With the development of technology, more and more organizations are facing the need to implement automated control systems to optimize their processes and improve product quality. One of the most effective solutions in this direction is an integrated automated control system (IACS). This comprehensive solution combines a variety of automated modules and programs that provide management of production processes, accounting of materials and goods, financial analysis, planning and control of operations, and much more.

IACS provides companies with an opportunity not only to automate, but also to integrate various management functions, which greatly simplifies the work of employees and contributes to the overall efficiency of the business. An integrated management system solves many problems related to business management, opening new horizons for improving business processes and reducing costs.

One of the key functions of an IACS is the management of production processes. With its help, companies can automate production, effectively manage raw material inventories, optimize equipment utilization and monitor product quality. IACS also helps to control inventory, track the status of goods, manage logistics and monitor order fulfillment. This enables organizations to respond quickly to changes in the market environment and improve customer service.

In addition, IACS plays an important role in financial management, resource planning and allocation, production cost control and cost optimization. It can be used to automate marketing and sales processes, manage human resources, and ensure data security and protection. Implementing an IACS allows companies not only to improve the efficiency of their operations, but also to create a more flexible and adaptive organizational structure that can quickly respond to the challenges of today's market.

The integration of control systems into automated production processes is a complex task that requires solving many problems. One of the main challenges is the compatibility of equipment from different manufacturers, which often requires additional software and hardware solutions. A critical aspect is the standardization of data and exchange protocols, without which the smooth exchange of data between systems is impossible. Integration projects are also characterized by high management complexity, requiring the coordinated work of multiple specialists and departments. Staff must be provided with training to work with the new systems, which involves time and cost, as well as overcoming resistance to change.

It is also important to plan integration in a way that minimizes production downtime and does not disrupt continuity of supply. Increased attention should be paid to cybersecurity aspects, as the increased number of connected devices increases vulnerability to cyberattacks. Systems must be flexible and scalable to meet the changing needs of production without requiring drastic changes. An integral part of successful integration is reliable technical support and maintenance of systems, which requires skilled technicians.

In addition, regulatory requirements affecting the integration process must be considered. Finally, it is important to not only collect but also analyze the large amounts of data generated by the integrated systems to further optimize production processes, which requires advanced analytical tools and knowledge of big data. The

success of integration largely depends on deep technical expertise, strategic planning and active participation of all stakeholders.

Integration of management systems implies combining various information and management systems into a single platform, which allows for “seamless” interaction between all components of the production process. Manufacturing Execution Systems (MES), Enterprise Resource Planning (ERP), Quality Management Systems (QMS) and others are used for these purposes [1] (Figure 1).

Figure 1. Automated control system

Approaches to the integration of control systems in automated manufacturing processes play a key role in ensuring effective interaction between the different components of the manufacturing environment. There are several main approaches (modular, systematic, cloud-based, standards-based integration), each with its own features, advantages and disadvantages.

The modular approach involves the step-by-step integration of individual modules or components of management systems, allowing new functions or systems to be introduced gradually, reducing the risks and costs of implementation. This approach is particularly suitable for companies that already have some systems in place but want to improve or extend their functionality. The main advantages of this approach are the ability to test and evaluate each module before fully integrating it, and the flexibility to choose which components to integrate. However, a disadvantage can be the difficulty in ensuring compatibility between different modules.

In contrast to the modular approach, the systems approach involves creating a single architecture in which all components work as a single entity. This involves using common standards and protocols to ensure interoperability between systems. The systems approach allows for a high degree of integration and interoperability, which contributes to more efficient data and process management. The main advantage is that

all processes can be centrally controlled and monitored, making it easier to manage the production environment. However, implementing a systems approach can require significant investment and development time.

With the use of cloud technology, the integration of management systems becomes more flexible and scalable. Cloud platforms allow companies to store and process data in remote data centres, reducing infrastructure and maintenance costs. Cloud solutions provide access to data and applications from anywhere in the world, making them particularly attractive to companies with distributed manufacturing facilities. The benefits of cloud solutions include ease of scalability, the ability to quickly implement new features, and access to advanced technology without requiring a significant upfront investment. However, companies must consider issues of data security and dependence on internet connectivity.

Standards-based integration involves the use of commonly accepted standards and protocols to ensure interoperability between different systems. Standards such as ISA-95 for integration between business and manufacturing systems, or OPC UA for device-to-device communication, allow manufacturing companies to create more unified and interoperable systems. The advantages of this approach include lower integration costs and the ability to use off-the-shelf solutions from a variety of vendors. However, the downside can be limited flexibility in technology choice and the need to adhere to standards, which can complicate the implementation process [2].

Modern control systems often offer Application Programming Interfaces (APIs) that allow different systems to communicate with each other. This approach provides the opportunity for more flexible and faster interaction between systems, which is especially important in a rapidly changing marketplace. API integration enables the creation of customised solutions tailored to specific business needs. However, successful implementation of this approach requires highly skilled professionals capable of developing and maintaining integration solutions [3].

Each of these approaches has its pros and cons, and the choice of an approach to integrating management systems depends on the specific needs and conditions of the company. It is important to consider not only technical aspects, but also organisational, financial and human factors to ensure successful integration and maximum return on investment in new technologies.

There are many benefits to integrating management systems. Firstly, it improves efficiency because it eliminates duplication of processes and optimises the use of resources, leading to lower costs and increased productivity. Second, integration improves product quality because quality management systems integrated into the production process provide tighter control at all stages, which helps reduce defects. Third, integrated systems provide flexibility and adaptability, allowing rapid response to changes in demand, which is particularly important in unstable markets. Finally, integration provides the basis for the adoption of new technologies such as IoT (Internet of Things), artificial intelligence and big data analytics, which facilitates innovation in manufacturing processes [4] (Figure 2).

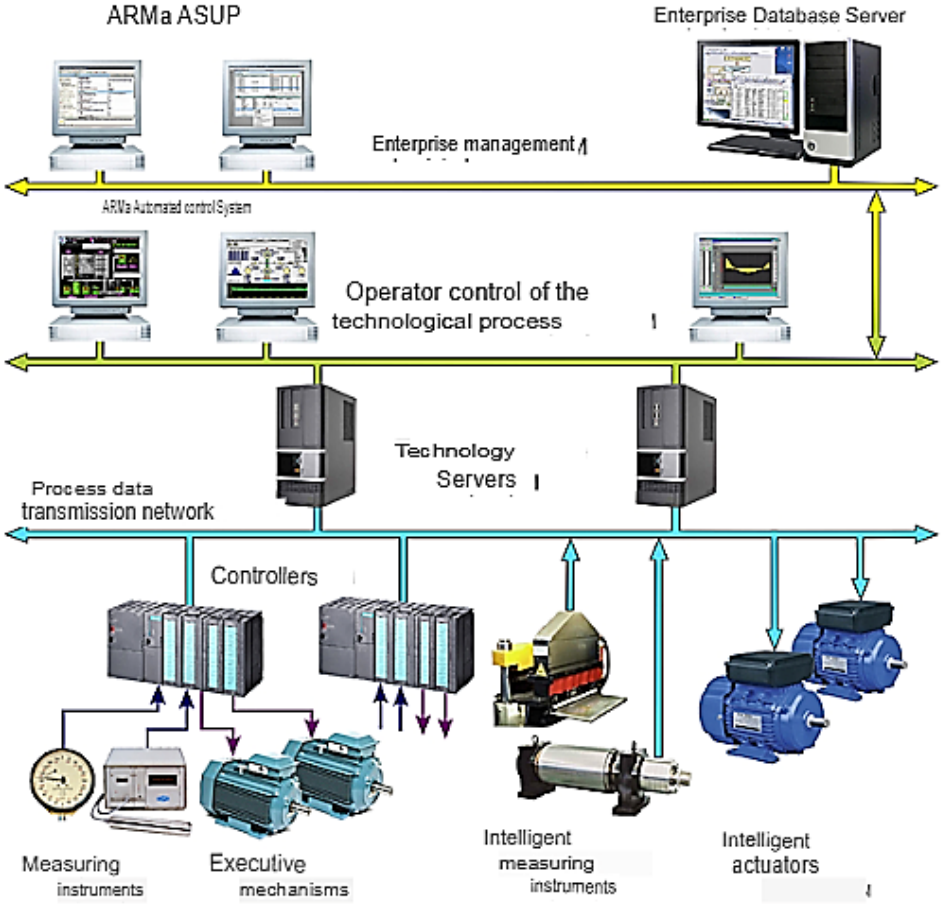

Figure 2. Structure of a modern industrial automated production management system

However, despite the obvious advantages, the integration of control systems in automated production processes also presents a number of challenges. First of all, technical difficulties can arise when integrating different systems, especially if they are developed by different manufacturers. In addition, employees may be resistant to new technologies and processes, which can slow down the implementation of integration solutions. In addition, successful integration requires staff training, which can require additional resources and time. Finally, implementing integrated systems can require a significant upfront investment, which is a barrier for some companies [5].

The integration of control systems in automated manufacturing processes is an important step towards innovation and efficiency. It enables companies not only to optimise their processes but also to adapt to rapidly changing market conditions. However, successful integration requires a comprehensive approach that includes technical, organisational and human aspects. In the future, companies that can effectively integrate their management systems will have a significant competitive advantage.

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УДК 628.35

REVIEW OF BIOLOGICAL TREATMENT FACILITIES FOR WASTEWATER FROM MCC

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Abstract. The article presents a review of biological methods for treatment of wastewater generated during the production of microcrystalline cellulose and containing high BOD. Particular attention is paid to the comparison of bio-treatment equipment, its operating principles and application to reduce the level of pollutants in wastewater. The paper analyzes the characteristics of the equipment and selects the best solution for wastewater treatment.

Keywords: biological treatment, BOD, biofilter, aerotank, MCC.

ОБЗОР СООРУЖЕНИЙ БИОЛОГИЧЕСКОЙ ОЧИСТКИ СТОЧНЫХ ВОД ОТ ПРОИЗВОДСТВА МКЦ

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Аннотация. В статье представлен обзор биологических методов очистки сточных вод, образующихся при производстве микрокристаллической целлюлозы и содержащих высокие показатели БПК. Особое внимание уделяется сравнению различных видов биоочистного оборудования, их принципам работы и их применению для снижения уровня загрязняющих веществ в сточных водах. В работе проводится анализ характеристик оборудования и выбор наилучшего решения для очистки сточных вод.

Ключевые слова: биологическая очистка, БПК, биофильтр, аэротенк, окситенк, биологический пруд.

Currently the production of microcrystalline cellulose (MCC) is not realized in Russia, this product is imported. Difficulty in availability of feedstock and selection of a proper system of treatment facilities for production wastewater are the main stopping factors for realization of production.

The most common and available production method is hydrolysis with hydrochloric acid at high temperatures [1]. The wastewater from the production of MCC contains a lot of organic matter BOD. There is a question of choosing a plant for BOD removal and bringing its concentration to the standard before discharge into a water body. Biological treatment methods are used to remove BOD from wastewater. The purpose of this work is to consider and select the most optimal treatment equipment

Biological treatment of wastewater is based on the ability of microorganisms to use dissolved organic matter of wastewater for nutrition in the process of life. Part of the organic matter is converted into water, carbon dioxide, nitrite and sulfate ions, and part of it is used for biomass formation. Biological water purification is based on natural processes of self-purification of water bodies. A biological complex of microorganisms capable of sorbing and oxidizing organic substances is called activated sludge. High-quality activated sludge settles quickly – this ability is assessed by the sludge index (sludge volume in cm^3 after settling for 30 min. referred to 1 g of dry sludge matter).

The advantages of such treatment include availability, destruction of organic contaminants without the use of chemical reagents, low energy costs and ease of implementation of wastewater treatment processes, stability of oxidation processes at the variability of incoming wastewater flow in terms of flow rate and concentration.

Biological treatment facilities can be conditionally divided into two types:

1. Facilities in which the biological treatment process takes place in conditions close to natural (biological ponds).

2. Facilities in which the biological treatment process is carried out under artificially created conditions (aeration tanks, oxitanks and biofilters).

A biological pond is a facility for treatment in natural conditions of domestic, industrial and surface wastewater containing mainly organic pollutants. It represents an artificial pond populated with living organisms (usually rectangular in shape) with a depth of 0.5 to 4.5 m [2].

Biological ponds are used for treatment and additional treatment of wastewater from industrial enterprises, livestock complexes and farms. The main disadvantage of biological ponds is that the efficiency of operation as independent treatment facilities is maximized only in the warm season of the year and reaches 80-93 % of BOD, and in the cold period it decreases by 2-3 times. However, they also have several advantages, such as the ability to treat large volumes of wastewater, which makes them more suitable for large-scale treatment plants, do not require significant energy and mechanical system costs, and are resistant to load fluctuations and changes in wastewater quality, as the ecosystem in the pond can adapt to different conditions.

A biofilter is a tank with filter media whose surface is covered with a biological film formed by colonies of microorganisms. In the biofilter undissolved and colloidal contaminants are sorbed on the surface of the grains of the filter media, forming a biological film populated by microorganisms. Once on this film, microorganisms oxidize dissolved sewage contaminants. The dead film is washed away by the

wastewater and removed from the biofilter. The scheme of a biofilter is shown in Figure 1.

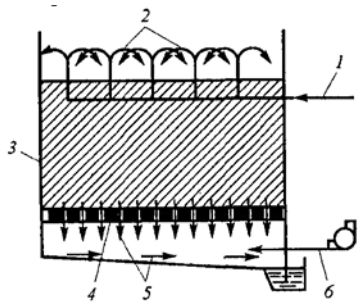

Figure 1. Scheme of biological filter:
1 – wastewater supply; *2* – water distribution device; *3* – filtering load; *4* – drainage device; *5* – filtered wastewater; *6* – air distribution device

The use of biofilters is widespread in various industries including food, pharmaceutical, textile and chemical industries. They are used to remove various pollutants such as organic matter, ammonia, nitrate, phosphate and some heavy metal ions [3]. Biofilters have a high efficiency of 95-98 %, low cost and environmental friendliness. Biofilters also have a number of disadvantages. They require the use of pumping and other mechanical equipment to ensure proper water flow. The accumulation of organic and inorganic substances can lead to clogging of filters, which reduces their treatment efficiency, and they are also sensitive to sudden fluctuations in the composition and volume of wastewater.

An aerotank is an artificial tank into which wastewater and activated sludge are fed, along with air, which serves as a source of oxygen for activated sludge microorganisms. The aerator uses the technology of forced aeration or forced oxygen oxidation – the devices are equipped with a pneumatic or mechanical aerator to saturate the activated sludge mass with oxygen necessary for the vital activity of aerobic bacteria. Simultaneously with air supply, a number of processes take place in the aeration tank, of which the process of keeping solid (insoluble) substances of wastewater, including activated sludge, in suspension plays an important role (Figure 2) [4].

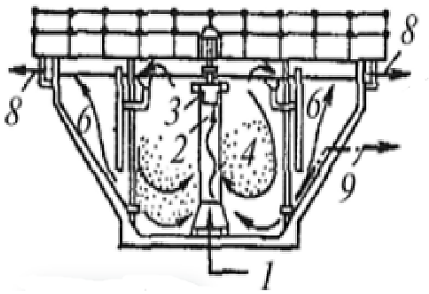

Figure 2. Schematic diagram of the aeration basin:
1 – waste water supply, *2* – flow stabilizer; *3* – surface type mechanical aerator; *4* – aeration zone; *6* – sedimentation zone; *8* – treated wastewater outlet; *9* – excess sludge outlet

Two degrees of purification take place in the aeration tank:

1. In the first phase in the pre-enrichment chamber the sludge mixture is saturated with oxygen, there is biosorption of contaminants in the mode of increased sludge load.

2. In the second phase in the fermentation chamber at low sludge load the sorbed biomass is oxidized, mineralization (stabilization) of activated sludge takes place.

As a result of microorganisms growth and sorption of organic pollutants, the mass of sludge in aeration tanks continuously increases. With the increase of its concentration in aeration tanks, the removal of activated sludge from secondary sedimentation tanks increases and the quality of treated water decreases.

Aeration tanks have a wide field of application and make it possible to treat wastewater from such pollutants as organic substances, chemical compounds, ammonia, metals, nitrates and nitrites, as well as suspended particles. The main differences of the aerotank are high quality and rapid purification of wastewater, they do not require the cost of insulation of the object as well, because a huge amount of heat energy is released as a result of chemical reactions. The negative indicator is the energy consumption, without which it is impossible to achieve high rates of purification. Also the need for regular use of the device, as long (about three months) breaks can lead to the death of microorganisms.

An oxytank is a biological wastewater treatment system that utilizes the process of aerobic decomposition of organic matter by microorganisms under conditions where the required oxygen level is maintained (Figure 3).

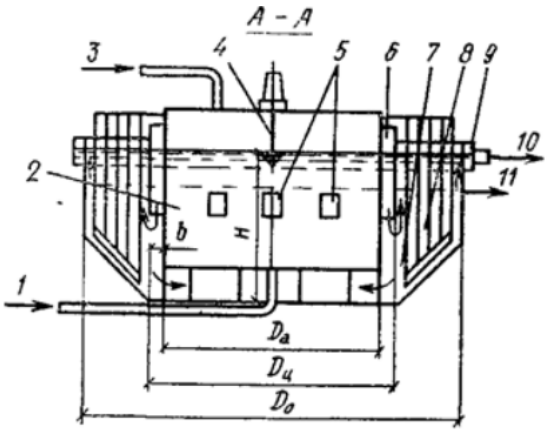

Figure 3. Scheme of the oxitank

1 – supply of clarified wastewater; *2* – reactor; *3* – supply of technical oxygen; *4* – mechanical aerator; *5* – outlet windows; *6* – air separator; *7* – sludge separator; *8* – mixing device; *9* – catchment tray; *10* – discharge of treated wastewater; *11* – discharge of excess activated sludge

Wastewater enters the aeration unit, where it is saturated with oxygen by turbo-aerator and intensively mixed with activated sludge. The water-sludge mass enters the sludge separator. Guiding devices force the mixture to move slowly around the circumference, intensifying the separation and thickening of the sludge. The liquid

passes through the activated sludge layer, getting rid of suspended and dissolved substances and organic contaminants [5].

Oxitanks can be used as independent facilities or in a two-stage scheme in combination with aeration tanks. Oxytanks have a high intensity of the biochemical oxidation process compared to other installations. This is achieved by replacing the supplied air with technical oxygen and increasing the activated sludge concentration. In addition, in such plants activated sludge is better separated from treated water and compacted. The main disadvantage is that the design and operation is more complicated. This is due to the need for almost full utilization of the supplied oxygen, taking into account the cost of obtaining and supplying it to the facility.

To determine which of these systems is most suitable for removing Biochemical Oxygen Demand (BOD) from wastewater, a comparative analysis was carried out as presented in Table.

Table – Comparative analysis of biological treatment equipment for the removal of BOD from wastewater

Characteristics	Aerotank	Oxytank	Biofilter	Biological pond
Degree of BOD purification	70-95 %	70-90 %	60-80 %	70-90 %
Operational peculiarities	Needs mechanical equipment, regularly requires maintenance.	Constant aeration, load and condition monitoring is required.	Dependent on filtration media, requires regular maintenance.	Minimal maintenance is required, resistant to stress.
Advantages	compactness; fast response to loads	high performance; good adaptability	simple design; lower power consumption	environmental friendliness
Disadvantages	energy consumption; sensitivity to loads	energy intensive; high dependence on mechanical devices	high dependence on mechanical devices; large dimensions	large size; climate sensitivity

It can be concluded that the aeration tank appears to be the most efficient plant among all existing biological wastewater treatment systems, as it provides removal of biochemical oxygen demand at 70-95 %, thus achieving high quality of treated water. This plant can be placed in limited areas, making it suitable for small treatment plants. In addition, it is highly responsive to changes in the load, allowing it to adapt quickly to fluctuations in wastewater quality and quantity. Thus, the aeration tank is the optimal choice for efficient BOD removal from wastewater, providing both a high degree of treatment and ease of operation.

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УДК 621.548

FLOATING WIND TURBINES AS A WAY TO EXTRACT ENERGY IN THE WATER SPACE

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Abstract. This article discusses the principle of operation of floating wind turbines. Their advantages and the challenges faced by this type of renewable energy are considered. The paper also compares the performance of traditional stationary wind turbines and floating wind turbines.

Keywords: wind turbines, turbines, electric power, alternative energy sources.

ПЛАВУЧИЕ ВЕТРОУСТАНОВКИ КАК СПОСОБ ДОБЫЧИ ЭНЕРГИИ НА ВОДНОМ ПРОСТРАНСТВЕ

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Аннотация. В данной статье рассмотрен принцип работы плавучих ветроустановок, их преимущества и проблемы, с которыми сталкивается данный тип возобновляемой энергтики. Также в работе произведено сравнение производительности традиционных стационарных ветряных турбин и плавучих ветроустановок.

Ключевые слова: ветроустановки, турбины, электроэнергия, альтернативные источники энергии.

The power of the wind has remained almost unused for centuries, despite its power and potential. It was only at the beginning of their development that people began to realize the opportunities that this natural resource provides. The first steps in the use of wind were made with the invention of windmills, which served for grinding grain and other agricultural needs. These simple devices have become a symbol of human ingenuity and the desire to optimize labor. Over time, with the development of technology and increasing energy needs, humanity has learned how to convert wind into electricity. Today, floating wind turbines represent an advanced solution that allows efficient use of powerful winds in deep sea waters. These innovative

technologies open up new horizons for renewable energy, ensuring a sustainable future and minimizing environmental impacts.

Floating wind turbines represent an innovative solution in the field of wind energy, allowing wind turbines to be installed in deep-water areas where traditional installations cannot be placed. These technologies open up new opportunities for harnessing the wind potential of the oceans and seas.

Floating wind turbines operate on the principle of converting kinetic wind energy into electrical energy, similar to stationary wind turbines, but taking into account the specifics of their floating design. Here are the main stages of operation of floating wind turbines:

1. Floating wind turbines are installed on special platforms that can be located at a depth of up to 800 meters. These platforms ensure the stability of the turbine in conditions of waves and currents. For example, the Hywind project uses ballast floats to hold the installation at the desired depth and prevent it from shifting.

2. When the wind blows, it acts on the blades of the wind turbine, causing them to rotate. The rotation of the blades drives the rotor, which is connected to the generator. The generator converts the mechanical energy of rotation into electrical energy. The angle of attack of the blades can be changed automatically using the control software, which allows you to optimize energy production depending on wind strength and pitching conditions.

3. The generated electrical energy is transmitted via underwater cables to the shore. For this purpose, special inverter systems are used, which convert the alternating current generated by the generators into a suitable one for transmission over the network.

4. Modern floating installations are equipped with intelligent control systems that monitor and regulate the operation of turbines in real time. These systems allow you to optimize performance and adapt to changing wind and marine conditions.

5. Some projects include energy storage systems such as rechargeable batteries, which allows you to accumulate excess electricity and use it during peak consumption or when there is a lack of wind [1].

Various materials are used in the construction of floating wind turbines, which ensure the strength, stability and durability of structures in difficult marine conditions. The main materials include steel, concrete, composite materials, sand, anti-corrosion coatings and flexible protective mats. All this is used for the construction of towers and platforms of floating wind turbines.

These wind turbines have a number of advantages:

- Resistance to strong winds: floating installations can be located in areas with higher and more stable winds, which increases their efficiency. For example, the Hywind Scotland project, consisting of five floating turbines, provides electricity to about 36,000 homes and is installed at a depth of more than 90 meters.
- Mobility: floating wind turbines can be moved depending on changing wind conditions, which allows them to optimize their operation and increase productivity. This is especially important for countries with changeable climatic conditions.

– Reducing environmental risks: the installation of floating turbines minimizes the impact on the marine ecosystem compared to traditional offshore installations, which require significant changes to the seabed.
– Flexible placement: floating installations can be installed away from the coastline, which allows you to use more extensive areas for energy generation without adversely affecting coastal ecosystems.

Technological features:

– Construction: floating wind turbines are usually installed on special platforms or buoys that are fixed to the seabed using mooring cables. This allows them to remain stable even in severe storm conditions.
– Innovative materials: the use of new lightweight and durable materials for the construction of blades and platforms contributes to an increase in the overall efficiency and durability of installations.
– Intelligent control systems: modern control technologies make it possible to optimize the operation of floating turbines, adapting them to changing wind conditions and ensuring maximum performance [2].

During the construction of floating wind turbines, various difficulties arise that may affect the design, construction and operation of these facilities. For example, floating installations must be designed to withstand various loads from waves, wind and ice. Reducing the metal consumption to cut the cost can lead to a decrease in the strength and stability of the structure. It is also necessary to find the optimal combination to counteract wave, ice and wind impacts, which requires complex calculations and engineering solutions. In addition, in waters with an ice regime, it is necessary to take into account significant ice loads, which complicates the design and requires the use of special structures designed for such conditions. In addition, floating wind turbines can affect the environment. In this way, installations can create infrasound noise, which negatively affects marine flora and fauna, as well as bird migration and other aspects of marine ecology. It can also cause public discontent [3].

Floating wind turbines are subjected to various tests before their operation to ensure their safety, efficiency and stability in difficult marine conditions. At the initial stage of development, scale tests of models are carried out. For example, the Nezzy2 project in Germany includes testing a 1:10 scale model on a lake, which allows you to evaluate the operation of wind turbines without exposure to waves and currents.

After successful completion of the model tests, the designs are tested in conditions close to real ones. This includes testing on artificial waves and currents, which makes it possible to assess the stability and behavior of the structure under various weather conditions. Further, floating installations are also tested in the open sea, where their operation is checked under real wind and sea conditions. For example, the Hywind Scotland project successfully survived stormy conditions with strong winds and high waves. An important part of the tests is to check the turbine control systems, which adjust the angle of the blades and ensure automatic shutdown in case of too strong wind, which prevents damage to the structure.

These comprehensive tests help to ensure the high efficiency of floating wind turbines and their safety for operation on the high seas, which is a key factor for the successful integration of these technologies into the renewable energy system.

Several countries are leading the development of floating wind turbines, each of which is actively developing technologies and projects in this area. We would like to consider some of them in more detail.

1. Norway

Norway is one of the pioneers in the field of floating wind turbines. The Hywind Scotland project, managed by the Norwegian company Equinor, became the world's first commercial floating wind turbine project (Figure). Norway continues to develop its technologies and plans new projects, including Hywind Tampen, which will provide electricity to offshore oil and gas platforms.

Figure. Hywind Scotland Project

2. Great Britain

The UK is actively developing offshore wind energy and is one of the largest markets for floating wind turbines. The country has clear goals to increase the capacity of wind farms and is developing new technologies for their installation.

3. Japan

Japan has also shown significant interest in floating wind turbines, especially after the Fukushima disaster. The Japanese government supports projects aimed at using marine resources to generate energy, which makes floating installations an important part of their strategy.

4. South Korea

South Korea is actively investing in the development of floating wind turbines and has ambitious plans to increase its capacity in this area. The country considers floating technologies as a key element of its energy strategy.

5. USA

The US is starting to develop the floating wind farm market, especially in states such as California. The U.S. government supports initiatives to increase the share of renewable energy sources, which creates opportunities for the growth of this sector.

6. France

France is also actively developing floating wind turbine technologies and plans to launch new projects in this area. The French company Ideol SA is already implementing pilot projects using floating technologies.

These countries are not only leaders in the development of floating wind turbines, but also set the direction for further technology development and the introduction of new solutions in the field of renewable energy [4].

Floating wind turbines are becoming an important part of the strategy for the transition to sustainable energy sources, allowing countries to efficiently use their marine resources to generate electricity. They represent an effective solution for harnessing the potential of wind in deep-water areas where traditional stationary installations cannot be installed. This makes them an important element of the strategy for the transition to renewable energy sources at the global level, despite the difficulties that require an integrated approach to the design, construction and operation of floating wind turbines to ensure their safety, efficiency and sustainability. This development remains very promising for future use.

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УДК 004.65

PROSPECTS FOR USING BLOCKCHAIN TECHNOLOGY IN STORING MEDICAL DATA

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Abstract. This article analyzes the potential of using blockchain technology for storing data in medical organizations. The main ways of using the technology in the medical industry are considered, the prerequisites for implementing blockchain for organizing data storage are described, and the reasons for the unpopularity of the technology are be analyzed.

Keywords: blockchain, data storage, medical organizations, data protection, data privacy.

ПЕРСПЕКТИВЫ ИСПОЛЬЗОВАНИЯ ТЕХНОЛОГИИ БЛОКЧЕЙН В ХРАНЕНИИ МЕДИЦИНСКИХ ДАННЫХ

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Аннотация. В статье проведен анализ потенциала применения технологии блокчейн для хранения данных в медицинских организациях. Рассмотрены основные способы применения технологии в медицинской отрасли, описаны предпосылки внедрения блокчейн для организации хранения данных и проанализированы причины непопулярности применения технологии.

Ключевые слова: блокчейн, хранение данных, медицинские организации, защита данных, конфиденциальность данных.

Blockchain technologies play a key role in storing and managing data in many organizations. Nowadays, it is becoming increasingly difficult to find an enterprise that would prefer paper data storage to using blockchain technology.

This is because blockchain provides high security for databases, simplifies their management and modernizes the work of the enterprise, uniting various departments of the company and improving external interaction with clients. This technology is of particular importance for medical organizations, where competent and confidential data storage, as well as their timely transfer, are the main priorities [1, pp. 1-3].

Blockchain is a cryptographic protocol that manages transactions of digital objects between different entities. Three types of blockchain are distinguished, namely

public, private and hybrid. Public blockchains are decentralized and freely provide access to all information contained in the blocks of the distribution register. Anyone can become a participant by installing a client software application on their computer. All participants in this type of blockchain have equal rights. There is no controlling body, and the regulatory functions are performed by the community. This is the most popular type of blockchain, used in most cryptocurrencies. Access to participation in a private blockchain is limited, there is a distribution of roles. The rights of participants have a hierarchy. The ability to access the system and enter data is available to users only with the permission of the owner. This type of blockchain system has a high level of security and guarantees the safety of confidential data. There is also a hybrid type of blockchain, which contains both private and public permissions. In a hybrid blockchain, there are managers who cannot change the data inside the registry, but can hide the personal data of new participants from others [2, pp. 16-18].

Blockchain technology was introduced in Bitcoin in 2008. It is considered a general-purpose technology and has since been successfully applied in various industries. In the healthcare sector, blockchain can be implemented in the management of electronic medical records (EMD). This technology can also be applied in the management of drug supply and biomedical research [3, pp. 25-29]. The idea of using blockchain to store patients' medical data is the most promising, so this article will focus on this idea.

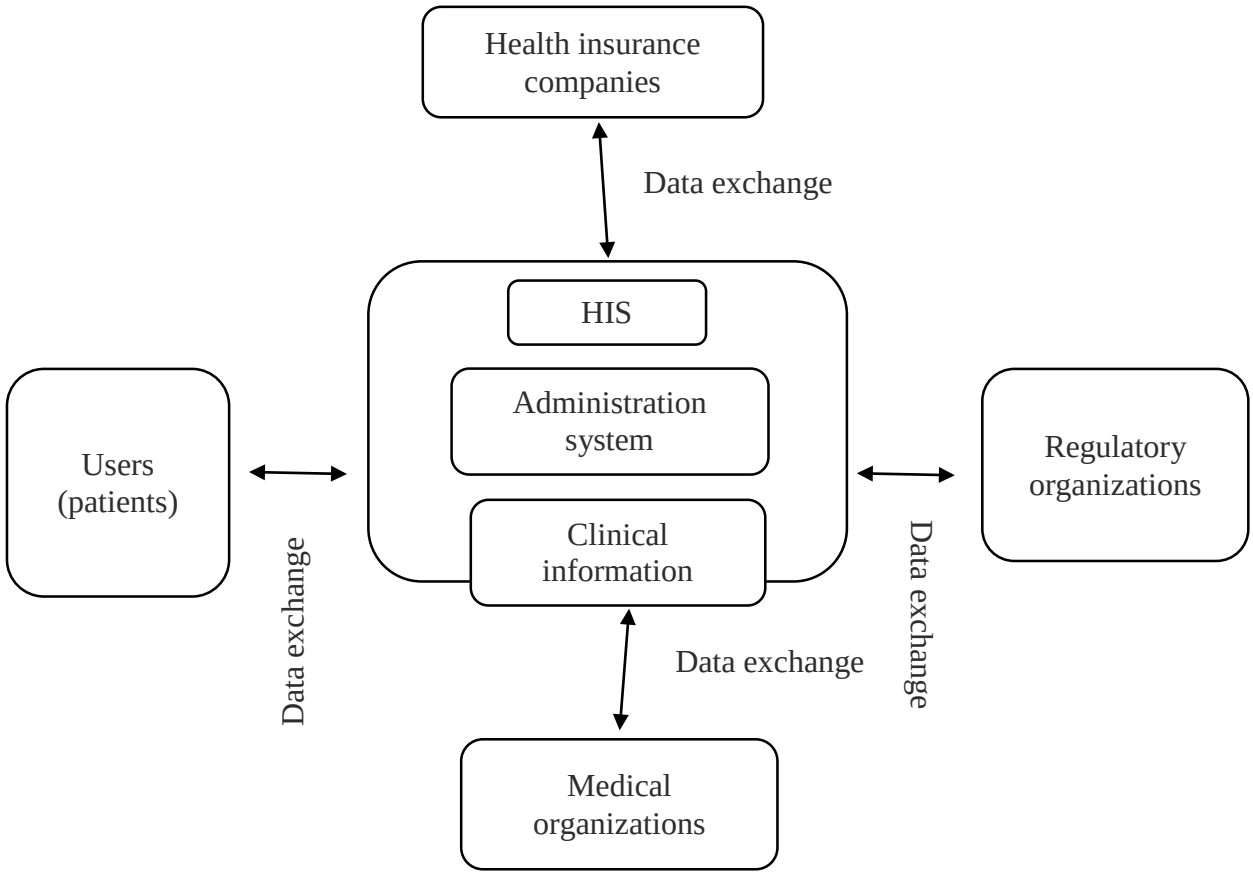

Figure 1. The process of exchanging medical data [4, p. 2]

The existing medical data storage system has many shortcomings (Figure 1) . One of the key ones is the problematic provision of confidentiality of stored data. Medical databases of both private clinics and laboratories, and public clinics are often the target of cyberattacks. Based on the study by Check Point Research from January to September 2024, the average annual number of hacker attacks in the healthcare industry is 2,018 incidents [5]. Such statistics make one think about the need to implement more effective solutions in terms of digital security.

Another problem is the loss of medical information. A key factor for a doctor to make the right decision about a patient's diagnosis is the integrity of the available data. Due to the human factor, outdated equipment and the need to constantly transfer data to inconsistent databases, valuable medical information of patients is lost.

The fragmentation of stored data is also one of the significant shortcomings of the existing system in medicine. Information about examinations and tests performed is often stored in various databases that cannot be accessed quickly and at the same time. This slows down the process of providing care to patients and adds a large number of unnecessary steps to obtain the necessary information for diagnosis [6, pp. 95-99].

It is blockchain that can solve the above-mentioned problems. This technology has the following advantages:

– Cryptographic security. Reliable encryption algorithms protect data from hacking. Blockchain decentralization makes it difficult to carry out cyber-attacks and allows for quick data recovery in case of hacking;

– Immutability. Once recorded in the blockchain, data cannot be changed or deleted, guaranteeing its integrity and authenticity;

– Traceability. Each access to data is recorded, saving a timestamp, which allows tracking the full history of consultations and information exchange. This allows you to track which users accessed specific information, which limits the possibility of abuse of access rights;

– Remote patient monitoring and mobile data integration. Blockchain facilitates integration with wearable medical devices such as smart watches, fitness trackers, glycemia monitors, etc. It also increases the security of storing the received data and makes it possible to effectively monitor patients;

– Real-time access to patient data. Often in the healthcare industry, workers need to make quick and accurate decisions. To work effectively, medical workers need to have instant access to all patient data. Blockchain technology allows real-time access to all updated patient data. With an up-to-date patient medical record, doctors can make accurate decisions in emergency situations [7, pp. 195-196].

Thus, blockchain technology can improve the efficiency of doctors and the activities of medical institutions. Thanks to its implementation, patients will be able to feel confident in the safety of their confidential medical data.

Blockchain technology has been known for quite some time, but it is still not actively used in healthcare organizations. Although an increasing number of startups are developing solutions to the problems of storing and transmitting medical data using

blockchain technology, its integration into large healthcare organizations is still under discussion. PwC conducted a survey among 74 companies around the world working in the healthcare sector to determine the popularity of blockchain technology in healthcare organizations [8]. Figure 2 shows the main responses of healthcare companies about the possibility of implementing blockchain technology for storing medical data. After analyzing the responses, we can conclude that although many company representatives are working on implementing the technology, most still do not have sufficient knowledge about blockchain technology or are afraid of its shortcomings.

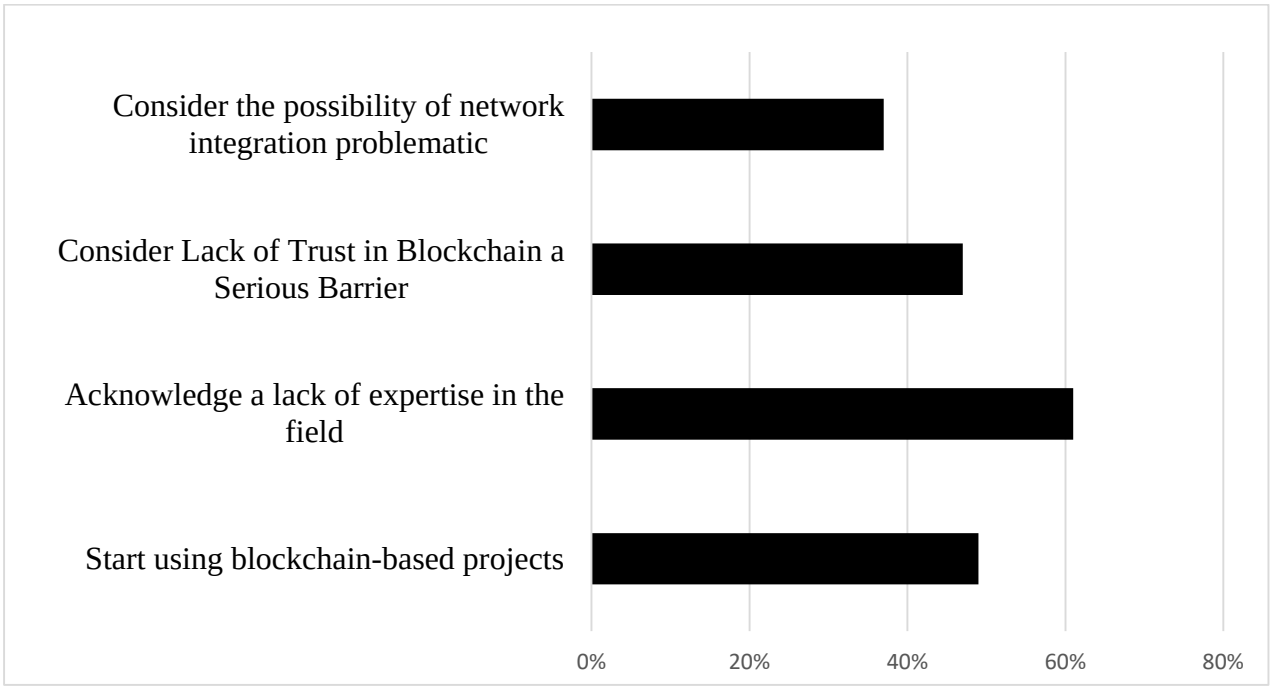

Figure. 2. Results of the study on the use of blockchain [8]

The main disadvantages of implementing the system:

1. The main obstacle to the widespread implementation of blockchain technology is the need for integration with existing systems. Medical laboratories, clinics, insurance companies have their own, unrelated databases. This factor and the presence of outdated IT systems, especially in remote cities, require careful adaptation of systems and reorganization of existing data. Given the lack of unified data storage formats in the industry, their unification into a single system will take a long time. It is also worth taking into account the need to retrain employees and explain the use of new data storage systems, which also slows down the process of implementing blockchain.

2. Another significant reason is high operating costs. In recent years, there has been a need to increase investment in the medical sector. The implementation of blockchain technology will entail a large amount of costs for the implementation of equipment and software, the transfer of existing data and ongoing maintenance.

Thus, it is the need for large financial investments and time resources that stops the possibility of developing blockchain for organizing the storage of medical data. It

is obvious that for the successful implementation of such a system, government intervention is necessary, which will ensure the creation of the necessary conditions and financial support for the implementation of these innovative solutions.

But at the moment, the most important step towards the implementation of blockchain in the data storage process is the need to instill confidence in citizens and owners of medical organizations in the technology. Despite all the positive characteristics, most are still skeptical about such a process modernization. Therefore, in addition to financial support, the state should also help with the introduction of technology to the market by regulating the use of blockchain in healthcare in regulatory legal acts.

Currently, the prospect of implementing blockchain technology for storing medical data in the Russian Federation is positive for all participants in the process. Thanks to this technology, patients will be able to be confident in the safety of their data, medical workers will have access to all tests and examinations performed on patients, and medical organizations will increase the efficiency of the data storage and transmission process. Of course, this will entail financial losses and will take quite a lot of time, but in the long term it will be able to solve many problems in the field, increasing the efficiency of interaction between medical organizations and patients.

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УДК 336.7

NEW APPROACHES TO LEASING IN CONTEMPORARY BANKING: A THEORETICAL REVIEW

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Abstract. This theoretical review examines recent advancements in leasing practices within contemporary banking, with attention to how economic, geopolitical, and regulatory dynamics have reshaped leasing markets and bank-leasing company relationships. Incorporating recent research and data from Russian and global contexts, this article provides an overview of current challenges and strategic innovations that drive profitability and operational efficiency in this complex landscape.

Keywords: banking, economic sanctions, bank-leasing company relationships, Lease accounting standards, Geopolitical tensions, financial reporting.

НОВЫЕ ПОДХОДЫ К ЛИЗИНГУ В СОВРЕМЕННОМ БАНКОВСКОМ ДЕЛЕ: ТЕОРЕТИЧЕСКИЙ ОБЗОР

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Аннотация. Данный теоретический обзор посвящен анализу последних тенденций в области лизинга в условиях современного банковского сектора. В работе особое внимание уделено тому, как экономические, геополитические и регуляторные изменения трансформируют лизинговые рынки и взаимосвязи между банками и лизинговыми компаниями. В статье обобщаются результаты актуальных исследований и данных как в российском, так и в международном контекстах, освещая ключевые вызовы и стратегические инновации, которые способствуют повышению прибыльности и эффективности операций в этой сложной и быстро меняющейся сфере.

Ключевые слова: банковский сектор, экономические санкции, взаимоотношения между банками и лизинговыми компаниями, стандарты учета лизинга, геополитическая напряженность, финансовая отчетность.

In contemporary banking, leasing has evolved into a crucial financial tool which enables the purchase of assets for a predetermined time frame without requiring an upfront capital investment, offering a flexible substitute for asset ownership. However, leasing practices in banks and leasing companies are changing dramatically as changes in regulation and geopolitical conflicts shift financial landscapes. In order to investigate how innovative leasing strategies might maintain profitability and improve operational resilience, this article synthesizes recent scholarly contributions and statistical insights to analyze the effects of various external pressures. In doing so, the article sets out strategic paths for stakeholders and provides insight into the difficulties facing the leasing industry.

The Russian leasing market has been particularly affected by economic sanctions, as highlighted in Shipshova and Nurtdinov's analysis [1]. The authors note a pronounced drop in leasing transactions due to restricted access to international financing, destabilizing leasing companies across various sectors. Statistical data indicates that, despite these difficulties, the Russian leasing market showed some resilience, with 625,724 assets leased in 2023 – a 45 % increase from the previous year, although numbers from early 2024 reflect a partial downturn as outlined in *Leasing Union Report* [2, p. 1]. This data emphasizes the need for initiatives that will enhance stability in risky geopolitical scenarios, reciting Alvi et al.'s call for reformed bank-leasing firm relationships to increase income streams during challenging times [3]. Amid the geopolitical challenges, banks and leasing companies are revising their collaborative frameworks to enhance profitability. Alvi et al. propose a new model where banks derive commission income by integrating leasing as a component of their credit portfolios. This approach, which includes targeting small and medium-sized enterprises, could provide a reliable income source even when conventional leasing profits diminish due to market instabilities. This is further supported by the recent emphasis on regional leasing in areas like Moscow and the Kaliningrad region, which accounted for a significant percentage of leased assets according to the Leasing Union Report [2]. Such targeted leasing strategies can mitigate risks while enhancing access to emerging markets.

Let us consider regulatory and accounting developments impacting leasing. Recent changes to lease accounting standards have influenced leasing practices. Maxim and Mikheev discuss the transition to the federal standard FSBU 25/2018, which aligns with IFRS 17 and mandates that companies recognize leased assets and liabilities on their balance sheets. This shift impacts financial reporting, potentially affecting asset acquisition decisions and lease-versus-purchase considerations. According to recent statistics, the number of active leasing companies in Russia rose to 669 in 2023, a 6 % increase from the previous year, indicating a growing adaptation

to these standards.

Therewith there are some strategic implications of lease accounting changes: the implications of IFRS 17 extend beyond compliance, influencing strategic decision-making in leasing. With the new standards altering key financial ratios and metrics, companies may find it necessary to reevaluate leasing strategies to maintain profitability. Merrill explains that the flexibility of leasing allows businesses to control assets temporarily without the obligations of ownership, which can align well with the revised accounting frameworks that highlight lease liabilities on balance sheets. These regulatory adjustments emphasize the importance of responsive, compliant leasing models that align with international standards [4].

In addition to regulatory changes, advancements in financial modeling have introduced new decision-making tools for lessors. The stochastic model proposed by De Cesare et al. employs an optimal stopping approach, enabling transformative changes [5]. This review synthesizes insights from recent studies, including empirical data from the Russian leasing market, the economics of leasing as analyzed by Merrill, and implications of new accounting standards. These resources highlight the economic and regulatory factors that influence leasing's role in modern banking and underscore innovative strategies banks are employing to sustain profitability amidst fluctuating market conditions.

Beyond that, leasing is affected by economic and geopolitical factors. Recent economic sanctions have created substantial constraints in the Russian leasing sector, particularly affecting cross-border transactions and funding access. According to data from the Leasing Union Report, leasing transactions involving non-resident companies from countries such as Turkey, Kazakhstan, and Bulgaria represented notable cross-border activity; however, overall leasing volumes and contract renewals have declined due to geopolitical instability [2, p.1-2]. Shipshova and Nurtdinov further emphasize that the Russian leasing market is in a downturn, necessitating strategic adjustments and state support to stabilize operations. Their study suggests that segments such as automotive leasing may offer growth potential, given their consistent demand despite overall market decline [1].

Therefore, the question arises, what bank-leasing company relationships amidst geopolitical risks are. Alvi et al. discuss the strain on banks and leasing companies as geopolitical risks disrupt profitability and lease term stability. In response, they propose that banks diversify income sources by leveraging commission-based services and extending credit to small and medium-sized enterprises (SMEs) in regional markets. The increased focus on Islamic regions within Russia highlights an additional approach, whereby banks can incorporate leasing arrangements that align with Sharia-compliant financing, allowing them to attract and support SME clients without relying on conventional interest-based loans [3].

Further consideration should also be given to changes in legislation and accounting that affect leasing. The transition to FSB 25/2018, aligning with IFRS 17, requires companies to recognize lease liabilities and right-of-use assets, leading to

significant impacts on balance sheets and financial disclosures. These changes affect key financial ratios, influencing investor perceptions and, potentially, lending capacity. With leasing companies needing to adjust accounting processes to comply with these standards, the complexity of managing leasing transactions has grown, making financial expertise and specialized training imperative. Based on the above, strategic planning in accordance with the new accounting rules is crucial.

The economic impacts of the FASB's updated lease accounting standards extend beyond compliance, as outlined in The Economics of Leasing by Merrill, leasing's financial appeal lies in its flexible cost structure, particularly valuable for businesses needing to conserve capital. This aligns with the rationale in Russia's updated leasing strategies, where firms must balance compliance with growth needs by strategically leveraging lease terms to optimize capital deployment [4].

With growing economic uncertainties, stochastic models have become pivotal for analyzing leasing contracts. De Cesare et al. developed an optimal stopping model that incorporates interest rate fluctuations and cost of capital to determine the most advantageous timing for lessors to terminate leases. This model reflects real-world complexities in financial decision-making and allows for dynamic adaptation to changing interest rates, providing a robust framework for evaluating contract sustainability [5]. The authors further introduce a recombinant binomial tree model that applies correlated random walks to simulate various market conditions, offering insights into potential scenarios affecting lease termination. Such models help leasing firms and banks understand how interest rates and economic shocks influence profitability. The findings underscore the value of integrating stochastic processes to capture market volatility and optimize leasing decisions under uncertain conditions.

An important point is challenges and opportunities for transition leasing markets. We will focus on structural and operational challenges. Data from the Leasing Union Report indicate a growth trajectory in the Russian leasing market in specific segments like automotive and specialized equipment, but challenges remain. Regulatory hurdles, low financial literacy, and insufficient infrastructure hinder expansion, especially in smaller regional markets where leasing is less developed. Addressing these obstacles requires policy support to enhance legal frameworks, promote financial literacy, and encourage leasing as a feasible financing alternative. Hence, some policy recommendations were made. Policies promoting leasing, particularly in regions with underserved markets, can boost leasing's role as a development tool. For example, enhancing the legal framework to streamline leasing agreements, as suggested by Merrill, would make leasing a more attractive and accessible option. Improving access to equipment leasing for SMEs could stimulate regional growth and provide a path to economic resilience for transitional economies.

In conclusion, this review allows stating the pivotal role of leasing in modern banking and the need for innovative approaches to adapt to geopolitical, economic, and regulatory pressures. With new accounting standards reshaping balance sheets and stochastic models enhancing decision-making, leasing companies and banks have tools

to navigate uncertainty and optimize leasing as a financial mechanism. Leveraging strategic policies and models, banks and leasing companies can improve operational efficiency and profitability, ensuring the continued relevance of leasing in the banking industry.

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УДК 336.1

TRANSFORMATION OF FINANCIAL SERVICES: APPROACHES TO THE INNOVATIVE REMOTE BANKING PRODUCTS IN RUSSIA AND THE USA COMPARED

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Abstract. The article discusses the transformation of financial services in Russia and the USA, namely it focuses on the factors shaping the implementation of the innovations in online banking in the compared countries. Digital transformation, based on new technologies such as artificial intelligence and blockchain, significantly alters the delivery of financial services, as a result, new business models and platforms emerge, making financial services more accessible and convenient for consumers, thereby promoting financial inclusion and enhancing service quality. However the approaches to the innovative products in Russia and the USA differ due to various reasons, investigated in the article.

Keywords: online-banking, artificial intelligence, blockchain, mobile banking, digital transformation, remote banking services.

ТРАНСФОРМАЦИЯ ФИНАНСОВЫХ УСЛУГ: ПОДХОДЫ К ПРИМЕНЕНИЮ ИННОВАЦИОННЫХ ДИСТАНЦИОННЫХ БАНКОВСКИХ ПРОДУКТОВ В РОССИИ И США

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Аннотация. В статье рассматривается цифровая трансформация финансовых банковских услуг в России и США, в частности, факторы, влияющие на процесс внедрения инноваций в этой сфере в обеих странах. Цифровая трансформация, поддерживаемая новыми технологиями, такими как искусственный интеллект и блокчейн, значительно меняет предоставление финансовых услуг, в результате чего появляются новые бизнес-модели и

платформы, которые делают финансовые услуги более доступными и удобными для потребителей, способствуя росту финансовой инклюзии и повышению качества обслуживания. Однако подходы к развитию инновационных дистанционных банковских продуктов в России и США разнятся по разным причинам, о которых речь также пойдет в данной статье.

Ключевые слова: онлайн-банкинг, искусственный интеллект, блокчейн, мобильный банкинг, цифровая трансформация, дистанционное банковское обслуживание.

Remote banking is the provision of banking services through electronic communication channels such as the Internet, mobile devices and telephone lines. The history of development of this sector began with the appearance of the first Internet banks at the end of the 20th century and continues to this day due to the development of mobile applications and other high-tech solutions [1]. The key types of remote products are mobile banking, internet banking, remote counseling and investment platforms. A special case of remote banking is mobile banking – a service that allows customers to access their accounts and perform various banking operations – money transfer, balance check, settlement and payment – using an electronic gadget – a smartphone or tablet [2, p. 115]. It is a digital personal cabinet of the bank's client, which can be accessed through the bank's official application. Modern financial innovations include the use of artificial intelligence (AI), blockchain technologies, digital identification and biometric authentication methods, as well as the development of online lending. These technologies contribute to improving the efficiency, convenience and security of financial services [3, p. 264].

To summarize the above, the review of existing published scholarly articles reveals that most researchers center their focus on the study of how technological and social determinants influence the way remote banking is developing. The differences in strategies depending on geographical position, economic development of the country, and existing legislative frameworks are of significant importance.

Let us analyze the factors that influence the development of remote banking. The policies adopted by the banks in deploying the remote services are determined by the following factors:

1) technological: availability of the necessary infrastructure, level of penetration of the Internet and mobile devices into the population;

2) social: the readiness of the customers to adopt new technologies and their level of trust in electronic communication channels;

3) economic: financial literacy of the population, the cost of implementation and support of remote services;

4) legal: regulation of banks' activities, protection of personal data, and fight against cyber threats.

Procedures used in the scope of our study are as follows:

1) a comparative analysis of the product and market data enabled us to estimate

the level of similarity/difference of the remote banking services provided in Russia and the USA;

2) an analysis of consumer behavior via qualitative research, including an exploration of user preferences and the difficulties experienced while using remote channels;

3) a statistical analysis of the penetration of the remote banking services based on official bank reports and consumer surveys.

The main peculiarity of the Russian oversight of the financial sector has been that it traditionally takes place under very rigid governance of the Central Bank of the Russian Federation (CBR). In the US, such institutions as the Federal Reserve System (FRS) and the Securities and Exchange Commission (SEC) function within a much more decentralized system, whereas in Russia, all financial institutions are under the full scope of supervision by the CBR. This may be a constraint in introducing new technologies, but, on the other hand, this condition creates stability and protects consumer's interests. There exist some supporting measures in Russia, such as the Digital Economy program; in general, though, these measures are more targeted to large companies and government projects rather than individual ones. The US financial sector actively supports startups and financial technology companies through venture capital funds, as well as special government programs that involve grants and tax incentives [4].

Russian financial institutions are involved in the area of developing mobile applications and online banking systems, offering a wide range of services that vary from simple transactions and utility payments to the most complex investment offerings. In this regard, one may refer to Sberbank and VTB Bank; however, American financial institutions, especially the bigger players like JPMorgan Chase and Bank of America, offer more advanced solutions like full-cycle financial management platforms, automated investment services based on robo-advisors, and improved data analytics capabilities.

The Internet is one of the major drivers of introducing innovative online banking products, but the access to the Internet is not equally provided to the residents of the compared countries, for example, in 2021, the share of Internet users in the USA was 88.1 %; however, the share of online banking users was substantially lower and equaled 59.3 %. In Russia, the number of Internet users equaled 73.1 % of the population in 2021. Nevertheless, the share of the population that uses the Internet for banking services also constituted 59.3 % in the indicated year (Figure) [5, p. 261].

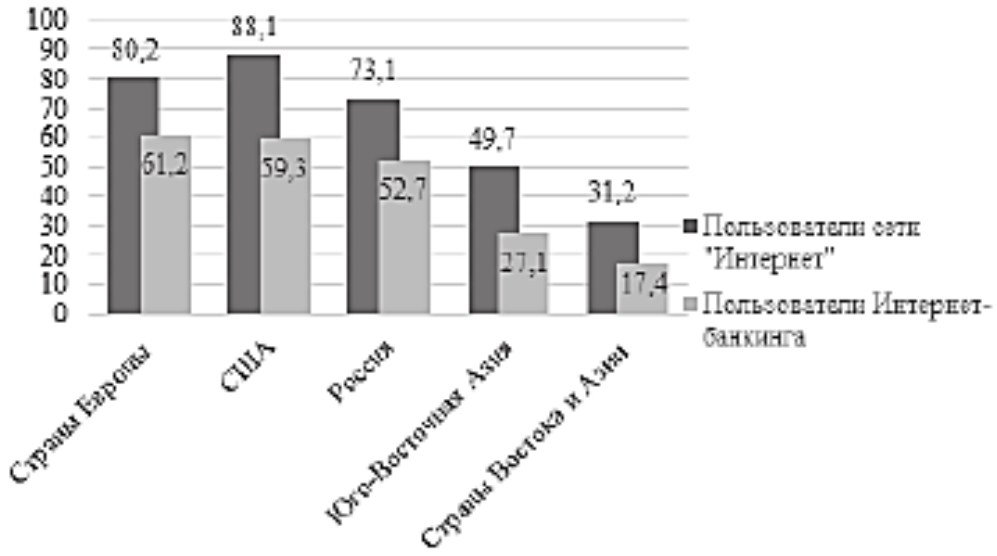

Figure. Share of Internet users and Internet technologies of banks in the population of countries of the world and Russia in 2021, %

The US market has a high degree of use of artificial intelligence, blockchain, and big data with the purpose of personalizing services and improving the security of transactions. Russian banks are also using these technologies, but at a slower rate due to regulatory constraints and less available resources.

Thus, from the point of view of customer perception and willingness to innovate, US banking consumers are more open to the advantage of new technologies like biometric authentication systems and voice assistants. They also habitually expect high standards of service and rapid access to financial services through digital channels. In Russia, consumers are interested in innovative products but take a cautious attitude toward security and data privacy. While using mobile applications for everyday transactions is more familiar for Americans, Russians would still prefer visiting bank branches for more complex procedures, like applying for loans or opening deposits. We believe that this could be a consequence of cultural differences and distrust of fully remote services. Interest in digital channels to access a bank account keeps growing. Multichannelization is necessary today: banks are obliged to create an environment where the client uses the channel that is convenient for him at a given time in a given place with the possibility of connecting additional communication tools.

Let us consider the factors affecting the transformation of banking services:

1) the economic environment. The economy of the US is among the most developed globally; hence, it allows swift innovation and investment in the technological sector. Sanctions and fluctuating currency are some of the major ec onomic setbacks that Russia faces, slowing the development of digital banking;

2) the level of digital literacy. Digital literacy in the US is higher due to widespread programs of education and awareness, while Russia is growing in the number of internet and mobile device users, which could build potential for growing

demand of remote banking services [6];

3) the access to technology. High-speed Internet access practically covers the whole of the US, a fact that enables banks to provide high-class online services. In Russia, infrastructure remains less developed in far-flung areas; because of this, it is hard for people to enjoy remote banking services on a mass scale.

The analysis of the research material allows us to draw the following conclusions:

1. The regulation and promotion of innovations significantly differ in the compared countries. To be more specific, in Russia, the financial sector is centrally regulated by the Central Bank of the Russian Federation, which ensures stability; however, such centralization may hamper the flexibility necessary for introducing new technologies. The United States has a much more decentralized system of regulation and promotes innovation through freedom, though it requires coordination among numerous agencies. Public support in the United States is directed to the development of startups and financial technology companies through venture capital and grants, while in Russia, it is mainly focused on supporting large-scale projects and government-initiated projects.

2. The approach to the use of innovative solutions and technologies also differs, while Russian banks are actively implementing mobile applications and online banking, providing basic services such as transfers and bill payments, US banks offer more sophisticated and high-tech solutions, including robo-advisors, integrated financial management platforms and advanced data analytics [7]. It should also be noted that the use of artificial intelligence, blockchain and big data in the US is far ahead of similar processes in Russia.

3. The perception and willingness of bank customers to innovate online banking products in the US and Russia are different. Banking consumers in the US demonstrate a high willingness to use digital channels and expect fast and convenient solutions, while in Russia bank customers are also interested in innovation, but they remain cautious about data security and privacy issues, preferring traditional methods of communication with banks for complex transactions [8].

4. The drivers influencing the development of banking services to be studied in these countries are many; the economy of the United States is one of the most developed in the world, hence encouraging fast technology innovation and investment in the industry. The level of digital literacy is higher in the United States compared to Russia, which affects both the perception and usage of remote banking services. Also, access to modern technologies is more extensive in the US than in some regions of Russia, where infrastructural development is relatively low.

In this connection, the article shows significant differences in strategies for the development of remote banking in Russia and the USA due to differences in the very regulatory environment, the level of population's technical literacy as well as readiness for innovations.

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МАТЕРИАЛЫ
IV Всероссийской
научно-практической конференции
на английском языке
«ТЕОРИЯ И ПРАКТИКА СОВРЕМЕННОЙ НАУКИ: ВЗГЛЯД МОЛОДЕЖИ»

2025 ● Часть I

PROCEEDINGS
of the IV All-Russian
Scientific and Practical conference
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“THEORY AND PRACTICE OF MODERN SCIENCE: THE VIEW OF YOUTH”

Part I

Редактор и корректор А. А. Чернышева
Технический редактор А. А. Чернышева

Научное электронное издание сетевого распространения

Системные требования:
электронное устройство с программным обеспечением
для воспроизведения файлов формата PDF

Режим доступа: http://publish.sutd.ru/tp_get_file.php?id=202016, по паролю.
- Загл. с экрана.

Дата подписания к использованию 23.01.2025. Изд. № 5325/24

Высшая школа технологии и энергетики СПб ГУПТД
198095, СПб., ул. Ивана Черных, 4.