ДИАЛОГ КУЛЬТУР

Материалы XIII межвузовской научно-практической конференции с международным участием

2020 года

Часть I

DIALOGUE OF CULTURES

Proceedings of the XIII Research and Practice Conference with International Participation

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Part I

Санкт-Петербург
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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

ДИАЛОГ КУЛЬТУР

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В сборник включены материалы студенческой научно-практической конференции с международным участием «Диалог культур». В публикуемых материалах отражены научные, технические и гуманитарные интересы молодежи из нескольких университетов Санкт-Петербурга.

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OFFSHORE WIND TURBINE GENERATORS. OVERVIEW AND ECOLOGICAL IMPACT

Abstract: This paper provides an overview of different existing and developing designs of offshore wind turbine generators. One of the problems requiring further research and analyse is being formulated.

Keywords: wind turbine generator, wind farm, green energy, ecological impact, pulsation.

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ВЕТРЯНЫЕ ГЕНЕРАТОРЫ В МОРЕ, ИХ ВЛИЯНИЕ НА ЭКОЛОГИЮ

Аннотация: Работа представляет собой обзор различных существующих и разрабатываемых проектов ветряных генераторов в море. Формулируется одна из проблем, нуждающихся в дальнейших исследованиях и анализе.

Ключевые слова: ветрогенератор, ветропарк, «зеленая энергия», экологическое влияние, биение.

Today the so-called “green” power technologies are the main stream in the consciousness of the society and in the media. One of the spheres that is considered to be very prospective is wind power generation and, as an important part of it,

offshore wind power or offshore wind energy as the opposition to on-land wind power generation.

Offshore wind power is the use of wind farms constructed in water, usually in the ocean, to harvest wind energy for generating electricity. Unlike the typical use of the term "offshore" in the marine industry, offshore wind power includes not only the ocean but also other water areas such as lakes or fjords.

The advantage of locating wind turbines away from the coast is that the wind is stronger and less gusty above the water, and especially in the afternoon, matching the time when people are using the most electricity. Offshore turbines can also be located close to plants or large cities, eliminating the need for new long-distance transmission lines. However, the disadvantages of these installations are difficulty of access and harsher conditions for the units compared to onshore wind turbines [1].

The expenses for the turbine construction, infrastructure and maintenance increase rapidly with distance from coast and water depth. This is why almost all currently operating wind turbines are installed in relatively shallow waters (up to 50-60 m) on fixed underwater foundations.

However, the fixed foundation turbines, such as monopiles, gravity base structures, steel jacket structures etc. cannot be used for depths over 60-80 m for either economical or technical reasons. A solution to this problem would be the installation of floating wind turbines anchored to the ocean floor. This type of wind farms have the potential to significantly increase the available sea area, especially in countries with limited shallow waters, such as Japan. Locating wind farms further offshore can also reduce visual pollution, provide better accommodation for fishing and shipping lanes, and reach stronger and more consistent winds. As they are suitable for towing, floating wind turbine units can be moved to any location on the sea without much additional cost [2].

Commercial floating wind turbines are mostly at the early phase of development, some several single prototypes have been installed since 2007 [3].

Two common types of engineered design for anchoring floating structures include tension-leg and catenary loose mooring systems. Tension leg mooring systems have vertical tethers under tension (a group of tethers is called a tension leg) providing large restoring moments in pitch and roll. They are suitable for water depths of 300-1500 m. Catenary mooring systems provide station-keeping for an offshore structure yet provide little stiffness at low tensions [3].

While the offshore wind industry has grown dramatically over the last several decades, there is still a great deal of uncertainty associated with how the construction and operation of these wind farms affect marine animals and the marine environment [4].

Common environmental concerns associated with offshore wind developments include:

- The risk of seabirds being struck by wind turbine blades or being displaced from critical habitats;

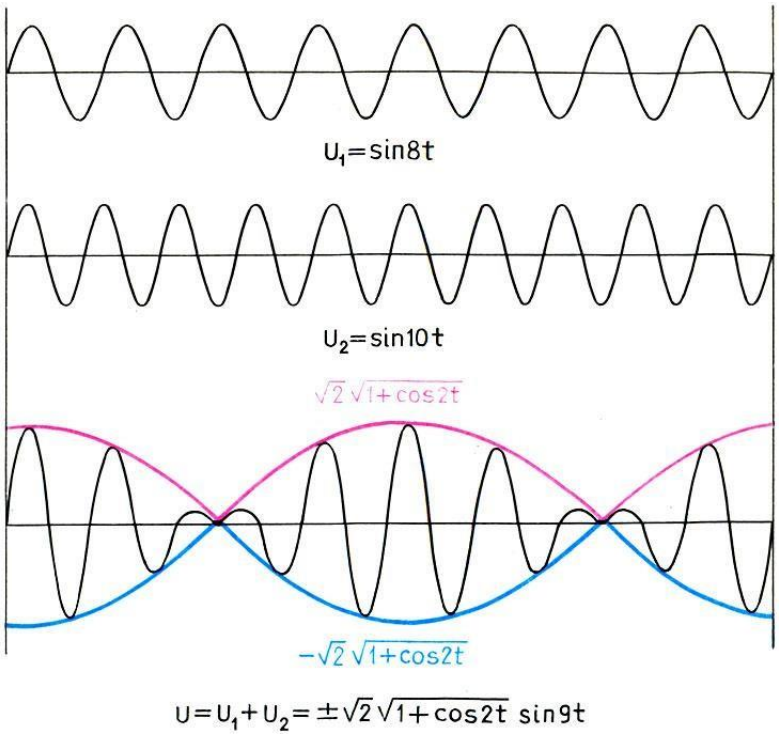
- The underwater noise associated with the installation process of driving monopile turbines into the seabed;
- The physical presence of offshore wind farms altering the behavior of marine mammals, fish, and seabirds with attraction or avoidance;
- The potential disruption of the nearfield and farfield marine environment from large offshore wind projects.

Besides all other types of pollution, the modern ecology concentrates on noise pollution. While studying the offshore wind power projects, there is a certain impression that a proper attention is not paid to this aspect of their work. However, it probably deserves a more detailed analysis.

Taking into consideration the author's personal experience while sailing and diving in various water areas, the sound from small boat motors can be clearly heard in the water at a distance of several hundred meters from the source, while the sound of bigger ship engines is distinguished at a distance of several kilometers. Although the droning sound produced by the generator of the wind turbine cannot be considered as very loud, it would be transmitted straight into the water by the hollow tower of the wind turbine.

The distance between the offshore wind turbines can be assessed as 200 to 400 m. As the water is a good sound conductor, the acoustic wave from one turbine will most probably reach the towers of the turbines next to it.

Physics knows the so-called pulsation effect when two sound waves of different but close frequencies add up. As a result, a new wave with a significantly lower frequency appears. In case of higher frequency wave interaction, the pulsation sound is often audible (a non-tuned musical instruments play) together with the sounds that produce the pulsation. In this case, the sound is usually unpleasant or even harmful for people.



Picture 1. Scheme of the pulsation effect (from mathemlib.ru)

As winds and water streams are often inconstant, it would be logical to say that the rotation frequency of all the windmills and their generators can be slightly different, and so would be the frequency of the drone sound. Generally, it can be assessed as about 280 to 350 Hz, which is a relatively high pitch tone. Due to the spherical shape of the sound wave spreading in the water mass as well as the variety of external conditions and the changing factors, it is complicated to predict the behavior of the sound waves originating from the wind turbines. Still, we can suppose that these sound waves will produce the pulsation effect at multiple points in the offshore wind farm. Taking into view the frequency of the drone sound, it would be reasonable to expect the pulsation wave to appear in the infrasound diapason (up to 16 Hz).

It is well known that infra sounds influence living organisms. Since there are many sound sources in a wind farm, many infra sound pulsation waves can be produced and, besides their ability to spread far away from the source, they can also add up reinforcing or weakening each other. Moreover, as the mooring systems of the floating wind turbines will have various systems of tethers, they might act similar to the strings of a musical instrument, also producing infra sounds which in turn could interact with the frequencies from the generators themselves.

As far as an uninitiated person can judge about the researches concerning offshore wind farm construction, there are no analysis regarding wave interaction produced by wind generators. However, this area of research, due to the diversity of constantly changing conditions, can be as complicated and as important as the technical solutions, since the effect can influence the life in the ocean.

Nowadays the discussion of plastic and exhaust gases pollution is probably reigning in the sphere of ecology. Trying to diminish the influence on the nature we invent alternative ways of energy production thinking of them as of a panacea. But before we actually start to implement the inventions, we should also think about the possible related risks. Thus, the aim of this article is to bring attention to a new possible ecological issue – the sound pollution.

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VIBRATIONS OF FLEXIBLE CYLINDRICAL TUBES

Abstract: Thin shells are widely used in various industries as a component of pipeline systems and analysis of the dynamics of flexible tubes is necessary to ensure reliability. In this paper, we study the dependence of wavenumbers and natural frequencies on external static forces during axial stretching of a flexible cylindrical tube. The obtained results demonstrate the influence of axial tensile forces acting in a flexible cylindrical shell on its waveguide properties and eigenfrequencies in the low-frequency region (i.e., around the ring frequency and below).

Keywords: soft thin cylindrical shell, elastic waves, oscillation frequency, wave number, tensile forces, dispersion curves, wave processes.

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КОЛЕБАНИЯ МЯГКИХ ЦИЛИНДРИЧЕСКИХ ТРУБОК

Аннотация: Тонкие оболочки широко используются в различных отраслях промышленности как компонент трубопроводных систем, и для обеспечения надежности необходим анализ динамики гибких трубок. В данной работе проводится исследование зависимости волновых чисел и собственных частот от внешних статических сил при растяжении мягкой цилиндрической трубки. Полученные результаты показывают, как влияют силы осевого растяжения мягкой цилиндрической оболочки на волновые процессы в низкочастотной области (на частотах порядка кольцевой и меньших).

Ключевые слова: мягкая тонкая цилиндрическая оболочка, упругие волны, частота колебаний, волновое число, растягивающие усилия, дисперсионные кривые, волновые процессы.

Thin shells as a separate element of engineering structures are widely used in shipbuilding, rocket engineering, aircraft construction, mechanical engineering, etc. This extensive use is due to the fact that the shell has a high strength at a relatively low weight [1; 2]. During operation, they are exposed to dynamic loads that can cause damage to them. To ensure the reliability of pipeline systems, it is necessary to analyze dynamics of their components, in particular, flexible pipes. The paper considers a thin, closed, soft cylindrical tube shown in figure 1, and establishes the dependence of wave numbers and natural frequencies on external static tensile forces.

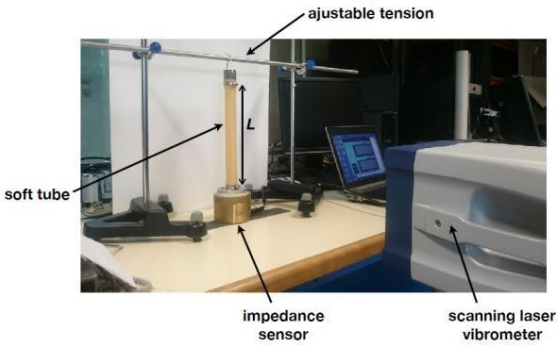

Fig. 1: Preliminary experimental study of a soft cylindrical tube.

Three cases are considered: the tube is located in a vacuum, the tube with air inside, and the tube with water. In each case, the effect of the axial tensile force on the natural frequency is analyzed. To do this, dispersion curves that describe wave propagation in a cylindrical shell and wave effects are used. To obtain dispersion curves, the dispersion equation, which establishes the dependence of the wave number on the frequency, k=k(ω), should be solved [3].

For the first case, the dispersion equation has the form [4]. When solving the dispersion equation for a tube in a vacuum, a number of assumptions are used, namely: the bending stiffness is zero, the length changes proportionally to the force, and the volume conservation condition.

Dispersion curves for an infinitely long tube:

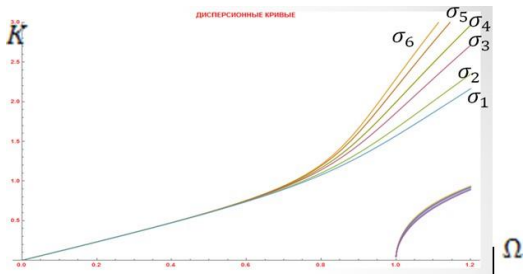

Fig. 2. Dispersion curve tension

Figure 2 shows that two traveling waves propagate in the tube, each of them characterizes the predominance of either bending deformations or longitudinal ones. Dispersion curves are presented for each of the six forces. It is seen that for the first curve in the high-frequency region at a fixed frequency, an increase in the tensile forces leads to an increase in the wave numbers. It is also noticeable that at low frequencies the influence of the longitudinal force on the wave number is small, but as the frequency parameter Ω approaches the unit, the influence of the tensile force increases. When $\Omega \geq 1$ a second wave appears, which is not affected by the tensile force.

Let's consider a hinged-hinged tube. These boundary conditions correspond to bi-orthogonality conditions and therefore the waveform is a superposition of a pair of waves with the same wave number that propagate in opposite directions.

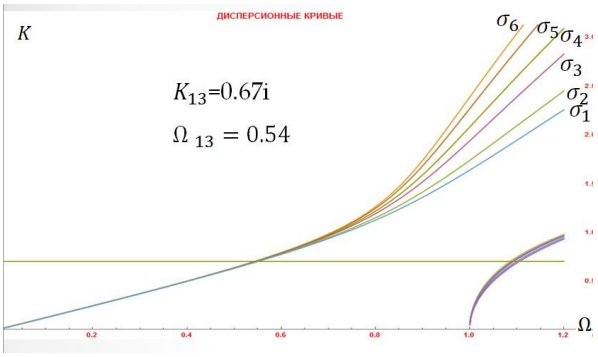

Fig. 3. Determination of natural frequencies by the graphical method (length)

Under considered boundary conditions, the shape of the tube oscillations is represented as a half-wave of the sine while the length of a tube is fixed. Thus, we can use the dispersion diagram to find a frequency, at which the wavelength matches the length of a tube so that, effectively, we move from the problem of free wave propagation to the eigenfrequency problem. We first determine the wave number associated with the lengthening of the tube. Then the straight horizontal line, which represents this wave number is drawn on the graph figure 3. Its intersection with dispersion curves identify the natural frequencies of the shell depending on the shape of the deformation. When the wave number is small and therefore the wavelength is large, the axial force affects the natural frequency solely by changing the length of the tube.

In the second and third cases, in addition to the equations of linear time-harmonic wave motion of a tube, equations describing the effect of air and water inside the tube on its dynamics are used. Then a simplified dispersion equation is introduced, in which the Bessel function and its derivative for the low-frequency range are replaced by finite products, and (with bending stiffness neglected) has the form [5]:

A) B)

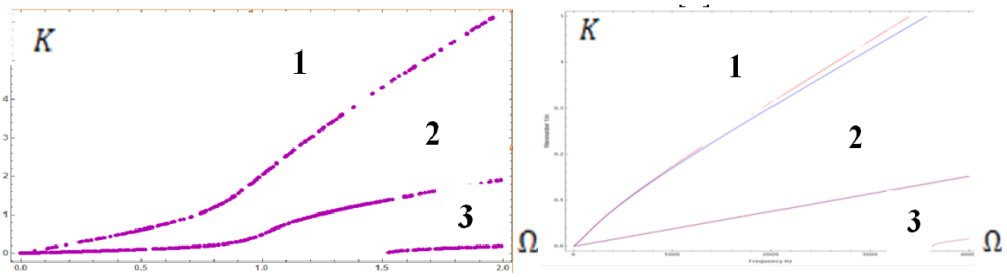

Fig. 4: Dispersion curves with the presence of air and water (1 curve - longitudinal wave 2 curve - acoustic wave 3 curve - flexural wave)

As soon as air or water inside the soft tube are accounted for, an acoustic wave is generated in the fluid-filled tube besides the longitudinal and transverse waves, see figure 4. The presence of an acoustic wave induces a shift in the cut-on frequency of the bending wave by one and a half times, this indicates that the bending wave begins to propagate in a fluid-filled tube later than in the absence of fluid loading. However, the effect of static axial forces on wavenumbers of the acoustic, longitudinal and flexural waves in the low frequency range is similar to the case of a tube in vacuum. A change in the natural frequencies occurs mainly due to the change in length, which is associated with static tensile axial forces.

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CHESS: HUMANITY AGAINST ARTIFICIAL INTELLIGENCE

Abstract: We create machines that solve certain tasks more efficiently than people. Computers today perform in seconds calculations that would take a person billions of years. Can the human mind resist such computing power in mind games like chess?

Keywords: chess, calculations, intelligence, Go (game), performance, grandmaster

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ШАХМАТЫ: ЧЕЛОВЕК ПРОТИВ ИСКУССТВЕННОГО ИНТЕЛЛЕКТА

Аннотация: Мы создаем машины, которые способны решать определенные задачи гораздо более эффективно, чем люди. Сегодня компьютеры за секунды производят вычисления, которые заняли бы у человека миллиарды лет. Можем ли мы противостоять растущей электронной мощности в интеллектуальных играх, таких как шахматы?

Ключевые слова: шахматы, вычисления, интеллект, Го (игра), производительность, гроссмейстер.

Computers are getting smarter every day. In practice, this translates into increased productivity. This is a quantitative characteristic of the speed of performing certain operations on the computer.

Back in the 70s, one of the founders of INTEL, Gordon Moore, deduced the famous empirical regularity. According to Moore, in the course of scientific progress and improvement of technological equipment, the number of transistors placed on the integrated circuit chip, and indirectly the computing power of computer equipment, doubles every two years.

In 2007, Moore stated that the law would soon cease to apply due to the atomic nature of matter and the speed limit of light [1]. Most often, computing power is measured in flops (the number of floating-point operations per second). At the moment, it is accepted to rank systems with a computing power of more than 10 teraflops as supercomputers (ten trillion flops; for comparison, the average modern desktop computer has a performance of about 0.1 teraflops).

A natural question arises: what does chess have to do with it? The fact is that chess, unlike poker, refers to games with perfect information. That is, players, know the utility function, the rules of the game, and the moves of other players. It may seem that in theory, we can calculate all possible moves and variants of parties.

Why is this game so difficult? Why do people spend thousands of years studying different variants of attacking and defensive combinations and positions

at different stages of the game? In order not to complicate the answer to this question, I will give an example of the Shannon number. In 1950, the American mathematician Claude Shannon calculated the minimum possible number of unique chess games based on the number of possible moves in his paper "Programming a Computer for Playing Chess" [2, p.4].

The final result is 10^120 unique games. The calculation is based on the assumption that each game lasts an average of 40 moves and the player chooses an average of 30 options on each move. For comparison, the number of atoms in the observed Universe is estimated from 410 10^79 to 10^81, which is 10^40 times less than the Shannon number.

After each player has moved 5 times each 69,352,859,712,417 possible games could have been played. Of course, this number includes combinations that are not possible under the rules and other flaws. Over the past 70 years, several specific articles have been published. However, there are astronomically many combinations and possible games in chess.

Speaking about the history of chess programming, it should be noted that since the beginning of the 20th century, people begin to create meaningful machines and algorithms for playing chess.

In 1951, the famous English mathematician and cryptographer Alan Turing developed one of the first working programs, Turochamp, on paper. In honor of the centenary of Alan Turing's birth, on June 26, 2012, 59 years after the publication of the article about Turochamp, Garry Kasparov won it in just 16 moves [3].

Modern chess programs are divided into two categories: some use the full search method, considering chess moves as a game tree and applying the Minimax algorithm and the evaluation function; others are not completely based on direct search and use artificial intelligence.

In the 50s, people came to alpha-beta pruning, a search algorithm that seeks to reduce the number of nodes evaluated in the search tree by the minimax algorithm. The algorithm is based on the idea that the evaluation of a branch of the search tree can be terminated prematurely (without calculating all the values of the evaluating function) if it was found that the value of the evaluating function for this branch is in any case worse than the value calculated for the previous branch.

Alpha-beta clipping is an optimization since the results of the optimized algorithm do not change. It allowed machine intelligence to continue to develop in chess at an incredible rate.

With technical progress, the development of chess programming was not long in coming. Already in the 60s, the first batch of computer programs took place. And in 1974, the first world tournament among chess programs was held. The winner was a Soviet chess program called Kaissa [4].

By the end of the 80s, chess programs began to beat professional chess players and grandmasters for the first time. Speaking about the epochal confrontation between man and machine, we can not fail to mention the chess supercomputer Deep Blue.

In 1989, its predecessor Deep Thought won the 6th world chess championship for computer programs, held in Edmonton, Canada. In 1989-90, Deep Thought lost to the two strongest chess players in the world at that time, first to Garry Kasparov and then to Anatoly Karpov. By this time, Deep Thought's rating had reached 2552 points on the USCF scale.

Deep Thought played in various configurations in competitions – the number of chess processors varied from two to six, and the total speed of search from 700 thousand to 2 million chess positions per second.

But at that time, even this was not enough to defeat the Soviet grandmaster. In 1955, the development of Deep Blue, a new improved version of this project, was completed. In February 1956, Deep Blue 1 lost the match to Garry Kasparov with a score of 2 : 4.

Garry Kasparov is a Soviet chess player who has been recognized by chess experts as the strongest player in the history of chess. And after this match, confidence in the ability of a person to resist the developing artificial intelligence was shaken. The best chess player in the world lost the first game to the computer, even though he won the match. In May 1997, an improved version of Deep Blue defeated Kasparov. In 2003, a documentary film was made that explored Kasparov's reproaches about the possible use of IBM as a chess player, called "Game Over. Kasparov and the Machine? [5].

The film claimed that Deep Blue's much-hyped victory was rigged to increase IBM's market value. In part, these reproaches were justified. The rules allowed developers to change the program between games. Deep Blue was changed between games for a better understanding of Kasparov's playing style by the machine, helping to avoid a trap in the endgame that the program fell into twice.

IBM disassembled Deep Blue after the match since then this computer has not played once. But this historical episode is considered to be the starting point when a man could no longer resist the machine's computing power. In November-December 2006, world champion Vladimir Kramnik played with the Deep Fritz program. The match ended with the machine win with a score of 2 : 4.

Today, almost 15 years later, chess programs have taken a step forward and comparing the peak capabilities of a computer and a person in the context of chess has lost all meaning. Playing in the endgame has long been a noticeable weakness of chess programs since the depth of the search was insufficient. Thus, even programs that played in the master's power are not able to win in endgame positions, where even a medium-strength chess player could force a win.

Computers are used to analyze certain endgame positions. Such endgame databases are created using retrospective analysis, starting with positions where the end result is known (for example, where one side was checkmated) and seeing what other positions are at the distance of a move, then one move away from these, and so on.

A computer that uses the endgame database will, when it reaches a position in them, be able to play flawlessly and immediately determine whether

the position is winning, losing, or tied, as well as find the fastest and longest way to achieve the result. Knowing the exact position estimate is also useful when increasing the computer's strength, as it will allow the program to choose ways to achieve the goal depending on the situation. In order to assess the scale: All 5-figure endings take up 7,03 GB. All 6-figure endings occupy 1,205 TB. All 7-figure endings occupy 140 TB. All 8-figure endings will take approximately 10 PB [6].

Speaking about artificial intelligence in games with complete information, I also want to dedicate the victory of the computer over a professional player in GO. AlphaGo was the first program in the world to win a match without a handicap from a professional GO player on a standard 19 × 19 Board, and this victory marked an important breakthrough in the field of artificial intelligence since most artificial intelligence experts believed that such a program would not be created before 2020-2025.

In March 2016, the program won 4 : 1 against Li Sedol, a professional of the 9th Dan (top rank), during a historic match that was widely covered in the press. After winning the match, the Korean Baduk Association awarded Alpha Go an "honorary 9th Dan" for the program's "sincere efforts" in mastering the game's skill.

The next stage in the development of computer intelligence is open-source technologies and the use of programs to simplify human learning and development. For example, Stockfish is a free, open-source UCI-enabled chess engine available for various desktop and mobile platforms. Stockfish consistently ranks at or near the top of most rating lists of chess engines and is the strongest regular open- source chess engine in the world.

The application of Magnus Carlsen, the current world champion, is based on such technologies. You can choose Magnus's age and play with a program that simulates his game, right from your phone and even without Internet access.

At the end of this article, I want to repeat the quote Garry Kasparov said at the Ted conference in April 2017 – "Don't fear intelligent machines. Work with them" [7]. It is the use of human development and experience that allows us to be at our quality level of life and progress. And the triumph of artificial intelligence in chess is one of the major stages in the development of our science.

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SUSTAINABLE DEVELOPMENT GOALS AND THEIR CONNECTION WITH ATMOSPHERIC AIR POLLUTION

Abstract: The article contains analysis of the special features of atmospheric air pollution reduction. The sources of atmospheric air pollution in various industries are noted. The main goals of sustainable development are listed.

Keywords: "costs-benefits", environmental policy, recycled resources, air pollution, harm for people and environment.

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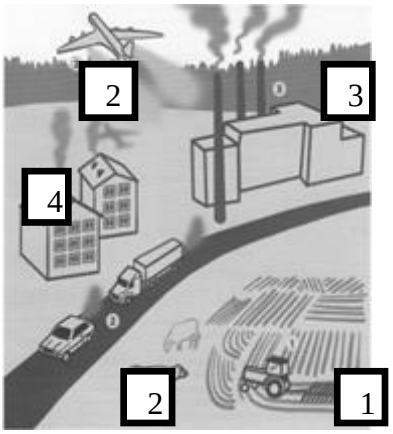
ОСНОВНЫЕ ЦЕЛИ В ОБЛАСТИ УСТОЙЧИВОГО РАЗВИТИЯ И ИХ СВЯЗЬ С ЗАГРЯЗНЕНИЕМ ВОЗДУХА

Аннотация: В статье проанализированы особенности стратегии снижения уровня загрязнения атмосферного воздуха. Указаны источники веществ, загрязняющих атмосферный воздух, возникающие в различных отраслях. Представлены основные положения устойчивого развития мирового сообщества.

Ключевые слова: «затраты-выгоды», экологическая политика, вторичные ресурсы, загрязнение воздуха, наносимый человеку и экосистемам ущерб.

A cost-benefit analysis of strategies to reduce air pollution indicates that the monetary benefits significantly exceed the costs in some industries. In the long term, environmental policy will have a positive impact on the economy through the use of secondary resources. Currently, profits are invested in the extraction and exploitation of new types of minerals, in real estate and in financial assets, and minimal funds are invested in the development of renewable energy [1]. Strategies for reducing air pollution are closely linked to those in the fields of energy and climate, transport and trade, and agriculture, and therefore cannot be considered in isolation from these industries. The damage to human health caused by polluted air exceeds in monetary terms all other types of damage (such as damage to buildings, structures and crops). Damage to ecosystems from polluted air also leads to losses, although they are difficult to imagine in monetary terms [2].



1. Agricultural activities generate 90% of ammonia and 80% of methane emissions.
2. Transport is the source of almost 40% of nitrogen oxides and fine matter (PM2. 5)
3. During the production of energy distribution, 60% of sulphur oxide emissions are generated
4. When fuel is burned by industrial, public and private buildings, half of the total volume of fine matter (PM2.5) and carbon monoxide is

Fug. 1. Sources of air pollutants.

The goal of sustainable development in relation to air pollution is to ensurehuman well-being and overcome poverty. It is assumed that the population wil lreach 9 billion people by 2050, which must be provided with fresh water and food,which is a problem, since, for example, there is already a shortage of fresh water and access to clean water is limited for 3 billion people. Liability for atmospheric air pollution, provided for in article 251 of the Criminal Code of the Russian Federation, occurs in case of violation of the rules for the release of harmful substances into the air during the operation of installations and structures, as this will entail a change in the natural properties of the air. About 58 million people live in cities with a high level of air pollution, including 100% in Moscow and Saint Petersburg, and more than 70% of the population in Kamchatka, Novosibirsk, Orenburg and Omsk regions. Cities where the atmospheric air contains high concentrations of nitrogen dioxide are home to 51.5 million of people, suspended substances – 23.5, formaldehyde and phenol – more than 20, gasoline and benzene – more than 19 million people [3].

The world community has defined and outlined the main provisions of sustainable development as follows:


Decent work and economic growth.

The goal of the green economy is to create new jobs by developing cleaner production and environmentally sustainable technologies.


Industrialization, innovation, and infrastructure.

Improving and modernizing the industry will reduce air pollution and reduce waste .


Sustainable cities and human settlements.

Storage and disposal of municipal waste will reduce air pollution in cities.


Low-cost and clean energy.

Energy production, consumption and transport are one of the main sources of air pollution. Increasing the share of renewable energy sources will help reduce air pollution and reduce air pollution and investment in clean technologies.


Clean water and sanitation

One of the ways to reduce the content of pollutants in the water environment is to reduce air pollution.


Good health and well-being.

Reducing air pollution reduces the risk of a number of non-communicable diseases (such as respiratory and cardiovascular diseases), including cancer.


Elimination of hunger.

The reduction of nitrogen emissions into the air and its more balanced use directly affect the state of soils.

In September 2015, as part of the sustainable development agenda, the countries of the world adopted a set of the above-mentioned goals to overcome poverty, protect our planet and ensure the well-being of all people.

The system of continuous education of all Russian citizens in the field of sustainable development should contain an environmental, economic and social component. This will allow people of all ages to understand that environmental damage negatively affects the opportunities for economic development and growth, and to realize that caring for the environment contributes to the health of the nation and the economy. Sustainable development assumes that we, our contemporaries and our descendants have equal rights to a favorable environment [4].

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INDUSTRIAL CULTURE AND ECO-CULTURE: IS THE DIALOGUE POSSIBLE?

Abstract: This paper discusses ecological problems of the two regions of the Russian Federation: the Republic of Adygea and the Kemerovo region. The main task is to identify the reasons for such a clear difference in the environmental

situation of the two administrative divisions: the Republic of Adygea in 2019 was recognized as the cleanest region with the most prosperous environment, while Kemerovo region is ranked first among the places with the worst environmental situation.

Keywords: ecological situation, the Republic of Adygea, Kemerovo region.

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ПРОМЫШЛЕННАЯ И ЭКО- КУЛЬТУРЫ: ВОЗМОЖЕН ЛИ ДИАЛОГ?

Аннотация: В исследовательской работе рассмотрены экологические проблемы двух регионов Российской Федерации: республики Адыгея и Кемеровской области. Основной задачей являлось выявление причин столь явного различия в экологической обстановке двух административных единиц: республика Адыгея в 2019 году была признана самым чистым регионом с наиболее благополучной окружающей средой, в отличие от Кемеровской области, которая занимает первое место в рейтинге мест с худшей экологической обстановкой.

Ключевые слова: экологическая обстановка, Кемеровская область, республика Адыгея.

Environmental problems are ones of the most discussed issues nowadays. Garbage on the streets, air and water pollution with industrial wastes are the most obvious problems that almost every citizen notices. But the real problem is deeper. It’s in the fact that nature is in such a bad condition that it leads to mass extinction of animals and causes various diseases of people. Unions and environmental organizations are created everywhere, but no matter how they try to fight the impending threat, “ecological” scale may reach its critical mark anytime soon. The anthropogenic factor has always been a key cause of this problem. Someone just throws a candy wrapper in the forest, thinking that it can not affect the nature, but the damage that is done appears to be very noticeable. One may ask why? There are almost 7 billion people in the world, and everyone has thrown away some garbage throughout their lives.

The world's major environmental problems in 2019-2020 are lack of fresh water, low sanitary and epidemiological level, large-scale production of polyethylene, global warming, reduction of species diversity of the planet [1].

The rating of the most environmentally friendly countries in the world is compiled annually by the Center for environmental policy and law at Yale University [1].

The ecological situation in Russia leaves much to be desired. Therefore, it ranks only 52nd with an index of 63.79. Currently, the Russian Federation has all possible sources of environmental pollution: electricity production, ferrous and non-ferrous metallurgy, oil production and refining, coal, chemical and gas industry, etc. Therefore, it is clear the causes of environmental hazards in the country [2].

In the Kemerovo region, mining, metallurgical and chemical production, production and distribution of electricity, gas and water have a negative impact on the environment.

The most common problem of this region is atmospheric pollution (coal and rock dust, ash, soot, sulfur dioxide, hydrogen sulfide, nitrogen and carbon oxides, hydrocarbon). Not surprisingly, locals often joke about being used to see what they breathe. Emissions of chemical substances in the air per year is about 463,852 thousand tons. 70% of the enterprises belong to the 4th class in terms of hazard (16,751 thousand tons of chemical waste per year). Mining industry has inflicted large-scale soil erosion, river pollution, land disturbance (14 thousand hectares, lost natural properties and economic value) [3]. Today, the Kemerovo region is the leader in the cancer morbidity level (in 2018, more than 6,000 people died).

Unlike the Kemerovo region Adygea is recognized as one of the most environmentally friendly regions. Environmental condition of the city is being monitored personally by the leader of the Republic. Meetings and scientific conferences dedicated to ecological problems in Russia are often held in Maikop. Citizens actively and responsibly take part in various cleaning activities. According to the results of the study, this region is famous for the most fertile soils and the best quality drinking water. However, since 2017, the issue of unauthorized solid waste dumps as well as problems related to healthcare facilities have been acute and require solution in the capital [4].

We have conducted a survey in order to find out the reasons for such differences in ecological situation between Adygea and Kemerovo.

The table below demonstrates the findings of the survey:

Reason	**Kemerovo**	**Adygea**	**Influence %**
Location of the region	The Kemerovo region is located in the southeast of Western Siberia in the center of the continent of Eurasia, and significantly removed from the seas and oceans	Adygea is located in the northern Caucasus, in the highlands, surrounded on all sides by the Krasnodar Territory. The northern border of Adygea goes along the Kuban River.	6%

Environmental awareness	Since 2017 the government has implemented separate garbage collection	Fertilizing soil, preventing erosion, conducting activities to track the illegal animal hunting, etc.	21%
Presence of special organizations that regulate the environmental situation in the region	"Aton Ecology" (groundwater monitoring, sanitary protection, registration of objects polluting the atmosphere)	Department of Environmental Protection and Natural Resources of the Republic of Adygea (program "Ecotourism", organization of specially protected natural areas)	44%
Traditions, priorities of the population of the region		The population of Adygea takes care of soils and animals	9%
Climate	Extremely continental and dry: winters are cold and long, summers are warm and short	Moderately warm and soft high humidity	2%
Resources, natural features of flora and fauna	Coal (58% of the production volume in the Russian Federation), iron ore, gold, phosphorites, other building materials, timber reserves 589 million m3. 4 zones of forest ecosystems (flora and fauna are diverse).	High soil fertility. Adygea has a high degree of biodiversity (the flora of the Republic of Adygea is represented by 2.5 thousand species, the fauna is multifaceted and unique)	17%

Table 1.

Based on the results of the survey we can suggest that environmental differences between regions are caused by the number of reasons related primarily to the human factor. Organizational structures of administrative units also play a big role in ecological situation. Thus, the environmental situation will improve only after the awareness of the population about the ways to reduce industrial and household waste has increased.

So the conclusion is that the present position of the Russian Federation in the rating of the most environmentally friendly countries is due to the weakness of certain regions. Adopting some measures of the subjects of the country with the most favorable environmental conditions, it is possible to implement improvements in the performance of Russia as a whole.

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THE IMPACT OF HOUSEHOLD CHEMICALS ON HUMANS

Abstract: Every person uses household cleaning products in the modern life. But not many of us think of their causing harm to our health. That is what I want to tell you about.

Keywords: household chemicals, health, dishwashing liquid, washing powders, aerosols for glasses, air fresheners, cleaning powders.

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ВЛИЯНИЕ БЫТОВОЙ ХИМИИ НА ЧЕЛОВЕКА

Аннотация: В современной жизни каждый человек пользуется бытовой химией. Но не многие из нас задумываются о том, какой вред она наносит нашему здоровью. Именно об этом я хочу вам рассказать.

Ключевые слова: бытовая химия, здоровье, стиральные порошки, средства для мытья посуды, аэрозоли для стекол, освежители воздуха, чистящие порошки.

The development of science and industry has led to a significant increase in the number of chemical industries. The growth of chemical production, on the one hand, and the development of chemical and technical sciences, on the other, made it possible to develop the foundations of chemical-technological processes.

The number of household cleaners has greatly increased with development of chemical industry. Sales of synthetic detergents in Russia increased from 679.6 thousand tons in 2006 to 1215.3 thousand tons in 2010. Over the five-year period sales grew by 78.8% [1].

These are substances usually used in household:

- chlorine, organochlorine compounds – in cleaning and detergents;

- phosphates and phosphonates – in washing powders;
- surfactants – in detergents and cleaners;

Chlorine is a rather dangerous substance that causes diseases of the cardiovascular system and contributes to the occurrence of atherosclerosis, anemia, hypertension and allergic reactions. This negatively affects the skin and hair, increases the risk of cancer. Its excess can cause cancer of bladder, liver and stomach in the body. Chlorine affects the human body, such diseases as pharyngitis, laryngitis, bronchitis (in acute or chronic form), various skin diseases, sinusitis, pneumosclerosis, tracheitis, visual impairment appear.

Phosphorus is a very important mineral element in the body, but a big amount of it in washing powders and detergents causes significant harm to health and can lead to changes in the gastrointestinal tract, liver damage, toxic phosphoric hepatitis.

Surfactants today are found in all cleaning products – soaps, detergents, detergents for washing dishes and rooms. Most modern household chemicals have a high concentration of anionic surfactants. When using any detergents (both for washing dishes and washing clothes), surfactants penetrate and accumulate in the body. In order to reduce their harmful effects, one should purchase cleaners with an amount of a surfactant of less than 5%. Surfactants affect the human body, there are difficulty breathing, coughing, digestive problems, problems with the heart and nervous system.

Now almost everyone uses various types of chemicals and does not even suspect what harm his body gets. Consider a few examples below.

Dishwashing liquid

Every day with food, we absorb a huge amount of harmful substances contained in dishwashing detergents. This can be avoided by switching completely to organic products that do not harm the body even if they get inside [2].

Washing powders

The composition of the powders contains anionic surfactants and phosphates, the combination of which is extremely dangerous for humans. If you wash it with your hands, it is recommended to do it with gloves so that toxic substances do not penetrate the skin through the skin. It is advisable to wear a mask on the face, since dry powder is extremely volatile and quickly penetrates the lungs.

In 2010, almost 1 million tons of washing powder was produced in Russia, and in 2019 – about 5 million tons [3].

Aerosols for glasses

At first glance, cleaning aerosols are harmless, but when sprayed, toxic isopropanol enters the respiratory system [4].

Air freshener

The effect of aerosols on human health may not appear immediately, but after a while in the form of allergic reactions, pain, dry cough and burning in the throat [5].

Cleaning powders

To clean various surfaces, special cleaning powders are used, which not only effectively cope with pollution, but also lead to disturbances in the functioning of internal organs, and also cause migraines and headaches [6].

And the saddest thing is that none of us connects the deterioration of general health, the appearance of chronic diseases at the age of 40-50 years with the effects of household chemicals. The manufacturers of these products are not interested in disseminating negative information about the danger of their product for the health of the nation. And for the same reason there was not a reliable study of a large group of people for a long period of time about the risk of using such products in everyday life.

Manufacturers claim that the amount of harmful substances in household chemicals is minimal, but they "forget" to mention such a fact as the combined effect of all components, which causes real harm to health. In addition, often the numbers on the packaging that indicate the composition of household cleaners are significantly underestimated in real terms.

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ECOLOGY AND SCIENTIFIC-TECHNICAL PROGRESS

Abstract: The present paper investigates the problem dealing with the society progress and natural resources. In the thesis we extend an existing approach to the ecological problem solution thanks to recent research and implementing new technology.

Keywords: ecology, environment, water, land, forests pollution, human population, flora and fauna, solutions.

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ЭКОЛОГИЯ И НАУЧНО-ТЕХНОЛОГИЧЕСКИЙ ПРОЦЕСС

Аннотация: В данной статье раскрываются экологические проблемы и новые разработанные высокотехнологичные пути их решения. Актуальность исследования проблем окружающей среды обусловлена экологической обстановкой современного мира.

Ключевые слова: экология, окружающая среда, загрязнение воды, земли, лесов, флора и фауна, решения.

People are used to live in grand style. The development of technology has led to the expansion of global problems, largely related to the environment. For the comfortable use of gadgets, all kinds of means of overcoming long distances, and much more, people do not notice what significant harm has been done to the environment. Not everyone even considers it.

People think about how to turn modern technology in favor not only of humans, but also of the Earth, however, few people really take steps to improve this situation. We increasingly rely on scientists and their development, and without appreciating their work at its true worth. By this we mean that new technologies that are either environmentally friendly or help correct the catastrophic situation in the world of ecology are poorly used. They have not got enough distribution. Actually, we want to draw attention to this kind of problems.

Goals of this research are to set the dissemination of information in wide circles of society, so that everyone or almost everyone not only knows about the existence of the problems, but also try to correct them. Scientific development allow people to do this, especially due to modern types of technology [1, p.53].

Three elements namely earth, water and space constitute the whole cosmos therefore it re-affirms to work with people towards creating awareness and as a movement for perseverance, sustenance of flora and fauna and cosmic elements and to usher ecology and environment of this earth where integrity of creation will be a cherished value [2, p.11].

One of the main problems raised by scientists deal with water pollution because:

- Half of the world’s wetlands has been lost and one-fifth of the 10,000 freshwater species is extinct.
- By 2050 47% of people on earth will struggle to find drinking water.

- The USA can only treat 70 percent of wastewater before adding it back to earth via reclamation.
- In Russia there are more than 1200 sources of groundwater pollution. According to the World Wildlife Fund in Russia, drinking water pollution is observed in 76 cities of the country.

Scientists are also worried about the condition of the land, soil and forests:

- According to the United Nations Food and Agriculture Organization (FAO), an estimated 18 million acres of forest are lost each year.
- Half of the world's grasslands is overgrazed. India is 25 % short of its fodder needs.
- In 2017, in the territory of 10 constituent entities of the Russian Federation, excess of pesticide content was found.

What about one of the important and main aspects of our environment – wildlife:

- Based on researches of World Society for the Protection of Animals, the causes of species loss are mostly manmade. They range from climate change, to pollution, to deforestation and beyond. According to different researches of Greenpeace, about 2,000 trees have been cut down every minute during the past 40 years.
- Scientists from the University of Illinois at Chicago, George Washington University etc. warn that the American black bear is one of more than 22,000 species threatened with extinction. During the past century, animals have been disappearing about 100 times faster than they used to. According to the World Wildlife Fund, around 70 species go extinct every day [3].
- Unfortunately, poaching in Russia is a well-established business.

Human population continues to grow rapidly worldwide, that's why people are also a problem for the ecology:

- Humanity entered the 20th century with 1.6 billion people; right now, we are about 7.5 billion. Estimates put us at nearly 10 billion by 2050.
- In 1970, 250 million cars were on the road worldwide. That number shot up to 1 billion in 2010 and it was estimated that it will have skyrocketed to 2 billion by 2020. The figures include cars, all kinds of trucks as well as buses.
- Back in 1970, the world's population exhaled about 14.4 billion tons of CO2. In 2015, we breathed out about 35 billion tons.

As we can see, there are many problems having destroyed our ecology and the world around us, so every time scientists and researchers try to come up with a more advanced technological development to solve these problems:

Environmental Monitoring

Innovation is additionally utilized to guarantee that ecology related laws and guidelines are being followed.

In regions where poachers as often as possible chase jeopardized animals, traditionalists have started utilizing drones to watch out for the territory. The special flying drones go about as surveillance cameras that can cover huge separations, making it increasingly hard for those chasing illicitly to pull off

violating the law.

The legislature additionally utilizes innovation to screen whether organizations follow natural guidelines. Geo-Spatial Measurement of Air Pollution frameworks attract air around gas and oil offices to test the measure of toxins present. Additionally, Environmental Simulation Testing guarantees new items and innovations are up to norms before they hit the market and begin to influence our planet.

Such exposure methods have been already actively used in highly developed industrial states like Russia and America.

Electric Cars

While ridesharing organizations empower us to utilize less vehicles, those vehicles are additionally getting increasingly manageable. The quantity of electric autos used has risen consistently in the course of recent years. Hybrid vehicles have also become more common [4].

The cost of electric autos has dropped too, because of specialized enhancements in the expenses of the batteries expected to run them. Specialists from International Council for Large Electrical Systems foresee that these cars will be less expensive to possess than conventional vehicles by 2022.

Smarter Homes

The home is one of the biggest energy users, but new technologies help to change that. Devices like smart thermostats and motion-activated lighting make it easier to use power only when you really need it, which saves both money and energy. These gadgets can be used both in private homes and in businesses, and they have the potential to reduce our energy usage significantly [5].

To conclude we can say that ecological problems also require appropriate legislative support that should ban modern technologies that have negative impact on environment, and only allow those ones that do not have, or have only minimum of negative influence on the environment. Passive observation is not sufficient, especially now when we have become witnesses of so many ecological disasters. It is really time for one global action, and maybe this is the only chance to protect Earth.

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SIMULATION OF A VESSEL'S ROLL SKIDDING ON A FLOATING DOCK WHILE SHIP DOCKING AND LAUNCHING

Abstract: The article focuses on the simulation of roll skidding a vessel on the floating dock for ship docking and launching, according to the current approach adopted in Russian shipbuilding, and using specialized software developed by SPbSMTU Ship Structure Department. The paper presents the description of roll skidding stages. The stages of vessel positioning on the supports and roll skidding of the vessel on the dock are considered in detail.

Keywords: floating dock, vessel, transfer cars, ballast, pontoon, railroad car trucks.

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МОДЕЛИРОВАНИЕ НАКАТКИ СУДНА НА ПОДЪЕМНО-СПУСКОВОЙ ПЕРЕДАТОЧНЫЙ ПЛАВУЧИЙ ДОК

Аннотация: Статья посвящена моделированию процесса накатки судна на подъемно-спусковой передаточный плавучий док, в соответствии с методикой, принятой в настоящее время в Российском судостроении, с использованием специализированного программного обеспечения, разработанного на кафедре конструкции и технической эксплуатации судов СПбГМТУ. Приводится краткое описание процессов накатки. Этапы установки дока на опоры и непосредственной накатки судна на док рассматриваются более подробно.

Ключевые слова: плавучий док, судно, транспортно-опорные модули, балласт, понтон, судопоезд.

Floating docks are widely used for the building of ships, ships' docking for technical state inspection, for vessels repair and launching. One of the major advantages of floating docks is their mobility: a floating dock does not require any yard space [1, 2]. However, at present, there is no general methodology, which provides detailed recommendations for transfer floating docks design and modelling the process of rolling a ship onto a dock under various docking conditions. The most likely reasons for this are the following:

- Such projects are extremely rare and each of them is unique; no tasks of the kind have been carried out in Russia for last 35-40 years.
- The method of launching a vessel using a transfer floating dock depends on the characteristics of a particular shipyard or ship repair facility which also determine the fundamental principles of the methodology.
- Simulating a vessel's roll skidding, especially in case of a large tonnage ship, requires specialized software that allows considering various solutions. All the above-mentioned emphasizes the importance of creating a multifunctional method for a vessel's roll skidding on the floating dock.

According to [3], the process of roll skidding a vessel onto the floating dock for ship docking and launching is divided into several phases.

The first phase is positioning the vessel on the railroad car trucks (RCT – special equipment consisting of transfer support beams, transfer cars and rails) and moving it from the building place to the transfer dock placed on special supports.

Before the second phase of a ship launching, a floating dock is exposed to such forces as those of the dock gravity, supports reactions, buoyancy forces. The dock hull also experiences thermal deformations.

The second phase is introducing the vessel into the transfer dock – from the moment of rolling the first pair of transfer cars on the pontoon deck to the stop of the RCT after the vessel is fully introduced into the dock. The reactions of the transfer support beams acting on the ship's hull change throughout the entire second phase as the ship moves into the dock and as the dock's deflection changes [4, 5].

The following forces affect the floating dock in the second period:

- gravity of the dock (taking into account the clamping ballast and additional ballast from the ballasting (re-ballasting) of the dock;
- buoyancy and supported reaction forces;
- gravity of the vessel transmitted to the pontoon deck by transfer cars or rails;
- gravity of some parts of RCT located in the dock (beams, cars, etc.).

The third phase is berthing the dock with the vessel on the supports from the moment the vessel is fully in the dock until the surfacing begins. During this period, the vessel is transported from transfer cars to stationary supports (keel-blocks with wooden pillows and wedges); this is done to ensure the possibility of rolling the cars ashore, because their flooding is undesirable. The forces acting on the dock during the third phase are the same as in the second one (taking into account the cars removal and the installation of transfer supports).

The fourth phase is surfacing the dock with the ship (from the surfacing beginning to its end). During this period the quantity and distribution of the dock ballast, the dock buoyancy forces and the reaction of the keel-blocks change.

The fifth phase is the removal of the vessel from the dock. During this period, the dock is towed to the place of submersion; ballast is added to the dock and the vessel is withdrawn.

An analysis of the regulations and project documents concerned with the problem of a vessel's roll skidding on the floating dock enables us to formulate a general sequence of steps – a general algorithm that can form the basis for an automated system for controlling the process of rolling a ship onto a dock.

It is assumed, that at the start of rolling the dock is located on supports, the relevant compartments are filled with the required amount of ballast.

The permissible loads on supports, the maximum permissible bending moment from the general longitudinal bending of the dock, the permissible deflections of the dock hull at the reference points are determined.

The rolling of the ship onto the dock is divided into several stages. During this process, it is necessary to consider: harmonizing RCT sections length and length of the dock pontoons, ensuring the uniform distribution of the load on the RCT.

The vessel rolling on the pontoons No. 1 and No. 2 is carried out in steps: first, the vessel rolls on the first half of the pontoon, and then, after ballasting, on the second one. The vessel rolls directly onto the pontoon, starting with pontoon

No. 3. Thus, the minimum total number of vessel skid rolling stages is $N_e = N_P + 2$, when N_P – number of docks pontoons.

Typical roll skidding sequence:

Stage 1: The first transfer cars group rolls on pontoon No. 1 to the middle of the pontoon; the process includes pumping the ballast from pontoon No. 1 compartments, the mass of the ballast is equal to the mass of the rolling part of the vessel.

Stage 2: Rolling the vessel to the end of pontoon No. 1; the process includes pumping the ballast from pontoon No. 1, the mass of the ballast is equal to the mass of the rolling part of the vessel.

Stage 3: Rolling the vessel to the middle of pontoon No. 2; the process includes pumping the ballast from pontoon No. 2, the mass of the ballast is equal to the mass of the rolling part of the vessel.

Stage 4: Rolling the vessel to the end of pontoon No. 2; the process includes pumping the ballast from pontoon No. 2, the mass of the ballast is equal to the mass of the rolling part of the vessel.

Stages 5 - N_e : Rolling the vessel to pontoons No. 3 - N_P. The process includes pumping the ballast from the pontoon, on which the ship is rolled, the mass of the ballast is equal to the mass of the rolling part of the vessel.

Calculations to be made for the roll skidding steps justification:

1. the support reactions in the rolling process can be found from the static equilibrium conditions: $R = m_1 g P_б + \Delta R_{кр Б} + \Delta R_{всплл} + \Delta R_{сзон} + \Delta R_{ТОМ}$
   $P_б$ – downforce ballast weight; $\Delta R_{Б_{кр}}$ – additional force from the heeling moment and crosswind additional reactions; $\Delta R_{всплл}$ – ascent prevention ballast weight; $\Delta R_{сзон}$ – water level consideration; $\Delta R_{ТОМ}$ – additional loads when the cars are located above the support;
2. the maximum bending moment and the deflection of the dock at the reference points are determined;
3. supports reactions, bending moments, deflections at the reference points are compared with permissible values;
4. the ballast is pumped from the pontoon, the mass of the ballast is equal to the mass of the rolled part of the vessel;
5. the values of the supports reactions, bending moments, deflections at the reference points are found more accurately;
6. supports reactions, bending moments, deflections at the reference points are compared with permissible values; rebalancing is done if necessary

Conclusion.

The multifunctional method of a vessel's roll skidding on the floating dock is under development and may be used for the creation of an automated system for controlling the process of rolling a vessel onto a floating dock. This system will help to simplify the procedures of floating docks design and the calculations of rolling the ship onto the dock.

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DIGITAL TRANSFORMATION OF EDUCATION IN RUSSIA AND CHINA: PROBLEMS AND PROSPECTS

Abstract: This article is devoted to the features of digitalization of education, analysis of the quality and problems of introducing new technologies in Russia and China. A survey of students was conducted that determines the attitude to the digital educational process and identify the prospects for the development of digitalization of education in our country.

Keywords: digitalization, education, modernization, technology, educational process.

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ЦИФРОВАЯ ТРАНСФОРМАЦИЯ ОБРАЗОВАНИЯ В РОССИИ И В КИТАЕ: ПРОБЛЕМЫ И ПЕРСПЕКТИВЫ

Аннотация: Статья посвящена особенностям цифровизации образования, анализу качества и проблем внедрения новых технологий в России и Китае. Был проведен опрос студентов, определяющий отношение к цифровому образовательному процессу и определены перспективы развития цифровизации образования на территории нашей страны.

Ключевые слова: цифровизация, образование, модернизация, технологии, образовательный процесс.

Nowadays attention is being paid to universal transformation and dissemination of digital technologies in various spheres of public life. In turn,

digitalization is defined as the global trend in the development of science, technology, economy and society as based on the transformation of information into a qualitatively new digital form that increases the efficiency and speed of many global processes.

One of the areas of digitalization implementation is the education sector, which provides for the effective and flexible use of the latest technologies in the educational process. A block of articles and reports were analyzed about the implementation of Russian and Chinese digitalization programs [1, 2]. The digitalization process is extensive and the participants in this global transformation – in their own way – see the way of introducing digital technologies into various spheres of public life, and especially in education. In this article, we have compared the principles and features of building a digital system in education for Russia and China and evaluated the current state programs that facilitate the process of transformation in the educational environment.

After having examined the general level of the country's digital development, we noted that Russia took the 46th place in 2018 in the International ranking of economic development by the Global Innovation Index and has held a stable position over the past 3 years. In addition, it is essential to understand the transition to digital learning cannot be realized in a short time, especially given the wide range of differences in the development of Russian regions, which complicates uniform process of transformation of the education sector. That is why the main federal projects posted in official reports are designed for the long term.

In 2016, the federal project "Modern Digital Educational Environment in the Russian Federation" was launched and approved by the Russian Government as part of implementation of the state program "Development of Education" for 2013-2020 [2, 3]. Within the framework of this project, it was planned to modernize the general system of education and training, as well as conduct educational programs in accordance with the needs of the digital economy and introduce digital tools in educational activities; thus, providing the opportunity for citizens to be trained according to an individual plan throughout their lives. A feature of this project is the growth in the active use of online courses, the creation of a "one-stop shop course", the mandatory assessment of online courses, and the voluntary assessment of online courses, which allows an objective assessment of effectiveness of the project.

If to turn to the process of digitalization of education in China, then in accordance with the strategic plans adopted since the beginning of 2000, China has already implemented a number of major technical and political measures to promote the spread of informatization. For many years, China has been actively involved in the implementation of information systems in the national structure of the educational process. In 2018 the Ministry of Education of China adopted the "Informatization Education Action Plan 2.0" in order to increase the level and standards of curriculum while introducing various kinds of courses on artificial intelligence and programming that serve to meet the needs of the information age and the development of the intellectual era in China.

Today in China the implementation of the "Modernization in China until 2035" plan has begun, which provides for a two-stage strategy for the modernization of education. This includes the creation of a digital educational space and a unified system for managing and monitoring the quality of educational environment [1, 4].

Summarizing, Russian and Chinese approaches to the transformation of education at different levels are different; however, there is a common trend in planning the implementation of information technology in educational process – each country considers the status and implementation plans in the long term and builds a design of measures and initiatives based on the degree of completion of previous government programs.

In our opinion, in Russia the process of integrating digital technologies into the education system is proceeding at a slower pace, including due to the unevenness of digital environment and the degree to which citizens are ready for global digital transformation, especially in remote regions of Russia. At the same time, we have identified a block of prospects for the development and improvement of the digital environment in our country:

1. The gradual introduction of distance education technologies on an ongoing basis both in the system of general and special education, and the improvement of online courses based on higher education, which is currently not being fully implemented.

2. Creation of a single accessible Internet platform with courses, online lectures, webinars by leading teachers, employers, and specialists in a wide range of professional educational environments.

3. Ensuring mobility of higher education with the ability to change the profile and specialty (direction) of training at various stages of training.

4. Promoting the interest and trust of citizens in the accessibility and the need for direct participation in the digital educational process through forums, conferences, lectures for all interested parties in open areas.

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THE NINTH PLANET OF THE SOLAR SYSTEM

Abstract: The article describes the composition of the Solar System, the order of the planets relative to the Sun, as well as the order of their discovery. As a result, it is noted that Pluto is not a Planet of the Solar System, and the reasons why it was deprived of the status of a planet, and also the hypothesis of the existence of a ninth planet, are revealed.

Keywords: ninth planet, Solar System, Kuiper belt, Konstantin Batygin.

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ДЕВЯТАЯ ПЛАНЕТА СОЛНЕЧНОЙ СИСТЕМЫ

Аннотация: В статье описывается состав Солнечной системы, порядок расположения планет относительно Солнца, а также порядок их открытия. В результате отмечается, что Плутон не является Планетой Солнечной системы, и названы причины, по которым он был лишен статуса планеты, а также раскрывается гипотеза о существовании девятой планеты.

Ключевые слова: девятая планета, Солнечная система, пояс Койпера, Константин Батыгин.

The number of planets that make up the Solar System has changed over time and with the development of astrophysics. At first there were eight, but in 1930 the ninth planet was discovered, which was named Pluto. Nevertheless, after 76 years, it has been proved that Pluto is only a dwarf planet that is part of the Kuiper Belt, which is a collection of 70,000 ice objects with a diameter of 100 km or more and having the same composition as Pluto. At the moment, there is a hypothesis about the existence of the ninth planet, which will be revealed in this article.

First you need to familiarize yourself with the order of the planets relative to the Sun, which are part of the Milky Way galaxy. This order looks like this: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune.

The way astronomers who lived hundreds of years ago discovered every planet in the Solar System deserves no less attention.

The first on the list of opened planets is Mars. At the moment, we do not know who pointed to the planet, but in 1576 Tyge Brahe managed to calculate its exact position. Venus, Jupiter and Saturn were discovered in 1610. The second largest planet from the Sun, Venus, is the brightest of the planets observed from the Earth. Saturn and Jupiter were first discovered through a telescope by the famous astronomer Galileo Galilei along with the four largest satellites. Jupiter is so large that it can always be seen in the starry sky with the naked eye. In 1631, the study of Mercury began. The theory of the heliocentric system of the world was first proposed by Nicolaus Copernicus. According to his hypothesis, the Sun was at the center of our system, and for the first time Mercury received the status of a planet. One hundred years later, on March 13, 1781, Uranus was discovered by English astronomer William Herschel. When Neptune was opened on September 23, 1846, it became the first planet discovered not by observation, but by mathematical calculations. Of course, one cannot fail to mention the only planet of the Solar System on which various life forms exist – Earth. This planet has been continuously observed by humanity from the very moment of its appearance. But although we knew that we were standing on solid ground, in order to find out the true nature of our home, we had to wait. For many centuries, people believed that Earth is not the same object as those observed above it: everything revolved around Earth. Already at the time of Aristotle, philosophers determined that Earth had a spherical shape, observing the shadow of the Moon. The last opened planet is Pluto, discovered in 1930 by Clyde Tombaugh [1].

Approaching the theme of the existence of the ninth planet, an important event is the exclusion of Pluto from the list of planets of the Solar System. Clyde Tombaugh found several more celestial bodies in remote areas of the Solar System, similar to Pluto in size and weight. This was the starting point in depriving Pluto of the status of the planet of the Solar System. Firstly, one of the basic requirements for planets is the presence of a strong gravitational field in order to clear its orbit from other cosmic bodies. From this point of view, Pluto is not suitable for the role of the planet, its mass is not enough to clear the path in the orbit. Secondly, it is important to pay attention to the nature of the moons of Pluto. It has five of them: Charon, Nix, Hydra, Kerberos and Styx. All of them, except Charon, are very small, and their orbits are too close to Pluto. This is another difference from officially recognized planets. Third, Pluto is the only planet whose orbit crosses the orbit of another planet, so this is an elongated ellipse. Fourth, the discovery of the Kuiper Belt in 1992 was the final point in this study [2]. The Kuiper Belt is an area of the Solar System that lies beyond the orbit of Neptune, extending at distances of 30-55 A.U. from the Sun. The first objects in the Kuiper Belt were discovered in 1992, except for the discovery of Pluto in the 1930th.

Pluto, included in the category of dwarf planets, also belongs to the Kuiper Belt. In addition to Pluto, other dwarf planets are also located here – Makemake and Haumea. Eris is also "here", but its orbit goes far beyond the belt. To date, more than a thousand large asteroids have been discovered in the Kuiper Belt. The estimated number of undiscovered small objects of about one hundred kilometers is several tens of thousands. The total mass of the Kuiper Belt is ten times greater than the mass of the inner ring of asteroids [3].

As a result, on August 25, 2006, participants in the Congress of the International Astronomical Union of 2500 people made a sensational decision – to exclude Pluto from the list of planets of the Solar System.

So, we come to the most important part, the theory of the existence of the ninth planet. In 2016, astrophysicists Michael Brown and Konstantin Batygin suggested the existence of a ninth planet. They saw the so-called gravitational signal of the ninth planet, light being an electromagnetic phenomenon. However, there is a possibility that this assumption is incorrect, and it is 0.2 percent.

As mentioned earlier, thanks to the Kuiper Belt in 2005, Michael Brown proved that Pluto is not a planet of the Solar System. In the end, before the discovery of Pluto, they were looking for a large planet beyond Neptune. Having discovered Pluto, scientists decided that was planet they were looking for, because there was a theory that Pluto had a mass equal to seven Earths. But it turned out that Pluto is 500 times smaller than Earth. Every night, scientists observe the sky from an observatory in Hawaii from the highest point of the island using telescopes. It is very difficult to control the orbit, because the orbits of the asteroids behind Neptune have a very specific structure, which contains the so-called signal of the ninth planet [4].

In the studies of the ninth planet, Konstantin Batygin argues that some asteroids outside Neptune have unusual trajectories of motion, which can be explained by the influence of a body that is 10 times the mass of Earth. Most people are familiar with the usual asteroid belt, which lies between Mars and Jupiter, but outside Neptune there is a second belt of ice asteroids, which has been discovered relatively recently. It is the structure of the second asteroid belt that shows that there is another planet in the Solar System. According to Batygin's assumptions, this planet is at a distance of about 600 A.U. from the Sun, and makes a complete revolution around Earth in a record 10-20 thousand years. It has also recently become known that planet nine belongs to the class of super-earths, and not gas giants, as previously thought [5].

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"C4" SELF-STEERING SYSTEM OF SAILING BOATS

Abstract: The article describes the "C4" self-steering system for sailing boats, which is believed to be the future of navigation. The paper presents analysis of the self-steering components interaction, installation of the incoming equipment variants and their effect.

Keywords: sailing, navigation, centerboarder, wind, course, directional stability.

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«С4» – СИСТЕМА КУРСОУСТОЙЧИВОСТИ У ПАРУСНЫХ ЛОДОК

Аннотация: Статья посвящена системе самоуправления парусных лодок, система «С4» – будущее в области навигации. В работе представлен анализ процесса взаимодействия составляющих устройства, вариации установки входящего оборудования и их эффект.

Ключевые слова: хождение под парусом, навигация, швертбот, ветер, курс, устойчивость на курсе.

The self-steering system is one of the most attractive and potentially efficient new ideas to be incorporated into a cruising yacht. It consists of four centerboards: one is located at the bow, one is midships and two are aft. The boards can be independently and easily raised and lowered. They can be controlled either manually or electrically via a touch-screen. By adjusting the position of these boards, we move the center of lateral resistance forward and backward. The main idea of such technology is to make a boat keep to her course for prolonged periods of time if she's not blessed with remarkable directional stability or kept on

track in an alternative way such as a sheet-to-tiller arrangement. The boat's balance changes according to a host of interrelated factors including point of sail, wind strength, sea state, sail plan, sail trim and, most importantly, angle of heel. These changes in balance result in a turning moment one way or the other: most of the time the boat is trying either to round up or to bear away. The helmsman compensates by turning the wheel or moving the tiller accordingly. In a way, rudders are a necessary evil, because every movement slows the boat down by presenting the blade at an angle to the water flow. Beyond a certain angle – either of heel or to the centerline – a rudder will stop working anyway. In this case with the proper setting of sails, suitable to the desired course and achieving the balance by an adjustment of the center of lateral resistance, the yacht becomes self-steering, regardless of the power of the wind and point of sailing [1,2].

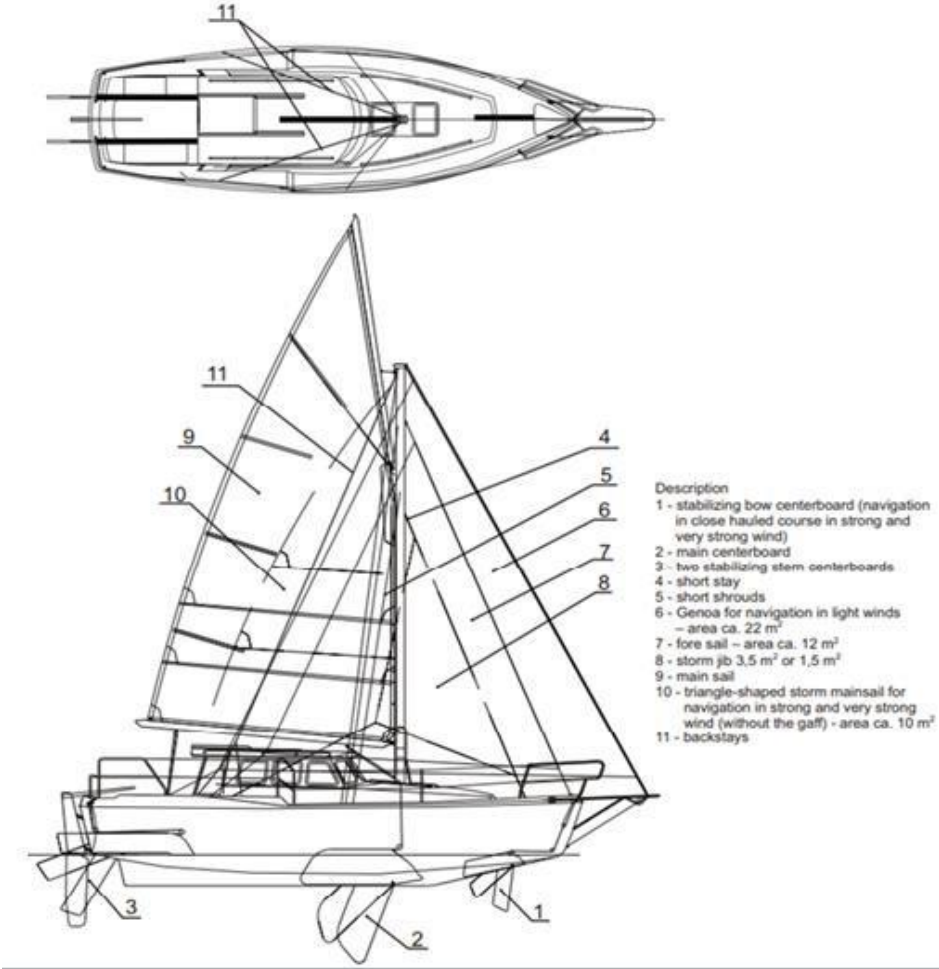

Fig. 1. A yacht with "C4" system

The centerboards are to improve directional stability on all courses as well as to gain self-steering on all courses: from a sharp close haul – through the beam reach and a broad reach – to running inclusive. By appropriate choice of sails to the course and to the strength of the wind and appropriate setting of centerboards, we can influence the distance between the center of effort and the center of lateral resistance ("a" in Fig.2) to obtain full course stability. Distributing the area of lateral resistance on a larger number of centerboards allows the yacht to keep full course stability in a range of the wind speeds. At the change of the strength of the

wind by 1B (up or down) the yacht sails correctly with minimal deviations from the course. Coming back to the optimal course, after the strength of the wind is stabilized at the new level (e.g. 1B more) requires a small change in the setting of one of the centerboards [3].

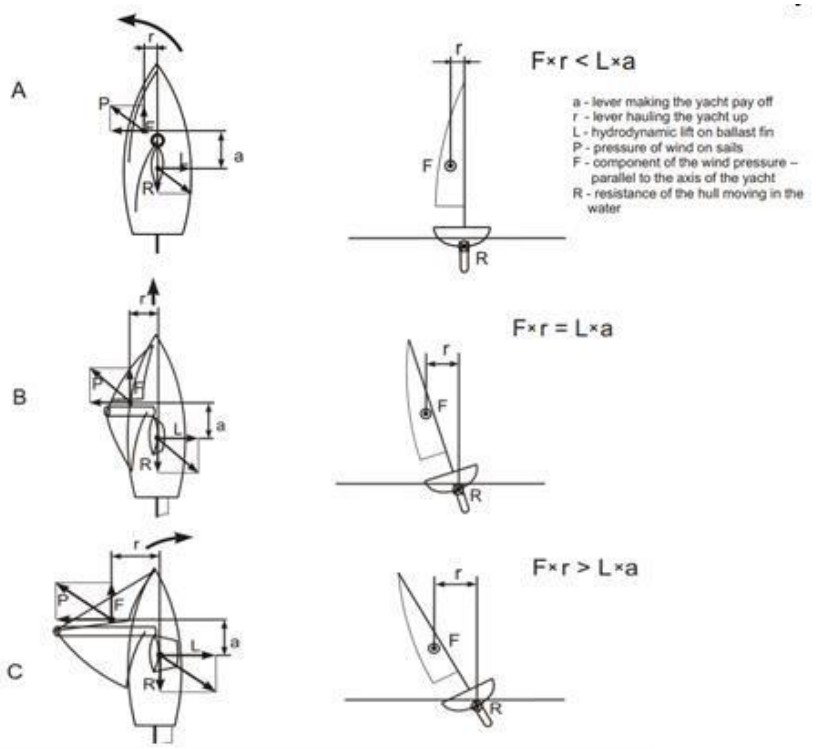

Fig. 2. Relation between sail balance and directional stability

Three typical states of a balanced sailing yacht in relation to the strength of the wind (assuming that the sails are the same in each of the states) are shown in Fig. 2: A – the yacht pays off: light wind, yacht sails with no heel; B – the yacht keeps the course: medium strength of the wind, moderate heel; C – the yacht hauls up: strong wind, extensive heel.

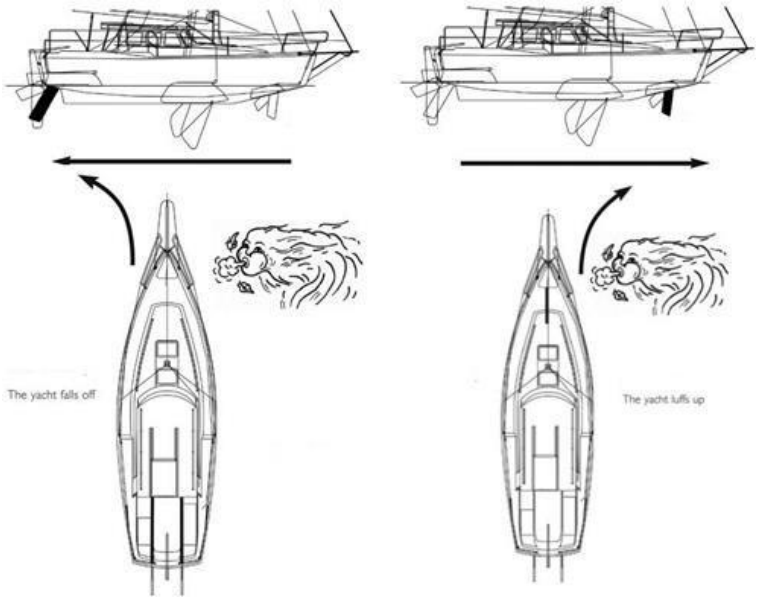

Fig. 3. Relation between direction of wind and centerboard selection

The C4 system is easy, quick and practical in use not only on long distances, but on short distances as well. After elementary experience is gained (2 days of common sailing) 15 sec. is enough to achieve preliminary directional stability. In the case of a strong wind – full course stability is achieved within 20 seconds. In a light wind about 1 minute is needed.

Also a typical modern yacht with an outside ballast has a positive righting moment up to a heel angle of about 130°-140°. In case of capsizing, the yacht of this type will remain upside down because the righting lever values are negative. In a typical modern sailing yacht with an outside ballast, the maximum values of negative righting levers are usually about 40-50% of the maximum positive righting levers. To recover to the keel-down position from the 180° heel, such a yacht must receive an impulse from the outside (e.g. an additional hit of a wave of sufficient energy), which will force the yacht to an angle of heel smaller than the one corresponding to the zero-value righting lever (less than 130 º-140 º). See Fig. 4.

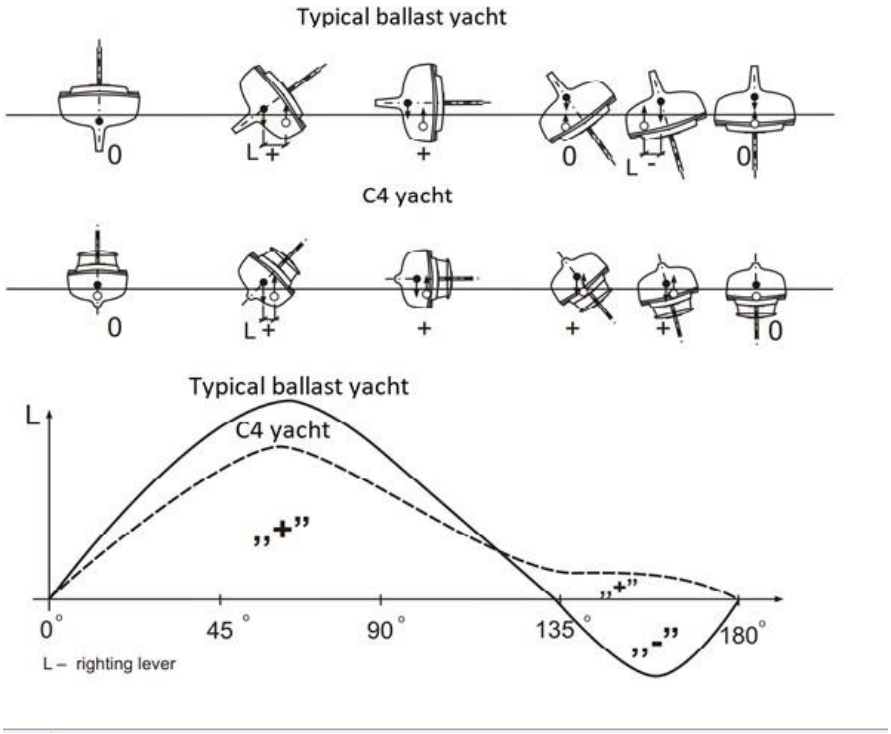

Fig. 4. The curve of the righting levers – comparison

A typical yacht with an outside ballast has a positive righting lever up to the heel angle of approximately 130°-140°. If we exceed this heel angle, the righting lever will achieve quite a large negative value – up to 50% of the value of the maximum positive righting moment, reaching zero at 180°. By comparison, a "C4" yacht has a positive righting lever in the heel angle range from 0° to 180°. The difference in stability between a typical outside ballast yacht with a low superstructure and a C4-yacht (especially at heel angles above 80°) is caused by a considerably high superstructure entering the water. The length-to-beam ratio is another element which has a great influence on the characteristics of the righting lever curves. So the slightest fluctuation in the environment causes the yacht to return to a stable (initial) position [4,5].

The “C4” system has a lot of potential for comfortable sailing. Some advantages over other yachts also include: course stability, patency, operating and balancing.

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BIOTECHNOLOGY AS A PART OF BIOMEDICINE

Abstract: This article discusses what biotechnologies are used to create transgenic animals, plants and diagnose diseases. It is known that biometric technologies are widely used to measure personal physical characteristics and human behavioral traits. However, in pursuit of scientific advances, mankind does not know what to expect.

Keywords: biomedicine, biotechnology, transgenic animals, transgenic plants, production of vaccines, antibiotics, hormones, genetic diagnosis.

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БИОТЕХНОЛОГИЯ КАК ЧАСТЬ БИОМЕДИЦИНЫ

Аннотация: В данной статье рассматривается, какие биотехнологии используются для создания трансгенных животных, растений и диагностики заболеваний. Известно, что биометрические технологии широко используются для измерения персональных физических характеристик и поведенческих черт человека. Однако в погоне за научными достижениями человечество не знает, что его может ожидать.

Ключевые слова: биомедицина, биотехнологии, трансгенные животные, трансгенные растения, производство вакцин, антибиотики, гормоны, генетическая диагностика.

Biomedicine is theoretical medicine. It is a branch of Medical Science which studies human body from theoretical positions. The results of research in Biomedicine are modern medicines, deeper understanding of the nature of illness, and more advanced knowledge about human body (for example, aging processes).

The most important branches of Biomedicine are Biotechnology, Biomechanics and Biomaterials. Today we want to tell you more about some biotechnologies.

Biotechnology is the broad area of biology, involving living systems and organisms to develop or make products, or any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products.

Transgenic animals are just one in a series of developments in the area of biotechnology. Biotechnology has transformed the way in which we understand processes such as engineering and manufacturing. These terms now include the use of living organisms or their parts to make or modify products, to change the characteristics of plants or animals, or to develop micro-organisms for specific uses. The novel uses of biological techniques such as recombinant DNA (deoxyribonucleic acid) techniques, cell fusion techniques, mono and polyclonal antibody technology and biological processes for commercial production have altered traditional distinctions and methods (US Congress, Office of Technology Assessment, 1989). Genetic manipulations at the level of DNA have also changed long held views as to what is considered to be animal, plant and human [1]. In turn, these changes have made it more difficult to evaluate the ways in which animals are used and have obscured distinctions between pure and applied research [2].

Consideration of the acceptability of creating specific transgenic animal strains or genetic manipulation involving interchanging DNA between species and kingdoms could be a simple animal care issue or a societal decision. The following is an attempt to show what the ability to create transgenic animals or engage in other forms of DNA manipulation means in terms of traditional ACC (automation classification code) functions, not forgetting that this impacts on wider considerations of human responsibility for the welfare of other life forms [3].

Manipulating the DNA of plants (creating genetically modified organisms, or GMOs) has helped to create desirable traits such as disease resistance, herbicide, and pest resistance, better nutritional value, and better shelf life. Plants are the most important source of food for the human population. Farmers developed ways to select for plant varieties with desirable traits long before modern-day biotechnology practices were established [4].

Traditional vaccination strategies use weakened or inactive forms of microorganisms or viruses to stimulate the immune system. Modern techniques use specific genes of microorganisms cloned into vectors and mass-produced in bacteria to make large quantities of specific substances to stimulate the immune system. The substance is then used as a vaccine. In some cases, such as the H1N1 flu vaccine, genes cloned from the virus have been used to combat the constantly changing strains of this virus [5].

Antibiotics kill bacteria and are naturally produced by microorganisms such as fungi; penicillin is perhaps the most well-known example. Antibiotics are produced on a large scale by cultivating and manipulating fungal cells. The fungal

cells have typically been genetically modified to improve the yields of the antibiotic compound.

Recombinant DNA technology was used to produce large-scale quantities of the human hormone insulin in E. coli (Escherichia coli) as early as 1978. Previously, it was only possible to treat diabetes with pig insulin, which caused allergic reactions in many humans because of differences in the insulin molecule. In addition, human growth hormone (HGH) is used to treat growth disorders in children. The HGH gene was cloned from a cDNA (complementary DNA) library and inserted into E. coli cells by cloning it into a bacterial vector [6].

Pre-implantation genetic diagnosis (PGD or PIGD) is the genetic profiling of embryos prior to implantation, and sometimes prior to fertilization. PGD is considered in a similar fashion to prenatal diagnosis. When used to screen for a specific genetic disease, its main advantage is that it avoids selective abortion, as the method makes it highly likely that the baby will be free of the disease under consideration [7].

To sum up, today biotechnologies play a very important role for the prosperity of our civilization. They help us treat diseases, grow morefood and adapt better to unforeseen situations. But science is developing very fast and it is difficult to predict what might happen in the nearest future. The main issue is in using all the biotechnologies properly otherwise such technologies can lead us to singularity which is the total malfunctioning of everything , the point at which any physical laws stop working.

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CAUSES AND COSEQUENCES OF PROBABLE GLOBAL CLIMATE CHANGE

Abstract: Causes and probable consequences of global climate change are considered. As a result of the analysis, two possible ways of development are being compared: global warming and ice age. The possibility of occurrence of one of them is determined.

Keywords: global climate change, global warming, ice age.

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ПРИЧИНЫ И ПОСЛЕДСТВИЯ ВОЗМОЖНОГО ГЛОБАЛЬНОГО ИЗМЕНЕНИЯ КЛИМАТА

Аннотация: Рассмотрены причины и вероятные последствия глобального изменения климата. В результате анализа сравниваются два возможных пути развития: глобальное потепление и ледниковый период. Определяется возможность наступления одного из них.

Ключевые слова: глобальное изменение климата, ледниковый период, глобальное потепление.

Researchers were always interested in the question of the degree of human influence on its environment. Abnormal natural phenomena, a growing number of natural disasters, significant temperature fluctuations raise questions about global climate change now. Many of them are caused by natural factors. However, a lot of specialists talk about increasing human influence on the climate. The nature of the changes is not clearly defined. A large number of representatives of the scientific world believes that the era of the warming comes. But some of scientists believe

that the ice age is a possible scenario. Various theories about the causes and consequences put forward.

The trend of increasing air temperature has been observed since the late 19th century. A further increase in average temperature is associated with the expansion of industry. Carbon dioxide is the main product of combustion of hydrocarbon fuels. An increase in the level of carbon dioxide, methane, ozone, water vapor leads to delaying the thermal cure at the earth surface [1]. There are natural sources of greenhouse gas emissions: volcanic activity at the bottom of oceans, evaporation of biological origin. However, the raising in global temperature is involved with anthropogenic activities.

An international group of experts created by the UN, has determined that a further increase in atmospheric temperature more than 2 degrees Celsius can be fatal. The mass of ice and snow will reach a critical minimum [2]. Many coastal towns of the United States, Japan, Baltic countries and others may be completely inundated. It will cause significant economic and geopolitical problems. The fresh water supply will be greatly reduced. The water balance of the planet is likely to be disrupted. Many species, especially endemic species, may disappear [3].

A group of scientists suggests that the Earth has entered a period of cooling. The proponents of this theory believe that natural factors are the main cause of climate change. Large-scale geological studies confirm that global changes in climate occurred repeatedly [4]. According to observations by Russian researchers over the snow cover of Antarctica the volume of ice and snow over the past 30-40 years has raised. Scientists have developed a theory based on climatic factors from periods of solar activity, the reflectivity of the Earth [5].

In the early twentieth century astrophysicist M. Milankovitch investigated the cause of occurrence of ice ages on Earth. He established a correlation between the advent of a cold snap and the change in shape of the Earth's orbit. Three positional cycles of various durations were identified that affect the Earth's climate. According to Milankovitch's cycles, the Earth is now in a relatively cool phase. Many modern studies of perennial ice confirm the theory of M. Milankovich [6].

There are several possible consequences of the onset of the Ice Age. Many areas will be unsuitable for living. The number of natural disasters will increase.

Climatic changes are characteristic of the history of the Earth. This is due to cosmic phenomena, geological activity, tectonic disturbances, human activity. Many specialists confirm that changes in climatic conditions are real at the present stage of development [7]. Humanity must be prepared to withstand them. There are government programs for the sustainable development of countries in this direction. Implementation plans should be developed and implemented. Many countries have high hopes for young scientists and students.

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UNDER THE WATER WITH “TRITON”

Abstract: People have always sought to conquer the water spaces. And at present they have made great progress in this direction. An example is the invention of “Triton”.

Keywords: artificial gill, device, invention, oxygen, to breathe under water.

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ПОД ВОДОЙ С «ТРИТОНОМ»

Аннотация: Люди всегда стремились освоить водные просторы. И на сегодняшний день они добились больших успехов в этом направлении. И примером может послужить такое изобретение, как «Тритон».

Ключевые слова: искусственные жабры, устройство, изобретение, кислород, дышать под водой.

As the great American inventor Thomas Edison said: "... Restlessness is discontent and discontent is the first necessity of progress. Show me a thoroughly satisfied man and I will show you a failure..." [1]. Man has always been interested in how the world was created. After all, interest pushes him to explore everything around him. Man has always been interested in what is in space, under the earth, under water, what these or other things are made of and how they can or should work. In order to find out all of this, people always came up with new inventions. Each time they became more complex, and with each new invention, people learned more and more about the world.

Humans are always interested in places that are most difficult to reach, such as the underwater world. Even in the V century BC, Herodotus wrote that his contemporaries used a diving device that descended to the bottom of rivers [2]. The first mention of devices that allow a person to descend to the bottom was recorded as early as 332 BC. These were large diving bells, and as we know, people always strive for something simpler and more effective. One of the first successful salvage operations using a one-person diving bell was carried out in 1531 in Lake Nemi near Rome. As the bell carried with it only the amount of air trapped within it once it submerged, it provided only a short bottom time [3].

By our time, technological progress has gone very far, we have invented submarines, bathyscaphes and aqualungs to study the deepest points. But for people who do not want to go deep under the water, but want to swim closer to the surface, the same aqualungs are not very convenient, they are large and heavy. It is for such people that the compact artificial gills called "Triton" were created.

A unique device for scuba diving was invented by a team of researchers from Stockholm (Sweden). It is an artificial gill that can be used to stay under water for 45 minutes. "Triton" quickly gained popularity on the Indiegogo crowdfunding platform. A similar device can be seen in the James bond movie called "Thunderball". In this film, the main character was given a compact device with which he could breathe under water. Inspired by this prototype, a team of young inventors introduced a similar gadget "Triton", which they nicknamed artificial gills [4]. In a short time, the company raised $ 700,000 for the startup, which was 14 times higher than the stated amount of $ 50,000. "Triton" is a mouthpiece attached to the main unit where the mechanism and filters are located, made in the form of two tubes with microporous membranes and filters. The total length of the device is about 29 centimeters, and the width is 12 centimeters, which allows it to fit in a bag without problems.

The principle of operation of the device is based on the respiratory system of fish. A person can dive with "Triton" up to 4.5 meters, if he is deeper than the specified mark, it will be much more difficult for him to breathe. In order to avoid this trouble, the developers have made it so that the device notifies you when you are approaching a critical mark. A special microporous filter that mimics the work

of gills extracts oxygen molecules from water. This filter is made in such a way that water cannot seep through it, since micropores are too small compared to water molecules. Then the oxygen passes through the filter to the microcompressor. The microcompressor, in turn, compresses the oxygen molecules to be contained in the chamber, and from the chamber the oxygen gets to the person through the mouthpiece. The compressor is powered by a small lithium-ion battery that lasts up to 45 minutes. Before the time spent in the water reaches a critical point, the device signals about that to the person with vibrations and an led indicator [5]. The Triton underwater breathing device one can apply in the ocean, sea, lake, river, and pool. The device can be used in salt water, but it is recommended to rinse it under fresh water after use [6].

Oddly enough, this device was named after the eponymous animal – Triton, since this mammal can feel comfortable both on land and in water. Thus, we can conclude that nature is the most ingenious inventor. And no one knows how many more inventions will be peeped at nature by people.

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THE EFFECTIVENESS OF HOMEOPATHY

Abstract: People often see advertising of various medicines, including homeopathic ones on TV and in the media. We want to find out how homeopathic remedies affect the human body. And the results of our study are represented here.

Keywords: homeopathy, potentiation, placebo, principle, «Memory of water».

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ЭФФЕКТИВНОСТЬ ГОМЕОПАТИИ

Аннотация: Люди часто видят рекламу различных лекарств, в том числе гомеопатических, по телевизору и в средствах массовой информации. Мы хотим выяснить, как гомеопатические препараты влияют на организм человека. И результаты нашего исследования представлены здесь.

Ключевые слова: гомеопатия, потенцирование, плацебо, принципы, «Память воды».

People often see advertising of various medicines, including homeopathic ones on TV and in the media. We want to find out how homeopathic remedies affect the human body. And the results of our study are represented here.

A little from the history of homeopathy.

The founder of homeopathy is a German doctor of French origin, Christian Hahnemann [1].

Hahnemann's main ideas about homeopathy arose during the translation of a medical treatise into German by the Scottish physician William Cullen. Cullen's idea of using cinchona tree as a cure for malaria seemed untenable to Hahnemann. Then he decided to test the effect of the cinchona tree when he took it in. During the experiment, Hahnemann felt symptoms similar to those of malaria: fever, joint pain, and shivering. Then the thesis was determined, which later became the basis of homeopathy: all effective drugs cause symptoms in healthy people similar to those of the diseases for which they are treated. Hahnemann's formulation was also based on the "law of similarity".

Later, in 1810, Samuel Hahnemann published the doctrine "Organon of medical art" (Organon der rationellen Heilkunde) [2], which became the catechism of homeopathy.

Later, the experiment with the use of the cinchona tree was reproduced by the American doctor Oliver Wendell Holmes, but he did not succeed. In fact, quinine in poisoning and overdose causes symptoms that are not similar to those of malaria. So that calls into question the teachings of Hahnemann [3].

Principles of homeopathy [4]:

Homeopathy is based on the following basic principles:

a) "the principle of similarity"

This principle states that you need to choose a medicine that causes symptoms of the disease in a healthy person, from which it treats. This principle goes back to the practice of sympathetic magic, which is based on the idea that similar bodies are in a special supernatural connection.

b) "the principle of testing drugs on healthy people"

Homeopathic remedies are tested on healthy people. We analyze the symptoms that occur when taking the drug, and then make a conclusion whether this drug is suitable for sick people with similar symptoms.

c) "low-dose principle"

According to this principle, the effect of the homeopathic drug increases with the increase in its dilution.

d) "the principle of potentiation"

Also, the effect of a homeopathic remedy is increased by "potentiation" – that is, by prolonged and vigorous shaking or rubbing, if the substance is insoluble.

e) "the principle of individual treatment"

This principle states that it is necessary to select a remedy taking into account the individual declared symptoms and personal characteristics.

"Memory of water"

Dilutions with an index of 40C (40: 4000) correspond to approximately 1 molecule for the entire visible Universe. But this is not the limit. There are also dilutions of 200C, for example, in Anaferon or Oscillococcinum preparations. And here 1 molecule is already correspondences to 10320 Universes. That is, it is possible to consider drugs with a dilution of 12C and higher simply as dummies, since they can not have any physical effect. However, some homeopaths adhere to the principle "water has memory", which means that strong dilutions only enhance the effect of the drug. But no modern chemical and biological researches confirmed the existence of a "memory of water", but only excluded the possibility of its existence [5].

As you know in liquid water there are hydrogen bonds between the hydrogen and oxygen atoms of neighboring molecules. However, it has been investigated that these bonds are completely mixed every few dozens of quadrillion fractions of a second. We can say that in water there is a continuous process of decay and the formation of local bonds. Consequently, any changes made to the structure of water disappear immediately after the removal of the source of these changes. So the "memory" of water does not exist.

Another problem is that the content of impurities at large dilutions will inevitably be an order of magnitude higher than the content of the active substance. This is due to the fact that there are always impurities in the substance used for dilution.

The last problem proceeds from the assumption of water memory: the mechanism of information loss from water is not explained in any way.

Thus, it is not known why, even assuming the presence of memory in water, when diluted, it should remember exactly the information added in the early stages of the preparation. Particles of contaminants, such as dust, also have a greater effect on the structure than the active substance of the drug in such a small fraction. Among other things, the "memory of water" hypothesis does not explain the mechanism of information transfer to sugar and other components of the pill. So it is simply impossible to apply the principle of "water memory" to this form of drug release.

"Placebo effect"

Placebo is not limited to drugs alone. Also placebo are considered to be bogus treatments, for example, performed on the deactivated device. It is based on the effect of suggestion, but then the doctor faces a difficult ethical issue – the problem of intentional deception of the patient.

Placebo works mainly on two neurophysiological mechanisms, such as expectation of improvement and associative learning. The first mechanism is to reduce the level of anxiety and to turn on the remuneration system. The second is the emergence of conditioned reflexes on the medication or the procedure. This effect is greatly enhanced if the patient got the real drug or a real procedure [6].

A negative placebo effect is logical: the patient is not undergoing real treatment, that can cause complications. Besides, an important part of the placebo effect is the formation of a conditioned reflex, which may lead to irreversible consequences.

However, the placebo effect has positive aspects, as well as the possibility of using. First, it is the activation of mechanisms of self-healing in the body, as after the real treatment. In addition, there are some illnesses that do not require real treatment. All these diseases are more psychosomatic in nature, that is the reason for their occurrence is the human psyche. Such diseases are better treated without the use of real drugs, they have side effects and affect the body on a somatic (bodily) level. That's what a placebo is for.

Also the failure of homeopathy is the fact that it has not only positive but also negative effects. But since homeopathic medicines do not cause the huge number of side effects due to the multitude of inevitable impurities (almost the entire Periodic table presents in trace amounts in solvents), it is very hard to judge about the validity of appearance of the positive effects.

The failure of homeopathy in some aspects, calls into question a real positive impact on human health. However, the impossibility of treatment with homeopathic remedies is often not the most dangerous aspect of this type of medicine. Many drugs cannot treat, they are also able to harm a person to exert a narcotic effect.

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ABOUT DESIGNING THE SHIP'S CENTRAL BULKHEAD STIFFENER

Abstract: The dock rack takes on the effort from the keel track when docking the ship. It is shown that the cross section of the dock strut can be included in the calculation of the skin and adjacent vertical struts, which are not taken into account in the classical method. The refined method allows reducing the dimensions and weight of the dock rack.

Keywords: dock's rack, numerical modeling, effective area.

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О ПРОЕКТИРОВАНИИ ЦЕНТРАЛЬНОЙ СТОЙКИ ПЕРЕБОРКИ КОРАБЛЯ

Аннотация: Доковая стойка воспринимает на себя усилия от килевой дорожки при доковании корабля. Показано, что к сечению доковой стойки в расчет можно включить обшивку и соседние вертикальные стойки, которые не учитываются в классической методике. Уточненная методика позволяет снизить габариты и вес доковой стойки.

Ключевые слова: доковая стойка, численное моделирование, эффективная площадь.

When designing flat transverse bulkheads, it is necessary to ensure the perception of significant reactive forces transmitted to the bulkheads from the keel track when docking ships. In traditional methods [1,2], the required cross-sectional area of the dock strut is determined without taking into account the bulkhead skin and the vertical struts closest to the diametrical plane, which leads to significant dimensions of the dock strut. This force can be considered to decrease linearly from the bottom to the deck with a sufficient degree of accuracy.

In this paper, the operation of the dock strut of the ship's flat transverse bulkhead during docking is numerically simulated. The purpose of this work is to determine the degree of participation of the bulkhead skin and adjacent vertical struts in the perception of the keel track reaction and to clarify the nature of the distribution of this reaction over the height of the dock strut.

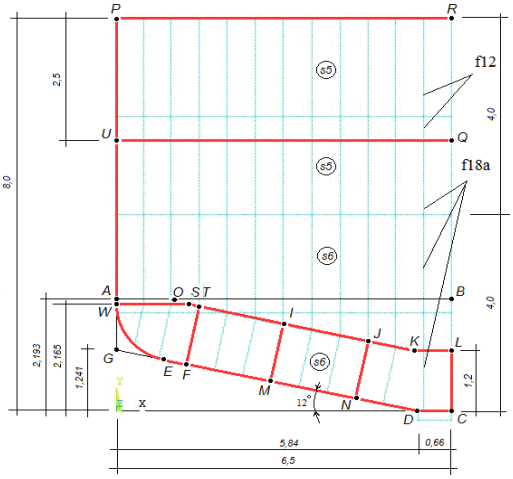

Fig. 1. Geometry and dimensions of the bulkhead, m

The transverse bulkhead considered in [3] is used as a model. The geometry and dimensions of the bulkhead are shown in Fig.1, where thick lines indicate the main longitudinal connections of the hull, the weight and stiffness of which are taken into account when the bulkhead is deformed in its own plane. These connections model the weight and stiffness of superstructures, devices, systems, and mechanisms within adjacent compartments. These weights are distributed on the bottom, upper and lower decks in a ratio of 6: 3:1. The material of the hull and bulkhead is steel, the profile of the dock stand is Tavr No. 56b. The bulkhead skin is modeled by shell elements, and the struts and belts of longitudinal connections are modeled by girders. The model is loaded by its own weight. The vertical keel is taken stationary, and the horizontal keel is supported on an elastic cushion.

The results of calculating the stresses in the calculation model, shown in Fig.2, show that the stresses σ_Y are concentrated in the lower part of the dock strut within the width of the horizontal keel and decrease as they move away from this zone. This area includes the vertical racks closest to the dock.

To determine the degree of participation of the bulkhead skin in the work of the dock rack in several sections, stress diagrams were constructed along the height of the bulkhead, and then the effective width of the skin belt was calculated in each of the sections $a(y_i)$, which perceives the same stresses as the dock rack in the same section.

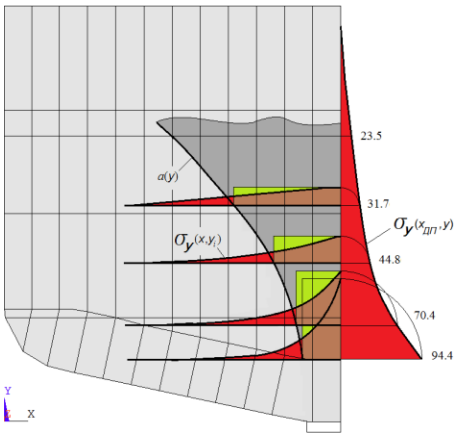

Fig. 2. diagram $\sigma_Y(x,y_i)$, $a(y_i)$.

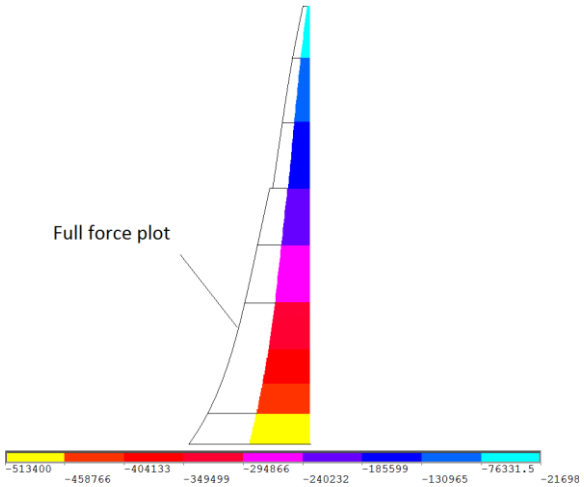

Fig. 3. Compressive force in the dock rack

Plots of axial forces in the racks show that the maximum compression in the lower section of the dock rack is about 1030 kN (Fig.3), and in the lower sections of the 1st and 2nd from the diametral plane of the vertical racks – about 105 kN and 70 kN, respectively, and the change in the height of all the racks is nonlinear. Thus, when ensuring the stability of compressed vertical racks, their cross-sectional area can be included in the required cross-sectional area of the dock rack with a reduction coefficient equal to

$$\phi = \frac{\sigma_{Y\,o}}{\sigma_{Y\,\partial c}} = \frac{T_o}{T_{\partial c}} \cdot \frac{f_{\partial c}}{f_o}, \qquad (1)$$

where σ_{Yo}, T_o is stress and force in the lower section of the vertical post; $\sigma_{Y\,дс}$, $T_{дс}$ is stress and force in the lower section of the dock rack; f_o is vertical rack profile area; $f_{дс}$ is dock rack profile area.

For the considered bulkhead model, the reduction coefficients for the areas of the 1st and 2nd vertical struts are

$$\phi_1 = \frac{105}{1030} \cdot \frac{0{,}015}{0{,}0022} = 0{,}70, \quad (2)$$

$$\phi_2 = \frac{70}{1030} \cdot \frac{0{,}015}{0{,}0022} = 0{,}45. \quad (3)$$

The effective area of the attached skin $f_{пр}$ belt for the dock rack while ensuring the stability of the vertical racks can be determined by the formula

$$f_{пр} = \frac{b_{гк}}{2}(1+\psi)t, \quad (4)$$

where t is thickness of the lower bulkhead belt; $b_{гк}$ is width of the horizontal keel; $\psi = \min\left(\frac{\sigma_{кр}}{\sigma_т}, 1\right)$ is reduction coefficient; $\sigma_{кр}$ is critical stress of the lower belt of the bulkhead skin; $\sigma_т$ is yield strength of the skin material.

The required profile area of the lower part of the dock span can be calculated using the following formula

$$f_{дс} = F - f_{пр} - f_{вс}, \quad (5)$$

where F is the cross-sectional area of the dock rack, determined from the condition of its compressive strength [2]; $f_{вс}$ is effective cross-sectional area of the vertical struts of the bulkhead.

The results of calculations show that the cross-sectional area of the dock strut can include twice the area of the vertical strut profile and the area of the bulkhead skin belt, even taking into account the loss of stability of the latter. The choice of the rack according to the refined method showed that for the considered bulkhead, the overall height of the dock rack and its weight can be reduced by 20% and 40%, respectively.

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SULFATE REMOVAL FROM INDUSTRIAL EFFLUENTS

Abstract: Treatment of wastewater from the pulp and paper industry from sulfates is an important environmental problem. This article describes two purification methods that we have experimentally tested.

Keywords: wastewater treatment, volumetric method, the ion exchange method, the pulp and paper industry.

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ОЧИСТКА ПРОМЫШЛЕННЫХ СТОКОВ ОТ СУЛЬФАТОВ

Аннотация: Очистка сточных вод целлюлозно-бумажной промышленности от сульфатов является важной экологической проблемой. В данной статье описаны два метода очистки, проверенные нами экспериментальным путем.

Ключевые слова: Очистка сточных вод, объемный метод, метод ионного обмена, целлюлозно-бумажная промышленность.

Wastewater treatment in the pulp and paper industry is an important environmental problem that every company faces. Violations of these processes necessarily lead to destruction bodies of waters because of the concentration of harmful substances the process of silting begins. Untreated runoff can end up in bodies of waters and soil and as a result for example can get into a well from which drinking water is taken. Therefore wastewater treatment remains a complex task to this day.

In 2019 on one of the companies of the pulp and paper industry in the Leningrad region experienced difficulties with wastewater treatment (table 1). The cleaning methods used did not meet the requirements for the content of certain components in particular sulfate ions.

The table shows that the amount of sulfate ions exceeds the maximum permissible concentration (the norm for the content of sulfate ions in water is 100 mg /dm^3).

Suspended solids, mg / l	SO_4^{2-}	210	147	190	295	123	115	156	145	136	135
Selection date		11.04	17.07	24.07	29.07	07.08	14.08	22.08	28.08	02.01	11.09

Table. Results of water treatment at the company of the pulp and paper pulp and paper industry for 2019

Thus, the purpose of the presented work was to select methods for removing sulfate ions from the effluents of this pulp and paper company.

There are various methods of wastewater treatment from sulfate ions, we have selected the most acceptable methods for environmental indicators:

- precipitation with calcium oxide (CaO);
- anionation using a strong-base ion-exchange resin AB-17.

Reagent treatment is one of the most effective methods of wastewater treatment from impurities. Calcium is an active metal that displaces heavy metals from soluble compounds converting them to insoluble ones. This method of treatment precipitates different salts including phosphates, sulfates and chlorides [1].

The concentration of sulfates is determined by volumetric method titrating solution with barium chloride (a precipitating reagent) [2]. The initial concentration of sulfate ions in the analyzed sample was 280.08 mg /dm^3.

Depending on the product of solubility we calculate the amount of calcium oxide required for precipitation of sulfate ions. The resulting weight of calcium oxide equal to 0.314 g /dm^3 is added to the analyzed water and left for 12 hours. Then we filtered the solution and determined the remaining content of sulfate ions in the analyzed sample by volumetric analysis titrating solution with barium chloride. The residual content of sulfate ions was 0.5 mg /dm^3. Thus the efficiency of wastewater treatment from sulfate ions was 99.8 %.

The second method used by us is the ion exchange method based on the use of cationites and anionites that sorbent cations and anions of dissolved salts from treated wastewater. Strong base anion exchange resins have been used for water treatment from sulfates [3]. The characteristic of ion exchange ability of ionites is their working capacity which shows the quantity of ions absorbed by the unit volume of ionites. To determine the dynamic exchange capacity (DEC), we used a laboratory installation consisting of a glass tube in the lower part of which there is a glass filter that does not pass ionite and has a low resistance to filtration [4].

For the ion exchange method, we used anionite AB-17 – an ion exchange resin used most often in industry. The analyzed water with a concentration of sulfate ions SO_4^{2-} equal to 280.08 mg /dm^3 – was passed in portions through a filter filled with anionite AB-17. Each portion of 20 cm^3 was analyzed for the content of sulfate ions. Based on the received data a graph is constructed (Fig.). The dynamic exchange capacity of the ionite was calculated based on the data obtained:

$DEC = \frac{280,08*0,08}{10} * 1000 = 2,24$ g/dm^3, where

C is the concentration of sulfate ions in the passable solution, mg/dm^3;

V_{skip} – the amount of water passed through the filter before the absorbed ion skips, dm^3;

$V_{sorbent}$ – the amount of water passed through the filter until the concentration equalization, cm^3.

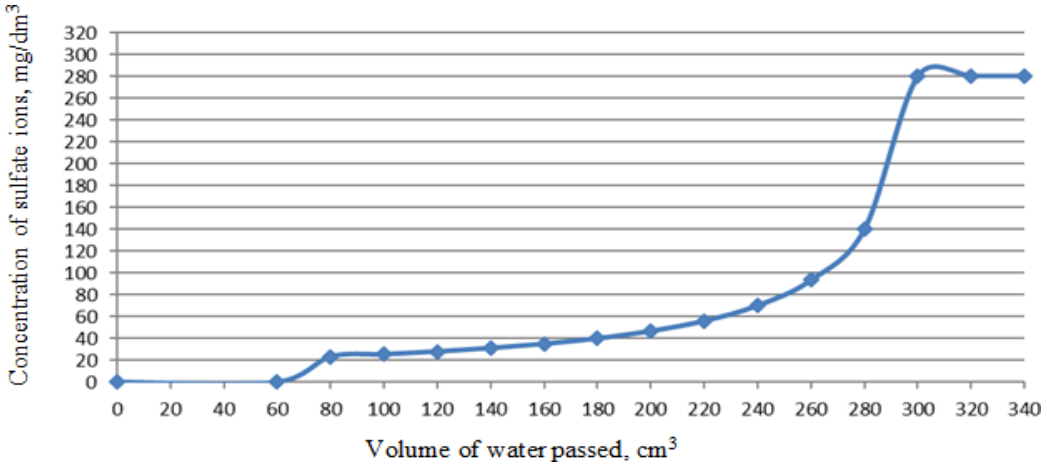

Fig. 1. Dependence of the content of sulfate ions (mg / dm^3) on the volume of water passed through the filter (cm^3)

The skip concentration is equal to 10 % of the initial concentrationof sulfate ions [4]. Therefore

C_{skip} = 0.1 * 280.08 mg/dm3 = 28,008 mg/dm^3.

The results of the experiments allow us to make the following conclusions. Both method – ion exchange and precipitation – are suitable for the treatment of the studied wastewater of the company. However using the precipitation method it is necessary to take into account the acidity environment of the effluent. If the treated effluents have a neutral environment adding calcium oxide to wastewater the pH may significantly increase, it means there will be a shift to the alkaline side. Then ammonia will accumulate in the wastewater that will lead to an increase the toxic effect on the activated sludge ecosystem. Also the treatment efficiency depends on the specific lime consumption. The optimal lime consumption required for treatment of the analyzed water from sulfate ions from a specific company was equal to 0.324 g / dm^3. An important feature for the ion exchange method is the achievement of a high degree of water purification. In addition ionites are used for water demineralization in water treatment process. In our experiment the dynamic exchange capacity of ionite was 2.24 g / dm^3. If we compare the two

theoretically studied methods the second method is more preferable because 10 ml of ionite can purify about 8 liters of the studied effluents. Besides ion exchange resins can be regenerated up to 400 times on average. However each of the methods considered has its own positive and negative aspects applicable to a specific production and further research is necessary to evaluate them more objectively.

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ATIFICIAL INTELLIGENCE IN THE MODERN WORLD

Abstract: This article discusses the role of Artificial Intelligence in the modern world and A.I. influence on our society. We will look at its advantages and disadvantages and the future capabilities of A.I.

Keywords: Artificial Intelligence, robots, intelligent systems, Recruitment and Human Resource management, accurate results.

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ИСКУССТВЕННЫЙ ИНТЕЛЛЕКТ В СОВРЕМЕННОМ МИРЕ

Аннотация: В данной статье рассматривается роль Искусственного Интеллекта в современном мире и влияние ИИ на наше общество. Мы проанализируем преимущества и недостатки ИИ, а также его будущие возможности.

Ключевые слова: Искусственный Интеллект, робототехника, интеллектуальные системы, подбор и управление персоналом, точные результаты.

Presently, in "our day", Artificial Intelligence (A.I.) influences people in the realm of their lives. A.I. has an immense potential for mankind, as well as giving them an unending responsibility to use it properly for the good of humanity.

Initially A.I. was introduced in Sci-Fi works as a universal assistant for mankind. After some time, the authors of those works became concerned about the possibility of A.I.'s rebellion against its creators. At the present and even so, A.I. is being introduced into people's everyday lives more and more…

The question arises: What is A.I. and is it a faithful helper for people or will it turn out to be a threat for humanity? A.I. is machines' ability to think, to learn things, perform actions, solve problems and tasks, and also to adjust to the real world and broaden people's capabilities. It particularly helps with automatic, cyclical, repetitive and dangerous tasks [1].

Benefits:

What benefit and advantage has A.I. brought to people up to this present point in time? For instance, robots are widely used for performing perilous and routine operations in production and in industry. These systems are used to help avoid human error and failings related to fatigue and concentration loss, resulting in accidents, trauma and possible human casualty. Another field of robots' use is for types of jobs which people consider humiliating and degrading (i.e. sewage cleaning, etc.). In addition, unlike humans, robots can work 24 hours a day, 7 days a week.

Let's look at another application of A.I. such as recruitment and Human Resource Management (H.R.). There are three different ways to use A.I. for managing H.R. and hiring specialists. First, A.I. is used to view CVs (curriculum vitae) and rank job candidates according to their level and skills. Then A.I. can be applied for predicting a candidate's success in performing specified roles; it is called a job matching platform. Finally, A.I. is used for creating chat-bots that can automate repetitive communication tasks for communicating with thousands of applicants.

Scientists program "electronic brains" to do compound tasks that demand accurate results. Superior precision make these electronic mechanisms impossible to replace in medical research work and in the medical field in general. Robots are capable of diagnosing serious diseases in humans, as well as performing complex surgical operations [2].

Artificial intelligence can be well applied in tasks such as research, observation, and calculation. Staying in outer space for long periods of time making scientific discoveries, studying stars and planets, remaining at critical depths of the ocean or even at the earth's core are impossible to do without A.I. If people want to know more about their planet and cross beyond Earth's orbit, these tasks have to be accomplished and artificial intelligence is the only way to achieve that.

Also A.I. is extensively utilized in:

- the field of security;
- speech and text recognition;
- data analysis and email spam filtering [3].

Disadvantages:

Technical development. It is known that in everyday life a person does not use 100% of their cerebral powers – but can we say the same about artificial "brains" of the future? This is far from fact, yet. But developments will continue, logic will improve and no one knows where this may lead to.

The use of robots for surveillance (privacy issues). Surveillance is thought to be one of the disadvantages in A.I. usage. Even the simplest household robots purchased for entertaining and housekeeping can report on their owners if they suddenly notice something "suspicious".

No crash protection. Although robots will be monitored by trained people, this does not mean that systems will never fail. At the same time, it can be very difficult to track errors, especially for a person without specialized training. The accumulation of errors can lead to severe system disruption and even data loss, which can sometimes be critical.

Loss of jobs. Robots may not replace people everywhere simultaneously because their wide introduction into service and production processes will require major investments. However, robots replacing humans are quite possible in the future. A functioning robot cannot make mistakes which would lead to terrible consequences, since it is not associated with the concept of the "human error", using A.I. is an obvious advantage. Of course, robots need to be monitored because they can break down. But does this mean that only robots will get all the jobs and their manufacturers and owners will receive all the money? This might be a possibility as well.

Huge investment. Unfortunately, *(although in some cases fortunately)*, scientific researching is not a financial priority for most countries. It can take years and years to develop something truly important and significant in the field of A.I. Few countries are willing to spend money on this, that is why the development of artificial intelligence for the longest time has stood still.

Going out of control. People's desire to create more autonomous devices can lead to the fact that devices are running under A.I. control, which cannot be stopped or corrected in time. Hacking: Managing A.I. systems associated with industries critical for the life of society such as water and energy supplies, and defense, etc. can be intercepted by hackers as demonstrated in some modern action movies [4].

A.I. in the future.

A.I. research is now underway in many countries and it is being deployed on a broader front. The research areas are grouped around the following directives or categories [5]:

- Intense learning. Here, efforts are aimed at significantly reducing the training time of the neural network and reducing the size of the training sample. Ideally the neural network should be trained in real time, but this requires a very high performance of the computing system, so we are exploring options for becoming commonplace. The volume of such requests will only increase.

- Navigation of autonomous vehicles in the human environment. This is the most promising direction from a market point of view. Wide introduction of unmanned vehicles and vehicles in which the driver's actions are fully controlled by the autonomous control system is planned to start in 2022-2025.

- Hyper personalization of services. Since the user is now constantly connected to the network, based on their past data and behavior patterns, A.I.

applications are able to make assumptions and transfer a number of processing functions to peripheral devices in order to move (for moving) them closer to the data source.

- Development of such areas as understanding the text, reasoning based on precedents.

Despite everything said, today intelligent systems still have quite narrow fields of application.

We need more time to develop superior software that is equivalent to human intelligence, or supersedes the capabilities and intelligence of humans today. The other restriction of technology from our present levels of development is resources, money, and skilled scientists to create a superior A.I. application. However, technology is advancing at such a pace that it looks like appears. A.I. will be fully function and replace humans within 10-15 years. Even so, we don‘t know what it’s going to look like in 10 or 15 years. But, hopefully, humans will be able to adapt to having “brains” working for them.

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APPLICATION OF COMPOSITE MATERIALS IN SHIPBUILDING

Abstract: This article gives information about composite materials, their future use prospects, as well as the evaluation of their environmental friendliness.

Keywords: composite materials, traditional materials, glass fiber, carbon fiber, sandwich materials.

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ПРИМЕНЕНИЕ КОМПОЗИТНЫХ МАТЕРИАЛОВ В СУДОСТРОЕНИИ

Аннотация: В нашей статье рассматриваются композитные материалы, применяющиеся в судостроении, перспективы их использования в будущем, а также взгляд на них с точки зрения экологичности.

Ключевые слова: композитные материалы, традиционные материалы, стекловолокно, углеволокно, сэндвич-материалы.

Humanity develops constantly. New inventions and technologies appear every day. The shipbuilding industry is also evolving quickly. Composite materials are now used as innovative materials for various parts of ships. Their properties are much better than those of traditional materials. The advantage of composite materials is that they are more durable and rigid in contrast to traditional materials, which include different types of steel. It should be noted that composites are more wear-resistant. This means that the various parts of the ship

that are made of composite materials have a longer service life. Composite materials make it possible to produce a ship's hull without a single welding seam. With this production, the reliability of operation increases.

Why composite materials are so well suited for shipbuilding? For example, carbon fiber is 30-40% lighter than steel [1]. If the hull is made of carbon fiber, the ratio of fuel used to the distance traveled will be much less. This means that vessels made of carbon fiber will be more economical.

Composite materials allow us to get rid of a large number of connections between the parts of the ship, which also makes it easier to assemble.

It should be underlined that some composites, such as carbon or fiberglass, allow to create parts of the ship in a variety of shapes. The process of manufacturing a ship's hull from fiberglass occurs in several stages: at the first stage, a matrix is created that repeats the outline of the hull; later, several layers of fiberglass are laid out inside (sometimes their number reaches several tens). At the second stage, the fiberglass is filled with a special binding solution, after which the resulting structure is dried and the layers of fiberglass are glued together [2].

Top composite materials used in shipbuilding are [1]:

- fiberglass (about 80% in 2011)
- sandwich materials (about 15% in 2011)
- carbon fiber (about 5% in 2011).

But despite such a large number of advantages of composite materials, they also have their drawbacks. First, the most significant problem in the production of various ship parts is the high cost of composite materials. Secondly, composite materials in most cases are not suitable for repair [3]. This, in turn, greatly affects the durability of the vessel. Similar repair of steel structures is much easier and cheaper. In this regard, the transition to composite materials in shipbuilding is currently expensive to implement. Third, while steel and aluminum are recyclable materials, composite materials are much more complex. Steel or aluminum can be remelted, and composite materials need to be subjected to complex chemical processes so that they can be reused in the future.

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REDUCTION OF ENERGY CONSUMPTION IN SOME AREAS OF ST.PETERSBURG

Abstract: This article defines the main problems of energy consumption and energy saving of residential and administrative buildings of St. Petersburg. A number of solutions have been put forward to reduce energy consumption. Some schemes of measures are proposed to minimize energy consumption. Based on the analysis, conclusions are drawn about the possible applications of using the proposals under consideration.

Keywords: energy system, energy saving, microclimate, energy service agreement.

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СНИЖЕНИЕ ЭНЕРГОПОТРЕБЛЕНИЯ В НЕКОТОРЫХ РАЙОНАХ САНКТ-ПЕТЕРБУРГА

Аннотация: В данной статье определены основные проблемы энергопотребления и энергосбережения жилых и административных зданий

Санкт-Петербурга. Был предложен ряд решений для снижения потребления энергии. Предложены некоторые схемы мероприятий по минимизации энергопотребления. На основании анализа сделаны выводы о возможности применения рассматриваемых предложений.

Ключевые слова: энергосистема, энергосбережение, микроклимат, энергосервисный договор.

Energy conservation and energy efficiency are now among the priorities that are linked to the economic development of the industry and the country as a whole [1]. The need for an integrated approach to the implementation of energy and resource-saving measures in the design, construction and operation of residential and office buildings, primarily their systems for providing the indoor microclimate, is beyond doubt. Federal laws of the Russian Federation and control in the regulation and creation of conditions for the development of measures within the framework of the energy conservation program direct specialists to use a limited set of tools that do not always meet specific construction conditions. Energy services are now considered to be the main tool for implementing energy-saving programs [2].

All measures in the field of energy efficiency differ in both technical characteristics and payback periods. Therefore, it is necessary to assess the appropriateness of their use specifically for each object, which is done by employees of specialized companies licensed for this type of activity. They recommend the use of energy-saving measures, based on an integrated approach to the optimal energy saving of buildings.

Recommendations of a suitable combination and the necessary depth of energy saving measures, as well as energy and technical and economic assessment of their combination depend on the purpose of the building, number of storeys, climatic characteristics of the area of the construction site and the level of prices and tariffs in a particular region.

An energy service agreement is a special form of agreement that aims to reduce operating costs by increasing energy efficiency and introducing energy-saving technologies. The essence of the energy service contract is that the energy service company installs equipment at its own expense, leading to a reduction in energy consumption (for example, heat or electricity). During the payback period of the project, the actual payment of residents remains at the same level and after the payback of the project, the amount of payment for utilities decreases markedly. The proposed scheme for the implementation of energy saving projects in a number of regions has shown that it can solve several contradictions that have hindered this process earlier, and it allows all parties to cooperate for their mutual benefit.

Many citizens are interested in what these plates with letters A, B, C, D, E mean, which can be found in many residential and administrative buildings. It turns out that the Latin letters indicate what class of energy efficiency is assigned to a particular residential or administrative building [3]. As a result of some activities in order to save energy on residential and administrative buildings, plates are attached with the class that was assigned (see Figure 1).

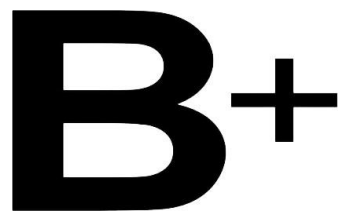

Fig. 1. Example of an energy efficiency class label.

The energy efficiency class of a building is an indicator that evaluates how measure of economy of a building that consumes thermal and electric energy during operation (see Figure 2).

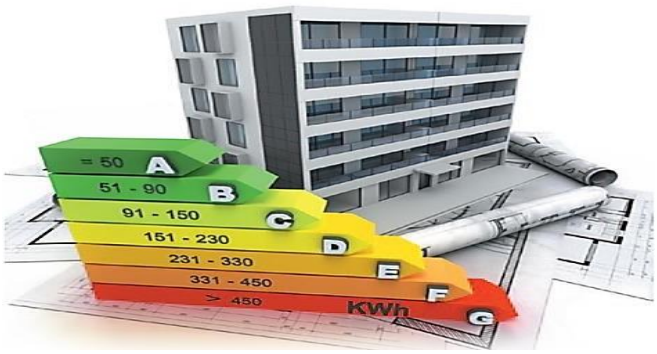

Fig. 2. Ranges of values of energy consumption depending on the assignment of energy efficiency class.

According to law No. 261 FA (Federal Act), with a high class of energy efficiency of the building, the period of preservation of energy consumption indicators is 10 years. High energy efficiency classes include buildings with “B” markings [4]. The state program of the Russian Federation “Energy Saving and Improving Energy Efficiency for the Period till 2020” provides for the construction of new houses and major repairs, modernization of buildings and structures, taking into account the requirements for their energy efficiency. The inclusion of buildings requiring major repairs in energy efficiency programs and monitoring their energy consumption will significantly reduce the energy consumption of buildings and save budget funds [5].

The mechanism of mass implementation of energy-saving measures during the overhaul of buildings is legally fixed by Decree of the Government of the Russian Federation No. 18 of January 17, 2017. The condition of the housing stock varies depending on the construction period and the material of the structures. After 1961, almost all brick buildings a part of panel and block houses built before 1981 have a wear of more than 32%, therefore, they must be repaired immediately, after that a significant reduction in energy consumption is expected.

Buildings and structures are classified using numerous parameters, each of which affects the energy efficiency of an object. If an object has several structures, which meet different classes and differ in specifics, this can significantly affect the list of recommended measures.

The most important indicator is identifying the pattern between the choice of measures and the parameters of construction. But with this approach, individual features that affect the efficiency and cost of making improvements in order to increase energy efficiency can be highlighted. Separation of energy saving measures is carried out in the order of priority for the user.

So, the preliminary list of measures is evaluated in turn by the selected criteria, and the number of such criteria may vary. Unlike other solutions, the proposed approach can be applied to buildings of various types with appropriate parameters and technical characteristics, therefore, the considered technique is multifunctional. The problem of choosing energy saving measures for residential and office buildings is relevant and requires in-depth analysis not only of the technology of its implementation, but also of methods for assessing energy-saving resources.

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MICROTRANSACTIONS IN VIDEO GAMES

Abstract: In this paper, microtransactions are considered as a way to monetize games distributed according to the shareware model. It is shown that microtransactions, although very profitable for publishers, are a well-tuned system for imposing optional purchases, which makes the user spend a lot of money. The article also explains the basic principles on which such games work and provides several examples of the most popular and profitable games of this kind.

Keywords: games, shareware games, free to play, microtransactions.

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МИКРОТРАНЗАКЦИИ В ВИДЕОИГРАХ

Аннотация: В этой работе микротранзакции рассматриваются как способ монетизации игр, распространяемых по условно-бесплатной модели. Показано, что микротранзакции хоть и очень прибыльны для издателей, но представляют собой чётко выверенную систему по навязыванию необязательных покупок, что заставляет пользователя тратить много денег. В статье также объясняются основные принципы, на которых работают такие игры, и приведены примеры самых популярных и прибыльных игр подобного рода.

Ключевые слова: игры, условно-бесплатные игры, микротранзакции.

In this article we would like to consider the concept of microtransactions in video games. To begin with, over the past year, the mobile games market has reached a turnover of 69 billion dollars worldwide. Most of this money was earned by games with a shareware distribution model, it implies the ability to download and play the game for free, but it has an in-game store in which you can purchase some content or goods for real money [1].

Let's take a closer look at how these games work, and why they are so popular and profitable. As the game is free, it is very easy for it to find its audience, because the buyer does not bear any risks, if s/he does not like the game, s/he does not lose anything, since s/he does not spend anything for this experience, but if s/he likes this entertainment, s/he will continue play it. Therefore, the developers are trying to keep the player in their game, for such purposes the system of daily bonuses is perfect, so that the player has to enter the game once a day. When the player's attention is already fixed on the game, it is necessary to make sure that s/he pays the money. Most often, in such games, the game process slows down, e.g., the production of units or upgrades can take from five seconds to one week. In some games there is an endurance parameter that can take up to a day to restore, or lives, which can be recovered for quite a long time. However, all these inconveniences can be removed by paying a certain amount of real money. After the first purchase is made, the next one will not take long come, and that is what developers are focusing on. The amount of purchases may not exceed several dollars, but after several purchases are made during a day, it can be seen that a lot of money is spent on the free game. With all of the above, many of these games are

designed so that one can play them endlessly, and they are almost all multiplayer, which adds a competitive moment to them, and can become addictive. It is worth noting that not all free games work according to a similar scheme, in some you can buy only cosmetic items that do not affect the gameplay, and some, on the contrary, work according to a pay-win scheme, in these types of games for money you can buy a clear advantage over other players.

Such games are most common on mobile devices, due to the prevalence of the platform and the low threshold of entry for the player because of the non-trivial nature of the gameplay [1].

Here are a few examples of the most successful free to play games for 2019:

• **Fortnite** game from the publishers of epic games in the battle royale genre earned $ 1.8 bln in 2019. The battle royale genre was one of the most popular in 2019. Monetization in this game is extended only to cosmetic items and does not affect the gameplay, but the desire of the players to show their personality and decorate the game character encourages one to spend real money. The game itself is made with high quality and is an example of a good free to play game, as it does not make one pay for the gameplay itself, and cosmetic items are absolutely optional.

• **Crossfire** shooter game from Tencent publishers, a multi-player game that was released back in 2008, managed to earn $ 1.4 bln in 2019, this is an example of a game in which one can purchase items that affect the gameplay, directly giving an advantage over players who did not spend money on purchases, but the publisher‘s correct policy towards players still keeps the game afloat.

• **Candy Crush Saga** game from the publishers of KING Digital Entertainment in the puzzle genre, earned $ 1.5 bln in 2019. The gameplay is pretty simple, all you need to do is to collect candies in a row, after which they will disappear and this is repeated again and again. These games are better known as three in a row, and everyone can play them. The basis of monetization in the game is the purchasing of boosters and energy, the first helps to complete levels, and the second is necessary for passing levels. In order to progress in the game, you need to have friends who, for example, have already passed up to a certain limit of levels, and can let you ahead. Without friend like these, you can just buy yourself a pass for real money. In my opinion, this game is a great example of a free to play game, also being one of the most successful games in general.

This type of game has one big problem which, to my mind, requires a speedy solution. This is an opportunity to spend money in such games by users who have not reached a conscious age or simply incapacitated people. For example, a student in England spent about a thousand pounds on Fortnite just not realizing that it was real money [2]. And this is only an example that created a sensation, so it makes sense to say that similar things on a much smaller scale are happening everywhere. And in some countries the struggle with children’s crazy spending on games has already begun, in Japan and China, the amount they can spend on online games is limited for teenagers [3].

Nowadays, games have become an integral part of life for many people, but

it is important to understand one thing: you should play games and not let games play you.

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APPLICATION OF INTELLIGENT TECHNOLOGIES TO BUILD A SYSTEM FOR MONITORING THE TRANSFER OF POLLUTANTS IN THE AQUATIC ENVIRONMENT

Abstract: At present, the program of neural network modeling has been developed for multicriteria processes modeling. The article presents the results of the study the purpose of which is to build the direct distribution network for the implementation of the monitoring system of the pollutant transportation process in the aquatic environment in terms of minimum error structure.

Keywords: forward propagation neural networks, Back-Propagation algorithm, transforming function of neurons, neural network modeling.

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ПРИМЕНЕНИЕ ИНТЕЛЛЕКТУАЛЬНЫХ ТЕХНОЛОГИЙ ДЛЯ ПОСТРОЕНИЯ СИСТЕМЫ МОНИТОРИНГА ПЕРЕНОСА ЗАГРЯЗНЯЮЩИХ ВЕЩЕСТВ В ВОДНОЙ СРЕДЕ

Аннотация: В настоящее время для моделирования многокритериальных процессов получили развитие программы нейросетевого моделирования. В статье представлены результаты исследования, целью которого является построить нейронную сеть прямого распространения для реализации системы мониторинга процесса переноса загрязняющих веществ в водной среде.

Ключевые слова: нейронные сети прямого распространения, алгоритм Back-Propagation, преобразующая функция нейронов, нейросетевое моделирование

In order to assess the possibility of training a neural network modeling program to calculate the processes of pollutant transfer in the aquatic environment this program was trained on the results of simulation modeling [1].

To fulfill this task a section of the Volkhov River (Veliky Novgorod) was selected with the following parameters: length – 1000 m, width – 10 m, depth – 5 m. The enterprise is located at the beginning of the settlement site on the right bank, the waste water consumption is 0.0001 m3/s.

Based on the results of the solution of the direct task 5000 examples were formed and the training of the neural network modeling program was carried out using these samples. One example contained 3 input parameters and 200 output parameters. Input parameters were the values of initial dilution concentration, background concentration and river flow rate. Output parameters were concentrations of different substances such as chloride, sodium, potassiumand sulfate in a number of controlled points of a water body.

Training of the neural model was implemented in the Neural Works Professional II Plus neural network modeling program. The model topology was a three-layer structure of direct distribution. The dimension of input and output signals in the neural model was 3 and 200, respectively (fig.1).

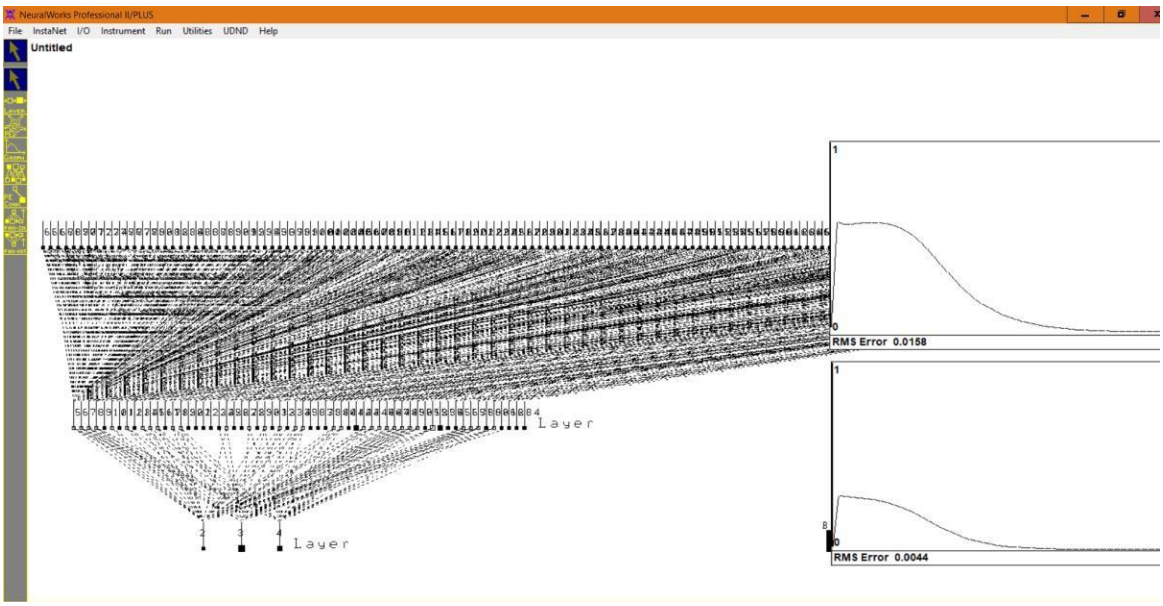

Fig.1. The neural network

As a result of the study, in order to obtain the best structure of the direct propagation network for the implementation of a system for monitoring the transfer of pollutants in the aquatic environment from the point of view of the minimum error, parameters were chosen, such as: the rate of training of the neural network, the number of network layers, transforming the function of neurons [2].

The standard Back-Propagation algorithm is used to teach this neural network. The initial concentration of the substance, the flow rate of the river and the background concentration are fed to the model input. The outputs contain information on the concentration of various substances such as chloride, sodium, potassium and sulfate in a number of controlled points in the water body [3].

All neurons of the input and output layers have a linear transforming function due to the fact that they perform only distributive and scaling functions. The task of compressing and approximating the data coming to the network is performed by an internal layer, the transforming function of which being of a sinusoidal shape. The number of neurons in the internal layer can vary depending on the complexity of the task.

As a result of this work we obtained a model with an error of 2% of the maximum concentration of contaminants. This information is necessary to control the spread of contaminants as well as to localize sources of increased levels of harmful substances.

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TRENDS IN THE USE OF SOLID FUEL MADE FROM WOOD WASTE

Abstract: The article focuses on the advantage of using wood briquettes as an alternative fuel, their economic, technological, social and environmental aspects.

Key words: fuelwood, pellets, fuel briquette.

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ТЕНДЕНЦИИ ИСПОЛЬЗОВАНИЯ ТВЁРДОГО ТОПЛИВА ИЗ ОТХОДОВ ДЕРЕВООБРАБОТКИ

Аннотация: В статье рассматриваются преимущества использования древесных брикетов как альтернативного вида топлива, а также экономические, технологические, социальные и экологические аспекты их применения.

Ключевые слова: биотопливо, древесное топливо, пеллеты, топливные брикеты.

All types of enterprises in the timber industry are characterized by waste generation at all stages of production. Wood waste pollutes the environment and occupies huge areas, and the organization of landfills and removal of waste itself is an expensive event. In order to eliminate such problems, laws are being developed that regulate the storage and processing of wood waste at enterprises.

Wood fuel (including wood waste) is an environmentally friendly fuel with a high calorific value, low ash content and minimal content of harmful substances. Therefore, the search of an effective method of wood waste recycling is being updated, namely, obtaining a special product, such as fuel for stoves, fireplaces and boilers [1].

Biofuels from wood waste, at the moment, are already very developed in the

world fuel market [2]. The most common products are pellets, briquettes, eurowood. Below is a comparative table of the world's leading biofuel products (Table 1).

Type of fuel	Characteristic	Features of production technology	Raw material
RUF fuel briquettes 	They have a rectangular shape , the original size is 150×90×60 mm, the density is 0.75-0.8 g / cm^3; the calorific value is 4350 kcal/kg.	It is manufactured on a high-pressure hydraulic press at a high temperature without the use of any chemicals.	Sawdust and chips of different fractions, chips are used as raw materials for briquettes, cropping, pruning, straw, peat (peat briquettes); the stems of sunflower, corn and other crops; grain husks; branches after pruning trees, etc., depending on the manufacturer.
Pini Kay fuel briquettes 	They have the shape of an irregular polyhedron with a characteristic dark crust and a hole in the center, dimensions 50-80 x 200-300 mm; density from 1.08 to 1.40 g / cm^3; calorific value-4900 -5100 kcal/kg.	Produced from pre-dried crushed wood (sawdust) on a screw press under high pressure, followed by a short firing without the use of any chemicals.	
Round briquettes Nestro 	They have the shape of a cylinder with a diameter of 60-90 mm and a length of 50-350 mm; density of 1-1. 15 g / cm^3; calorific value of 4500-5250 kcal/kg.	The raw material passes through a hydraulic press, where it is strongly compressed. Unlike Pini-Kay —- there is no Central hole in the final product and a shorter length. According to the production	
Fuel pellets 	Have the shape of a cylinder with a diameter of 6-8 mm and a length of 10-40 mm; density of 1.0-1.4 g / cm^3; calorific value - 4500 kcal / kg.	It is manufactured on a high - pressure granulator at a high temperature without the use of any chemicals.	Shavings, sawdust, wood chips, hump , balance, peat, straw.

Table. 1. Comparative table of the world's leading biofuels [3].

Raw materials for the production of pressed materials are: any wood waste as well as agricultural waste. The technology of the pressing process depends on the humidity (the optimal value is 6-12%) and the size of particles.

To ensure an efficient combustion process of the resulting fuel, all raw materials must be uniform in size, which will make it possible to mechanize their supply to the furnace, as well as to obtain the highest efficiency.

The technological process of wood waste briquetting generally consists of the stages shown in the diagram below (fig. 1) [1].

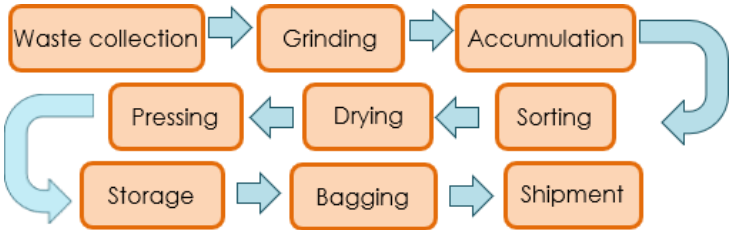

Fig. 1. The technological process of briquetting.

An important advantage of pellets, briquettes and eurowood is the absence of chemicals in their composition, since the role of binder is performed by lignin (natural wood binder).

Also the considered biofuels have a high volume density, due to which they burn 4 times slower than wood fuel (wood density ~ 0.5-0.7 g/cm^3). At the same time, they give away 2 times more heat. They burn evenly, not producing sparks with minimal smoke, and the combustion process is more controlled. Due to more complete combustion, the release of harmful substances into the air is minimal. Briquettes and pellets require significantly less storage space than firewood, and they are easier to transport, which significantly reduces the cost of fuel transporting and storing.

Production of biofuels from wood waste can solve the following issues:

1. Disposal of various wood wastes;
2. Obtaining of environmentally friendly biofuels;
3. Improving the culture of production;
4. Getting additional profit from the sale of fuel.

Due to a number of advantages, the production and use of pellets, briquettes and eurowoods is widely spread throughout the world.

According to FAOSTAT (food and agriculture organization of the United Nations) – forestry database for 2018, an analysis of the pellet market was made, according to which the leading producer of pellets in the world is the United States as a percentage of world exports – 25%. The production of pellets in the United States has increased one and a half times since 2012 and amounted to 6.9 million tons in 2017.

The second largest producer of pellets in the world is Canada (11% of world exports). In 2016, this country recorded a record high volume of production of fuel pellets from wood waste – production increased by 38%. In 2017, Canadian producers produced about 2.7 million tons.

Since 2012, Germany has shown a decrease in the volume of production of pellets, but in 2017, the output has recovered and amounted to 2.25 million tons. All homeowners receive a subsidy to convert boilers to biomass feedstock, so the volume of production of wood biofuels will increase annually.

The volume of pellet production in Sweden remained unchanged at the end of 2017 and amounted to 1.74 million tons. Slightly less amount is noted in Latvia – 1.5 million tons.

According to the results of 2017, Russia produced 1.34 million tons of pellets, which is 33% more than in 2016. Large-scale production of pellets in

Russia began in 2013 and by the end of 2017 doubled, but in 2018 fell again to 972 thousand tons.

The global trend of Green energy dictates a shift away from the use of fossil raw materials, in particular coal. Along with wind and solar energy, the consumption of various types of biofuels is growing. Briquettes and pellets can be produced from wood chips, but this is not rational at a time when sawmilling and woodworking waste is a growing problem worldwide. This is why the demand for biofuels from wood waste is growing every year and will continue to increase due to the commitment of countries around the world to improve the environmental situation.

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EFFICIENCY OF TREATMENT FACILITIES ASSESSMENT OF THE PULP MILL

Abstract: Assessment of the efficiency of the existing pulp mill treatment facilities is related to the need to achieve the specified environmental standards in the zone of pollution and the zone of influence of the water body. The normalized indicators of the degree of purification and measures to ensure them are determined depending on the pulp production technology.

Keywords: treatment, waste water, treatment efficiency, biological treatment, pulp production.

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ОЦЕНКА ЭФФЕКТИВНОСТИ ОЧИСТНЫХ СООРУЖЕНИЙ ЦЕЛЛЮЛОЗНОГО ЗАВОДА

Аннотация: Оценка эффективности работы действующих очистных сооружений целлюлозного завода связана с необходимостью достижения заданных экологических нормативов в зоне загрязнения и зоне влияния водного объекта. В зависимости от технологии производства целлюлозы определяются нормируемые показатели степени очистки и мероприятия по их обеспечению.

Ключевые слова: очистка, сточные воды, эффективность очистки, биологическая очистка, целлюлозное производство.

Enterprises placed in proximity to water bodies are major sources of anthropogenic pollution of rivers and lakes. Insufficiently treated wastewaters from a pulp mill contain pollutants that impact aquatic ecosystems, thereby disrupting the internal balance and biotic structure of the water body. The waste

water of the pulp mill is mainly contaminated with suspended and dissolved organic substances [1].

To assess the effectiveness of biological treatment, the content and level of specific indicators of the quality of treated water before discharge into a water body were determined. They are lignosulfonic acids, phenols, suspended substances, BOD, COD, phosphorus and nitrogen compounds [1].

The company in question is located in the North-Eastern part of lake Ladoga. The plant operates on a periodic mode of pulp cooking, uses a sulfate method of cooking, so the alkaline-containing effluents of the pulp mill have organic compounds in their composition, mainly lignosulfonic acids. To preserve the water ecosystem of lake Ladoga, it is important to use high-quality water treatment.

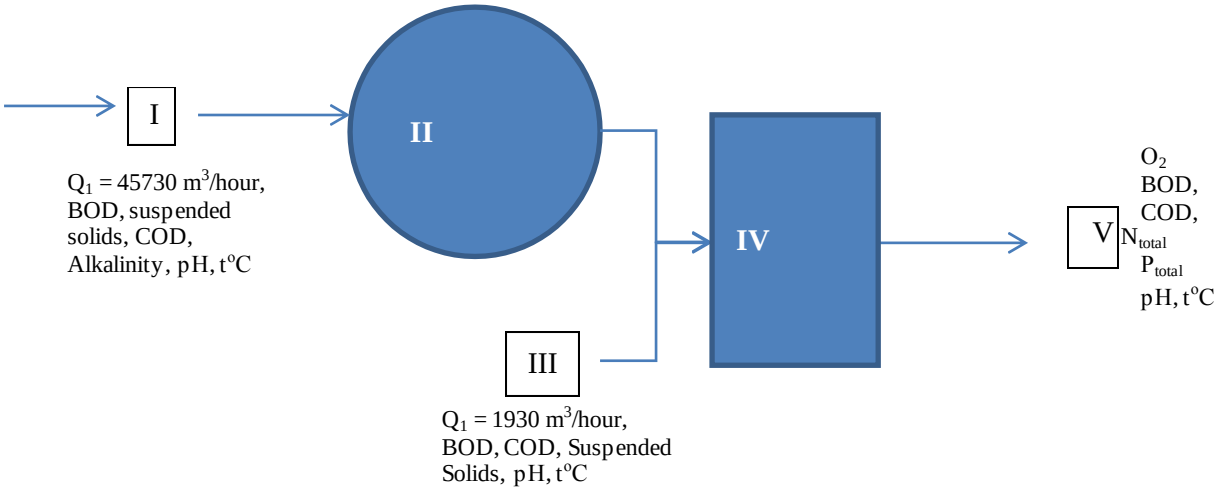
The complex of sewage treatment plants provides deep treatment of industrial and household waste water of the enterprise and the city. The design capacity of the structures is 4275 m^3/hour (102,6 thousand m^3/day). The actual capacity of treatment facilities is 1782 m^3/hour (15,6 thousand m^3/year).

Treatment facilities consist of two main stages of treatment – mechanical (settling tanks) and biological (aeration tank). The project provides for separate mechanical treatment of industrial and household wastewaters, then their joint biological treatment and discharge through a deep dispersing discharge into lake Ladoga.

Figure 1 shows a diagram of the sewage treatment facilities of the pulp mill under consideration by treatment stages, indicating the controlled pollutants by the average values of the flow rate of incoming wastewaters treatment.

The choice of controlled substances by treatment stages is determined by the orientation of each treatment stage to a certain list of indicators that assess the degree of wastewaters treatment.

After the first stage of treatment, the sump (II), regular monitoring of such indicators as suspended solids, nitrogen total, phosphorus total is performed. These indicators must be monitored for the effective operation of the aeration tank.



I – input of industrial wastewaters entering for treatment, II-settling tanks , III-input of domestic wastewater entering for treatment; IV-aeration tank; V - output of treated wastewaters

Fig. 1. Scheme of sewage treatment facilities of the pulp mill

Entering the purification of waste water pulp mill are alkaline in nature, as pulping the sulfate method begins with processing the wood in an alkaline solution of a mixture of NaOH and Na_2S. Thus, it is necessary to control the rate of alkalinity input to the treatment system. Also, incoming effluents contain suspended substances formed mainly by lignin and BOD, COD, as an indicator of organic compounds.

In the process of mechanical cleaning in the settling tanks, it is necessary to control the suspended substances, as well as the amount of total nitrogen and total phosphorus before these substances are added to the aeration tank reactor to maintain the necessary environment.

At the third stage, suspended substances, BOD and COD, as the main parameters of organic pollution, are controlled at the entrance of incoming domestic wastewater for treatment. In an aeration tank, it is important to know the amount of nitrogen and phosphorus compounds, as well as the organic load. At the discharge of wastewaters, all the above indicators must be supplemented with monitoring of the level of dissolved oxygen. At each stage, it is necessary to monitor the temperature regime and pH level.

To assess the quality of incoming water for treatment and compare it with the design characteristics of the plant's treatment facilities, statistical links are constructed based on the results of increasing the efficiency of treatment [2]. Data on monitoring of industrial and household waste water was provided by the laboratory of treatment facilities of the Central district for various stages of treatment during August 2019.

Figure 2 shows a diagram of the dynamics of changes in BOD total by day at different stages of treatment in order to assess the treatment efficiency.

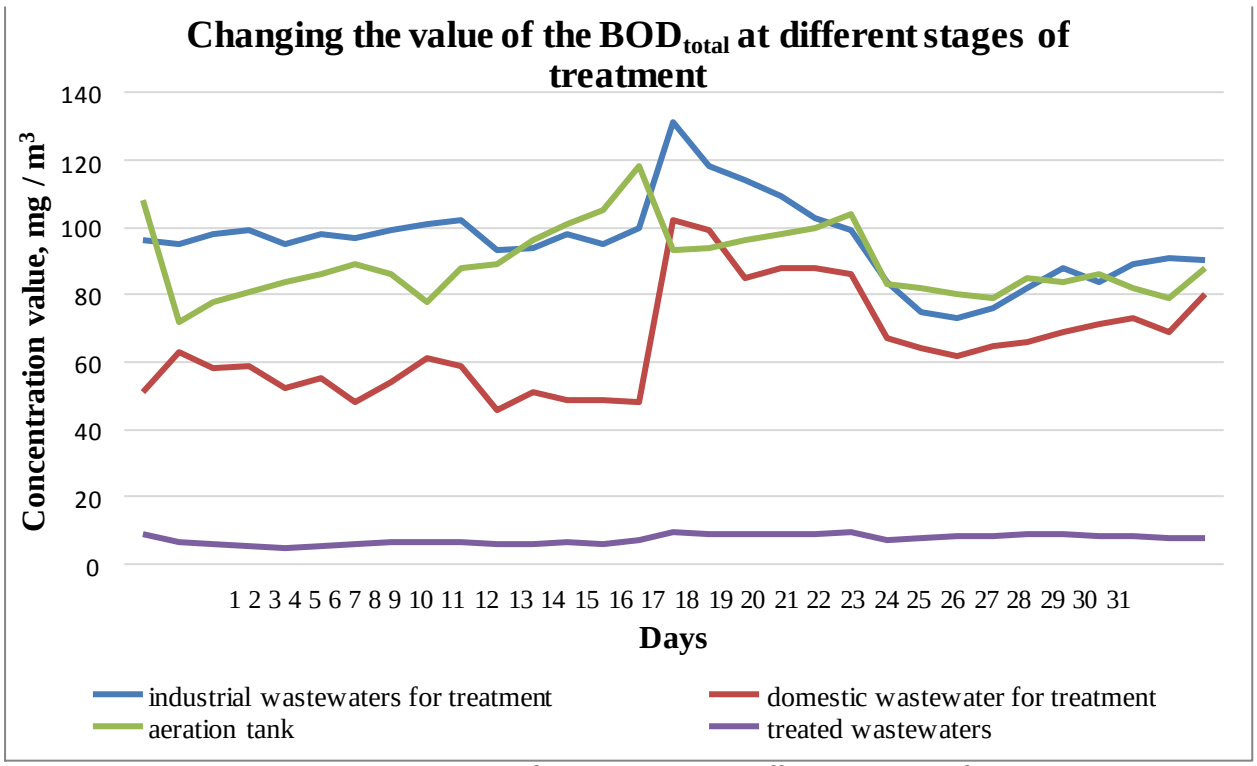


Fig. 2. Changing the value of the BOD_{total} at different stages of treatment

It is necessary to take into account all the characteristics of the products, including the degree of pulp delignification, as well as the modes of pulp cooking in order to further assess the quality of wastewater generated by the technological process [3].

To reduce the values of the company's target indicators, the following technologies and methods should be used: dry debarking and high-efficiency flushing of unbleached mass and sorting with a closed water cycle, thus reducing the percentage of waste water after the debarking and flushing processes after cooking [3]. It is important to effectively control leaks and contamination, as well as in the chemical and energy recovery system.

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EPIDEMICS IN THE WORLD: H.I.V

Abstract: This paper discusses HIV and its status as a generalized epidemic. Here we report on the statistics in Russia, the ways of transmission and protective measures. We also refer to the topic of therapy for people who have positive HIV status and their life after the diagnosis.

Key words: HIV, AIDS, positive HIV status, epidemic, virus.

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ЭПИДЕМИИ В МИРЕ: ВИЧ

Аннотация: В работе рассматривается ВИЧ и его статус генерализованной эпидемии. Здесь мы приводим российскую статистику, способы передачи и меры защиты. Мы также обращаемся к теме терапии для людей с положительным ВИЧ-статусом и их жизни после постановки диагноза.

Ключевые слова: ВИЧ, СПИД, положительный ВИЧ-статус, эпидемия, вирус.

Humanity went through many massive epidemics such as typhoid, leprosy, plague, smallpox, malaria, tuberculosis. Nowadays many of them are gone, treatable, controlled or we have a vaccine that provides active acquired immunity against ones. Among these diseases must be A.I.D.S (Acquired Immunodeficiency Syndrome) and the virus, which causes it called H.I.V (Human Immunodeficiency Virus). It is intentionally emphasized because this one has no treatment, it is very "successful" as a virus and all we can do is control it. Lack of treatment leads to

death in all cases. For being able to fight the enemy, you need to know everything about him. Scientists have spent many years examine H.I.V from the start of the epidemic. H.I.V is currently known as two species of Lentivirus, which is a subgroup of retrovirus that can infect humans [1].

For the first time, Dr. Michael S. Gottlieb faced the disease in 1981. One of his immunology fellows found an "interesting case". A young gay man, who has unexplained fevers and dramatic weight loss, was diagnosed with Pneumocystis pneumonia. This type of pneumonia is often appears in very weak people, even newborn is capable to fight it. Apparently, the patient's blood had almost no $CD4^+$ T_h cells that provide suppression, regulation and enhancement adaptive immune response. At the same time, the doctor began to look for similar cases in other US hospitals. He found out that not only his patient, but a few of Joel Weisman has the same diagnosis and they also didn't have any $CD4^+$ T_h cells [2]. Later, several more patients with Pneumocystis pneumonia contacted the Dr. Gottlieb and then it was decided to report this to the Center for Disease Control and Prevention. In June 1981 appeared the first article about unknown disease. During 1982, patients with Kaposi's sarcoma began to be admitted to US hospitals. Kaposi's sarcoma is believed to be a rare manifestation of skin cancer mainly in the elderly [3]. Because of that, doctors observed this kind of patients more attentively. As it turned out these people also suffered from acute immune deficiency and the majority of investigated were gays. For this reason, the disease got its first name – G.R.I.D (gay-related immunodeficiency disease). However, after a year it became clear that heterosexual men, women are also affected by new disease, and in 27 July 1982 it was given a new name, which we know now – A.I.D.S. Following this, Robert Gallo obtained the pathogen (H.I.V virus) in 1984 and the transmission methods of H.I.V became clear in 1985. At the same time, the first H.I.V test was received in Japan [4].

At the beginning of article, H.I.V was called a "successful" virus. The mainreasons of it are the ways of H.I.V transmission and its impact on the human body. The Human Immunodeficiency Virus infects the immune system and weakens the body's defense against infections and certain types of cancer. The virus disrupts the function of immune cells, reducing their number; thus, infected people acquire immunodeficiency The number of the white blood cells called $CD4^+$ cells usually measures immune function. The lower this number, the lower the person's ability to resist diseases. If $CD4^+$ cells count falls below 200, it is said that the person has A.I.D.S. A.I.D.S is the last deadly step of H.I.V [5].

There are four ways of transmission the virus: unsafe sex, injections, passage from mother to baby, includeing breastfeeding and blood transfusion. It is not transmitted by touching, kissing, insect biting or through food [6]. In case of contacts that can infect the person, H.I.V testing must be done. There are two types of tests: rapid diagnostic self-test and enzyme-linked immunosorbent assay (E.L.I.A) in the laboratory. Usually, the first antibodies to H.I.V develop within 30 days of infection. During this period that called seronegative window, the virus may be asymptomatic, but headache, fever, rash, or sore throat may also occur.

The big danger is that people are not aware of their positive H.I.V status and continue to spread it. In addition, sometimes, the seronegative window can lasts from one to six months and because of that retesting is advised. The transaction from H.I.V to A.I.D.S usually takes 2-15 years. As the infection gradually weakens the immune system, some symptoms, such as dramatic weight loss, swollen lymph nodes, diarrhea, fever, and cough, may occur. Lack of treatment can result in serious illnesses such as tuberculosis, bacterial infections, cryptococcal meningitis, and cancer [5].

By following the usual protective measures, humanity can stop the spread of the disease. Preventive measures include usage of condoms, early testing for HIV and tuberculosis, usage of sterile injection equipment, including needles and syringes, for each injection and usage of antiretroviral therapy if one of the partners is H.I.V-positive or the person is exposed to risk factors [5]. One of the most important measures is the usage of antiretroviral therapy (A.R.T). It allows not only to reduce the spread of the virus, but also to H.I.V-positive person to live a healthy and long life. The first usage of A.R.T was in 1987, but the drug zidovudine, which was the basis of the therapy, was quite toxic. Already in the early 1990s, combination therapy drugs, consisting of protease inhibitors and non-nucleoside reverse transcriptase inhibitors were widely used [7]. The most modern treatment options have practically no side effects, are safe for humans and consist in taking one tablet per day or one injection in one or two months. The effect of A.R.T is that an H.I.V-positive person reaches zero viral load, as a result he may have unprotected sexual contacts for conceiving and giving birth to a baby, as well as for breastfeeding [8]. Unfortunately, to date, H.I.V is not completely treated, despite the latest news about the second person to recover [9]. Scientists are actively searching for a vaccine, as well as a possible way to completely defeat the virus.

The first cases of H.I.V in Russia were recorded in the USSR in 1980s. Today the number of patients is growing steadily every year. For 2018, 85,995 H.I.V positive people were registered [10, p.40]. The data also indicate that the highest incidence is in the Ural (108,2 per 100.000), Siberian (124,9 per 100.000) and Volga (68,2 per 100.000) federal districts [10, p.40]. Statistics on drug use in Russia also indicate increased drug addiction in these regions [11]. From the above data, it is concluded that the first problem associated with such a large number of cases is related to drug addiction. The second possible problem is low funding for A.I.D.S centers [12]. The third and very important problem is the high cost of condoms and the lack of sexual education [13, 14]. Statistics for these regions also draws attention to the fact that testing H.I.V-positive patients for viral load is lower by an average of 7.65% than in other regions [10, p.83]. The Northwestern (179,5 per 100.000), Ural (254,6 per 100.000) and Siberian (147,7 per 100.000) federal districts are leading in the number of patients with severe H.I.V [10, p.78]. The majority of people will learn about their status after a long time, since the testing policy is not supported by the state at the proper level, and the number of tests is limited [12]. This indicates a lack of funding for health. It is also worth

noting statistics on H.I.V treatment by district. Only 56.4% of patients have access to therapy. In today's Russia, financing of medicines for H.I.V patients is an acute problem [10, p.88]. Since 2017, Russia has moved from regional to federalprocurement of medicines. Consequently, the most patients receive an incomplete or inappropriate course of drugs, which leads to the progression of the disease [12].

According to estimates, in 2018, 38,000 people died from A.I.D.S [15]. This is approximately 100 people a day. In total, more than 1 million people are infected in Russia, in 13 regions of the country the number of infected exceeds 1% of the population [16, 17]. Unfortunately, all the data presented only indicate that Russia has a generalized H.I.V epidemic. Only a solution to the above problems will help change the situation for the better. This work was done to draw attention to the H.I.V problem in Russia, as well as to educate the population in this topic.

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ARCTIC ECOLOGY: LAST PROJECTS AND FUTURE PROSPECTS

Abstract: This paper deals with the ecological problems in the Arctic. The new projects and efforts of some organizations are described.

Keywords: the Arctic, ecology, oil, gas, economy, project.

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ЭКОЛОГИЯ АРКТИКИ: ПОСЛЕДНИЕ ПРОЕКТЫ И БУДУЩИЕ ПЛАНЫ

Аннотация: Эта статья затрагивает экологические проблемы Арктики. Описываются усилия некоторых организаций, созданных в разных странах, и их проекты.

Ключевые слова: Арктика, экология, нефть, газ, экономика, проект.

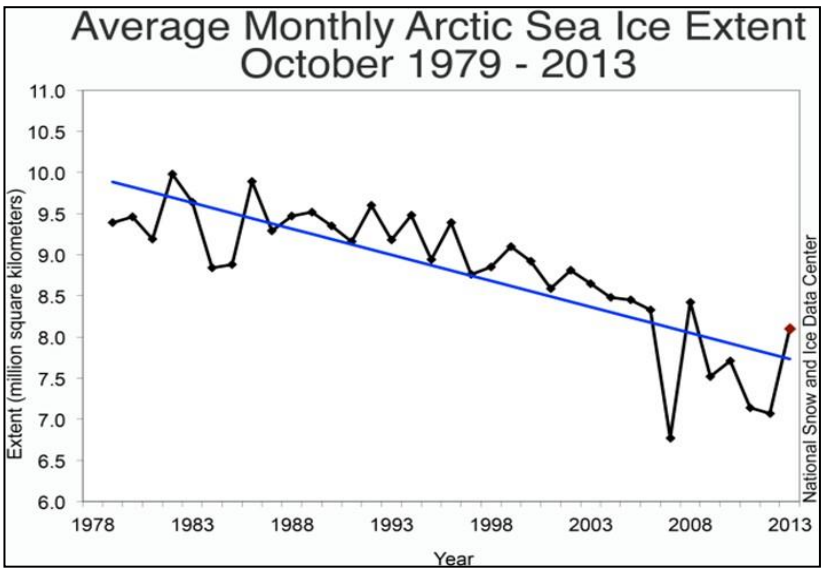
The Arctic is the northern part of the planet Earth. It consists of the Arctic Ocean with its seas and islands. Arctic is one of the unpopulated places in the world but people really want to inhabit it.

It is obvious that the Arctic is suffering from the ecological crisis. It is polluted and it is changing every year [1].

As you can see in the graph, its ice is being melted more and more now. The ecosystem is being destroyed by people.

Scientists predict that the Arctic Ocean is now on track to become ice-free in summers as soon as two decades from now, while autumn and winter temperatures

in the Arctic will be about 22 degrees higher in 2100 than they were at the end of the 20th century. Consequences will be fatal.



But you can ask why melting ice is so dangerous? The disappearance of ice will entail irreversible changes in our lives.

Arctic is one of the few untouched corners in the Earth. There is a huge amount of oil and gas deposits, though.

Modern world extremely depends on oil. That is why, oil companies continue to move to Arctic space as they want to find last drops of oil ignoring the fact of possible dangers. There is no doubt that it is awful.

However, we have a chance.

The world is constantly changing. More and more attention is paid to Arctic ecology problems. For example, from 2012 to 2015 general cleaning was carried out to liquidate the ecology damage caused in the past in the islands of New Earth and Franz Josef Land. At that time more than 42 thousand tons of different types of waste were taken away and technical reclamation of 349 hectares of damaged land was done [2].

As for the oil, people also try to save Arctic from predatory industrials. In October 2016 Norwegian ecological organization "Natur og Ungdom" which was organized by young people and "Greenpeace Norge" supported by society, scientists and some people from all over the world sued the Norwegian Government because of issuing permissions for oil companies to extract oil in the melting Arctic [3].

However, saving Arctic ecology can give the bad influence to economy of all countries. Thus, in 2018 Russian government approved a national project "Ecology" which will last until 2024 year. Now innovated technologies that provide balance between economy and ecology are practiced in the Arctic. It is planned to use environmentally friendly fuel for vessels widely, for instance liquefied natural gas [4]. It combines both ecological and economic sides.

Moreover, initiated by David and Lucille Packard Foundation in partnership with the Oak Foundation and the Good Energies Foundation a new "Climate

Breakthrough Project" was created as a sign of recognition that existing strategies to solve the climate crisis problem are not enough for the decision of this problem.

The project is looking for new people with potentially breakthrough ideas which can lead to significant reduction in greenhouse gas emissions [5].

In the conclusion it is necessary to notice that the problem of the Arctic is urgent and requires the effort of all people in the world. We must struggle and save the Arctic for the future generations.

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IMPLEMENTATION OF NON-STANDARD TECHNOLOGIES IN CAR DESIGNS

Abstract: Throughout the history of the automotive industry, designers have sought to improve the technical characteristics of a car. The results were different, as were the goals. The authors of the article analyse the most unusual designs and the boldest concepts.

Keywords: automobile, car, horsepower, engineer, brake system, race, concept, motor.

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НЕСТАНДАРТНЫЕ ТЕХНИЧЕСКИЕ ВНЕДРЕНИЯ В КОНСТРУКЦИЮ АВТОМОБИЛЕЙ

Аннотация: На протяжении всей истории автомобилестроения конструкторы стремились улучшить технические характеристики автомобиля. Результаты были разными, также как и цели. Авторы статьи анализируют самые необычные конструкции автомобилей и весьма смелые концепты.

Ключевые слова: автомобиль, лошадиная сила, инженеры, тормозная система, гонка, концепт, мотор.

Since the invention of the car, design engineers have sought to improve their technical characteristics, such as convenience, capacity, maneuverability, reduced fuel consumption; environmental and safety issues were also addressed. The aims and results of the improvement were different, for example, victory in races, accessibility for the population, off-road performance, nature conservation. Some ideas have been recognized and are still in use, while some remain concepts.

(a) Bugatti Veyron (b) Alfa Romeo 16c bimotore

(c) Tata Nano (d) Ford Mustang Mach-E

Fig. 1. Released models

Let's start with **Bugatti Veyron** (figure 1, (a)).

Aerospace engineers participated in its development, thus, a special wing was created to prevent the machine from taking off, since it has higher speed than an aircraft during acceleration. The brakes were developed by a company which specializes in making brakes for airbuses. This way, the car has two brake systems: mechanical (on its wheels) and aerodynamic (the wing). The motor capacity is 3,000 hp, of which 2/3 is heat generation: during the first test, the whole building almost burned down, as the released heat would have been enoughto heat hundreds of houses in winter, and a two-meter flame burst out of the exhaust pipe. It was illegal to leave this schtick, therefore a unique cooling system was developed. All Bugatti cars are assembled by hand and special tires have been designed for them, becausethere were no tyres that could withstand driving at a speed of more than 400 kmbefore. In addition, the gearshift controller is more powerful than four computers. The volume of the gas tank is 100 l, with fuel consumption of 47,2 l per 100 km. The price is impressive –1,650,000 dollars.

The next car is **Alfa Romeo 16c bimotore** (figure 1, (b)).

It was manufactured only in 1935. This car is designed for racing, with two motors mounted to increase its performance. Although it sounds simple, it is technically difficult to do. Later, in different years, many automobile companies turned to this solution. The car is still remembered not due to its victories (as there were none), but due to its new and unusual design. The driver was sandwiched between two heavy engines that would wear out the tyres and empty the fuel tank, but the speed was unique for that time: the car accelerated to 364 km/h, and the capacity was 540 hp. Ferrari participated in its development, so their emblem is present on the hood. As mentioned earlier, the car did not win any of the three races in which it participated: due to its high power and weight, the rubber wore off quickly and the car left the race. At the moment, there are only two copies left in England and in Italy [1].

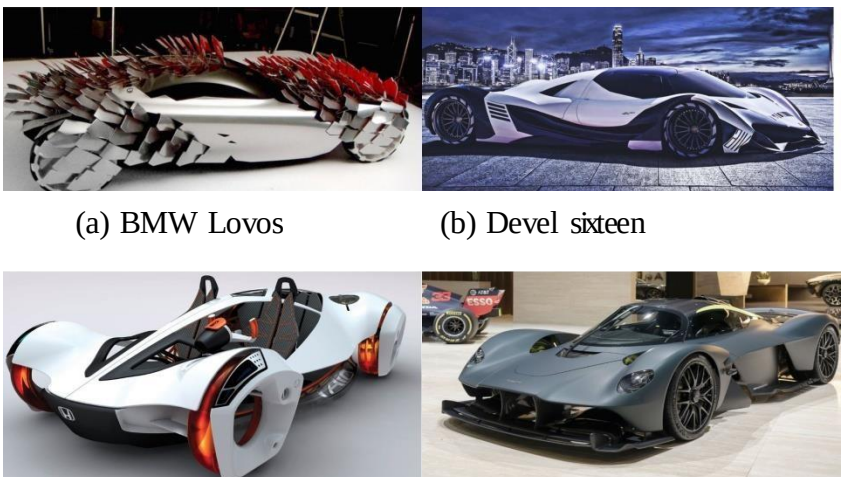
What about cheap cars? The **Nano car** from the Indian company Tata motors was designed to be cheap (figure 1, (c)).

The task of the engineers was simple – to create a compact, cheap model for the Third World countries. The production version was presented in 2008 with a listing price of $ 2,000. Due to the low price, the car turned out to be very primitive, its capacity is only 38 hp; and the motor, which is located under the boot floor, can only be repaired from the inside of the passenger compartment. The following characteristics hav been simplified: the car has only one wiper (instead of two), three retentions crews (instead of four), one side mirror, no airbags; the trunk opens only from the inside. Despite expectations, the car was not successful in the market. Some buyers preferred cheap and light motorcycles, some would choose less primitive four-wheeled vehicles. Besides, right after Nano was launched, the listing price increased 1.5 times due to rising prices for materials.

Cheaper than Tesla, faster than Porsche is Mustang-style electric crossover.

Ford introduced the **Mach-E** coupe-shaped crossover (figure 1, (d)) with an electric motor unit. The rear-driven version costs just $ 43,000 (about $ 4000 less than Tesla). Two more rear-wheel drive versions are expected with a 75.7 kW battery and 282 hp and all-wheel drive options. Cruising range of the car is from 340 to 600 km, its 0-100 km/h takes from 7 to 5.5 s. The Mach-E GT modification is superior to the Porsche Macan Turbo, it will include 2 electric motors with a total capacity of 459 hp and 1-100 km/h in3.5 seconds [2].

Also, many concepts are being created to improve the ride quality in future.



(a) BMW Lovos (b) Devel sixteen

(c) Honda Air (d) Aston Martin Valkyrie

Fig. 2. Concept-cars

The first concept to be focused on is the **BMW Lovos** (figure 2, (a)).

This model resembles an armadillo, porcupine, or armor suit at the same time. Developed by German designer Anna Forschner in 2009 as an educational project, it is supposed to be a completely ecofriendly vehicle, consisting of 260 identical plates coated with photovoltaic elements, which can move on hinges after the sun, like a sunflower, or be controlled by the driver. Also, this “scale” can be used as air brakes to reduce the braking path, whereas during the acceleration the

plates can be folded to obtain a streamlined body. So far, this concept has not been implemented, but it may motivate designers to use solar energy [3].

The next design is too expensive and too powerful, created in the UAE for entertainment rather than for an average use – **Devel sixteen** (figure 2 (b)).

This supercar got its name because of the stated capacity of 5,000 hp and a 16-cylinder engine. The body is made of carbon fiber mounted on an aluminum frame, which provides for sufficient strength and lightness, as in racing cars, these being all the car‘s advantages. Many criticise its outside appearance, saying that it was designed by amateurs and nonprofessionals similar to the "hodgepodge" of Bugatti, Ferrari and Lamborghini. The engine, developed by an American company, showed only 4,500 hp and a maximum speed of 560 km/h during the test. So far it is just a concept and the supercar has not passed the tests on a track yet, it does not have the necessary cooling system and transmission. However, its listing price amounts to $ 1,600,000, and it has not been confirmed whether at least one copy will be produced for sale [4].

Honda Air (figure 2, (c)) is a compressed-air car, demonstrated in 2010 at an auto show in LA. Its engine is driven by compressed air or a combination of air with gasoline, diesel or electric motor. The car is only 363 kg in weight due to lightweight materials and the fact that all the parts are mounted on the main frame, for the safety of passengers, polymer panels are used. The design is inspired by a roller coaster and wingsuit.

The next project was created from scratch in 2014. **Aston Martin Valkyrie** – an exclusive hypercar (figure 2, (d)), the F1 car – went down to public roads in 2019.

To reduce weight, its body is made of carbon fiber, under which there are aerodynamic tunnels to provide downforce, the logo is thinner than a human hair, side mirrors are replaced by cameras, the car is fitted with ultralight tyres and lightweight compact headlights. The Valkyrie can accelerate to 320 km/h in 10 s and brake in 5 s. Owing to the hybrid power plant from an atmospheric v12 engine and an electric motor, the capacity of the car is more than 1100 hp. It is planned to produce at least 150 cars and 25 racing copies, worth about $ 3,000,000 [5].

Fortunately, not all concepts are useless and unusable. Such developments as auto drones, electric cars, the ability to park sideways or call a car from the remote control, the use of hydrogen fuel and non-standard materials (for example, bamboo, wood and even plastic tubes) are already being implemented in everyday life.

In conclusion, it should be emphasized that at the moment the possibilities of this area are unlimited. Designers invent something new every day and perhaps in the future we will not recognize our life.

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SOLID HOUSEHOLD WASTE RECYCLING

Abstract: Solid household waste recycling is one of the hottest issues nowadays. The author of the article points out to the importance of this process in the modern world. Up-to-date means and problems of solid household waste recycling are considered.

Keywords: solid household waste, solid waste, garbage, processing, raw materials, incineration, burial.

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ПЕРЕРАБОТКА ТВЕРДЫХ БЫТОВЫХ ОТХОДОВ

Аннотация: Переработка бытовых отходов является серьезной проблемой в наши дни. Автор обозначает роль данного процесса в жизни человека, а также анализирует способы и проблемы, возникающие при переработке твердых бытовых отходов в мире.

Ключевые слова: Твердые бытовые отходы, ТБО, мусор, переработка, сырье, сжигание, захоронение.

The population is growing every year. The number of products consumed is also growing. Accordingly, the area of landfills increases over time. Under the influence of natural and temporary factors, household waste decomposes, oxidizing with air oxygen and releasing toxic substances into the environment, which leads to a deterioration of the environmental situation on our planet [1].

Currently there are several ways to eliminate waste:

1. disposal of waste in the soil and sea;

2. burning of waste;
3. biodegradation of waste to produce biogas;
4. sorting and reuse.

The above methods partially solve the problem of waste disposal. When dumping waste in the soil and sea, it decomposes, polluting the soil, groundwater, and sea. Waste incineration also leads to air pollution with harmful flue gases. Biodegradation of waste is not productive and is still under development and experimentation. In Russia, the trend of separate collection is not developed, but this is the first step to recycling, without which this problem cannot be solved. In our country, 5-7 % of waste is processed into materials, and the remaining 95-97 % is disposed of [2].

The garbage processing industry is now at the very initial stage of development. There are more than 240 waste processing plants operating in the Russian Federation, but they are not enough to process this amount of waste [1].

Currently, they try to use waste incineration much less, because it not only pollutes the atmosphere, but also requires very high energy costs. But separate waste collection will be promoted at a higher level. Also, every year there is more and more waste for recycling, and less and less for landfills. For example, by recycling 25 plastic bottles, you can make a fleece jacket. You can make a Bicycle out of 670 tin cans. 100 kg of waste paper saves wood. Developed countries, in particular the EU and the US, have long perceived garbage as a strategic resource for generating heat and electricity, non-ferrous and rare earth metals, plastic, glass, and new materials. Garbage has become a commodity that countries purposefully buy from each other for recycling. The global garbage market, which includes collection, removal, recycling and disposal of household waste, is estimated at $ 120 billion [3].

Plastic, metal, and clean cardboard are in high demand, with China showing particular interest in them. Non-ferrous and rare earth metals, plastic and aluminum are extracted from electronics. If we take into account that about 1 kg of gold and 10 kg of silver can be extracted from 5 thousand mobile phones, and about 160 million of them are thrown out over the whole planet in a year, half of which will most likely end up in China, then we get at least 16 tons of gold and 160 tons of silver. The entire turnover of the electronic landfill is estimated to be $3 billion annually [4].

From 1 ton of salt and alkaline batteries, you can get 350 kg of ferromanganese, 280 kg of zinc oxide in metal form (roofing, gutters) or in the form of zinc chloride (in other batteries), 190 kg of slag (mineral product, material for embankments) and 5 kg of pure iron from the shells. At the same time, batteries contain useful elements in a more concentrated form than natural ore. Up to 80% of the components can be used for recycling, and the processing time is up to 3-4 days.

Let’s consider the most profitable raw materials for processing.

1. Metal

The best raw material for recycling, because all you need is to collect garbage, separate metal parts, separate ferrous metals from non-ferrous metals, melt them down and sell them for production. The metal melts without any damage and can be reused. Only radioactive metals are not recyclable – they are disposed of in a specialized way.

2. Cardboard and paper

Processing is not complicated and is as follows: raw materials are packed according to density, color shade, material (there are only twelve options), dissolved in water, separated from impurities and pressed. The resulting raw materials are used to produce napkins, toilet paper, egg stands, and some roofing materials.

3. Plastic

The recycling of plastic requires using special equipment. It is collected, packed (there are several types of plastic, which is indicated separately on the package), labels are removed and sent to the press, after which the raw material is crushed and sold. It is used for the production of different plastic products and is recyclable in any state.

4. Glass

Glass is collected, packed, melted, after which impurities are removed. The resultant mass is sold and can be easily used in production – its quality is not worse than that of the newly manufactured glass, and it melts at a lower temperature.

5. Automobile tyres

It is unacceptable to burn tyres because the smoke released in the process is poisonous. Therefore, they are to be processed by either crushing them into crumbs, which is then used to create road surfaces, or splitting to get artificial oil, gases or raw materials for metallurgy. Tyres can be processed in any form.

6. Wood and construction waste

Wood and construction waste are Packed, cleaned of impurities and sold [5].

Garbage disposal in the Russian Federation differs from similar procedures in Western countries. In Russia, almost no sorting of solid waste is used. Different types of scrap are destroyed together, which leads to serious environmental pollution. Incineration plants can harm not only the Earth's atmosphere, but also the health of people living nearby. Incineration of waste leads to carcinogenic emissions. Such substances can significantly worsen human health. People living near the plant may experience headaches, malaise, diseases of the cardiovascular system, and so on. Carcinogens can contribute to the development of allergic reactions. From the above it follows that the sphere of waste processing in the Russian Federation is poorly developed. Organizations that burn solid household waste strongly pollute the environment and the Earth's atmosphere. Harmful substances released during the destruction of solid waste, adversely affect the health of the country's residents. To solve this problem, it is necessary to build high-tech complexes and implement a waste sorting system.

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THE INFLUENCE OF NATURAL DISASTERS ON THE STATE OF GLOBAL ECONOMY

Abstract: In our article we investigate the impact of natural disasters on the global economy. The basis of the work is statistic research which presents changes in the country's income and it is very important directly due to that factors.

Keywords: natural disasters, global economy, consequence.

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ВЛИЯНИЕ ПРИРОДНЫХ КАТАКЛИЗМОВ НА МИРОВУЮ ЭКОНОМИКУ

Аннотация: В нашей статье мы исследуем влияние стихийных бедствий на мировую экономику. Основой работы является статистическое исследование, которое представляет изменения в доходах страны вследствие указанных факторов.

Ключевые слова: стихийные бедствия, мировая экономика, результат.

The danger of natural disasters is increasing in the length of time. Everyone should take into account that this danger has an impact on economy of any country and global economy. According to many scientific researches a negative influence of natural disasters on global economy's stability has increased during the first decade of the 21 century. About 2,7 billion people have suffered in the period of 2000-2010 years because of disasters. It is more than the third of all population [1].

All countries lose a lot of financial and human resources every year because of natural disasters. In this case the damage is distributed unevenly. Growing economy and economy of poor countries suffered from the damage more than others. For example, if disaster happens in poor countries, increase of fiscal deficit can be from 0,23 to 1,1% of GDP [2]. A big part of damage in growing countries are not covered by insurance while developed countries compensate for the third of economic loss by using insurance mechanisms. Growing countries do not have a chance of attracting funds of international insurance company because the value of insurance premium is very high.

The most famous natural disasters on the scale of destruction are the flood in Thailand, tsunami and earthquake in Japan, tsunami in Indian Ocean and others. Scientists from different countries are researching the dangers of their consequences for a global economy. They marked basic factors which show the impairment of the economic situation. We revealed that the financial damage from disasters is often higher than the rate of growth of the world gross product. The tendency of increasing the frequency of natural catastrophes is dangerous because of the increased amount of suffered population. Working capacity is reduced or lost, additional costs are required to restore the physical and psychological conditions of employees. Moreover climate change leads to an increase in the intensity of certain types of extreme events. We suppose that despite of modern technologies and scientific progress people become more vulnerable because even if scientists can prognosticate natural disasters, still, there is nothing that could prevent it.

Due to recent events, our world faces a terrible epidemic. The name of this epidemic is coronavirus. It was found in Chinese town Wuhan in December 2019. During the two months the coronavirus was recorded in many countries. It is a big blow to the global economy. According to the Organization for Economic Co-operation and Development growth in the global economy slowed down twice. A lot of manufactures suspended cooperation with China resulting in lower efficiency.

We came to the conclusion that the state should improve the insurance system, make it more advantageous for private entrepreneurs and citizens, and introduce laws to protect small businesses from natural disasters.

The system of insurance must be regulated in every country to repair the damage and to restore the infrastructure with the smallest State budget expenditures.

The risk coverage system can be called effective if the national budget acts as reinsurer. So, the State should not subsidize insurance premiums, it should participate in payments that exceed a certain set level. It is determined in advance, taking into account the exposure of the territory or object to a particular risk at the legislative or governmental level.

For uninsured citizens and businesses, there must be compensatory damages. Such compensation may be provided by a state Bank in order to encourage them to enter into further contracts of insurance against the risks of natural disasters.

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FOOD DELIVERY MARKET OVERVIEW

Abstract: In this work we conducted a research of food delivery market. In the course of work, economic, statistical, marketing methods were used to analyze demand, supply, trends and other indicators. An analysis of several locations in St. Petersburg was also conducted.

Keywords: market research, food delivery, delivery market, Delivery club, Yandex.eda, market review, demand, statistics.

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ОБЗОР РЫНКА ДОСТАВКИ ГОТОВОЙ ЕДЫ

Аннотация: В работе выполнен анализ рынка доставки готовой еды. В ходе работы использованы экономические, статистические, маркетинговые методы для анализа спроса, предложения, трендов и других показателей. Также был проведен анализ нескольких локаций в Санкт-Петербурге.

Ключевые слова: Исследование рынка, доставка еды, рынок доставки, delivery club, «Яндекс.Еда» , обзор рынка, спрос, статистика

In this article we are going to analyze online food delivery service, consumers preferences and the locations of the highest demand in Saint Petersburg in order to help entrepreneurs understand the atmosphere in the market and consider the opportunity of opening their own restaurant.

Modern world is a non-stop mechanism that is trying to become more and more productive. Digital generation is committed to insuring the proper perfomance of it. That is the reason of modern culture transformation especially in food consumption. Food delivery is a term which stands for providing food service at a remote site. It has transformed beyond belief over the last couple of years. Nowadays more and more people prefer eating out to cooking. With the help of several units such as Delivery Club or Yandex.Eda this delivery service expanded. It results in the change of the market segment. Due to this fact it is obligatory to acquire clear data. Another important demanding factor is millennials and generation Z entering the economy. These age groups increase the frequency consumption of services and goods.

However, there are negative factors as well, such as decline in income, which prevents people from eating out. Experts say that not only frequency is lowering but also an average bill.

Now turn to statistic, three out of four Russians visit restaurants and bars from time to time (every ten days on average) and spend about one thousand nine hundred and fifty rubles for each visit. Men visit restaurants and bars a bit more often (three point five times per month versus two point one). Among Russians from eighteen to forty-five visiting restaurants and bars, people at the age of forty-five and older spend the most (two thousand two hundred rubles). Young visitors

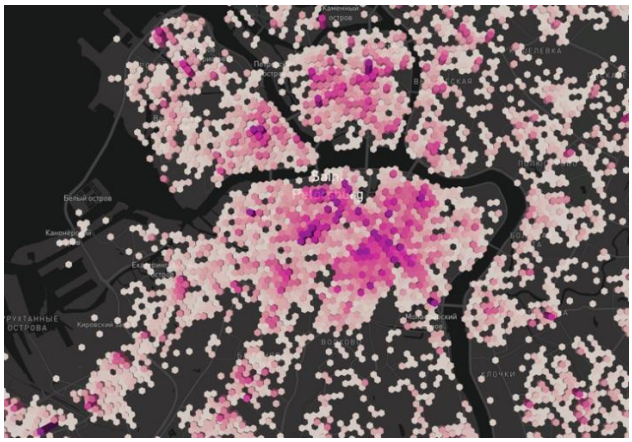
(eighteen to twenty-five years) have the highest frequency but the lowest bill (one thousand five hundred and fifty rubles). 90% of high-income Russians visit bars and restaurants. Frequency of visits and an average bill vary from income. From one point six times per month and one thousand five hundred and fifty rubles among low-income Russians to four point three times per month and two thousand three hundred and fifty rubles among high-income Russians. Muscovites are on the top of the list (three point seven times per month along with paying the highest bill – two thousand two hundred rubles [1].

It is also important to pay attention to the statistic of circumstances and the frequency of visits. According to this data the highest relevance of food delivery forms at lunchtime. Muscovites more than anyone have a lunch out – on average nine point three times per month. In order to view a whole situation, it is essential to analyze global statistics. According to this data online food delivery service keeps on growing. However, there are several exceptions such as China, which culture implies preparing and eating food at home. Experts observe such changes in Russian market as well nevertheless online delivery market keeps on growing fast. Cultural transformation of food consumption is reigning all over the world. In the next passages we will dwell on the figures of two main rivals in this field.

The residents of Moscow and Saint Petersburg are the most common users of Delivery club and Yandex.Eda. Respondents aged eighteen to twenty-five years prefer Delivery Club in 53% of cases and Yandex.Eda in 33%. In this case increase of quantity of orders may be indicative of positive climate for the opening new services [2].

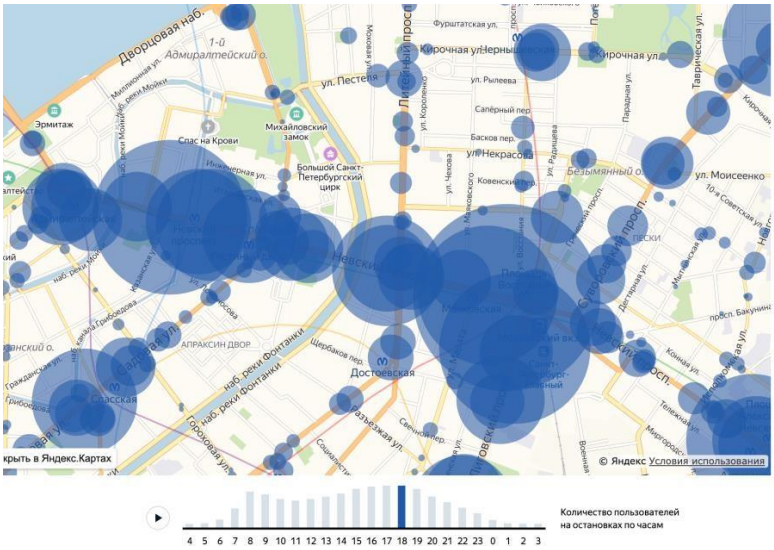
Having based on our research the main reason of ordering obvious, it is time saving which is a key dimension for a digital generation. The average click-to-eat in Saint Petersburg for Yandex.Eda is thirty-three minutes and for Delivery Club is forty-five minutes.

After analyzing the whole market, we have considered the opportunity to open our own service-restaurant. Picture 1 presents the density of districts in Saint Petersburg as well as visualization of local centers. We outlined two locations: Chernyshevskaya 4 and Bolshaya Konushenaya 8. Analysis of potential demand and competition have been included in the research.

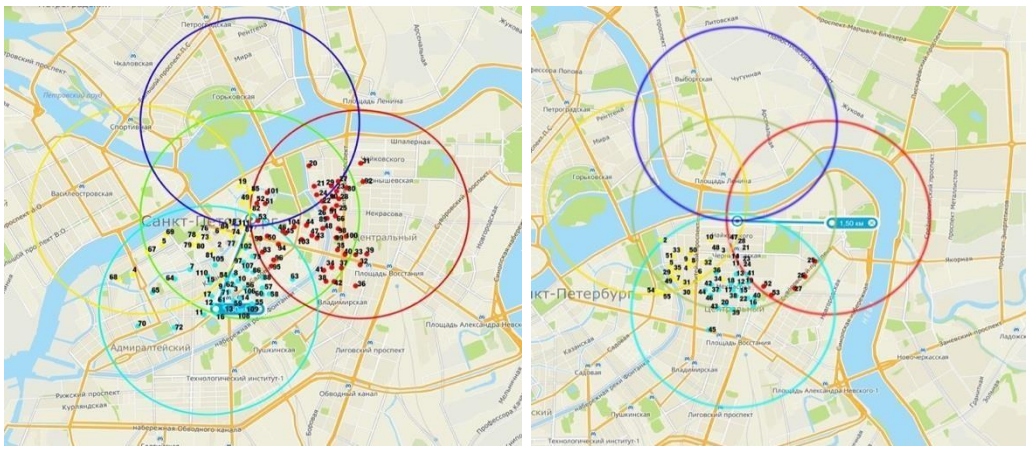


Picture 1. St. Petersburg Density Map

Another vital factor is traffic level. Picture 2 represents a demand for public transport for weekday at 6 p.m. Due to it we can calculate the percentage of the working population in a particular district and evaluate the demand at lunchtime. Then we focused on our competitiveness.



Picture 2 Ground transportation demand



Picture 3 Competitive environment analysis

Green circle is a radius of potential delivery. Other circles are competitors delivery areas, which takes fifteen to thirty-five minutes. Dots on the maps show competing restaurants. The right picture shows that this area is of low density of corporations and business centers as well as restaurants. The left picture shows that this area is of high density of corporations and business centers as well as restaurants [3].

According to the data and the research above we can draw conclusions regarding the effectiveness of existing units and predict the possible effect from the opening new subsidiaries. It is obvious that this sphere will keep on growing in foreseeable future. We have analyzed the areas of the highest demand and infrastructure, density of potential clients, so the research allows to choose preferable locations according to your request.

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CURRENT RUSSIAN AND FOREIGN INTERNET MARKETING TRENDS

Abstract: The paper will consider the main promising directions of development in the field of Internet marketing, aswell as the main tools of influence on the users. The place of the Internet in the Russian and foreign advertising market will also be highlighted.

Keywords: internet marketing, advertising, SMM, social media, contextual advertising, advertising market

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СОВРЕМЕННЫЕ ТЕНДЕНЦИИ ИНТЕРНЕТ-МАРКЕТИНГА В РОССИИ И ЗА РУБЕЖОМ

Аннотация: В работе рассмотрены основные перспективные направления развития в области интернет-маркетинга, а также главные инструменты воздействия на российского и зарубежного пользователя. Также подчеркнуто место интернета в российском и зарубежном рекламном рынке.

Ключевые слова: интернет-маркетинг, реклама, маркетинг в социальных сетях, контекстная реклама, рекламный рынок

In the modern world, business is increasingly moving to the digital environment. Marketing is no exception in this area. It’s getting harder and harder to attract customers, but at the same time, there are more tools for making an impression. Marketing communications are no longer limited to outdoor and television advertising, and a new phase in this industry is being added – Internet marketing. What is it? Internet marketing is a set of measures to promote and sell

goods and services on the market using Internet network technologies [1, p. 2]. Today, it is difficult to imagine a company that does not use the Internet to build its marketing strategy. This can be explained by the fact that in the twenty-first century, the world wide web has covered the entire planet. Let's consider the statistics.

#	Country or Region	Population,	Internet Users
		2019 Est.	30 June 2019
1	China	1,420,062,022	854,000,000
2	India	1,368,737,513	560,000,000
3	United States	329,093,110	292,892,868
4	Indonesia	269,536,482	171,260,000
5	Brazil	212,392,717	149,057,635
6	Nigeria	200,962,417	123,486,615
7	Japan	126,854,745	118,626,672
8	Russia	143,895,551	116,353,942
9	Bangladesh	168,065,920	96,199,000
10	Mexico	132,328,035	88,000,000

Table 1. Top 10 countries with the highest number of internet users [2].

At the end of June 2019, there were 4,536,248,808 Internet users in the world, which is about 60% of the world's population. Russia ranks 8th in terms of the number of Internet users in the world, however, this is only 80.8% of the population of the entire country [2].

If we turn to the Commission of experts of the Association of Communication Agencies of Russia, we can see in the table below that the Internet is replacing other means of advertising distribution, showing the dynamics of 20%, as well as making up half of all advertising budgets in the country. In 2019, advertisers spent 494 billion rubles on media promotion, showing an increase of 5% compared to the previous year. Based on the table data, it can be understood that the growth was only due to the Internet [3].

Segment	Billions (₽)	Dynamics (%)
TV	175	-6
Radio	16	-5
Press	15,1	-16
OOH	43,8	0
Internet	244	20

Table 2. Structure of the Russian advertising market in 2019 [3].

The use of Internet marketing methods is aimed at saving money (wages, sales Department, advertising), as well as expanding the activities of companies (moving from the local market to the national and international market). At the

same time, companies of any level have a more balanced chance in the fight for the market. Unlike traditional advertising media, entering the market via the Internet is not too expensive. An important point is that in contrast to traditional marketing methods of promotion, Internet marketing provides a clear statistical picture of the effectiveness of a marketing campaign.

The integrated use of Internet marketing tools allows you to develop an effective online promotion campaign that considers aspects of interaction with the audience and is based on the use of proven means of advertising. The most popular tools in Russia are contextual advertising, search engine optimization (SEO) and social media marketing (SMM). Contextual advertising is the showing of text ads or banners in search engines, catalogs, and other advertising platforms that are linked to keywords [4, p. 291]. This tool is the absolute leader, 103.7 billion rubles were spent on it out of all advertisers spending on promotion on the Internet, and contextual advertising is also projected to grow in the future. [2] This applies not only to Russia, but also to such a digital marketing giant as the United States, where contextual advertising in 2019 accounted for 37440 million dollars [5].

However, technology does not stand still, in our time smartphones have become available to all segments of the population. This has contributed to the development of the mobile Internet, which makes it difficult to find a site that does not have a mobile version or its own app. This development of mobile devices has led to the development of social networks and messengers. According to We are social, together with Hootsuite, users aged 16 to 64 spend an average of 3 hours and 40 minutes online every day, excluding other devices with Internet access [6]. Half of this time is spent on social networks, and 21% on video hosting services, which also actively display ads [6]. Also, 4.54 billion people now use social networks from smartphones, which is 59% of the world's population, and this indicator has grown by 2% since last year [6]. When building a marketing strategy, a good marketer will always focus on a large crowd of people, and now social networks fit this criterion more than ever. If we talk about the cost of advertisers for promotion, in the United States, this indicator of social networks in 2019 amounted to 35,789 million dollars.[5] According to forecasts, in 2020, social networks will finally overtake contextual advertising in this indicator. The most popular social networks in the world are Facebook, YouTube and WhatsApp. Today, Facebook has 2.449 billion users, of which almost 80% is the target audience of marketers [6]. In Russia, this trend is also not ignored, the most popular applications from the category of social networks are WhatsApp, Viber, VK and Instagram. VK and Instagram are particularly interesting for advertisers, because in messengers, ads are often only in the form of teasers. Such a wide potential of social networks in the field of Internet marketing is justified for the following reasons. First, in social networks, the advertiser can get a response in the form of comments and answers to questions. Second, users can share what they liked or what their friends might be interested in, creating trust in the product. Third, ads in social networks can be targeted due to the data specified on the user's personal page, such as their gender, age, place of study or work, and the groups they belong to. This data makes it easier for the advertiser to find «their» client.

In 2020, to promote products and services on the Internet, it is worth looking at some tools for influencing the consumer. The most striking of them are chatbots that do not require human intervention to solve simple questions, applications with augmented reality that allow you to try on things through the camera, it can be clothing or even furniture. Voice commands are becoming more and more popular. Since 2019, the number of users using voice commands has increased by 9%, which leads to the idea of improving this technology and adding it to many other applications [6]. Nowadays, advertising campaigns are reaching such a scale that it is becoming more difficult to monitor indicators such as audience coverage, the number of actions in the network, and others. To solve this problem, marketers should think about implementing artificial intelligence, which is faster and better able to tell you what to do with each individual client and which marketing communication channels are better to use.

Most of these things are already being actively used and developed in the United States, because this country has huge budgets, for example, in 2019, advertisers, spending on Internet promotion amounted to 123.1 billion dollars, the difference with Russia is huge, which is why in Russia, promotion is often fragmented, and not across all channels, as it requires large financial costs [7]. Also, marketers in Russia often focus on quick results, when in the United States you need to immediately offer a long -term strategy with a variety of development.

Thus, we can say that the future is behind Internet marketing, new users appear every day, trends change, and strategies are invented. On the Internet, advertisers will always be able to understand where they are going with a competent strategy, because using this type of marketing, they guarantee a response, which is the best Navigator. Of course, it is important to combine Internet marketing with traditional marketing, but it is also crucial to understand that the digital component in the modern world should be a priority.

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IMPLEMENTATION OF NEW TYPES OF TOURISM IN LENINGRAD REGION

Abstract: The main task that of this paper is a discussion of several new types of tourism with further implementation in Leningrad region. As a result of the analysis of regional peculiarities four main types of tourism are chosen and discussed in relation to the Leningrad region and implementation of each is substantiated.

Keywords: Type of tourism, tourism, Leningrad region, development, implementation.

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ВНЕДРЕНИЕ НОВЫХ ВИДОВ ТУРИЗМА В ЛЕНИНГРАДСКОЙ ОБЛАСТИ

Аннотация: Основной задачей данной статьи является обсуждение нескольких новых видов туризма с дальнейшей реализацией в Ленинградской области. В результате анализа региональных особенностей выделены и обсуждены четыре основных вида туризма применительно к Ленинградской области и обоснована реализация каждого из них.

Ключевые слова: вид туризма, туризм, Ленинградская область, развитие, реализация.

There is no one out there, who would question the potential and power of St.Petersburg. But what about Leningrad region?

The absolute majority of people unite St. Petersburg and Leningrad region in one territory. That’s not quite like that. The Russian Federation consists of 85 subjects or federal units. St. Petersburg and Leningrad region are the two of them, not one.

Leningrad region is an underrated and unexplored region. For the most part that is because people tend to visit St. Petersburg, witness its beauty without paying attention to anything else, which is a loss not only for the economy of this region but also for tourists themselves [1, p. 109].

Leningrad region is a symbiosis of history, culture and fun and it is unreasonable not to use its potential. It would be fair to say that there are a lot of places on the territory of Leningrad region that represent history and culture, among which: Staroya Ladoga – the very first capital of ancient Russ; Viborg city – a little Europe in the heart of Leningrad region; countless manor houses and mansions. But this place lacks a key ingredient – keeping up with the modern world in terms of tourism.

The world is constantly changing and so Leningrad region must do? Too. And this brings up a serious question – how?

The answer is very simple – through new types of tourism. The time to change has come.

There are 4 types of tourism the implementation of which will attract a large number of tourists:

- Ecological type of tourism;
- Active type of tourism;
- Rural type of tourism;
- Gastronomical type of tourism.

Ecological type of tourism is the type of tourism that is related to the nature that remains untouched by a man. Nature is a core of the mankind's survival. Studying, learning and simply enjoying true genuine forms of nature is a gift, especially at our age [2]. Nature of Leningrad region is unique and various. Waterfalls, large and ancient caves, ancient canyons of the Tosna and Sablinka, which are ancient quarries, expose rocks of the Cambrian and Ordovician periods [3, p. 5]. On the territory of Leningrad region more than 70 species of mammals, 80 species of fish and more than 300 species of birds can be found, which is quite rare for this part of Russia [4, p. 111].

If you define yourself as a man of XXI century and prefer nature and outdoor activities to clubbing in bars and pubs you must take a closer look at the active type of tourism. Active type of tourism includes skiing and skating, bicycle tourism, climbing and camping [5, p. 23]. And if you think there is no place for that in Leningrad region, think again. For those people who like winter, snow and skiing or skating or even snowboarding, visiting ski resorts of Leningrad region is a must. There are quite a lot of them: "Snow", "Golden valley", "Red lake", not to mention Kavgolovo. You will not be disappointed and if you develop a hunger or simply would like to have a rest there are plenty of cafes and restaurants nearby. It is not too difficult to find yourself a companion these days for such type of tourism. Even such an obstacle as warm weather won't be able to stop you.

Rural tourism. This type of tourism is new not just for Leningrad region but for the world in general. Rural tourism is a type of tourism that consists of work, joy and fun. From the period of one day up to a week you will receive a chance to milk a cow, to pet calves, pigs and take care of other types of cattle. Also you will

be able to discover or develop a new set of skills, like chopping firewood, planting, collecting mushrooms and berries, etc. Such type of tourism will reveal to you how it was before the gadgets and electricity were invented and help youfeel the warmth of the hearthstone of the Russian house. Russia has never been older, but at the same time it has never been more cosy and natural.

And now last but not least – the world of gastronomy. Russian cuisine has existed for more than 12 centuries by now and it hasn't changed much. It is one of the simplest and yet most delicious in the world. I'm sure that you're familiar with most of the Russian traditional dishes: borshch, pelmeni, shchi, etc. Basically this type of tourism consists in moving from place to place, from village to village. It would be quite boring to make a trip in order just to eat. That is why there will be not just feasts, but masterclasses during which you will be able to join and delve into the intricacies of the Russian cuisine. This will be accompanied by all sorts of activities possible – from sightseeing the nature of Leningrad region to active tourism in summer and skiing and skating in winter.

To summarize all that has been said before, Leningrad region, its nature and potential is a national treasure that must be noticed by any tourist no matter if they are Russian or come from abroad. Indeed the history of the XVIII and XIX centuries lives within St. Petersburg, but the history of Russia lives within Leningrad region.

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SOLVING THE PROBLEM OF CLIMATE CHANGE AS ONE OF THE KEY STAGES OF RUSSIAN ECONOMY GROWTH IN A GLOBALIZED WORLD

Abstract: Economic actors have to adapt their policy due to ecological actions of world community. Russia is a participant of global society, so it also has to customize its ways of economic development in environmental sphere. Thus, economic growth strategy of Russia will be investigated in this research article.

Keywords: economy growth, greening, climate change, global warming, ecology, CO_2 emissions.

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РЕШЕНИЕ ПРОБЛЕМЫ ИЗМЕНЕНИЯ КЛИМАТА КАК ОДНО ИЗ КЛЮЧЕВЫХ НАПРАВЛЕНИЙ РАЗВИТИЯ ЭКОНОМИКИ РОССИИ В ГЛОБАЛИЗОВАННОМ МИРЕ

Аннотация: Актуальность проблемы изменения климата повышается с каждым днем, вынуждает экономические субъекты адаптироваться к решениям мирового сообщества в экологической сфере. Россия, будучи

участником международных отношений, также выстраивает свою экономическую политику с учётом экологических изменений в мире, способствуя решению проблем охраны природы. В статье рассмотрена стратегия экономического развития России в рамках содействия решению экологических проблем.

Ключевые слова: рост экономики, экологизация, изменение климата, глобальное потепление, экология, выбросы углекислого газа.

The most pressing issue today is the problem of climate change. Throughout the world, global average temperature has grown significantly over the last few decades. Furthermore, temperature growth is sure to rise faster and faster. Experts prognose that the world temperature will climb to the level of 4-5 degrees above normal. It will lead not only to nature disasters but also to economic shocks.

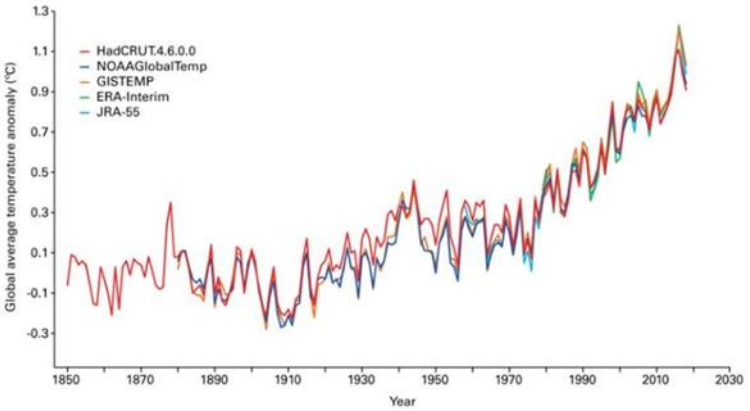

Fig. 1. Global average temperature anomaly.
(Source: Journal of Geoscience and Environment Protection).

Today people mostly are aware of environmental problems. Some of them try to support environmental rescue movements. Russian Federation does the same. In this research report we would like to analyse why Russian ministers plan to achieve economic goals by dint of decreasing harmful climate change effect.

Why does the government begin to take environmental problems into consideration? Russia is a part of the globalized world. Now everybody can notice that there is a trend of greeningin our globalized world. The majority of environmental organizations have become more popular in our world.

So why is greening a key stage of economic growth in Russia? Firstly, developed countries can toughen their punitive actions against Russia because environmental problems are such problems which can only be solved by the whole world. So, if Russia does not participate in the process of finding the solutions it will become derelict in world society. Secondly, Russian economy is based on extractive industries and agriculture. Unfortunately, these two areas are the most vulnerable to climate change. This provides the opportunity of economic crisis in Russia and in the countries with same economies.

There are some problems which may become a barrier to the economic growth in Russia:

1. *Dependence on extractive industries*

Global warming has an influence on extractive industries in Russia. More than 70 per cent of oil and gas are concentrated in the area of permafrost. Due to climate change, the area is steadily decreasing. It leads to temperature rising of the upper permafrost layer. In turn it is a reason of soil erosion in which the equipment is installed [1]. Such problem will decrease oil and gas mining in Russia. Extractive industry is the economic activity that contributes more to Russia's GDP than any other industries [2]. So, developing of economy depends on extractive industry which is under influence of global warming. The solution of the problem of climate change can increase oil and gas production.

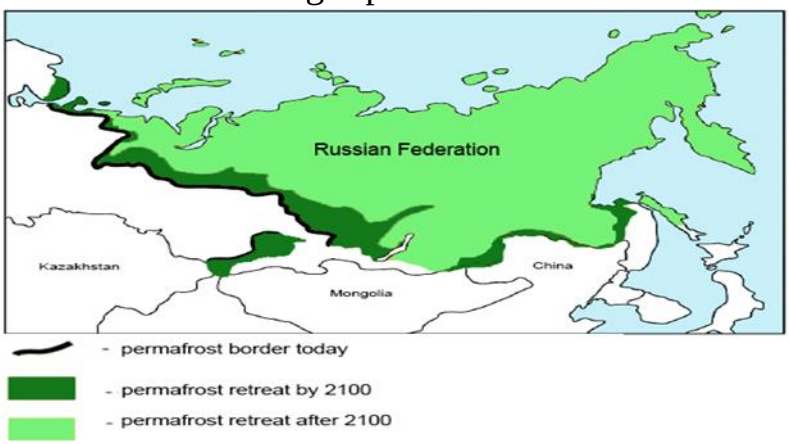

Fig. 2. Forecast of permafrost retreat by 2100
(Source: 4th IPCC Assessment Report, Russian Regional Environmental Centre)

2. Thermal power plants working on coal.

The biggest amount of electricity is generated by thermal power plants in Russia [3]. Basically, such plants use coal. Burning coal causes a large amount of carbon to be released into the atmosphere. This heats the air very much and raises the temperature. Economically this is not a problem. But according to the Paris Agreement [4], Russia must reduce greenhouse gas emissions by 30% from the 1990 level. Reduction of generating electricity cannot be the right decision. Using more environmentally friendly fuels can help Russia to implement Paris Agreement.

3. Increase in the number of natural disasters.

There have been several disasters in the recent one year. For example, we can remember terrible fires in Australia and in Siberia, droughts in Africa, hurricanes in the USA, floods in Australia and in Japan, earthquakes and volcanic eruptions. Such increase is a consequence of global warming. 79 million 559 thousand hectares are allocated for sowing. Nature disasters can spoil millions of kilograms of cereal. It is a real economic problem because agriculture is one of the most important industries in Russia.

These are the main problems which stop the development of Russian economy. Global warming solution will help Russian economy to grow to a world level and higher. Optimisation in the sphere of extractive industries will cost very much but if Russia does it today it will get more profit in the future. Such costs always pay off.

Russian Government understands the problems. Now ministers are working on an environmental development strategy until 2050 [5]. They will take into account Paris Agreement that obligates Russia to reduce CO2 emissions. Moreover, today government support companies which switch to green production. More than 70 per cent of nature protection costs come from private commercial sector. Sure, if the government continues to increase the attractiveness of environmental activities for the private commercial sector, it will help to increase the amount of funds that can be spent on activities to implement environmental policies in the future. In addition, a rising of investments to environmental protection from the commercial sector may even reduce costs from the state budget.

There are environmental economic trends in our world. More and more organic waste processing plants open in the world. For example, one plant was launched in the Leningrad region in October 2019. Now at least two more plants are planned to be opened [6]. Moreover, "vegan" economy is rapidly gaining popularity. The number of companies which produce organic goods is constantly growing. Firstly, they improve the environment. Secondly, entrepreneurs invest a lot of money in such companies. Increasing of the number of investment flows develops the economy [7]. Furthermore, The Ministry of Industrial Development has developed a forest development strategy. It plans to increase forest area and the amount of timber extracted from 1 sq km. It will help to decrease the amount of CO2 and rise volume of production and export of wood [8]. These are the main ecologically economic trends in Russia and in the whole world.

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BLOCKCHAIN IN THE LOGISTICS OF THE OIL AND GAS SECTOR

Abstract: This article is dedicated to the issue of modern trend – using technology in supply chain in O&G sector. The paper comprises of theoretical part and practical results

Key words: blockchain technology, supply chain, artificial intelligence, application, services, availability, development prospects.

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БЛОКЧЕЙН В ЛОГИСТИКЕ НЕФТЕГАЗОВОГО СЕКТОРА

Аннотация: Данная статья посвящена современному тренду – использованию технологий в процессе поставок. Работа состоит из теоретической части и обзора практических результатов.

Ключевые слова: блокчейн-технология, искусственный интеллект, приложение, услуги, доступность, перспективы развития.

After several years in relative obscurity, blockchain's profile is becoming more prominent. Adoption is growing in multiple industries, and leading oil and gas organizations are exploring proofs of concepts to assess the potential value.

Blockchain is a distributed transaction-ledger database shared across traditional boundaries. The seamlessness of sharing a constantly updated, single source of the truth is one of the digital technology's primary strengths. Think of blockchain as providing an ongoing record, whether for an asset (e.g., blowout preventer) or a product (e.g., lube, a unit of energy), from start to finish [1].

The expanding chain of "blocks" of digital data preserve every follow-on action by parties who have played roles in sourcing, producing, transporting, installing, trading and reselling oil and gas products. After business rules have been encoded, blockchain helps eliminate the need for human intervention to

validate and reconcile the data.

Application of blockchain technology:

1. Inventory and asset management – registration of the status / origin of materials / stocks;

2. Transport and logistics – state registration when collecting information from sensors, sensors;

3. Trading and sales – registration and certification of property rights, trade financing; non-clearing trade; certification and tracking of the origin of goods;

4. Document management – the maximum simplification and total control over the exchange of documents both within the company and in the external environment

5. Procurement and sales optimization – optimization of supplier identification, signing of procurement contracts, audit and transaction tracking;

At the last point, we just stop in more detail [2].

Supply chain relationships in the chemicals and petroleum industry are as vast and intricate as the geographies in which they operate. In the current "lower-for-longer" crude oil market, capitalizing on meaningful insight, cost take out, and the associated transformation opportunities for efficiency and longevity are keys to profitability. This applies across all internal and external supply chain functions for different subsidiary companies and divisions, and across established joint venture partners and supplier/subcontractor relationships.

Each participant in a supply chain must maintain their records, updated with their transactions and systems, which must then be reconciled among other participants in the network. This time-consuming, manual reconciliation process is susceptible to errors or manipulation of transactions.

As a result, all participants in the supply chain incur costs and delays associated with this reconciliation. These issues are further complicated when third-party validation or intermediaries have to be brought in to resolve disputes.

Nowadays' problems in supply chain:

1. Inefficient

Inefficiencies result from the duplication of a single contract by each participant in the supply chain. The time it takes for each participant to record and reconcile transactions can slow down the flow of capital and revenue recognition throughout the entire supply chain.

2. Expensive

This duplication of effort, and the need for third-party validation of transactions, adds to the interaction and administrative cost of doing business. Additionally, the expense of an intermediary to resolve disputed transactions further increases interaction costs and also delays the reconciliation process of the other participants in the network.

3. Vulnerable

In such a tightly woven network, the risk of any compromise in one participant's system can affect every participant in the supply chain network. Incidents can include fraud, cyberattack or a simple mistake. This depletes trust,

prevents automatic verification or authentication of assets, and increases costs even more [3].

Opportunities:

1. Smart contracts. This is a program that writes information to the blockchain and remotely starts when specified conditions are met. Allows:

a. Settle settlements with counterparties. (Automatic payment of counterparty services upon fulfillment of the contract)

b. Maintaining a rating of suppliers (Formation of a rating of suppliers of the oil and gas industry based on incoming data)

c. Supporting documentation (Documents cannot be compromised, replaced or lost throughout the delivery cycle)

2. Receive information from sensors (the Internet of things allows you to connect goods to the information field using sensors and tags. Used for the functioning of smart contracts)

a. GPS (Information about the location of the cargo and vehicle is constantly updated and stored in the unit)

b. RFID-tags (Tags are read in all warehouses along the route of goods and are protected)

c. Electronic digital signature (Any fact of business activity is recorded in the block and cannot be changed)

3. Exchange tokens (a system of digital payments and transfers, which allows much faster and without bank commissions to carry out settlements in universal currency, avoiding currency control) [4].

Case (shipment from Rotterdam to NYC):

The product goes the following way:

1. an empty container is filled with goods in Lyon;
2. sending to Rotterdam by road;
3. the goods pass through customs inspection;
4. shipping to New York by sea;
5. clearance at American customs;
6. delivery to the final consumer [5].

The usual way took 60 days. With the blockchain, it required 14 days.

All this thanks to the smart contract. It provides unified information to each node (2 customs, sender, client, carriers) during delivery. It allows you to control everything and quickly get any information about the product. That is, the amount of documentation will decrease (there are no filling errors, filling costs), risk minimization (the fight against customs fraud), the ability to track the location of the goods, etc.

Blockchain has the potential to generate substantial benefits for companies in the chemicals and petroleum industry. IBM understands the complexities of supply chain relationships in the chemicals and petroleum industry. Blockchain solutions create an opportunity to become more productive now and derive even greater benefits with the imminent increase in adoption. Blockchain

technologies enable faster, permissioned, immutable, transparent and auditable business-to-business transactions among participants in the network and their suppliers, distributors and partners. Chemicals and petroleum industry executives need to understand how best to extract value from blockchain technologies and develop an adoption strategy. Blockchain adoption across the hemicals and petroleum industry and strategic ecosystem suppliers has the potential to transform how companies work across operations on a global industry scale, delivering meaningful value for every participant in the supply chain network.

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