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Современное развитие науки, технологий, бизнеса: сборник студенческих работ на иностранных языках

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Сборник включает студенческие статьи по актуальным проблемам социально-экономического развития общества, вопросам науки, технологий, бизнеса, технологического образования на иностранных языках (английском, немецком, французском, испанском, русском как иностранном), написанные в процессе языковой подготовки под руководством преподавателей в Белгородском государственном технологическом университете имени В.Г. Шухова и Московском государственном техническом университете имени Н.Э. Баумана (национальном исследовательском университете).

Представленные материалы являют собой наглядное отображение практического воплощения важного тезиса университетского технического оборазования касательно роли языковой подготовки и повышения уровня коммуникативно-речевого компонента профессиональной компетентности специалистов естественнонаучного и инженерного профилей на базе кафедр иностранных и русского языков.

Издание рассчитано на широкий круг работников органов управления образованием, промышленностью, труда и занятости, руководителей промышленных предприятий и организаций, научных учреждений и учебных заведений всех уровней инженерно-технического образования. Оно может быть полезно при решении проблем развития национальных образовательных систем, совершенствования подготовки специалистов и деятельности высших учебных заведений, решения вопросов кадрового обеспечения в различных сферах общественного производства и, прежде всего, для предприятий высокотехнологического комплекса на межгосударственном уровне в рамках Содружества Независимых Государств.

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ПРЕДИСЛОВИЕ

Основу настоящих и будущих преобразований составляют уникальный опыт, традиции и непреходящие ценности подготовки специалистов в российских университетах, высшей инженерной школе, достижения лучших зарубежных вузов. Подготовка современного, элитарного специалиста базируется на анализе происходящих содержательных, структурных изменений в научно-технической и социально-экономической сфере, прогнозе развития науки, производства, культуры страны.

Технические университеты России в настоящее время активно реализуют современные концептуальные подходы и принципы управления. Стратегической целью является подготовка современного высококвалифицированного специалиста, способного активно влиять на духовно-нравственные ценности общества, воссоздать отечественные культурные традиции в новом качестве современной общественной жизни. Существенные социальные, экономические, культурные изменения, произошедшие в России за последние годы, постепенное вхождение России в мировое единое научно-образовательное пространство обусловили переосмысление места и роли языковой подготовки и повышения уровня коммуникативно-речевого компонента профессиональной компетентности специалистов естественнонаучного и инженернго профилей на базе кафедр иностранного и русского языков.

В контексте формирования единого культурно-информационного и образовательного пространства, глобализации научных исследований и осуществления инновационных проектов в области техники и технологий знание родного и иностранных языков воспринимается как естественное и первоочередное условие успешного творческого сотрудничества на международном уровне.

Выпускники технических университетов работают во многих международных корпорациях и проектах, подтверждают необходимость уверенного владения навыками речевой деятельности в социально-профессиональной сфере на русском и иностранных языках. Этим обусловлена общая стратегия языкового обучения в техническом вузе, которое направлено на приобретение социокультурной, коммуникативной и предметной компетенций как основы межкультурного профессионального общения. Последнее предполагает усвоение участниками коммуникации всего комплекса социо- и лингвокультурологических аспектов речевой деятельности разнонациональных носителей языкового сознания.

Особая область вузовской лингводидактики – это изучение языка науки, языка естественнонаучных исследований, техники, технологий. Этот аспект теории и практики языкового обучения в техническом вузе является приоритетным согласно установкам профессионально ориентированной лингвометодики.

Задачи обучения иностранному языку в техническом вузе достаточно обширны и заключаются в следующем:

- развитие умений свободно ориентироваться в современном информационном пространстве;

- извлечение и оценка значимости необходимой информации;

- готовность к вступлению в непосредственное иноязычное профессиональное общение, участие в дискуссиях и выступление с докладами на международных конференциях, семинарах и симпозиумах;

- расширение кругозора студентов, повышение уровня культуры и образованности, а также совершенствование культуры речи и общения;

- изучение традиций, обычаев, этнопсихологических особенностей, речевого этикета конкретного народа/страны изучаемого языка;

- воспитание уважительного отношения к духовным ценностям своего и других народов;

- развитие творческой активности и личной ответственности всех участников образовательного процесса за результативность обучения.

Для выполнения поставленных задач в технических университетах:

- разрабатываются новые и совершенствуются действующие многоуровневые программы языкового обучения в технических вузах с учетом целей обучения;

- создаются современные профессионально ориентированные учебники и учебные пособия по языку специальностей вуза (в том числе мультимедийные), нацеленные на развитие умений научно-делового профессионального общения (устного и письменного);

- используются новые технические средства обучения и новые технологии;

- постоянно обновляется сайт языковых факультетов и кафедр для расширения возможностей самостоятельной работы студентов;

- проводятся студенческие научные конференции на иностранных языках (включая русский) и языковые клубы;

- с учетом социального заказа общества расширяется палитра изучаемых языков в техническом вузе русского, английского, французского, немецкого, испанского, итальянского, китайского;

- преподаватели языковых кафедр взаимодействуют с языковыми кафедрами зарубежных вузов в учебно-методической и научно-исследовательской областях.

Настоящий сборник включает студенческие статьи на иностранных языках, раскрывающие некоторые аспекты научно-технологического развития тех специальных областей, в которых обучаются студенты - авторы работ, и подготовленные в процессе языковой подготовки на иностранных языках под руководством преподавателей Белгородского государственного технологического университета имени В.Г. Шухова и Московского государственного технического университета имени Н.Э. Баумана (национального исследовательского университета). Данный сборник студенческих работ являет собой продолжение и развитие материалов сборника научных статей «Современное технологическое образование», изданного в мае 2021 года в соответствии с решением Совета Ассоциации технических университетов от 10 декабря 2020 года.

Дирекция Ассоциации технических университетов
Деканат факультета лингвистики МГТУ им. Н.Э. Баумана

Окружающий мир и социально-экономические проблемы развития общества

21st century innovation: pros and cons*

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Abstract. *The article deals with the issues of innovations of the 21st century and their impact on people. The pros and cons of new technologies are shown. The problem of ecology and the impact of technologies on the environment is considered. The article also discusses the great founders of chemistry, who are directly related to the development of technology, as thanks to their work, new inventions still appear.*
Keywords: *science, innovation, development, technology, ecology.*

Инновации 21 века: плюсы и минусы

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Аннотация. *В статье рассматриваются вопросы инноваций 21 века и их влияние на человека. Показаны плюсы и минусы новых технологий. Рассмотрена проблема экологии и влияние технологий на окружающую среду. Также в статье упомянуты великие основоположники химии, которые связаны напрямую с развитием технологий, так как благодаря их трудам до сих пор появляются новые изобретения.*
Ключевые слова: *наука, инновации, развитие, технологии, экология.*

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* Современное технологическое образование. Сборник научных статей: в 2-х частях / Под ред. А.А. Александрова и В.К. Балтяна – М.: Ассоциация технических университетов, 2021. – С. 171-173 (статья была опубликована в Сборнике в качестве примера студенческой статьи по проблематике научно-технологического развития на иностранном языке, подготовленной в процессе языковой подготовки в техническом университете под руководством преподавателя).

Recently, the world has seen a lot of discoveries in completely different and dissimilar industries. Our world has changed a lot over the past 20 years, thanks to discoveries. Innovations simplify human life in many ways and give a «new breath» for the field of science. Science is moving forward every day, although not as fast as expected in the last century. Astronomy, electronics, nanotechnology, and medicine are steadily developing. Humanity is creating grandiose projects for the development of the moon, and a flight to Mars is planned.

Every year, scientists make the most incredible discoveries, from minor to global for the history of all mankind, from completely random to those that scientists have been going for years. No one will deny the importance of modern technology. Innovation has made people's lives easier. Thanks to the rapid development of technology, people can use many smart gadgets in their daily lives. Modern technologies have replaced people in the workplace, robots do the work that people used to do. Many businesses have used robots to increase productivity and efficiency. I believe that new discoveries have their pros and cons because even after new tools for helping with housework, people become lazier.

I think that in the new decade we will see even more new discoveries and inventions. After all, people now see only the tip of the iceberg of what we can learn. But this does not cool the fervor of scientists and researchers, but rather warms their interest. After all every scientist strives to discover something new so that his work is noticed.

Thanks to the work of great scientists, discoveries are now taking place. After all, without the works and research of Lomonosov and Mendeleev, there would not have been the discoveries that we see now.

Looking at Lomonosov's research in the field of chemistry, we can say that many of his works were significantly ahead of the science of those years. Nowadays, Lomonosov could have won the Nobel prize for his atomic-molecular theory, since, within the framework of this theory, he clearly distinguished two stages in the structure of matter: elements and molecules. Lomonosov justified the need to involve physics to explain chemical phenomena and proposed the name «physical chemistry» for the theoretical part of chemistry, and «technical chemistry» for the practical part.

Dmitry Ivanovich Mendeleev was also a great scientist and a great man. Being in difficult living conditions, this versatile person was able to prove what he is capable of. Mendeleev went through a difficult path to recognition and fame. The periodic law became the great brainchild of the scientist. The discovery of the law accelerated the development of chemistry and the discovery of new chemical elements.

After all, without opening the periodic table, we would not have known so soon how many elements exist. After all, until now all the elements are not known and they are only beginning to be studied by new scientists who could not have done it without the works of Mendeleev. Breakthroughs occur in completely different areas from space exploration and archeology to biology and many other scientific fields. Some of these discoveries help to explain the most

mysterious secrets in the world and allow you to see something incredible for the first time. In the 21st century, there was such a big leap forward that a group of scientists was able to develop a device that detects the early stage of lung cancer.

The discovery is something that has long existed in nature, we just did not know about the fact of its existence. It is difficult to overestimate the role of science in the modern world. With the help of science, a person gets knowledge about nature, society, and thinking.

In the 21st century, mankind is facing several new challenges, their solution will determine future progress. In the 21st century, there are thousands of scientific discoveries. In the 21st century, we have seen the emergence of smartphones, computers, and new cars.

I think we live in a unique time. New discoveries in the 21st century play a very important role. After all, by opening something new, we learn more and more about the world. The 21st century has only recently begun, but much has already been achieved in different areas.

Almost every day we learn about new interesting inventions that make our life easier and, in general, contribute to progress. Almost two decades of the 21st century have brought a lot of significant inventions. We now have sensors that can detect the existence of a dangerous virus in the air. A goal of the 21st century should be to develop the capability latent in everybody by harnessing powerful technologies that accelerate learning potential.

I believe that in the future we will have even more discoveries that will turn our consciousness, including our view of the world. After all, by taking steps towards discoveries, we make our life more interesting and easier. But also do not forget what harm we do to the planet when we make discoveries. The 21st century is the century of environmental pollution. Pollution of the atmosphere, water bodies - this is all behind the global discoveries of the 21st century.

Now it is very important to pay attention to problems that are related to the environment. After all, for example, global warming is happening. Scientists have shown that the melting of glaciers increases every year.

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What inventions await us in the future…

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Abstract. *The article examines the main problems of the development of modern science and technology. Examples of improving technology, equipment and methods are given here. Possibilities of solving the problem by improving the tools for technical application are analyzed in the article.*
Keywords: *technique, equipment, approach, improvement.*

Какие изобретения ждут нас в будущем...

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Аннотация. *В статье рассматриваются основные проблемы развития современной науки и технологии. Даны примеры совершенствования техники, оборудования и методики. Проанализированы возможности решения проблемы усовершенствованием инструментов для технического применения.*
Ключевые слова: *техника, оборудование, подход, совершенствование.*

I often wonder what our future will look like. Modern technology is rapidly progressing, which means the appearance of various new products. There are hundreds of films describing various theories about this. Some, of course, are fantastic, but many are quite realistic. A large number of people are waiting for robots to start doing housework, until flying machines appear, until computers begin to do most of the work that people today do. In addition, machine can replace many professions. I personally hope that in the future, people will solve many of the problems of today's life, such as discrimination, homeless people and unemployment. It will be difficult to solve environmental problems due to the development of the industry, but I still hope that technological progress will make it possible to stop global warming and pollution. Speaking of the distant future, maybe we will even find another planet for life, which would be incredibly cool. Now it looks more like a fantasy.

Nowadays, people can hardly imagine their life without modern technology. It is almost impossible to leave home, for example, without a mobile phone

or MP3 player. These devices have become an important part of our lives. In addition, almost every day new technologies are invented or existing ones are improved. To keep up with the times, people are buying new items. Soon our homes and jobs will look like electronics stores.

Technology surrounds us everywhere. Firstly, they are needed for work. All modern offices are equipped with computers, scanners, printers and other useful machines. One of the most important devices today is the Wi-Fi modem, as it provides the Internet. Secondly, technology surrounds us at home, in cars and everywhere. This includes televisions, radios, refrigerators, vacuum cleaners, washing machines, CD players, e-books, cameras and the like. Perhaps the most important thing in technological progress is that it allows us to do many things that would not have been possible without it. For example, we can communicate with friends from other countries using computers. We can even see them and communicate in real time.

Recently, the speed of human development has reached incredible proportions. This has been achieved through the development of information technology. Information is everywhere. The volume is growing very quickly. The exchange and search for information is no longer a problem today. This is leading to globalization. The entire planet can work for its own sake, although this level, to put it mildly, has not yet been reached. What we got used to in the distant past, in most cases, could only be perceived as the fruit of a beautiful fantasy. What discoveries await us in the future and what will the life of an ordinary person be like? When you envision the future, you can look into the future for ten or a thousand years. This question is very entertaining, it allows you to stimulate the imagination, but at the same time, of course, we cannot accurately predict the smallest part of new discoveries. It would be interesting to know what areas of life will be affected in the near future.

Let us start with the future of human habitation. Attempts to make him «smart» took a long time. There are mirrors with built-in TVs, switches that respond to sound commands or movement. Then it will be a system with memory, which stores settings such as TV volume, water or air temperature, light brightness and other parameters for each family member separately. The washing machine with special technology can operate without water and fight dirt with air and ions. The automatic vacuum cleaner works by itself and avoids obstacles. All devices communicate wirelessly. You can also exclude cables for powering devices later. Multifunctional devices such as modern smartphones do not need to be charged.

On the street, public institutions react to the environment. For example, the seats at bus stops glow differently depending on the rhythm of the environment and the intensity of their use.

The technique is getting smaller, thinner and more functional. For example, a small virtual album can store many photos and videos and immediately share them with others. The image can be projected anywhere. Among other things, technologies are being developed with the help of which images float in the air right in front of the viewer.

In the distant future, problems with drinking water may arise. To purify water, it is enough to drink it through a small, similar-to-ordinary straw.

Shape-shifting devices will take a big place in our lives. A phone is already being developed that can be worn on the wrist like a watch, straightened and made very thin, placed on a table in the form of a chic figure, or attached to the ear in a curved manner. Complex form – depending on use.

In the pen device, you can combine a mobile phone with handwriting function, virtual keyboard, projector, and scanner and at the same time electronic ID card with wireless Internet access. In case of loss, it is easy to find, and in case of failure, it can be restored from the global network.

However, what if you look far into the future...

The most significant discovery expected in the future is, of course, artificial intelligence. The so-called «neural networks» that mimic the work of the brain are now developing rapidly. Then all devices can think, make decisions and act differently under different conditions. For example, transport can run smoothly and intelligent robots can be created.

This also includes the interaction of a person with devices or with each other through thoughts, as well as the introduction of devices into a person. It will be possible to communicate without a voice. In this case, it will be possible to simultaneously draw thoughts from the global network. The question of human knowledge is being greatly revised, since it will acquire a completely new character.

Genetics is becoming the main branch of science. Tree seeds have already been grown that can instantly grow into a stool or other shape and be used throughout the home. They are strong and durable. These technologies are now very expensive.

If it is possible to influence the genetics of the organism, then it is possible to choose and correct the appearance of the child born in the family, as well as to exclude the development of pathologies.

It is possible that in the distant future a new profession will appear, very similar to the computer programmers of our time, but in the field of genetics. Then, first, a low level of programming for new organisms is created, and then a higher level, thanks to which completely new, incredibly complex organisms can be created in a short time.

In conclusion, I would like to say that technological progress continues, and it moves quite quickly. Thus, I think that soon we will live in «smart» houses with robots that will do everything instead of us. The development of technology in the future will allow you to conquer the vastness of space and so on... However, all this is only an assumption... Time will tell what will actually happen.

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Technical sciences and their history of development

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Abstract. *The article deals with the issues of formation of technological Sciences as an independent science. The origin of technical sciences and the stages of their development are shown. The contribution made to the development of the society is considered. Its purpose, created technologies and devices are considered. It is shown which areas are closely related to technical sciences. The history of the formation of technical sciences is divided into several stages that characterize the development of technology. It is also shown how technical science contributed to the formation and development of the information society, the emergence of new sciences, such as nuclear physics, theoretical and experimental materials science, and others.*
Keywords: *technical sciences, development, practical knowledge, achievements, scientific and technological progress, the modern world.*

Технические науки и история их развития

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Аннотация. *В статье рассматриваются вопросы становления технологических наук как самостоятельной науки. Показано происхождение технических наук и этапы их развития. Рассматривается вклад, внесенный в развитие общества. Рассмотрены его назначение, созданные технологии и устройства. Показано, какие области тесно связаны с техническими науками. История становления технических наук делится на несколько этапов, характеризующих развитие техники. Показано также: как техническая наука способствовала становлению и развитию информационного общества, появлению новых наук, таких как ядерная физика, теоретическое и экспериментальное материаловедение и др.*
Ключевые слова: *технические науки, развитие, практические знания, достижения, научно-технический прогресс, современный мир.*

The modern world has evolved and is still developing. New technologies, devices and gadgets appear every year. It is thanks to the development of science that we have those benefits without which we can no longer imagine our life. Technical sciences have made a great contribution to the development of the world.

Engineering sciences are applied sciences that study technology and processes that are associated with its creation, development and interaction with environment and humans. Engineering Science Provides Transfer human knowledge into the physical environment through the creation of technology, the totality of which makes up an artificial, consciously created human habitat – the so-called techno sphere. Despite, that technology is only a product of human activities, technical sciences are associated with natural and social sciences since technology obeys the same objective laws as natural objects.

Technical sciences have an exclusively applied, practical purpose. However, there is an inextricable link between applied research and fundamental science: on the one hand, the results of fundamental research are the theoretical basis for conducting applied research, and on the other hand, the results of scientific and technical activities provide evidence that can confirm or refute scientific theories formulated by scientists-theorists. It was the applied orientation of technical sciences that led to the creation of the first heat engines, flying and further spacecraft, and the most complex technical objects. The technology is based on the use of the laws of nature. The entire history of technology reveals the interaction of technology and natural science. Solving this or that technical question based on the already discovered laws of nature, man at the same time discovers new properties of things and thereby moves natural science forward.

Technical sciences appeared and began to develop relatively recently, at the beginning of the 19th century, and technology itself appeared much earlier. In modern times, there is a gradual formation of classical scientific and technical knowledge. Several stages can be distinguished in the development of technical sciences in modern times.

Stage I (XVII – mid-18th century) – the time of the first proper scientific revolution, which is marked by the formation of the experimental method and the mathematization of natural science as the application of scientific results in technology. By the end of this stage, thanks to I. Newton, the first – mechanistic – scientific picture of the world was formed. Under these conditions, technology acts as an object of research in natural science, since the formation of experimental science requires the creation of tools and measuring instruments. During the period under review, the first specialized technical educational institutions began to appear, mainly military engineering and mining. At the beginning of the XVIII century. the training of military engineers (gunners and builders) was most widely represented in France. In Russia, founded in 1700–1701. applied disciplines were taught at the School of Engineering, as well as at the School of Mathematical and Navigational Sciences. In 1715 the St. Petersburg Naval Academy was opened.

Stage II (second half of the 18th – mid-19th centuries) is characterized by the formation of scientific and technical knowledge based on the use of natural sciences knowledge in engineering practice and, secondly, by the emergence of the first technical sciences. The industrial upsurge led to the emergence of new types of production and stimulated a number of technical inventions. In the first half of the 19th century, they changed the entire system of social relations (railway locomotives, steamships, agricultural machines, electric telegraphs, cameras). The foundations of electromechanics were laid. Under these conditions, the need arose to replicate and modify the invented engineering devices. During the period under review, the scientific foundation of heat engineering was created, electrical engineering was born, the analytical foundations of mechanical sciences were laid.

Stage III (the last third of the 19th – beginning of the 20th centuries) – the time of completion of the transition from a simple transfer of technical knowledge and skills accumulated by previous generations to the development of science through a system of professional activity and education, the basis of which was a mechanistic picture of the world. The stage is characterized by the disciplinary design of technical sciences and the construction of a number of fundamental technical theories. By the end of the stage, a system of international scientific communication in the engineering field is formed: scientific and technical periodicals appear, scientific and technical communities are created. All this contributes to the disciplinary formulation of the classical technical sciences - the theory of machines and mechanisms, heat engineering, electrical and radio engineering, the theory of automatic control. The formation of the classical theory of resistance of materials and fracture mechanics is coming to an end. The formation of the theory of steam engines leads to the creation of scientific calculations of steam 9 turbines and the development of scientific and technical foundations of combustion and gasification of fuel. The theoretical foundations of the flight of aircraft are being created. Formation of fundamental sections of technical sciences is nearing completion.

In the middle of the XX century. humanity is entering a new information era, the folding of the information society. This was facilitated by such technical advances as the emergence of atomic energy, rocket technology, the creation of synthetic materials, television, electronic computers. New areas of scientific and technical knowledge are emerging: nuclear physics, nuclear instrumentation, theoretical and experimental materials science, and the theory of creating artificial materials. New technologies and technological disciplines are emerging. Quantum science is born and theoretical disciplines of laser technology are developed.

Summing up, I want to say that the interaction of science and technology is the most important condition for the implementation of not only scientific and technological progress, but also social development in general.

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Maybe someday artificial intelligence will outplay us…

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Abstract. *This article describes the emergence and development of artificial intelligence. It also deals directly: with what it is, starting with the basic, what is «intelligence», touching on the application of this technology in everyday life, and ending with the newest developments and the most original ideas.*
Keywords: *artificial intelligence, intelligence, neural network, virtual, gallery, mind reading.*

Быть может, когда-нибудь искусственный интеллект нас переиграет…

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Аннотация. *В данной статье описано возникновение и развитие искусственного интеллекта. Также здесь рассматривается непосредственно: что это такое, начиная с базового, что такое «интеллект», затрагивая применение данной технологии в повседневной жизни человека и заканчивая самыми новыми разработками и оригинальнейшими идеями.*
Ключевые слова*: искусственный интеллект, интеллект, нейросеть, виртуальный, галерея, чтение мыслей.*

Currently, it is generally accepted that there is such a thing as artificial intelligence, and that it is developing at a tremendous speed. One has only to look at the world around us and it becomes clear that artificial intelligence is everywhere, from production automation to smart assistants at home; it wakes up a

lot of people in the morning, and connects their favorite music when they go to make breakfast.

But if artificial intelligence is really so close to us and widespread, then shouldn't we strive to learn a little more about it than most people know?

So, to begin with, what is intelligence in principle? Generally speaking, this word was borrowed in the first third of the XIX century with the meaning «thinking ability». It is not known what language it came from, but German, English, and French, which were popular in Russia at the time, are cited as possible sources. It also means the thinking ability of a person, the mind, the level of mental development

The term artificial intelligence (artificial intelligence) was proposed in 1956 at a seminar with the same name at Stanford University (USA). Currently, there are many different definitions of artificial intelligence. This diversity is explained by the fact that this concept can be considered in different contexts. That is, it can be considered as a science (a branch of computer science), a set of technologies, or an implemented model of the mind (a goal). Some scientists tend to view artificial intelligence as something that is constantly elusive and inaccessible (a goal that is always beyond the horizon). This view is explained by the fact that technologies and algorithms developed within the framework of artificial intelligence, over time, become an integral part of information technology and are no longer associated with it. If we take this point of view, then artificial intelligence can be called «not yet widely used or not yet open technologies that implement or model the processes of information processing in the nervous system».

Picture 1. Stanford University (USA).

The idea of creating an artificial likeness of the human mind for solving complex problems and modeling the thinking ability was first expressed by R. Lulli, who in the XIV century tried to create a machine for solving various problems on the basis of a general classification of concepts [1].

In the XVIII century, G. Leibniz and R. Descartes independently developed this idea, offering universal languages for the classification of all sciences. These ideas formed the basis of theoretical developments in the field of creating artificial intelligence.

During its existence, artificial intelligence has undergone numerous changes.

At first, under the influence of the first successes, the researchers allowed themselves somewhat rash statements, which were later repeatedly reproached by them. For example, in 1958, the American Herbert Simon, who later became a Nobel Prize winner in economics, said that if machines were allowed to participate in international competitions, they would become world chess champions in the next ten years.

Progress slowed in the mid-1960s. In 1965, a ten-year-old boy defeated a computer in a chess match; in 1966, a report commissioned by the United States Senate described the inherent limitations of machine translation. For about a decade, the press has been disapproving of AI.

The research did not stop, but went in new directions. Scientists became interested in the psychology of memory, the mechanisms of understanding that they tried to imitate on a computer, and the role of knowledge in the thought process. This led to the emergence of significantly developed methods of semantic representation of knowledge in the mid-1970s, as well as to the creation of expert systems, so named because they used the knowledge of qualified specialists to reproduce thought processes. In the early 1980s, great expectations were placed on expert systems due to their wide application possibilities, for example, for medical diagnostics.

Technical improvements allowed the development of Machine Learning algorithms, thanks to which computers were able to accumulate knowledge and automatically reprogram based on their own experience.

Such intelligent systems were used to perform a wide variety of tasks (fingerprint identification, speech recognition, etc.), and combinations of various methods from the field of artificial intelligence, computer science, artificial life, and other disciplines were used to create hybrid systems.

Since the late 1990s, artificial intelligence has been combined with robotics and the human – machine interface to create intelligent agents that assume the presence of feelings and emotions. This led, among other things, to the emergence of a new research direction – affective (or emotional) computing (affective computing), aimed at analyzing the reactions of a subject who feels emotions, and their reproduction on a machine, and allowed improving dialog systems (chatbots) [2].

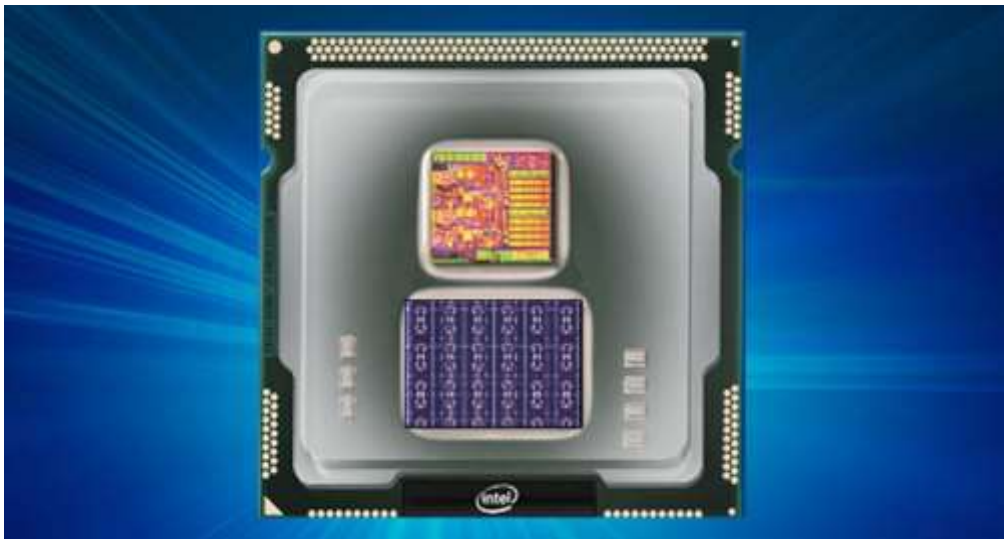
Since 2010, the power of computers allows you to combine the so-called Big Data with Deep Learning, which is based on the use of artificial neural networks. Very successful application in many areas allows us to talk about the revival of artificial intelligence.

Self-learning intelligent systems are widely used in almost all areas, especially in industry, banking, insurance, healthcare and defense. Many routine

processes can now be automated, which will transform our professions and eventually eliminate some of them.

In recent years, the IT market has seen a real boom in the field of solutions based on artificial intelligence. And this is not surprising: modern computing and neural network technologies have reached a level that allows AI systems to solve very complex practical tasks for humans, and developers to create innovative applications and services that demonstrate the limitless potential of electronic intelligence.

One of the brightest examples of the intensive development of artificial intelligence technologies was created by specialists of Intel Labs and Cornell University AI-a complex that can distinguish odors and simulate the work of the human olfactory nervous system. The development is based on Intel Loihi neuromorphic processors that combine learning, training and decision-making processes in a single chip and allow the system to be autonomous and «smart» without connecting to the cloud (to a database). During the experiments, the complex designed and equipped with chemical sensors demonstrated high efficiency in detecting odors of dangerous substances in the air, even in conditions of strong interference. Such solutions, Intel believes, will help in the development of robotics, when robots will be able to sort products themselves, focusing on the smell, will push the development of environmental monitoring systems, will lead to increased occupational safety in production and, in general, will give an impetus to the development of the cognitive abilities of silicon processors.



Picture 2. Intel Loihi processor.

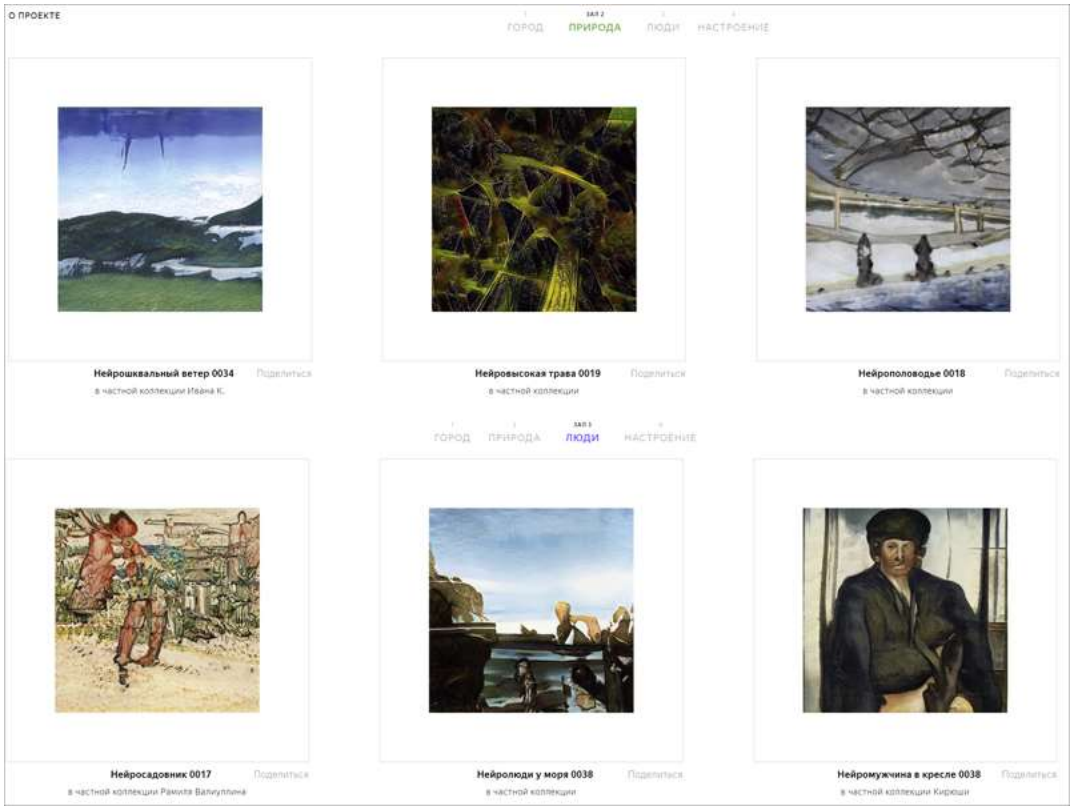
AI system developers have made significant progress in the field of medicine in 2020. So, the company DeepMind, owned by the holding company Alphabet (Google), announced a significant breakthrough in predicting the folding (folding) of proteins. The problem of predicting protein folding is considered one of the 125 most important problems to solve today, as well as one of the

greatest problems in biology over the past 50 years. The fact is that proteins are assembled from linear sequences of amino acids, which after synthesis take a unique spatial form, and there are a huge number of such forms. At the moment, out of hundreds of millions of proteins (combinations of amino acids), only 0.1% of the compounds whose spatial structure is also well known have been studied. Unknown proteins, as well as compounds whose properties have not yet been confirmed experimentally, scientists are trying to predict with the help of computers. But until now, no one has been able to calculate with a sufficient degree of accuracy what 3D shape a protein will take from a given set and sequences of amino acids. DeepMind claims to have found the key to solving this problem. If this is the case, then we can expect a breakthrough in the discovery of new drugs and vaccines, as well as in understanding the origin and course of many diseases.

Mind reading is still the domain of science fiction movies and books. However, science and technology do not stand still, and there is every reason to believe that in the future this kind of technology will become a reality. A group of scientists from the University of California, San Francisco, managed to make a step forward in this direction, experimentally proving the possibility of recognizing nerve signals in the human brain and translating them into understandable words using a recurrent neural network and electrodes implanted in the brain. The experiment involved patients with epilepsy, whose electrodes were implanted to fight the neurological disease and track seizures. It so happened that some of the electrodes were in the areas of the brain in which the selection of words, the composition of expressions and feedback is carried out with the areas of the brain that perceive a person's own speech. The subjects were asked to mentally and then aloud say several sentences with a limited set of words. Simultaneously, signals were taken from the sensors implanted in the brain. The resulting data was transmitted to a neural network for training, and the intermediate result was given for analysis to another AI network. The probability of misidentifying words was only 3 percent. An impressive figure!

Electronic intelligence has found application in the visual arts. In mid-2020, it became known about the creation of the Timecraft machine learning system by specialists of the MIT Artificial Intelligence Laboratory, which allows you to recreate the process of writing paintings and applying brushstrokes for paintings by famous artists, whether Monet, Vincent Van Gogh or Salvador Dali. It is reported that the neural network was initially trained on two hundred videos with accelerated shooting techniques for writing real digital and watercolor paintings. After that, the researchers created a convolutional neural network that is designed to «deconstruct» artwork based on their knowledge of the process of creating paintings. As a result, the Timecraft system managed to show higher efficiency than existing similar projects in more than 90 % of cases. Not a bad result. In addition to virtual history lessons, the Timecraft AI system can be useful for illustrating general drawing techniques and techniques for beginners. The company «Yandex», which opened a virtual gallery of neural network art, which presents four thousand unique paintings created by artificial

intelligence, also sang to be noted in the creative AI segment. The gallery is located at yandex.ru/lab/ganart and it is divided into four thematic halls: «People», «Nature», «City» and «Mood». To train the neural network, Yandex specialists used works belonging to different areas of painting: from Fauvism and cubism to minimalism and street art. In the course of training, the AI system studied 40 thousand paintings, and then took up the creation of its own works. To select pictures by different categories, we used a different neural network, which is used in the Yandex. Pictures service to search for images by search queries. It was she who was able to see people, nature, the city and different moods in the paintings, sorting the available works by categories [3].



Picture 3. Virtual gallery of neural network art.

Artificial intelligence has found many applications in other areas of human activity. For example, NVIDIA used AI to recreate the gameplay of the famous arcade video game Pac-Man using the GameGAN neural network. To solve this problem, the artificial intelligence took only 4 days. The company trained the neural network using 50 thousand game sessions in Pac-Man. Then she was given the task of recreating the entire game, from the static walls and dots to the moving ghosts and Pacman himself. The game was trained and recreated using a quartet of NVIDIA Quadro GP100 graphics accelerators. The most interesting thing is that GameGAN was not given access to the original code of the game or its engine. The whole training consisted of one neural network watching another neural network play Pac-Man. «To create a game like Pac-Man, the programmer needs to come up with and prescribe the rules of be-

havior and interaction of all available agents inside the game. This is a very painstaking job. GameGAN can simplify this task. The neural network is able to learn new rules through observation. Ideally, algorithms like GameGAN can be trained to generate procedural rules for the game you want to create», explain the NVIDIA researchers, who emphasize that in the future, their development can be used not only in the gaming industry, but also in other areas.

A curious development in the field of artificial intelligence was noted Mail.ru Group, which introduced the platform in 2020 dictor.mail.ru, which allows you to create studio-quality news and reportage videos in a few clicks. To create a video, it is enough to upload the text of the news to the system – and the virtual presenter will read it out. The announcers look and talk like real people: when reading the news, they realistically reproduce facial expressions, react emotionally and place semantic accents. The appearance of the speaker is chosen by the user: the company has created several models of digital presenters, the prototypes for which were real people. In Mail.ru They emphasize that machine learning methods were used to create virtual presenters. Speech synthesis is based on the developments of the voice assistant Marusya. And the video image is synchronized with speech in real time using the Vision computer vision system from the same company. Mail.ru A group trained on real prototypes and video recordings.

Even now, despite the coronovirus pandemic, we can safely say that artificial intelligence continues to develop intensively. According to analysts at International Data Corporation (IDC), global spending in this area amounted to approximately $ 156.5 billion last year. By 2024, the market volume will double and exceed $300 billion. In the distant future, artificial intelligence will affect almost all areas of human activity. This is one of the milestones of human development, artificial intelligence is an integral part of our lives. And even despite the numerous ambiguities, it is safe to say that this is necessary for humanity. Well, the amount of benefit and harm that can bring or already brings again depends only on humanity.

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Künstliche Intelligenz revolutioniert die Ordnung derWirtschaft

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Zusammenfassung. *Der Artikel beschreibt die Hauptanwendungen von Künstliche Intelligenz in der modernen Wirtschaft. Es wird berichtet, warumKI und Big Data heute sehr aktuell ist und in welchen Branchen sie am häufigsten verwendet wird. Es wirddie ethische Seite dieser Technologien betrachtet. Darüber hinaus wird die zukünftige Entwicklung der künstlichen Intelligenz erwähnt.*
Stichworte: *Wirtschaft, Künstliche Intelligenz, Kapital, Produktion, Arbeit.*

Искусственный интеллект меняет порядок экономики

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Аннотация. *В статье рассматриваются основные применения искусственного интеллекта в современной экономике. Рассказывается, почему искусственный интеллект и большие данные сегодня очень актуальны, а также в каких сферах они чаще всего используются. Рассмотрены этические стороны этих технологий. Также упомянуто будущее развитие искусственного интеллекта.*
Ключевые слова: *экономика, искусственный интеллект, капитал, продукция, работа.*

Es ist immer ein Menschheitstraum gewesen, die natürlichenGrenzen des Menschen zu überwinden, einen Deus ex Machina zuerschaffen. Früher waren Rechenleistungen und Speicherkapazitätenzu gering, um künstliche Intelligenz praktisch zu benutzen. Aber dashat sich verändert und heute können wir massenhaft Daten (BigData) erheben, speichern und über Algorithmen intelligentmiteinander verbinden. Es ist also kein Zufall, dass das Themakünstliche Intelligenz wieder in der Wissenschaft sehr aktuell ist, aber auch die Wirtschaft sich für praktischeAnwendungsmöglichkeiten interessiert.

Die Daten haben eine zentrale Bedeutung in der Anwendung undEntwicklung von KI. Ohne Big Data gäbe es kaum Anwendungen vonKI. Und umgekehrt ist Big Data ohne KI nutzlos. Deswegen kann mansagen, KI ist der Schlüssel zur Wertschöpfung aus Daten.

Die Ökonomisierung von KI besteht im Kern darin, dass sie schneller, und systematischer und effizienter als Menschen mit großen undunstrukturierten Datenmengen umgehen kann. Durch den Einsatzvon KI entstehen neue Produkte, insbesondere im Bereich vonPredictive und Contextualized Services. Zum Beispiel benutzt manheute KI in der Banken fürKreditwürdigkeit. Also kann man sagen, wird ein Mensch Kredit bezahlen oder nicht. Die ökonomischeVerwendung von Technologien enthält auch effiziente Kombinationvon Ressourcen. KI kann man in diesem Sinne als Erweiterung dertechnologischen Möglichkeiten verstehen, knappe Ressourcenmiteinander zu kombinieren, um mehr und auch neuen Output zuproduzieren.

KI ersetzt spezialisierte Arbeit durch daten-basierte Algorithmen.Wissen und Erfahrung sind nicht mehr an Personen gebunden und benötigen keine Ausbildung mehr. KI kann nun alles Wissen und alleErfahrung ohne großer Spezialisierungskosten heben undzusammenführen. Die qualifikatorische Lohnprämie für spezialisierteArbeit wird geringer, weil KI immer mehr kognitive und nichtroutinemäßige Tätigkeiten ausführen wird. In der Zukunft drohtkeine Massenarbeitslosigkeit durch den Einsatz von KI, aberAusbildungskalkül und Tätigkeitsprofil von Berufsbildern werden sichmassiv verändern.

KI definiert das Verhältnis zwischen Kapital und Arbeit.Daten als Produktionsfaktor durch KI verändern das Verhältniszwischen Kapital und Arbeit. Für weniger qualifizierte Arbeit wird dasVerhältnis Kapital geschwächt, d. h. die Arbeitsintensität sinkt, wie z.B. im Transportsektor, wo es Kapital gibt, aber man braucht mehrArbeit. Umgekehrt wird der Markteintritt neuer Wettbewerber ohneKapital deutlich leichter, weil die Anwendung der Daten nicht vonKapital abhängt.

Künstliche Intelligenz wird zukünftig in vielen Lebensbereichen undoft selbstständig Entscheidungen treffen. Was bedeutet das für unsMenschen, auf die sich diese Entscheidungen auswirken? Es brauchteinen gesellschaftlichen Konsens darüber, wie und in welchemUmfang künstliche Intelligenz in unser Leben eingreifen darf. Wirbrauchen also eine Digitale Ethik, die als Navigationsinstrument hilft, die Werte, die in der analogen Welt existieren, auch in die digitaleWelt zu übertragen, weil für unsere Wirtschaft KI entscheidendeFrage von Wohlstand und Wettbewerbsfähigkeit ist. Auf KI könnenwir nicht verzichten.

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Анализ различий в экономическом развитии регионов на основе интеллектуального гибридного алгоритма

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Аннотация. *Актуальность исследования обусловлена различиями в природной, социальной и антропогенной среде российских регионов, что приводит к разному уровню их экономического развития: промышленной структуры и планирования. Хотя умеренные региональные различия могут стать толчком к усилению экономической жизнеспособности и дальнейшего развития этих регионов, однако, чрезмерные различия часто отрицательно отражаются на социальной стабильности. Установлено, что практика применения интеллектуальных алгоритмов позволяет достичь более успешных решений практических проблем, связанных с нелинейными, дискретными и не дифференцируемыми множественными ограничениями. Цель данной статьи – анализ различий в экономическом развитии регионов на основе интеллектуальных гибридных алгоритмов.*
Ключевые слова: *экономическое развитие, гибридные алгоритмы, промышленная структура, эффективность развития.*

Analysis of differences in the economic development of regions based on an intelligent hybrid algorithm

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Abstract. *The relevance of the study is due to the differences in the natural, social and anthropogenic environment of Russian regions, which leads to different levels of their economic development: industrial structure and planning. Although moderate regional differences can be an impetus to strengthen the economic vitality and further development of these regions, however, excessive differences often have a negative impact on social stability. The practice of applying intelligent algorithms has been found to achieve more successful solutions to practical problems associated with nonlinear, discrete and non-differentiated multiple constraints. The purpose of this article is to analyze the differences in the economic development of regions based on intelligent hybrid algorithms.*
Keywords: *economic development, hybrid algorithms, industrial structure, development efficiency.*

В условиях развития экономики и общества Российской Федерации актуальными являются вопросы совершенствования экономического развития регионов, включая различные методики оценивания и вычисления показателей, за счёт которых можно выстроить определённую цепочку представления экономической обстановки и технологического прогнозирования.

Развитие региональной экономики, которая представляет собой сложную систему с неопределенными характеристиками, зависит от таких факторов, как политика, экономика, культура, общество и окружающая среда. Эти факторы приводят к высокой степени нелинейности различных данных, отражающих региональное экономическое развитие [1]. Региональные экономические различия означают, что в рамках объединенной страны некоторые регионы имеют более высокий уровень и темпы своего экономического развития, нежели другие регионы. Это приводит к модели сосуществования развитых и менее развитых регионов, что является ключевым показателем определенного региона [2]. Региональное экономическое развитие зависит от объективных факторов, таких как природно-географические условия, условия движения, среда обитания человека и исторические причины [3]. Умеренные региональные различия могут мобилизовать экономическую жизнеспособность и повысить эффективность развития, но чрезмерные различия могут привести к социальной нестабильности или даже турбулентности, тем самым препятствуя экономическому развитию. Поэтому анализ различий в экономическом развитии регионов имеет важное исследовательское значение [4].

Традиционные методы количественного исследования в анализе различий экономического развития регионов включают коэффициент вариации, количественный графовый анализ, стандартное отклонение и индекс энтропии [5]. В последние годы алгоритмы искусственного интеллекта быстро развиваются и широко используются в задачах оптимизации систем, таких как нечеткие алгоритмы, генетические алгоритмы, алгоритмы нейронных сетей, алгоритмы муравьиной колонии, алгоритмы моделирования отжига, алгоритмы оптимизации хаоса и алгоритмы роя частиц [6]. Усовершенствованные и гибридные алгоритмы в системе интеллектуальных алгоритмов могут обеспечить более подходящие решения практических задач, связанные с нелинейными, дискретными, не дифференцируемыми и множественными ограничениями. В отличие от традиционных математических методов, интеллектуальные алгоритмы решают сложные задачи оптимизации, моделируя разумное поведение определенных групп в природе [7]. Фундамент регионального экономического развития заключается в непрерывном развитии и обновлении региональной промышленной структуры [8].

Цель данной статьи – проанализировать различия в экономическом развитии регионов на основе интеллектуальных гибридных алгоритмов, составить прогнозную оценку определённого региона, в котором наиболее соблюдались аспекты исследований.

Методология исследования

Сегодня ключевую роль в развитии важнейших составляющих экономики играют цифровые технологии, т.к., являясь инструментами инновационных процессов в отдельных регионах, обеспечивают повышение производительности труда и открывают новые горизонты для развития социально-экономической системы. Поэтому, разработка методики оценки готовности регионов к переходу к цифровой экономике является одной из важнейших задач. Для этих целей может быть использован индекс готовности регионов к цифровой экономике.

Для определения индекса цифровой готовности используют 17 показателей, разделенных по трем блокам (субиндексам), в число которых, в основном, входят показатели использования цифровых технологий.

Субиндекс 1. Обеспеченность региона информационно-коммуникационными средствами (количественные показатели на 100 человек):

- установленные телефонные линии;
- пользователи мобильных телефонов;
- пропускная способность Интернет-канала каждого пользователя;
- домохозяйства, имеющие персональный компьютер с выходом в Интернет;
- пользователи Интернета;
- абоненты фиксированного Интернет-соединения.

Субиндекс 2. Уровень информатизации региона (доля субъектов, %):

- население, использующие сервисы госуслуг через Интернет;
- население, использующее Интернет на рабочем месте;
- организации, использующие специализированное ПО для деятельности;
- затраты на ИКТ (к общему объему затрат из бюджета региона);
- организации, использовавшие ЭДО.

Субиндекс 3. Кадровый потенциал региона (количественные показатели на 1000 человек):

- выпускники вузов региона;
- выпускники СПО региона;
- занятые граждане с высшим образованием;
- выпускники с третичным образованием;
- затраты на научные исследования и разработка (% к общим затратам из бюджета региона);
- затраты на технологические инновации (% к общим затратам из бюджета региона).

Значения подиндексов – среднее арифметическое оценок показателей, которые его характеризуют:

$$S = \frac{\Sigma_{i=1}^{n} k_i}{n} \quad ,$$

где S – подиндекс индекса цифровой готовности;

k – показатель, его характеризующий;

n – общее число показателей.

Общий индекс готовности регионов – сумма оценок подиндексов.

Показатели индексов по федеральным округам представлены в Таблице 1; представление индексов по федеральным округам – Рис. 1.

Таблица 1. Показатели индексов по федеральным округам за 2020 год

Наименование федерального округа	Индекс готовности к ЦЭ	Тип региона
ЦФО	0,95	Регионы с высокими цифровыми дивидендами
УФО	0,94	
СЗФО	0,92	
РФ	0,87	Регионы цифрового роста
ЮФО	0,87	
ДВФО	0,86	
ПФО	0,83	
СФО	0,77	Регионы с низкой готовностью к цифровой экономике
СКФО	0,76	
Крым	0,77	

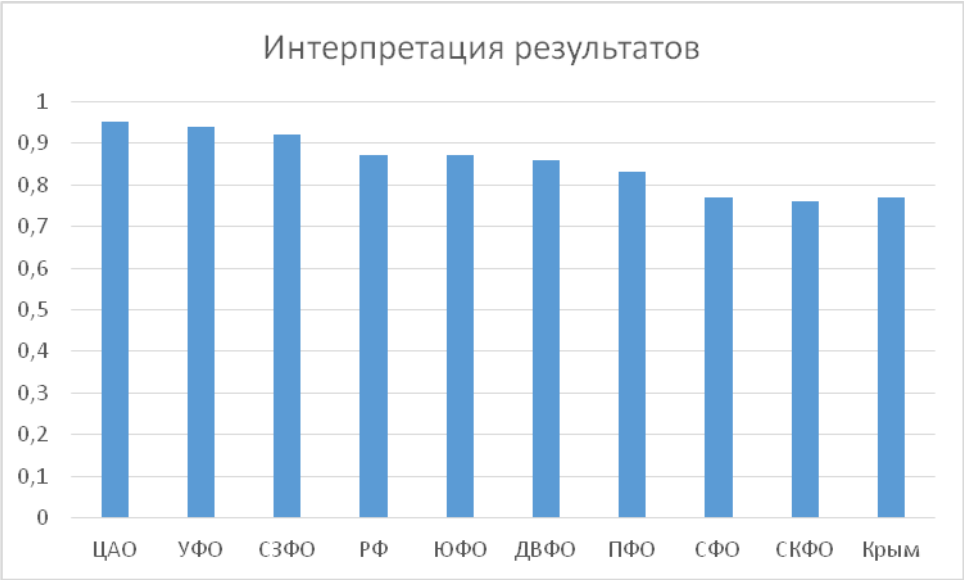

Рис. 1. Представление индексов по федеральным округам.

Предложенную классификацию необходимо дополнить, т.к. необходимо учитывать основные виды ресурсов, которыми обладает регион (интеллектуальный капитал, финансы, сырье, развитость цифровых технологий) и скорость перехода к цифровой экономике – Таблица 2.

Таблица 2. Классификация регионов по типам развития при переходе к цифровой экономике

<table>
<tr><td rowspan="4">Основные ресурсы региона</td><td>Интеллектуальный капитал</td><td colspan="2" rowspan="3">Регионы, осуществляющие переход к прогрессивным технологиям</td><td rowspan="3">Регионы - локомотивы роста</td></tr>
<tr><td>Развитые цифровые технологии</td></tr>
<tr><td>Финансы</td></tr>
<tr><td>Сырьё</td><td colspan="2">Дотационные регионы</td><td>Регионы, внедряющие в производство новые технологии</td></tr>
<tr><td colspan="2" rowspan="2"></td><td>Отстающие</td><td>Согл. срокам</td><td>«Пионеры»</td></tr>
<tr><td colspan="3">Скорость перехода к цифровой экономике</td></tr>
</table>

Итак, согласно предложенной классификации, можно выделить четыре основных типа регионов при переходе к цифровой экономике. Каждый тип региона имеет свои отличительные особенности – Таблица 3 [9].

Таблица 3. Характеристика регионов при переходе к цифровой экономике

Тип региона	Краткая характеристика	Особенности при переходе к цифровой экономике
Дотационные регионы	Регионы, переживающие спад в экономике основных отраслей; бедность населения, нехватка трудовых ресурсов; высокий уровень безработицы, экономическая стагнация.	Значительные затраты бюджетов различного уровня на обеспечение выполнения Федеральной программы, низкая отдача от инвестиций.
Регионы, внедряющие в производство новые технологии	Внедрение современных форм и методов хозяйственной деятельности; регионы с высокой долей низкотехнологичных производств значительное количество образовательных учреждений неполного и среднего профессионального образования.	Средние затраты бюджетов разного уровня на обеспечение выполнения Федеральной программы, средняя отдача от инвестиций.

Регионы, осуществляющие переход к прогрессивным технологиям	Регионы, с высокой долей высокотехнологичных производств. Большое количество учебных заведений профессионального образования. Развитие инвестиционной активности. Активное развитие инновационной инфраструктуры. Высокий промышленный потенциал.	Средние затраты бюджетов разного уровня на обеспечение выполнения Федеральной программы, высокая отдача от инвестиций. Реальная возможность существенного улучшения качества жизни населения региона.
Регионы - локомотивы роста	ВРП субъекта является существенный приростом ВВП страны; регион обладает значительным научно-техническим и кадровым потенциалом; в субъекте РФ или макрорегионе готова или реализуется стратегическая инициатива, которая имеет приоритетное значение в масштабах всей страны. Высокий промышленный потенциал. Развитая инженерная инфраструктура. Возможность наращивания энергетических мощностей с динамично развивающейся финансовой инфраструктурой.	Высокая степень окупаемости инвестиций на развитие цифровой экономики.

Различия в экономическом развитии

Глобальный анализ главных компонентов основан на классическом анализе, включает идею временных рядов. В настоящее время исследования взаимного влияния региональной экономики, энергопотребления и экологической среды в основном используют панельные измерения и модель аналитической иерархии для количественного анализа или с помощью различных статистических методов, теории регрессии для обработки данных и результатов, анализа структуры энергопотребления. Фактически, экономический дисбаланс между двумя регионами не связан напрямую с размером региональной экономической мощи в двух регионах, потому что приток торговой экономики в целевой регион не увеличивает стоимость переработки и производства в месте назначения – это просто цена на продукцию в двух регионах.

Одна из наиболее важных причин, по которой машины опорных векторов могут использоваться в экономической сфере, заключается в том, что они могут обрабатывать сложные нелинейности экономических систем. Кластеризация в основном вычисляет расстояние от точки до центральной точки, классифицирует образец по ближайшей категории, заменяет исходную центральную точку новой центральной точкой, затем вычисляет расстояние от точки до центральной точки и итеративно запускает. Его недостатком является то, что он учитывает только расстояние, а

формула расстояния может быть не идеальной и не учитывает плотность между распределениями точек. Машина опорных векторов преобразуется в многомерное пространство признаков посредством нелинейного преобразования и находит оптимальную кривую в многомерном пространстве, чтобы максимально классифицировать два типа. Математически ее можно свести к задаче квадратичного программирования с ограничениями-неравенствами. По сравнению с алгоритмами кластеризации теория статистического обучения и методы опорных векторных машин стали более зрелыми методами для решения ограниченных выборочных задач и сформировали более широко используемые методы на основе своих теоретических систем.

Моделирование, эксперимент и анализ результатов

В данной статье выбираются типичные регионы для анализа различий в региональном экономическом развитии на основе интеллектуальных гибридных алгоритмов. Со ссылкой на соответствующую литературу в документе выбрано 10 показателей в 3 категориях, чтобы отразить состояние экономического развития целевой области моделирования; то есть, показатели масштаба включают годовой валовой продукт и общие инвестиции в основной капитал. Структурные показатели включают долю добавленной стоимости вторичной промышленности и добавленной стоимости в сфере услуг. Доля и уровень урбанизации постоянного населения, показателей качества включают валовой внутренний продукт на душу населения, розничные продажи потребительских товаров на душу населения, располагаемый доход жителей на душу населения и количество патентных заявок на 10 000 населения. Эти 10 показателей в значительной степени отражают важные аспекты целевых областей моделирования, таких как строительство инфраструктуры, корректировка промышленной структуры, улучшение инновационного потенциала и прогресс в социальной сфере. Система относится к комплексу взаимодействующих элементов, или система представляет собой органическое целое с конкретными функциями, синтезируемыми взаимодействующими и взаимозависимыми компонентами, а основными характеристиками системы являются целостность и согласованность между элементами. Целостность относится к взаимозависимости между элементами, составляющими систему, а согласованность относится к неаддитивной природе эффектов элементов. Многие факторы в регионе влияют на экономическое развитие; все эти факторы органически связаны, и любое механическое разделение приведет к сбою в работе системы.

В алгоритме определенное количество простых индивидов формирует кластер, и каждый из них выполняет поиск в допустимой области индивидуально, что придает всему алгоритму отличную параллельную характеристику и повышает эффективность алгоритма. Кроме того, оптимальное решение, полученное при каждом поиске, будет использоваться для направления следующего поиска. Это – механизм обмена социальной информацией, так что этот случайный поиск не является полностью слепым, но он заставляет поиск двигаться в направлении сходимости алгоритмов. На самом деле расстояние между городами постоянно, общую

протяженность маршрута легко найти после получения сводного плана. Этот алгоритм представляет собой технологию ограниченного поиска, которая может получать информацию в процессе поиска путем записи истории поиска и использовать ее для определения последующего направления поиска, чтобы избежать локального оптимального решения. Данный алгоритм подходит для решения задач комбинаторной оптимизации и может эффективно работать с не дифференцируемыми целевыми функциями. Нелинейный метод внутренней точки имеет выдающиеся преимущества: хорошая сходимость, быстрая скорость оптимизации и высокая надежность. Он подходит для решения задач оптимизации непрерывных дифференцируемых функций, но трудно иметь дело с дискретными переменными; генетический алгоритм получается путем случайной комбинации оптимизационных переменных. Глобальное оптимальное решение подходит для решения различных задач дискретной оптимизации, но скорость оптимизации генетического алгоритма мала, и при определенных условиях легко попасть в локальное оптимальное значение [10].

Заключение

В данной статье была построена базовая модель различий в региональном экономическом развитии на основе интеллектуального гибридного алгоритма, проведено построение системы показателей анализа и гибридного интеллектуального алгоритма, проанализированы различия в региональном экономическом развитии. На основе гибридного алгоритма, выполнен анализ главных компонентов и времени, пространственный анализ экономического развития региона и, наконец, проведен имитационный эксперимент и анализ его результатов. На данный момент, существует корреляция между экономическими показателями, и анализ главных компонентов может устранить корреляцию и получить новые главные компоненты в качестве исходных данных для кластеризации. Однако развитие региональной экономики осуществляется в процессе стремления каждого хозяйствующего субъекта к максимизации выгод. По сравнению с алгоритмами кластеризации теория статистического обучения и методы опорных векторных машин стали более зрелыми методами для решения ограниченных выборочных задач и сформировали более широко используемые методы на основе своих теоретических систем. В разные периоды регионального экономического развития импульс роста, как правило, относительно концентрируется на экономических субъектах с превосходными географическими условиями, ведущими и инновационными отраслями.

Одна из наиболее важных причин, по которой машины опорных векторов могут использоваться в экономической сфере, заключается в том, что они могут обрабатывать сложные нелинейности экономических систем. Результаты исследования показывают, что интеллектуальный гибридный алгоритм может моделировать интеллектуальное поведение определенных групп в природе при анализе различий в региональном экономическом развитии, так что он имеет параллелизм, высокую точность и скорость конвергенции.

Результаты исследования данной статьи служат ориентиром и могут быть использованы для дальнейших исследований по анализу различий в региональном экономическом развитии на основе интеллектуального гибридного алгоритма.

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Conseguences of the informatization of socity

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Abstract. *This article examines the main consequences of the informatization of society. Currently, it is difficult to imagine any production without the use of computers. In connection with the development of information technologies over the past decades, such a concept as cybercrime has appeared. Cybercrime is one of the most serious problems that have emerged in the process of improving the efficiency of the use of information with the help of information technologies.*
Keywords: *informatization, information society, data security, cybercrime.*

Последствия информатизации общества

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Аннотация. *В данной статье рассматриваются основные последствия информатизации общества. В настоящее время трудно представить какое-либо производство без использования компьютеров. В связи с развитием информационных технологий за последние десятилетия, появилось такое понятие как компьютерная преступность. Киберпреступность – это одна из серьезнейших проблем, появившихся в процессе повышения эффективности применения информации с помощью информационных технологий.*
Ключевые слова: *информатизация, информационное общество, защита данных, киберпреступность.*

The activities of individuals, groups, collectives and organizations are now increasingly dependent on their awareness and ability to use the available information effectively. Before taking any action, it is necessary to do a lot of work on the collection and processing of information, its understanding and analysis. Finding rational solutions in any field requires processing large amounts of information, which is sometimes impossible without the involvement of special technical means.

Informatization is the process of increasing the efficiency of the use of information in society with the help of information technologies. This is an organized socio-economic, scientific and technical process of creating optimal conditions for meeting information needs and realizing the rights of citizens, state authorities, local self-government bodies, organizations, and public associations on the basis of the formation and use of information resources. Informatization of society is one of the regularities of modern social progress [1, p. 21-24].

This term is increasingly replacing the term «computerization of society», which was widely used until recently. Despite the external similarity of these concepts, they have a significant difference. During the computerization of the company, the main attention is paid to the development and implementation of the technical base of computers that ensure the rapid receipt of the results of information processing and its accumulation. In the informatization of society, the main focus is on a set of measures aimed at ensuring the full use of reliable, comprehensive and timely knowledge in all types of human activities.

Let's consider the process of informatization in more detail. The history of informatization development began in the USA in the 60s, then in Japan in the 70s, and in Western Europe in the late 70s. Modern material production and other areas of activity are increasingly in need of information services, processing of a huge amount of information. A universal technical means of processing any information is a computer, which plays the role of an amplifier of the intellectual capabilities of a person and society as a whole, and communication tools that use computers serve to communicate and transmit information. The emergence and development of computers is a necessary component of the process of informatization of society. Informatization of society is one of the regularities of modern social progress.

One of the most unpleasant aspects of the informatization of society is the loss of stability of the information society. Due to the increasing role of information technologies in the life of people, such a concept as «cybercrime» has appeared. Cybercrime is one of the consequences of reducing the resilience of society as it becomes more informatized.

Such a high urgency of the problem of cybercrime is justified by the appearance of «hackers». The meaning of the word «hacker» first appeared within the walls of MIT in the 1960s. Then it was part of the local slang and originally meant a simple but rough solution to a problem, regardless of computer technology in general. A little later, «hackers» began to be called programmers who

corrected errors in the software in some fast or elegant way. But then the value changed several times. As a result, a new, distorted understanding of the word «hacker» has emerged: it means an attacker who uses extensive computer knowledge to carry out unauthorized, sometimes malicious actions in a computer – hacking computers, writing and distributing computer viruses. Experts prefer to divide hackers into virus writers and hackers themselves who are looking for gaps in operating systems, but there is an alternative division:

1. «white» hackers are engaged in finding holes in software products to ensure security,

2. «black» hackers use the information obtained for their own purposes,

3. «scriptwriters» – young people who use ready-made scripts, and often do not even know how they work [2, p. 66-68].

If the first type of hackers is safe, then the second and third create quite a lot of problems for modern infrastructure. «Black» hackers are most often engaged in serious computer crimes. One of the most popular computer crimes is the «crack attack». A «cracker attack» is an action that aims to seize control of a computing system, either to destabilize it, or to deny it service. The most popular cracker attacks are: mailbombing, DDoS attacks, and so on. Mailbombing is considered the oldest method of attacks, although its essence is simple and primitive: a large number of mail messages make it impossible to work with mailboxes, and sometimes with entire mail servers. For this purpose, many programs were developed, and even an inexperienced user could make an attack by specifying only the victim's e-mail address, the text of the message, and the number of necessary messages. A distributed denial of service attack, or DDoS is a real bombardment of a central server with simultaneous data requests. The attacker analyzes the desired network, searches for vulnerabilities, and sends data requests from several compromised systems. Thus, it tries to completely occupy the Internet channel. The ultimate goal is to disable the systems of such a company and interrupt its business processes. A DDoS attack can be a way for an attacker to extort money. In addition, such attacks sometimes bring political benefits to the government [3, p. 118].

At the moment, a fierce fight is being waged against such a phenomenon as cyberterrorism. Cyberterrorists pursue the following goals: to threaten property or the life and health of people, or to arrange a serious disruption of the functioning of infrastructure facilities. The Center for Strategic and International Studies defines cyberterrorism as «the use of computer network tools to disrupt the functioning of critical national infrastructure (in particular, energy, transport, government), or to coerce or intimidate the government or the civilian population». In cyberspace, various methods can be used to commit a terrorist attack:

- obtaining unauthorized access to state and military secrets, banking and personal information;

- damage to individual physical elements of the information space, for example, the destruction of power supply networks, interference, the use of special programs to destroy hardware;
- theft or destruction of information, programs and technical resources by overcoming security systems, introducing viruses, and program bookmarks;
- impact on software and information;
- disclosure and threat of publication of classified information;
- seizing media channels in order to spread disinformation, rumors, demonstrate the power of a terrorist organization and announce their demands;
- destruction or active suppression of communication lines, incorrect addressing, overload of communication nodes;
- conducting information and psychological operations, etc. [4, p. 232-235].

Over the past 10 years, cybercrime has become the most dangerous and, most importantly, the most common type of international crime. Not every country in the world has adequate and competent legislation on crime in the field of information technology, not to mention decent regulation of the Internet.

Now the problem of cybercrime is being actively solved. This is done by international bodies and organizations: the UN, the Council of Europe, the International Organization of Experts, the OECD, and Interpol. In Russia, Europe and America, computer hacking, destruction of information, creation and distribution of computer viruses and malware are punishable by law. Malicious hackers, according to international laws on combating cybercrime, are subject to extradition like war criminals.

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The company that changed the world…

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Abstract. *This article examines the impact of Apple on the development of information technology, as well as the stock market. The stages of the formation of this corporation from the very first devices to modern flagships are considered, and the reasons for the popularity of the products are revealed. The features of using the IOS operating system are shown, as well as the advantages of interaction between the devices of this company are revealed. Some facts that help the society are also considered.*
Keywords: *company, corporation, device, logo, profit.*

Компания, которая изменила мир…

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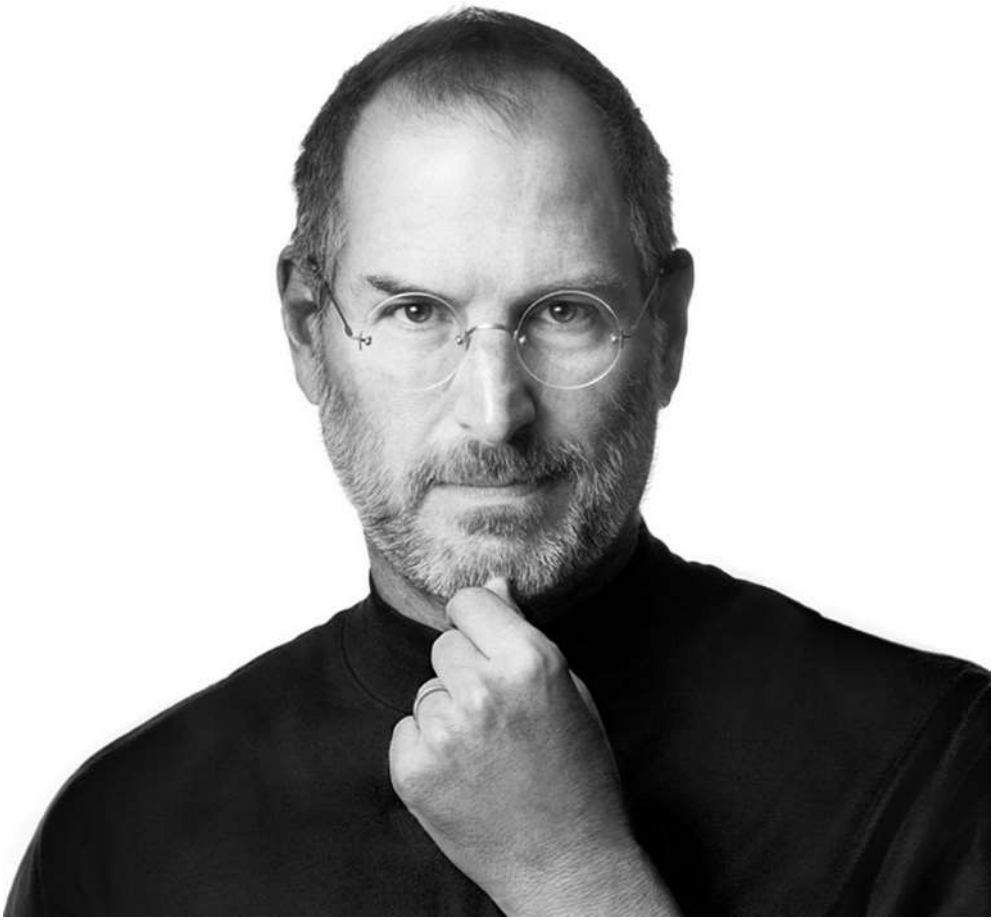
Аннотация. *В данной статье рассматривается влияние компании «Apple» на развитие информационных технологий, а также фондового рынка. Рассмотрены этапы становления данной корпорации с самых первых устройств до современных флагманов, а также раскрыты причины популярности продукции. Показаны особенности использования операционной системой IOS, а также выявлены плюсы взаимодействия между устройствами данной компании. Также рассмотрены некоторые факты, оказывающие помощь обществу.*
Ключевые слова: *компания, корпорация, устройство, логотип, прибыль.*

What is the success of each start-up company? Of course, in the hard work of its creators, as well as spending a huge amount of time developing new products and improving existing ones. So in 1976, the company «Apple» was founded in California, whose office was located i456+n an ordinary house, but after a while the whole world will know about this corporation, and the products of this company will have a huge demand. [1, 50-72]

In general, many promising people with amazing ideas think that huge funds are needed to open their own business, however, the founders of Apple did not have anything like this. Closer to the mid-1970s, Steve Jobs, Ronald Wayne, and Steve Wozniak built the first personal computer based on the MOS Technology 6502 processor.



Picture 1. Steve Jobs.

In the years 1976-1977, several companies released the first personal computers, including since 1977, thousands of computers were sold by the companies Commodore and RadioShack, but the first mass-produced personal computer, produced in millions of copies, was the Apple II computer. From 1977 to 1993, the company «Apple» produced various models from the line of 8-bit computers «Apple II». In the late 1970s and early 1980s, the Apple II and its clones were the most widely used personal computers in the world. More than 5 million Apple II computers have been sold worldwide.

Then by 1980, the company had a downturn due to the fact that the Apple III project was quite a failure, the death in 1981 of Steve Wozniak, one of the company's founders. For these reasons, Steve Jobs was forced to reduce the number of employees, and to review the policy of the corporation. After that, in 1984, he managed to introduce a new personal computer-the «Macintosh».

Picture 2. Photo of the «Macintosh» computer.

In the future, the production of personal computers will become one of the main earnings of the company. In general, the «Macintosh» was a very successful project, since computers equipped with a proprietary operating system turned out to be very convenient to use. For example, Apple gained quite a strong position in the segments of government and educational organizations, and later in the music industry. It was the company of Steve Jobs that first offered a graphical user interface and a computer mouse in their computers. However, against the background of these events, Steve Jobs is leaving the corporation, which will have an impact on the company's development in the future.

In 1994, the company introduced the first digital cameras of the modern type «QuickTake 100», «QuickTake 150» and «QuickTake 200» to the public, however, this Apple product did not receive further development. Unfortunate-

ly, by the end of the 1990s, things had deteriorated sharply, as the company's losses increased, for this reason, in 1997, Steve Jobs returned to the company, thanks to which Apple opened new markets. One of the largest markets for electronics is the market for mobile phones. By 2007, Steve Jobs showed the world his legendary creation-the «iPhone». At first, mobile phone users were quite skeptical about the new product, but after a while, the company's creation was appreciated with dignity.

Picture 4. iPhone Presentation.

By 2010, the first tablet computer – the «iPad» - entered the market. The production of the «iPod», «iPhone» and «iPad», which were in high demand around the world, dramatically improved the financial situation of «Apple», bringing the company a record profit. By August 2011, the company managed to become the most expensive in the world by market capitalization. Apple products have a unique charm that no other company has. At first, the company's logo was Isaac Newton, on whom an apple fell, but then the design was simplified, and the company's symbol was a bitten apple. As you know, the founder of the company – Steve Jobs died quite early-on October 5, 2011, it was on his grave that many people brought bitten apples. [2, 298- 301]

In our opinion, one of the most famous devices of the company was presented on September 10, 2013 – «iPhone 5s». Mobile phones of the company «Apple» have become so popular that a few days before the start of sales, many people are lining up in long queues, waiting for the purchase of a new smartphone of the company. Of course, do not forget about the laptop series. In general, the «MacBook» is a rather successful product that has filled the niche of convenient ultrabooks on the market, since they are incredibly light, as well

as easy to use. It is worth noting that the company pays special attention to the interaction between Apple devices. For example, interaction and data exchange between «iPhone» and «MacBook» can be easily carried out with a couple of taps. No operating system in the world has such amazing interaction between devices. However, the revenue from sales is not only from the sales of the previously listed devices, do not forget about accessories. For example, in modern «iPhone 12» there is no power adapter, for this reason, the user has to buy it again, with which the corporation has a good profit. Not to mention cases and headphones, which are just as common as power adapters. The company is also actively investing in medicine, namely, when buying a mobile device from Apple red, part of the funds from this purchase go to help people who are infected with AIDS infection. Of course, the company «Apple» is quite popular in the modern world, however, what useful has it done for information technology and society as a whole? [3, 256- 270]

Of course, the development of the company is directly related to the development of technology in the world, and it is thanks to this company that we can actively use the fingerprint sensor, and do not forget about the magnificent cameras of mobile devices that can compare with professional cameras. The products of «Apple» in its own way is a certain standard of how it should be, because it is this company that sets trends for the further development of electronic technology. The corporation also actively cares about the environment, namely, making the boxes for its devices more compact, which in turn will save more wood. In our opinion, it is worth saying a huge thank you to the founder of the company – Steve Jobs, a man who changed the world of information technology. We did not just give the example of the «iPhone 5S», because this device was the last one that this legendary man started developing. The equipment produced before the death of Jobs is certainly good, but alas, it is not the same as it was before…

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The influence of digitalization on the economy

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Abstract. *The relevance of works on digitalization is due to the active introduction of information technologies in the life of the entire society. The purpose of this article is to analyze the impact of digitalization on the life of society and on the functioning of its economic sector. The contribution of digitalization to GDP growth is estimated with a forecast until 2030.*
Keywords: *economy, technology, digitalization, gross domestic product, Internet.*

Влияние цифровизации на экономику

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Аннотация. *Актуальность работ по цифровизации обусловлена активным внедрением информационных технологий в жизнь всего общества. Целью данной статьи является анализ влияния цифровизации на жизнь общества и на функционирование его экономического сектора. Приведена оценка вклада цифровизации в рост ВВП с прогнозом до 2030 года.*
Ключевые слова: *экономика, технологии, цифровизация, валовой внутренний продукт, интернет.*

At present, the information technology is developing rapidly, which is reflected in the fast development of the digital economy, the growth of which is outpacing other industries. The digitalization of the economics is taking place at a quick pace. It is evident as information technologies present the possibility to have got involved into the people's lives by 2021.

We will analyze the involvement of society into the use of digital technologies by means of data taken from the Global Digital report (Table 1) [1].

Table 1. Public engagement in digital technologies

	Number of people, 2021, billion people	% of the total population, 2021	Number of people, 2020, billion people	% of the total population, 2020
Population, billion people	7,83	100%	7,75	100%
Number of mobile device users	5,22	66,6%	5,19	67%
Growth of unique mobile users	0,93	1,8%	0,124	2,4%
Number of Internet users	4,66	59,5%	4,54	59%
Number of social media users	4,2	53,6%	3,8	49%

The analysis of the above data shows that the involvement of society in the Internet space is growing every year. Along with the growth of Internet users, the number of users of social networks is also increasing. Over the past year, this number has increased by 13%. The comparison of users activity in social networks is shown below (Fig. 1).

Fig. 1. Social media use around the world.

Thus, an active user of social networks in various platforms spends about 2.5 hours a day, which corresponds to about one day a week, minus the time for sleep. We will display the collected statistics in the form of a chart (Fig. 2).

Fig. 2. Evolution of daily time spent using social media.

We are seeing how mobile phones have become the priority device of almost every person. Two-thirds of the world population use them every day. According to the App Annie Agency [2] Android phone users spend more than 4 hours a day on their smartphones, which is more than 3.5 trillion hours in 2020 (Fig. 3).

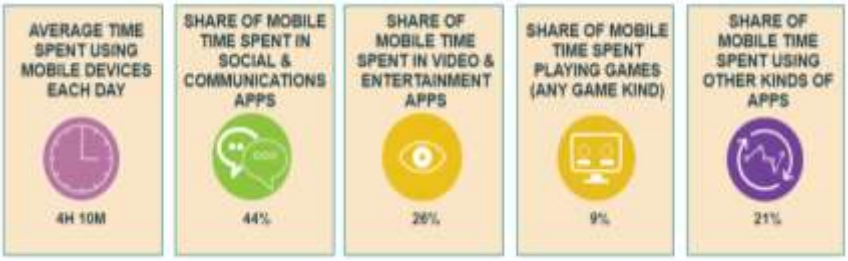

Fig. 3. Share of time spent in mobile apps by category.

Currently, the average user spends about 42% of their time in the Internet. Despite the large percentage, the amount of time in the Internet is growing every year. After analyzing the data of the GlobalWebIndex agency [3], we concluded that users spend more and more time on the Internet every year (Fig. 4).

Fig. 4. Evolution of daily time spent using the internet.

All of the above figures indicate that there is a basis for large-scale implementation of digitalization around the world. In all countries that are leaders in the field of digital technologies, the state initiates the relevant initiatives. Without their active participation, it is impossible to imagine both the successful development of the technological offer in the leading countries, and the commercialization of technologies, including the creation of flagship corporations that form the "digital image" of the modern economics.

Most developed countries have programs for digitalization of the economics and society. The goals and objectives of the countries are generally similar, but there are some differences in the approaches to policy implementation. Some of the initiatives are part of a broader supranational science, technology and innovation agenda. Thus, the digital development strategies of Germany (Digital Strategy 2025) and other *European Union* (EU) countries are consistent with the pan-European digital agenda (Digital Agenda for Europe, 2010) [4].

«Digital» initiatives are usually based on the results of previous experience in the field of information technology (hereinafter referred to as ICT). The first development of ICT strategies in most countries occurred in the late 1990s and early 2000s. Thus, the initiative of the EU «Electronic Europe» (eEurope) for the transition to an information society was adopted in 1999 [5]. The main objectives of the policy in the field of digitalization during the 2000s were related to the construction of an information infrastructure and the promotion of the gradual introduction of ICTs in various fields of activity. As part of the implementation of the National Broadband Strategy (2010), the UK has achieved the goal of providing the population mainly in rural areas with high-speed broadband Internet (download speed-24 Mb / s) [6]. The next stage of the state policy was the launch of pilot programs for the introduction of digital technologies in the industry. This was due to the search for new sources of growth due to the global financial and economic crisis that occurred in 2008-2009. In 2011, the Industry 4.0 initiative was launched, which combined a set of projects for the creation, implementation and the use of digital solutions in manufacturing industries. At that time, the main task was focused on the distribution of effective solutions for enterprises.

Now, the policy of the leading countries of the world demonstrates the transition to a comprehensive digital agenda. The main objectives of this program are as follows [4]:

– digital transformation of public administration;
– development of information and communication infrastructure based on new technologies;
– strengthening information security;
– development of digital skills and competencies.

In addition, strategies are being developed for the introduction of individual digital technologies with high potential effects in various sectors of the economy (for example, the National Strategy for the Development of Artificial Intelligence in Germany, 2018) [7].

Digitalization of industries brings changes to the demand of factors of production. Under the influence of digital technologies and the new business models associated with them, not only individual sectors are transformed, but also the entire structure of the economy and interpectoral interactions. The calculations of the HSE ISSEK [8] show that in the baseline scenario, under moderately favorable macroeconomic and institutional conditions, digitalization can significantly increase the factor productivity of both industries and services in Russia (Table 2).

The maximum effect of digitalization can be achieved in the knowledge-intensive sectors of the service sector and high-tech industries, whose efficiency can grow faster than in other sectors of the economy.

According to the calculations of the Higher School of Economics, Institute for Statistical Research and Knowledge Economics (HSE ISSEK), by 2030, GDP growth will be more than half associated with digitalization [8]. This will be primarily due to the result of improving the efficiency and competitiveness

of all sectors of the economy. Some additional effect will ensure the growth of the information industry.

Table 02. Average annual values of the additional contribution, Russia

Economic sectors	**Productivity contribution (SFP), %**	**Capital contri-bution, %**	**Labor contri-bution, %**	**Result, %**
Financial sector	0,92	1,20	0,93	3,04
Transport	1,29	1,20	0,55	3,03
Construction	0,98	1,02	0,88	2,88
Education	1,00	1,20	0,57	2,77
Chemical industry	1,64	1,40	-0,43	2,61
Mechanical engineering	1,52	1,48	-0,46	2,54
Other services	0,93	0,79	0,24	1,95
Healthcare	0,81	0,58	0,25	1,65
Light industry	1,02	0,96	-0,65	1,32
Electric power industry	0,32	0,83	0,04	1,19
Trade	0,60	0,36	0,04	1,00
Agroindustrial complex	0,78	0,69	-0,56	0,91
State governance	0,58	0,24	-0,4	0,41
Timber industry complex	0,31	0,14	-0,53	-0,08
Metallurgy	0,25	0,10	-0,55	-0,21
Extraction	0,08	0,04	-0,46	-0,35

Taking into account the accelerated socio-economic development, the growth due to digitalization should be more than 2% annually (Fig. 5). In order to achieve the maximum economic effect, it is necessary to radically increase productivity and investment activity in the sectors of the economics.

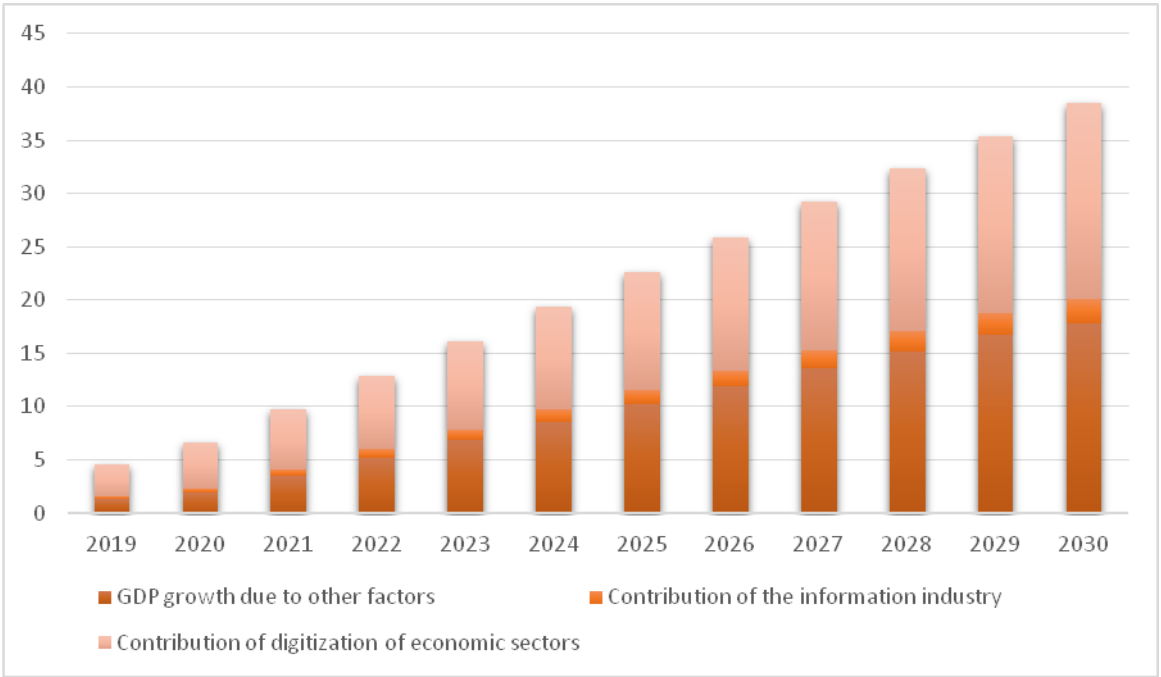

Fig. 5. Assessment of the contribution of digitalization to GDP growth (%/year).

Summing up, it should be noted that digitalization in the long term can become a significant structural factor of the economy growth under various scenarios of the development of the Russian economy. Its important role in GDP growth should not be overlooked. Based on the rapid increase in the use of digital devices by society, we can conclude that the trend of digitalization will continue for many years to come.

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Programming languages of the future

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Abstract. *The article discusses various programming languages. It describes their advantages, capabilities and scopes of application. Their future development prospects are considered.*
Keywords: *programming language, development, future,* development.

Языки программирования будущего

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Аннотация. *В статье рассматриваются различные языки программирования. Рассказано об их преимуществах, возможностях и областях применения. Рассмотрены их перспективы развития в будущем.*
Ключевые слова: *язык программирования, развитие, будущее, разработка.*

There are many languages that are currently not popular, but may become mega popular in the near future. Every year there are more and more of them. For example, Scala, Kotlin, Go, and Closure are relatively new languages.

So, which programming languages will dominate in the near future? This is my point of view.

- R

By convention, it is a programming language, but more precisely, it can be described as a set of template queries designed to perform data analysis and processing. This language is quite young (only 20 years old), but it has managed to become one of the best in its niche due to its accessibility, ease of development and ease of operation. During its existence, a lot of literature and several powerful IDEs have appeared: Commander and Studio.

A way to change the future: mass data analysis will become public and get a household level, something similar happened with spreadsheets.

➢Java 8

Java can not be called a new language, in almost all ratings it occupies, if not a leading position, then it is among the top three. Today, universities with world-famous names, mainly in the United States, are required to take the APCS test, which is performed in Java-this is a standard test of knowledge in programming.

The popularity and the title of leader is well deserved, since the language includes infinite functions that go far beyond the functions used today. One of the important features is the ability to use functional programming and support multithreaded processes, that is, an asynchronous event handler with multiple data processing threads.

How it will manifest itself in the future: the popularity of the language unites the best programmers in finding solutions to existing problems and developing new features. Even if the whole idea fails, the impact on the development of computers will remain huge.

➢Swift

The Swift language is not a universal solution to all life's difficulties, but it is used to develop all sorts of programs on Apple products. It is the best tool on the MAC OS and iOS platforms. The language is devoid of many problems common to other well-known languages (Objective-C, Python, Java), which makes the code cleaner and increases the speed of the product.

What a prospect: if the language continues to gain popularity, Swift will become mandatory for all programmers who are focused on developing applications for mobile platforms.

➢Go

Such a large and developed system of software products as Google, began to need a separate language that would allow extremely fast data processing. So there was the Go language, which aims to simplify the code as much as possible, sometimes by rejecting a number of useful ideas inherent in competitors.

The emphasis was made correctly, as evidenced by the growing popularity of the language, regular press releases and high speed of work. This is an ideal solution for working with large data streams, as it is resistant to failures and errors.

What to expect from Go: interaction and work with artificial intelligence through Go will become so accessible that even a schoolboy will be able to do it for fun.

➢CoffeeScript

Another option that lies between the classical shell representations and a full-fledged language. With the role of a beautiful shell, it copes with 100%. When working with JavaScript, there are numerous attachments and parentheses that CoffeeScript lacks. There are no special differences between these languages, except for the ease of use of the second one. Perhaps, over time, JS will be remembered exclusively as a compiled language for CoffeeScript.

How to improve your life: Remove the cluttered JavaScript language and make your code much cleaner.

➢Scala

Functional programming (FP) has almost captured the minds of the IT world. In Scala, all work is done not with a value or a specific variable, but with whole functions that describe the values. Among the OP Scala takes the first place, the language is compiled in the JVM. The advantage of Scala is that it supports all the platforms that Java runs on, and today it's hard to find another one.

At the initial stage, it is important to understand the language and go beyond the standard programming stereotypes, then learning will not cause any special difficulties.

What remains to be seen: FP will go to the masses and partially displace Java.

➢Haskell

Scala also has worthy competitors in the FP world. For the previous version, you can assign the title of the most popular in this area, and for Haskell – the most favorite.

Gradually, but there is a trend of transition of large companies, whose work is related to the processing of data arrays, to Haskell. One of the latest is Facebook. Its advantages include intuitive clarity of action and compactness.

What to expect: can take the place of the Rock or go on equal terms.

➢Jolt

In the days of big data XML, the best tool for processing XML was XSLT. After losing the lead and passing it to JSON, XSLT was replaced by Jolt. It allows you to create the simplest filters, to group huge amounts of data with minimal resources. If the developer is facing a difficult task, it is better to look at more functional languages.

➢Kotlin

Kotlin has been a common feature, and it's clear that developers are keeping a close eye on the language, especially given how Google encourages its use for Android development. Google's adoption of Kotlin has really accelerated this process. Kotlin is well-placed to take on the attention that has historically been focused on Java. The portability of Kotlin, built on the JVM, gives the language a great breadth: from mobile devices to server-side (through frameworks like Spring) and web interfaces (through JavaScript compilation), Kotlin can work in a wide variety of environments. Developers love features like zero security, coroutine support, and a mix of procedural and functional programming features.

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Digital ruble: Pros and Cons

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Abstract. *Digitalization of the national currency has become a global project. The article contains the introduction of a new payment system of the Russian Federation – the digital ruble. The main characteristics, advantages and disadvantages of the system at the initial stage of its development are given. The work is completed by an analysis of the competitiveness of the digital ruble in comparison with the digital Yuan, which is currently at the testing stage. Based on the study, the authors assessed the prospects for the creation and implementation of a new payment system and made a forecast regarding its impact on the financial sector.*
Keywords: *payment system, Central Bank, digital ruble, digital wallet, offline payment.*

Цифровой рубль: преимущества и недостатки

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Аннотация. *Цифровизация национальной валюты стала глобальным проектом. В статье рассматривается вопрос введения новой платежной системы Российской Федерации – цифровой рубль. Приведены основные характеристики, преимущества и недостатки системы на начальном этапе ее развития. Работа дополнена анализом конкурентоспособности цифрового рубля по сравнению с цифровым юанем, находящимся, на данный момент, на стадии тестирования. На основе проведенного исследования авторы оценили перспективы создания и внедрения новой платежной системы и сделали прогноз относительно его влияния на финансовый сектор.*
Ключевые слова: *платежная система, Центральный банк, цифровой рубль, цифровой кошелек, офлайн-оплата.*

The rapid development of financial technologies and the digitalization of economies are shaping new global trends, including those taking place in Russia. At the current moment, the Russian financial system is characterized by the non-stable condition. The epidemic of the new coronavirus infection *COVID-19* caused negative trends in the financial sector i.e.: the price of petroleum products fell to the level of the year 1999, the exchange rate of the Russian ruble fell against the US dollar and the euro, the stock prices of some companies decreased by 20-45%. The tense political situation is also influencing and complicating the situation: the countries of European Union (EU) and the USA continue to impose sanctions that slow down the growth of the Russian economics. Thus, in Russia, the issue of developing and switching to a national digital currency is particularly acutely a matter of concern.

According to the results of population surveys in the period of 2017 up to 2019, the share of adult consumers, who use online banks for transfers and other transactions increased from 32 up to 55%. At the same time in the period of 2016-2020, the percentage of non-cash payments for goods and services in Russia increased from 39 up to 70%. Thus, there is an active use of remote and non-cash forms of payments being observed [1]. The volume of online transfers and other transactions is shown below (Fig. 1).

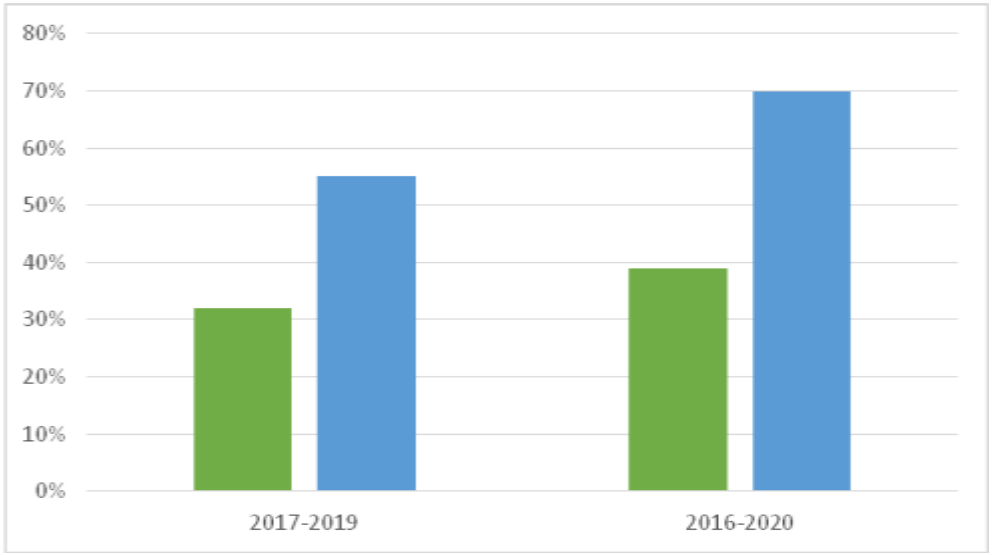

Fig. 1. The percentage of online transfer payments and other banking services.

Based on the data obtained, we can conclude that the Russian population is open to switching to use the digital payment systems. Therefore, the Bank of Russia is studying the possibility of issuing a digital currency of the Central Bank called *central bank digital currency* (CBDC), which is the digital ruble.

The digital ruble will present a program code in a special electronic wallet opened by the payment system of the Bank of Russia. In this case, each wallet

will be linked to a specific person-similar to cash in a wallet. According to the report of the Bank of Russia, the main idea of the introduction of the new tool consists in the fact that the digital ruble should combine the advantages of the cash and non-cash ruble.

In terms of practical use, the main advantage of the new payment system is that non-cash payments, transfers and other banking operations can be carried out online with the same effect as within the absence of the Internet connection. Unlike non-cash payments, the digital ruble does not bind a consumer to a certain bank and will release him/her from following conditions imposed by banks as well as from manipulations with tariffs. Digital currencies have a higher transaction rate and provide a higher transaction convenience.

Thus, the digital ruble is being planned to be constructed by the use of the distributed ledger technology. Due to the distributed storage and processing of information, this system exhibits more resistance to various incidents compared to centralized systems. That is, the introduction of the digital ruble will reduce the level of fraud in the economic sphere; it is expected to reduce the costs of legal support of transactions and various transaction costs.

As for the state benefits, the use of the digital ruble will create favorable conditions for improving the effectiveness of financial control due to higher transparency of operations. The Central Bank of Russia will be able to automatically calculate taxes and deductions for them, to distribute subsidies, to transact incentive payments, etc.

Transparency of operations will make the digital ruble the main tool in the fight to reduce the shadow sector of the economy and reduce the level of corruption, where cash payments are now being actively used. At the moment, the volume of the shadow economics in Russia is about 22% of GDP [2].

The creation of a new national payment system is also of political importance: every bank in Russia is linked to the *Society for Worldwide Interbank Financial Telecommunications* system (SWIFT), which has a foreign origin and which may be disabled due to new sanctions. Now it is impossible to make a cashless payment without the banking sector and without the SWIFT system. In fact, disconnecting Russia from the SWIFT system will mean the collapse of the entire banking system. It is for this reason that the Central Bank is planning to introduce a new format of funds – the digital ruble. This type of currency will allow consumers to exchange money without reference to banks, and transfer systems, such as the SWIFT system.

It is expected that the introduction of the digital ruble is expected to reduce the cost of issuing physical paper money. Accordingly, the operating costs of banks will be reduced, as they will not have to use a network of automated teller machines (ATM), collect and transport large amounts of physical currency, pay for its storage, which will reduce the cost of banking services for the users.

Of course, the digital ruble has a number of disadvantages. Firstly, digital currency is devoid of security, the exchange rate of the digital currency largely depends on the demand for it on the part of the buyer. Secondly, the digital ruble will have high volatility, which may reduce the growth of user confidence in the new payment system. Thirdly, there is still a risk of the new payment system being exploited for illegal purposes.

The infrastructure and legal framework necessary for the circulation of the digital ruble must have an extremely high level of stability, reliability and information security. All these aspects will be taken into account by the Bank of Russia when developing possible options for the digital ruble project, including its functional and technological components.

The international experience shows the results of the implementation of the national digital currency. Thus, China has already completed three stages of the *Digital Currency Electronic Payment* (DCEP) testing in Shenzhen, Suzhou and Beijing, which confirmed the country's readiness to launch the digital Yuan [3].

China has been positioning the digital Yuan as an effective competitor and a full-fledged replacement for the dollar. The need for the rapid introduction of the digital Yuan is dictated by the following feature of the local financial system: Yuan is not a freely convertible currency, that is, its exchange rate depends on the monetary policy of the People's Bank of China and on the policies that may change any time, which poses a serious risk for global companies.

The key difference between the digital Yuan and the digital ruble project is that the first one is already at the stage of implementation, and not at the stage of concept formulation. China has the opportunity to influence the economic system even more, but at the same time not to be dependent on global financial institutions as much as it is the case now [4]. However, the Russian ruble does not have such an opportunity, and it is unlikely to appear. This fact may somewhat undermine the position of the digital ruble in the ranking of world currencies. In this regard, Russia should respond as quickly as possible to changes in the course of digital development in order to maintain and ensure its competitiveness at the world arena. Nevertheless, close Russian-Chinese relations will positively influence the development of each of the currencies and ensure their potential growth.

Thus, the creation of the digital ruble is a necessary step in the economic development of the country, which will ensure Russia's competitiveness at the world arena, as well as the country will enjoy a more attractive environment for the development of innovations and attracting investment. For the Russian population, the introduction of the digital ruble may have a positive effect: the appearance of a more convenient and reliable payment instrument.

However, for successful implementation of this type of money transactions, it is necessary to carry out a number of preparatory activities such as starting from choosing the most effective method of distributing digital currency,

creating competent legislation regulating its release and turnover, and ending with ensuring information and technical security.

It is still difficult to say how many years it will take to implement and switch to the digital ruble system. According to our forecasts, the currency itself will be introduced in the coming one or two years, whereas the full control over the system is expected to be achieved no less than in the period of ten-fifteen years.

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Tax literacy in the digital age

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Abstract. *The article considers the issue of formation the tax literacy and culture of the population of the Russian Federation. It studies the reasons of the violation of tax discipline by the taxpayer. It is shown that digitalization significantly expands the impact on the tax literacy of the population through the use of remote electronic services. The important role of the Federal Tax Service of the Russian Federation in the further development of digital instruments of influence on the tax literacy of the population is indicated.*

Keywords: *innovation, tax literacy, digitalization, interaction with the population, tax culture.*

Налоговая культура в цифровую эпоху

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Аннотация. *Рассмотрена проблема формирования налоговой грамотности и культуры населения Российской Федерации. Выявлены причины несоответствия в соблюдении налогоплательщиком налоговой дисциплины. Показано, что цифровизация способствует повышению налоговой грамотности населения через применение дистанционных электронных сервисов. Проведен анализ заинтересованности студентов в решении вопросов в налоговой сфере.*
Ключевые слова: *инновации, налоговая грамотность, цифровизация, взаимодействие с населением, налоговая культура.*

Tax literacy and culture of the country's population are important in the period of economic development of the Russian Federation. The digital age forms the tools to actively support many improvements in various economic fields. Along with various achievements in the field of digitalization of tax relations, it is necessary to take into account the fact that there may be a negative impact of digital tools.

The purpose of this article is to examine the tax culture of the population, the impact of digitalization on tax literacy, and the positive and negative features of the digital economy on taxation.

According to the theory of the American sociologist, Professor of Harvard University George Homans: tax culture is a stable product of the exchange of activities of tax and other authorities involved in the tax process, on the one hand, and taxpayers, on the other [1, p. 168].

Thus, a solid foundation of the tax culture is the combination of the interests of taxpayers and the interests of the state. The tax culture of the population is a system of values, established rules, norms and principles in the field of tax relations. It is a model that includes the legitimate actions of taxpayers and tax authorities [2]. An important element of the tax culture is tax discipline. It is a systematic training, development and control of moral and financial abilities and the ability of payers to pay with the budget, taking into account the interaction of inspections for the reception and registration of obligations [3].

The activity of the state in the field of science, education, production, etc. depends on the awareness of taxpayers of the need to pay basic payments to the state budget, including taxes. Therefore, a mandatory point on the way to

achieving an economically developed state should be the promotion of the level of tax literacy of the population.

Digitalization has a dual impact on tax literacy and tax culture. Thus, digitalization is a derivative of automation and informatization of the management of socio-economic systems, currently it represents the highest level of development of intelligent data processing systems. Digital technologies are actively implemented by the Federal Tax Service through various mechanisms and methods that operate on various digital platforms. We can consider the main directions in the implementation of the development and use of digital technology in taxation.

The first direction includes the absolute interaction of tax authorities with taxpayers, which is implemented in the form of tax supervision, and is a special form of tax control. In this case, the organization voluntarily provides access to accounting and tax data.

As a second, but already one-sided direction of the use of digital technologies in the tax authority, we can single out a data set that opens up information in the public domain about taxpayers. The publication of this information began in 2018 in the «Open Data» section of the website of the Federal Tax Service.

The third direction contains the data of the service and provides obtaining a certain status without unnecessary administrative costs. We are talking about the formation of a Unified Register of small and medium-sized businesses, which operates on the basis of Article 4.1 of the Law «On State Support for Small and Medium-sized Businesses», introduced by Law No. 408-FZ of 29.12.2015 [4].

The fourth direction of digitalization in tax administration is being implemented within the framework of structural changes in the tax system – the introduction of a new special tax regime «Tax on professional income» (Law № 425-FZ of 27.11.2018) in the territory of Moscow, Moscow Region, Kaluga Region and the Republic of Tatarstan in an experimental version from the first of January, 2019. The regime is aimed at legalizing the income of persons who receive income on a systematic basis, but do not register as individual entrepreneurs [5].

The fifth direction of digitalization are additional services that allow us to electronically:

1. manage payment documents;
2. check the filling out of invoices;
3. calculate the cost of the patent;
4. calculate taxes on the property of individuals;
5. select the tax regime using the tax calculator;
6. calculate the tax burden.

To clearly describe the use of digital technologies and the awareness of young people in the field of taxation, we conducted an analysis among students (n=25) of the Bauman Moscow State Technical University. The survey was conducted in Google form. The questions were as follows:

1. Your attitude to taxes. Does the society need them?

2. How can you assess your level of awareness in the sphere of taxation?

3. How often do you apply to the tax authorities?

The results of the survey are presented below in the form of diagrams. The data is calculated as a percentage of the number of respondents. The following data was received for question 1:

- 56% of students believe that taxes are necessary;
- 24% of students believe that taxes are useless;
- 20% of students found it difficult to answer.

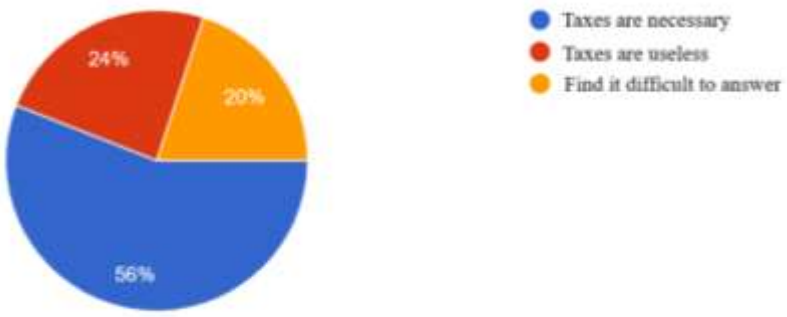

Fig. 1. Respondents' attitude to taxes.

It follows from this that the majority of respondents noted a positive attitude to taxes and the importance of taxes for the society.

In response to question 2, the following can be identified for assessing the level of awareness:

- 44% of respondents believe that they are sufficiently knowledgeable in this area;
- 56% of the respondents have approximate knowledge.

There were no students who were not interested in this topic.

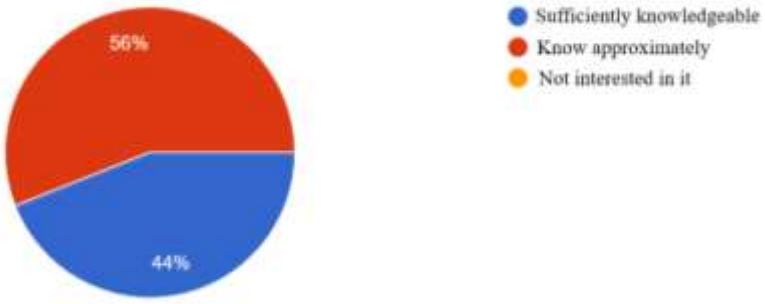

Fig. 2. Awareness assessment.

To the third question about the frequency of appeals to the tax authorities, the answers are presented in the form of a bar chart. The responses distributed as follows:

- 16% often visit tax authorities;
- 36% sometimes visit;

- 20% rarely apply;
- 28% do not apply.

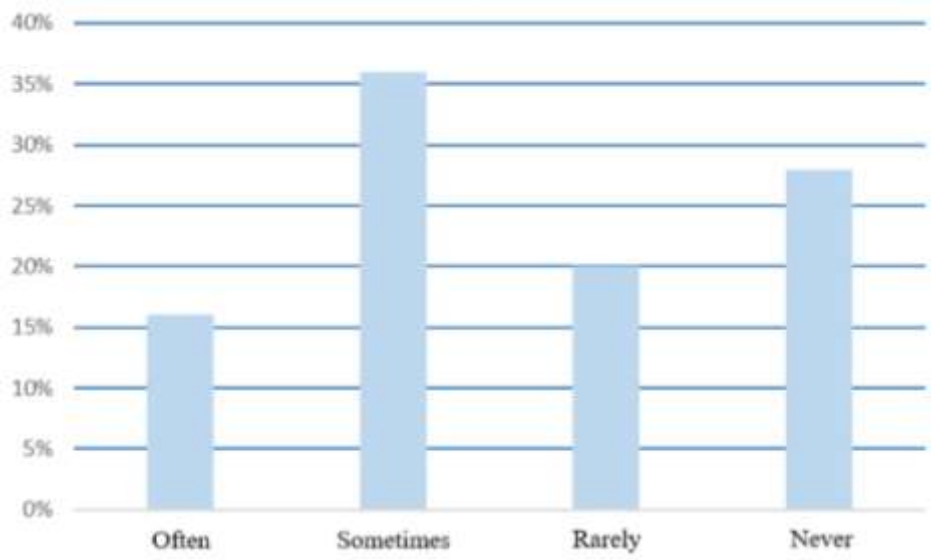

Fig. 3. Frequency of appeals to the tax authorities.

Based on the statistics obtained, we can conclude that the students of Bauman Moscow State Technical University are interested in the tax sphere. Currently, we can observe the tendency of young people to form a tax culture, building a positive attitude to the performance of their duties to pay taxes.

Now let's look at the pros and cons of using digital technologies in the tax system.

Among the shortcomings, certain restrictions for the access of some citizens with a high level of Internet penetration in the modern world are highlighted. For example, for certain individuals, digital technologies could be a solution to the problem of direct physical contact with employees of the tax service (residents of remote areas), as well as to comply with aspects of financial literacy (elderly citizens). Not only for the latter, but also for the younger population, there may be problems related to their own digital competence, namely, the availability of certain knowledge and skills for acting in a digital environment [6].

In the digital sphere, we can note another problem from a psychological point of view. This is the problem of fatigue, burnout of the individual from digital technologies. This is typical for the young and middle-aged population living in megacities, who have to work in a digital environment regularly, both as part of their work activities and in everyday communications. Fatigue from digital technologies gets accumulated, there is a shortage of live communication, emotions, it all destroys the nervous system, the psyche and increases depressive states. This situation intensifies the topic of preference for traditional communication and rejection of digital technologies. And this should be taken into account in a society where the digital impact of the tax service with the population is developing: if effective solutions are not found in the field of balancing interests, this will lead to an undesirable outflow of active users of digital tax

services in the future, which will have a negative impact on the tax culture and literacy of all generations.

The positive aspects of digital technologies in the tax system include:

1. An increase in the possibility of direct contact with the taxpayer through new digital services, the emergence of the possibility of immediately informing the taxpayer on all important issues. For example, information about the amount of taxes and fees owed, the timing of their payment, and measures of liability for non-performance of obligations.

2. Active involvement of the population in the discussion of various draft laws through digital platforms.

3. The convenience of using digital services, which acts as an additional motivation for responsible behavior of the taxpayer.

4. Implementation of opportunities for maximum coverage of the population on the basis of digital services and platforms of the Federal Tax Service of Russia.

These advantages help to develop the tax literacy of the population. Citizens who actively contact the Federal Tax Service of Russia through digital services can:

- receive enhanced opportunities to inform about the state of tax relations with the state;
- improve their own competence in tax matters;
- act as a subject for developing proposals for improving tax administration using the feedback system.

The main area of application of digitalization is the economy. Today it is becoming "digital", that is, all data is processed digitally. Examples of the digital economy are: electronic document management, online services, electronic payments, etc.

Realizing the urgency of the problems of tax literacy, we will formulate ways to solve these problems. First, it is necessary to come to an unambiguous interpretation of the tax legislation. It is precisely because of the complexity of the content of normative legal acts that it is difficult to determine the specific meaning and form accurate conclusions about the purpose of a particular paragraph in the acts. In this regard, the tax authorities are obliged to explain and interpret the laws. Secondly, it is important to hold various seminars, lectures and conferences on issues related to solving problems of tax literacy. Thirdly, in the form of additional solutions, can serve as consulting services on taxation of citizens in rural areas, the introduction of tax literacy lessons in the educational program among students of grades 9-11, the creation of the Government of the state program on tax literacy, the improvement of the electronic Internet service «Personal Account of the taxpayer for individuals» [7].

Thus, our article deals with the problems of the formation of tax literacy of the population, the main directions in the implementation of the development and use of digital taxation technologies, as well as the positive and negative aspects of the use of digital technologies in the tax system. In general, the promotion of the level of tax literacy of the population is an important aspect of the

formation of an economically developed state. The contribution of the Federal Tax Service of Russia to digital education and ensuring universal access to the Internet, including through social access points, is particularly important.

User requests can be calculated and processed using digital technologies that allow you to model customer behavior. As a result, it will make it easier for citizens to use digital tax services and help maintain interest in them, which will have a positive impact on the state of tax literacy and tax culture of the population.

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Information and communication technologies in the context of distance learning, their forms and application

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Abstract. *The article is devoted to the relevance of the use of Information and communication technologies in the context of distance learning in the system of modern education. Special attention is paid to the description of the unique features of distance education technology, the use of which creates prerequisites for improving educational activities. It is concluded that the maximum quality from the use of the distance approach can be achieved only if it is possible to use various means of information and communication technologies in various types of educational activities in a comprehensive manner.*
Keywords: *distance learning, information and communication technologies, Internet technologies, telecommunications.*

Информационно-коммуникационные технологии в условиях дистанционного обучения, их формы и применение

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Аннотация. *Статья посвящена актуальности применения информационно-коммуникационных технологий в условиях дистанционного обучения в системе современного образования. Особое внимание уделено описанию уникальных возможностей дистанционной образовательной технологии, использование которых создает предпосылки для улучшения образовательной деятельности. Сделан вывод о том, что максимального качества от использования дистанционного подхода можно достичь только в том случае, если иметь возможность комплексного использования различных средств информационных и коммуникационных технологий в различных видах учебной деятельности.*
Ключевые слова: *дистанционное обучение, информационно-коммуникационные технологии, интернет-технологии, средства телекоммуникации.*

1. Distance learning.

The constant and continuous development of information technologies has had a strong impact on all spheres of society, not least on education. Distance learning is becoming more and more popular every year. And if earlier leaving for remote training was a single and rare phenomenon, then the pandemic has made its own adjustments, gave a huge boost to life in a remote format. The transition to distance learning is a great progress for our society.

Distance learning is a set of educational services that are provided to students at any distance from educational institutions with the help of a specialized information and educational environment, which are based on telecommunications means of information exchange. Such as: radiotelephony, satellite TV, Internet technology, etc. The set of means of receiving and transmitting data, information resources, hardware and software, organizational and methodological support, interaction protocols, forms an information and educational environment received by the user in the form of a distance course [1].

Distance learning is a method of implementing the learning process, in which the exchange of information and feedback between the teacher and the students is carried out using modern information and telecommunications technologies that allow for distance learning without direct, personal contact between the student and the teacher.

Distance learning allows you to implement the principle of accessibility of education for all, to train a large number of people, to reduce the cost of conducting classes in classrooms, to improve the quality of training, to create a unified educational environment.

Distance learning has characteristic positive features:

– the ability to learn from anywhere in the world, where there is a computer and the Internet;

– ability to adjust the training time without reference to the schedule;

– save time to combine with other activities;

– individual approach, taking into account the needs of students;

– accessibility and openness of training;

– possibility of self-realization;

– effective use of educational institutions, technical vehicles;

– social equality (equal educational opportunities).

Distance education also has a weak side – it is the lack of real communication. For many people, it is important to be in society and interact with people in person, and not through a monitor screen. But life is not just about learning. Therefore, if necessary, you can fully get enough of communication in other areas of life.

Of course, for effective distance learning, it is important to have the skill of self-control and the ability to self-educate; perseverance and concentration on the learning process are important. Timely completion of all test work and systematic assimilation of the acquired knowledge are mandatory conditions for achieving the student's goal. In principle, as with training in any format.

The combination of information technologies, in distance learning, provides:

– interactive interaction between students and the teacher;

– delivery of the main volume of the studied material to students;

– presentation of the possibility of independent work [2].

2. The role of information and communication technologies in the organization of the distance course.

Currently, due to the difficult situation around the world, against the background of the global COVID-19 pandemic, distance learning is a real alternative to learning within the walls of an educational institution. Due to the widespread introduction of new information technologies in the education system and the lack of the ability of traditional forms of education to always provide high-quality and affordable education, the use of distance learning tools and technologies allows you to create completely new educational models.

The use of information and communication technologies provides the learning process with a number of advantages:

– the duration of the lesson time is determined by the needs of the student himself;

– providing on-the-job training opportunities;

– by providing the opportunity to choose the pace of assimilation of the material and the choice of pauses in the work, a more complete account of the individual characteristics of the listeners is carried out;

– creating conditions for internal motivation;

– create more vivid, dynamic and memorable visual information thanks to multimedia. Increases the degree of stability of interest in the study;

Distance learning-is the main tool used in conducting distance learning, working in which students will gain knowledge and acquire the necessary skills and abilities.

The main form of educational activity in the distance learning system is the independent work of the listener (IWL).

Proper organization of independent work ensures effective management of the learning process by clearly organizing the training material and effectively controlling the actions of students. When creating a course of study, the teacher is required to properly plan and manage the independent work of the students, both in terms of duration and volume in each specific module. The most effective is the calendar planning of monitoring the phased implementation of the IWL.

Control, in the form of intermediate and ongoing testing, as well as feedback from students, allows you to coordinate systematic work throughout the course.

It is confirmed by experience and experiments that the quality and structure of distance learning courses, as well as the quality of teaching in distance learning is not worse than in traditional forms of education.

With the help of telecommunications, such as: teleconferences, video conferences, webinars, teachers have the opportunity to carry out interactive

communication with students throughout the entire course of study. Forums and chats provide an opportunity to quickly and timely adjust the learning process. It is an indisputable fact that ICT plays a leading role in the work of the course.

3. Technologies and means of distance learning.

Based on modern technological advances, distance learning methods have come to play a major role, because they have a high degree of coverage and long-range action.

Significant experience in the implementation of distance learning systems using Internet technologies and telecommunications systems is currently accumulated all over the world. A significant place is occupied by systems that use computer networks, direct television broadcasting systems, and distance learning systems using modern telecommunications technologies.

When analyzing the existing distance learning systems, the following technologies can be distinguished: case-technology, TV-technology and network technologies. Let's consider their features.

Case technologies are a system in which educational and methodological materials are completed in a special set (case). This set is mailed to the student for self-study. Communication with teachers-consultants is carried out in the training centers created for this purpose. This group can be attributed to the traditional technology of distance learning.

TV-technology is based on the use of television lectures. This form of distance learning is used in the system of professional development, training and retraining of personnel.

Network technologies include Internet technology and technologies that use the capabilities of local and global computing networks. Network technology has a number of advantages over others, as it allows you to study on an individual schedule, with constant contact, both with the teacher, and with other students and the administration of the educational institution. The ability to communicate with all participants of the educational process is a fundamental difference between Internet technology and other distance learning technologies: such interaction creates the effect of «presence» [3].

In distance learning, methods of synchronous and asynchronous learning are used.

Asynchronous is a means of communication that allows you to transmit and receive data at a convenient time for each participant in the process, independently of each other. This type of communication includes the following:

– forums and bulletin boards. Usability is based on the public exchange of experience, knowledge and other information. Just create a new topic or join an existing one, then leave your messages. The information will be available to all participants in the process, which will allow you to respond or read the message at any time. Bulletin boards play a similar role, but have limited functionality, so they are the least popular. This method of feedback has a positive side – the accumulation of information. You can read all the discussions and add your answer to them at any time;

– email address. One of the first means of communication on the Internet, still not lost its popularity. Questions, answers, or statements can be sent purposefully to any participant in the training process by email. This type of communication is only suitable for personal «address» communication, making public discussions difficult. It is extremely inconvenient to save and accumulate materials in the form of emails. In addition, spam filters are increasingly blocking emails, thereby disrupting the dialog and making it unreliable;

– wiki. A new and popular way to share information. This is a website, the content of which is filled by any participant of the training with the possibility of multiple editing and entering new data. Group participation in the creation of the material makes the process interesting, involving participants in the formation of the knowledge base. The ability to edit is not only a strong point of the wiki, but also a weak point, since the abuse of the ability to change the content and make your own data can lead to negative consequences. Therefore, constant monitoring and restriction of rights is necessary.

Synchronous is a means of communication that allows you to exchange information in real time. This type of feedback between the participants of the educational process provides an opportunity for direct communication and is the most promising;

– voice and video conferences. Communication takes place in direct contact with the teacher and listeners. The line between personal presence in the audience and distance learning, with the help of video communication, is blurred. This method of obtaining knowledge combines all the positive qualities from classical full-time training and from distance learning;

– text conferences (chats). The most common communication options are personal chats between two participants in the learning process. But, if necessary, the chat can be public with 3 or more participants in the distance learning process. The disadvantage is the lack of visual contact, and on the part of the teacher, the inability to check with whom he really communicates. This is especially important when conducting distance exams or seminars, during testing and testing of knowledge.

A competent combination of technologies and tools provides great opportunities, as it allows you to combine and use the best elements of various ways of organizing distance learning, at certain points at the discretion of the teacher to organize the workflow with students in a virtual classroom, giving them the necessary explanations and at the same time controlling their knowledge.

The analysis of the current state and use of innovative technologies in an educational institution allows us to conclude that the maximum quality and the greatest effect from the use of the distance approach in the educational process can be achieved only if you have the opportunity to use various means of information and communication technologies in various types of educational activities [4].

Distance education is not a fad. This is our future, which we are already shaping today.

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New technologies and innovations in modern technological education

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Abstract. *This article discusses the problems and prospects for the development of the introduction of innovative technologies in polytechnic education. The use of innovative technologies is evaluated. The place of innovations in the educational process is specified.*
Keywords: *technology, innovations, distance learning technologies, electronic learning environment, quantoriums, houses of scientific collaboration.*

Новые технологии и инновации в современном технологическом образовании

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Аннотация. *В данной статье рассматриваются проблемы и перспективы развития внедрения инновационных технологий в политехническое образование. Дана оценка использования инновационных технологий. Уточняется место инноваций в образовательном процессе.*
Ключевые слова: *технология, инновации, дистанционные образовательные технологии, электронная среда обучения, кванториумы, дома научной коллабарации.*

Currently, our country is experiencing an acute shortage of engineers and skilled workers (70% of the total demand in 2019). The personnel shortage in working specialties amounted to 700,000 people in 2019. Two-thirds of the country's enterprises report a personnel shortage. There is a shortage of qualified personnel in almost all industries: mechanical engineering, the military-industrial complex, and almost all manufacturing and light industry. Acute personnel problems exist even in the most priority industries, in particular in the rocket and space complex, where 44% of employees are over 50 years old, and 25% are of retirement age. There are less than 5% of highly qualified workers in Russia, and 45-70% in developed countries [3].

Modern production constantly needs highly qualified engineering personnel. In this regard, it should be noted that high-quality training of an engineer is possible only if innovative training technologies are actively introduced and developed in education using modern high-tech equipment that ensures the creation of an innovative competitive product of labor. As noted by V.V. Putin at a meeting of the Presidential Council for Science and Education on June 23, 2014 in Moscow: «Today, the leaders of global development are those countries that are able to create breakthrough technologies and on their basis form their own powerful production base. The quality of engineering personnel is becoming one of the key factors of the state's competitiveness and, crucially, the basis for its technological and economic independence». According to the main indicators that determine the level of scientific and technological development, our country still lags behind the leading countries of the world, such as Norway, Sweden, the Netherlands, Denmark, etc. In our research, we relied on the rating of the international magazine Global Finance, which once a year forms a rating of countries with a high-tech level of production. Today, practice shows that science lags behind the demands of society and the state in creating innovative products that are the basis of the economy of any country. This raises a lot of questions: who we teach, how we teach, and what we teach. Innovations in education should be considered as a tool for self-development, which creates conditions for preparing a person for life in society, including for work, including the acquisition of project and research skills in the process of his education. In the educational environment, innovation processes open up wide opportunities and prospects, which we understand in a broad sense, as introducing something new, as changing, improving and improving the existing one. The problems of innovative transformations in the field of education at one time became a topic for research by such well-known scientists as M.M. Potashnik, A.V. Khutorsky, A.B. Pugacheva, V.S. Lazarev, V.I. Zagvyazinsky, etc. [1, 2].

At all times, and especially today, the need to update the content of technological education, in the search for new forms and methods of training is due to the introduction of modern high-tech machines and equipment into production, for the maintenance of which specialists are needed who possess strategic engineering thinking, at the right time ready to find the most optimal and rational way to solve a problem situation. In modern realities, production needs real strategists who can quickly analyze, have the skills of engineering thinking, and predict results. Today, we are all witnessing the fact that digital and electronic

educational technologies are being actively introduced into the educational process of the subject area «Technology». The computer becomes an integral part of the educational process, without which training at the current level of requirements is impossible. Before you learn how a tool, machine, or equipment works, you need to understand the functioning of its individual parts, its structure. The lack of educational posters of the necessary content in the technology classrooms can be compensated by showing the object under study on the slide of the educational computer presentation, by selecting a picture on the Internet. In this regard, however, a number of shortcomings should be noted, which everywhere reduce the quality of technological education. Many teachers «sin» by using raw images of poor quality for teaching, or even worse, that they undertake to explain new educational material created by another author. It is difficult to imagine how such a teacher can teach his students at someone else's presentation, if he himself does not always fully understand it. In this case, you can advise to process it in Photoshop or Corel DRAW. Individual technological processes when using animation effects can be shown in dynamics. The use of copyrighted or borrowed videos undoubtedly improves the quality of technological education. It should be noted, in particular, that the assimilation of the content of the educational material within the framework of the use of video clips in the lesson should not exceed 5-7 minutes of training time. The lesson should be rich in new educational material, but within reasonable limits. According to L. N. Bobrovskaya, a representative of the Volgograd Scientific School, the lack of use of electronic educational resources in the classroom, as well as their excessive use, leads to a decrease in the quality of education [2].

The study of innovative transformations in the field of polytechnic education could not be considered complete, without taking into account the use of distance education technologies. We consider distance learning as providing equal conditions and opportunities for all participants of the educational process. Their creation and implementation, on the one hand, requires improving the skills and competencies of the teacher, on the other-the opportunity to get the necessary knowledge in a comfortable environment for the student. The use of distance learning technologies today is dictated by the current situation in the educational environment. The analysis of the current situation in education suggests that in the conditions of coronavirus infection, not all educational institutions, as well as teachers in general, are ready for such changes. The transition to distance learning, as there is no alternative at the moment, becomes quite tangible and relevant. There are several reasons why the introduction of distance learning technologies should become an urgent need for every technology teacher. These include the following:

– Textbooks give a brief description of the object, process, phenomenon, and technology being studied. In the framework of a distance course, this material can be given in a more expanded form and studied in depth and in detail;

– The lack of study time in technology lessons (theory – 30%, practice – 70%) for learning new educational material is always limited, which allows you to think that in the framework of distance courses, this can be done for the student in a more comfortable, home environment, not limited in time;

– Studying the subject environment and showing the object being studied with your hands is not always convenient. Not all students, especially at the back of the class, can see, understand, or assimilate anything. In addition, the subject or object being studied is not always present in the technology room. As part of the distance course, this can be done using videos, presentation slides, where processes and technologies can be shown in dynamics;

– A distance learning course in the evaluation of educational results allows you to reach a larger number of students than you can do in the classroom, when the responding student is limited in time;

– As part of a distance learning course, the student has the opportunity to test themselves before they give an answer (training-trial test). The student simply does not have such an opportunity in the classroom;

– As part of the distance course, it is possible to use the «Inverted Classroom» model, when the teacher gives students the opportunity to familiarize themselves with the educational material at home, and in the classroom, due to lack of time, only to clarify individual questions [1].

One of the innovative and promising areas of obtaining modern polytechnic knowledge today is the creation of «quantoriums» and houses of scientific collaboration. In 2015, Vladimir Putin signed the strategic initiative «A new model of additional education for children». This strategic initiative provided for the creation of children's centers «quantorium» in all regions of the Russian Federation. It is in «quantoriums» that the STEM approach to learning is reflected, where STEM education should be understood as a modular direction of education, the purpose of which is to develop the intellectual abilities of the child with the possibility of involving him in scientific and technical creativity. Of course, the mission of «quantoriums» and houses of scientific collaboration contributes to the technical development of children, contributes to the implementation of the strategy of polytechnic education of young people defined in the Presidential address, but today these centers are able to take on their «shoulders» only part of the problems of modernizing education. In each region, there are too few such centers to meet the needs of everyone. Only a single part of the children such centers are able to bring to the planned level of quality of education. The rest of the children will remain outside the innovative processes in polytechnic education, which were discussed in our study [2].

Summing up all of the above, we can emphasize that technological education in Russia is at a good level, but the use of new modern technologies can help improve this situation. It is important to remember that the use of modern technologies should be accompanied by competent teaching, because only in this way can you get competent specialists in this industry.

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The problem of technology education in modern schools

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Abstract. The article deals with the main problems of technological education in schools. The reasons for their occurrence and possible solutions are given. An explanation of why it is important not to allow a decrease in the level of technological culture of society and to increase it among students is given.
Keywords: technological culture, the problem of education, workers, transformative activities.

Проблема технологического образования в современных школах

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Аннотация. В статье рассматриваются основные проблемы технологического образования в школах. Приводятся причины их возникновения и возможные пути решения. Объясняется, почему важно не допускать понижения уровня технологической культуры общества и повышать его у обучающейся молодежи.
Ключевые слова: технологическая культура, проблема образования, рабочие кадры, преобразовательная деятельность.

Education is one of the key components of human culture and society. And to conclude how modern education is effective, it is necessary to consider it within the framework of the culture in which it develops.

The term «culture» is the antonym of the word «nature» and means something «artificial», «cultivated». «Culture appears to us as a special image of nature, unknown to itself, but realizing the possibilities contained in it, the way of its existence» – M.S. Kagan [2]. In the process of human development, this term

has undergone some changes, of course. Now the concept of «culture» is seen as some kind of model to which everyone aspires, as a system of values that is shared by the majority of people. In general, culture is divided into two kinds: spiritual and maternal. The first is a set of ideas, knowledge and moral norms. The main elements of spiritual culture are spiritual values, spiritual activities and spiritual needs. The second type is usually understood as objects created by people, i.e. artificially, that help them to adapt and comfortably exist in the natural and social conditions of life, satisfying their needs. Looking at material culture in more detail, we can see that it contains three components:

- Object world – objects created directly by a person. For example, a computer, buildings, roads, household appliances, etc.;
- Technologies-algorithms for creating and applying objects of the object world;
- Technical culture – a set of certain skills, abilities of a person. All knowledge, skills and abilities are passed down from generation to generation and implemented in practical activities.

Today, the concept of "culture" runs through all aspects of human activity and society. Therefore, it is divided into the following types: economic, legal, political, artistic, domestic, professional, and many others.

However, despite all the diversity of types of culture, in the process of human development at different stages of its history it is possible to distinguish a common, universal type of culture, which was formed on the basis of the needs of people priority at one time or another and united all other types of cultures. To date, four types of universal culture have been identified:

- Mythological-is the very first universal culture. It was inherent in «natural» people, for whom the explanation of all observed phenomena, processes, events were some «hidden» forces inherent in all objects of the surrounding world. Without sufficient scientific knowledge, the peoples of that time resorted to fictions and fantasies-myths;
- Cosmological-began with therenaissance epoch, when the dictatorship of the church was broken. The basis of this culture was the opinion that all phenomena are the action of the forces of nature in accordance with their inherent regularities. In addition to nature, they used the concept of «cosmos» – the world, the universe, something unified, connected whole. Thus, people lived in the natural world, obeyed it and could not change it. This type is a continuation of the mythological culture, with one difference – a higher awareness. Peopleinteractedandcollaboratedwithnature;
- Anthropological-characteristic of a developed natural civilization. A time of discoveries and inventions in many fields of science and technology. Attention to the study of human physiology and psyche has increased;

Technological-originated during the anthropological culture. It is characterized by active human intervention in the natural course of processes (space exploration, genetic engineering, etc.), while supported by technical means. A

person becomes the «king of nature» and has a consumer attitude to the world and natural resources.

Thus, technological culture represents a high level of development of transformative human activity, based on a combination of achievements in material and spiritual production. This activity requires knowledge, skills and creative abilities of a person. Technological culture makes it possible to improve the human environment. As you can see, it is an important indicator of the level of development of society and production.

In order to improve this indicator, it is necessary to pay attention to technological education and preparing students for transformative activities. Already during school education, it is necessary to provide children with technological knowledge, to form certain skills and abilities, to bring up the necessary personal qualities, such as: the desire to constantly improve existing skills, to carry out continuous self-education, entrepreneurship. This is especially important in our time, because production technologies are changing very quickly.

It has been repeatedly noted that today there is an acute problem of a shortage of qualified workers, for example, welders, engineers, and vice versa, too many economists or, for example, lawyers. The logical question is: «Can this trend be stopped in any way?». The answer is «yes». It is necessary to make changes in the technological training of young people.

First of all, I would like to note that modern school curricula do not allow students to fully form a technological worldview because of the fragmentation of school subjects. The learning process, in principle, is passive, because there is only the delivery of the material, without the necessary amount of practice. This leads to the fact that the knowledge will later be shallow, formal, and students will not have the skill to independently search for the necessary information. In order to fix this, we should introduce creative, active learning methods, such as project activities and learning experiments. And also we should change the role of the teacher: he should no longer be the main source of knowledge. The teacher should become an organizer of the student's activities, a mentor who will guide them.

The second thing that should be reviewed in the education system is the number of hours and the quality of teaching such a subject as «technology». Why is this so important:

- Now the number of hours to study the technology is rapidly decreasing. In accordance with the Approximate basic educational program of 2015, 1 hour per week is allocated for the discipline «Technology» from the 1st to the 4th grade, 2 hours per week in grades 5-7 and 1 hour per week in the 8th grade in the stages of basic general education in 2020-2021 [4]. Ingrades 9-11, thissubjectisnotstudiedatall;
- The number of future technology teachers is decreasing in pedagogical universities;
- There are no proper positive images of workers, teachers, engineers, and scientists in the mass media. This causes some neglect of these professions and an outflow of potential specialists to other areas;

• Weak equipment of technological training classes or lack of it at all. Students do not have the opportunity to work with their hands with special materials and tools. The entire educational process is often implemented only by providing theoretical material.

Since the lack of technological knowledge and skills does not allow young people to develop entrepreneurial qualities, be able to design objects of labor, carry out project activities, plan their activities, carry out work using the necessary tools and equipment, it should not be underestimate and even more weshould not lose such an important area of knowledge, because this can lead to a decrease in the availability of qualified employees in the country, and also to the emigration of young specialists.

What other actions can help prevent a possible negative outcome? It is necessary to develop or open new modern educational and production complexes, to provide high school students with high-quality initial professional labor training, followed by the issuance of certificates of mastering the specialty. At the same time, allocating school hours for visiting these institutions. It is also a good option to organize interaction between educational institutions and production companies in order to get acquainted with the real process of work and possible work practice under the supervision of specialists.

These problems and ways to solve them are of great national importance and require their careful consideration, because a positive outcome in solving this issue will contribute to improving the quality and efficiency of technological education, and to increasing the number of highly skilled workers, the great demand for which our society is experiencing.

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The future of human development in terms of technology-augmentation

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Abstract. *This article will consider one of the variations in the development of mankind through scientific advances in biomechanics, etc. The history of the appearance of implants and what these achievements threaten us in the social sphere of the future society.*
Keywords: *augmentation, development, implants.*

Будущее человеческого развития в плане технологий-аугментаций

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Аннотация. *В этой статье будет рассмотрена одна из вариаций развития человечества посредством научных достижений в биомеханике и др. История появления имплантов и то, чем нам грозят эти достижения в социальной сфере будущего общества.*
Ключевые слова: *аугментация, развитие, импланты.*

The future of mankind is one of the most frequently used plot bases in mass media and we can make up several variations in the development of mankind, but they are united by the fact that they will all go through a stage of technological development, and this is difficult to deny. Unfortunately for me, I like stories that are tragic in some way, and that's why I don't see a happy ending for us. But now not about this. I want to discuss with you exactly the era when the technological capabilities of people will reach the stage when we will cease to consider fiction as it. Namely: artificial intelligence, flying equipment, cyborgs

and much more that we now consider fiction. And now I'm excited about the idea of how we can treat ourselves and improve with science.

The human body is not perfect. All people living on planet earth are aware of this. Heart defects, genetic errors, missing limbs, all these are only a small part of the shortcomings of the human race. To combat the shortcomings described earlier, there are different types of Sciences. But I want to understand only one of them, and it is augmentation of limbs or in simple language-implantation of cybernetic limbs or bionics.

First, let's understand what implantation is. Implantation is a Surgical operation of implanting biological or artificial tissues, organs and the like into the human or animal body. But still, is it real that the human body could interact with non-living, artificial organics? And I want to talk about it with you.

Replacing any organs with artificial organs has been used for a long time, and their idea and then before. The first implants were teeth, but more interesting was-prosthetic hands, made of steel, dates back to the XVI century. It has dual fingers and thumb that can take certain positions. Control was carried out with the help of a button on the back of the palm. This device is one of the three prostheses of the knight Götz von Berlichingen[1]. The device made it possible to pick up objects and perhaps even write with a pen.

Do we also have any innovations in our 21st century? Of course there is, because as it is possible to connect the human body with a bionic limb so that it does not need a separate control from the person himself, this problem is trying to solve in the 21st century[2]. The first thing that scientists have tried to do is by means of interaction with the brain («catching» brain activity associated with this, missing limb) to make the artificial limb move[3]. This was paid off, but the effectiveness was not at such a high level, so to replace this idea it was conceived to use the remaining nervous and muscular system as the main conductor between the brain and the prosthesis. It works like this: the prosthesis is connected by special conductors to the nerve endings of the limb and through them interact with the brain, having full direct access to the brain, the limb works without problems. But there are several problems that are likely to be solved in the future for example:

Due to the fact that the mechanism is not so similar in structure to a real limb, it does not work as efficiently and quickly. A solution to this is already being developed. These are artificial muscles that are several times stronger than real ones. With the help of smart alloys, heat-restoring or electro-active polymers.

There is one more problem it is the problem of equipping the prosthesis problem with energy.

Also it is rejection by the body of those «conductors» allowing to interact with the brain.

These are the problems to be solved in the future. Just imagine people who do not have any part of the body will be able to return it and at the same time if the conductor really will work steadily, it will be possible to create artificial nerves, and then they will be able to feel these limbs all that and ordinary.

But here, too, there are new problems that have been described in many books, movies and games related to the future, namely:

1) The problem of human envy, after all if these limbs will so more effectively ordinary, then not will whether they replace their on artificial simply so?

2) The problem of human morality is "mechanization of the soul" it is how much a person will consider and associate themselves with a person. Will not change whether he is in the car?

3) Will criminals be able to hack body parts and control them from outside?

And I can not give the right answer all these questions. In order to give the right answer you need to be not just an analyst, but also someone big.

What are some examples of what I'm talking about? I will now answer this question. In fact, there are many examples and all do not remember. But I will try to give examples that I remember. The first I want to mention a computer game called «Deus Ex». This game tells us the story of Adam Jenkis, but his main story is not so important, we are more interested in the world in which he lives. Look, in his world, after a certain "epidemic", there is a subspecies of racism, but in relation to people with cybernetic prostheses. In a nutshell, limb systems have been hacked and forced by cybernetic humans to attack ordinary ones. You ask me, «why are you saying all this?», and I answer that in this game highlights those, some problems about which I spoke previously, namely: the problem envy (because people began to to change limbs from-for moreover that they more effective and show status rights) and the problem crime (because people have been able able to crack and to control).

The second example can be lead, describing the plot series full-length anime and now already and movie «the Specter of in armor». But I won't do that anymore. Just describe the problem that occurs there. In this anime the main problem is that the worst of all possible problems, and this cibernetice soul.

Little can be said about the future with certainty, we can only guess about what awaits us, I want to see a world where people will surpass their weaknesses, both physical and spiritual, and augmentation is one of the ways to this future, because we are not perfect ...

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Natural language processing technologies

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Abstract*. The article deals with the issues of natural language processing. The classification of dialog models when using natural language as a means of communication is given. The conclusion is made about the ways of development of processing technologies.*
Keywords: *data processing, natural language, machine learning, artificial intelligence.*

Технологии обработки естественного языка

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Аннотация*. В статье рассматриваются вопросы обработки естественного языка. Приведена классификация диалоговых моделей при использовании естественного языка как средства коммуникации. Делается вывод о путях развития технологий обработки.*
Ключевые слова: *обработка данных, естественный язык, машинное обучение, искусственный интеллект.*

Introduction. To begin with, the possibilities of the human brain are limitless. Such thing as eyes, tongue, ears allow process information, which coming from the outside at a speed less than a second. If for some reason this is not the case, then a person may improve these skills throughout their life and not even realize it. It all starts in early childhood. At 3-5 months, children distinguish between speech and sounds from toys, musical instruments. After 6 months, they can already differentiate sounds themselves by their timbre and tonality. By his first birthday, the child begins to distinguish many words from the speech of adults, understanding their meaning. By the age of two, the child can name the objects depicted in the pictures shown to him. At the same time, his training includes the study of images with objects, but also picture with plots. It significantly accelerates the formation of cause-and-effect relationships and expands the vocabulary used, which by the 3rd year expands to 1,500 words. Writing skills begin to form closer to the 5th-6th year.

Unfortunately, when creating artificial systems like humans for recognizing written and spoken speech, most often there are no 6 years for training. Therefore, the developed technologies look functionally developed but, need to be supplemented and improved. However, both the human and the «machine» try solving the same unifying problem – Natural language processing – the field at the intersection of computer science, artificial intelligence, and linguistics. The goal is to process and «understand» natural language to translate text and answer questions (for example, in dialog and expert systems).

Problem description. Any computer system from the moment of its creation is designed mainly for processing numerical values, which are a human-readable representation of the signals transmitted at the physical level. Therefore, when we talk about the processing of natural language (written, spoken) the following features should be taken:

– Natural language is a specially designed system for transmitting the meaning of what is said or written. This is not just an exogenous signal of conscious transmission of information. In addition, the language is encoded so that even small children can quickly learn it.

– Natural language is a discrete, symbolic, or categorical signal system that has reliability.

– Language symbols are encoded as signals for communication through several channels: sound, gestures, writing, images, and so on. At the same time, the language can be expressed in any way.

The first try to create a conversational agent (chatbot) more than half a century ago. MIT professor Joseph Weizenbaum created the computer program ELIZA, which was a virtual conversationalist with a dialog interface and imitate the conversation of a psychotherapist at the first meeting. In addition, it is considered one of the first programs that attempted to pass the Turing test.

The demand for dialog agents is justified by the fact that they allow keep a natural way for any person to interact with a device or computer program: there is no need-to-know Python, Java, etc. You can speak or write by natural way, and the program fetch from it the necessary information or performs the task. But often the user wants to conduct not only a meaningful dialogue or perform a specific task (launch a favorite song, weather forecast). Person tasks often go beyond the set scenarios. Modern developments involve the creation of several separate systems, to which the virtual assistant used (Alice, Siri, Google Assistant) is accessed when processing a question asked by the user. In addition, virtual assistants to carry an informal conversation.

Solution description. Human-computer interaction imitate structure of the classical dialog and the role models of interaction of agents within it. An agent who has the motivation to continue the communication act can take the initiative. A dialog system assumes the function of managing interaction is built on a linear (simple) or tree-like (multitasking) script, prescribed with the help of formal rules. The motivation of the system to build a dialogue in this case is based on the presence of a goal-oriented algorithm. Taking the initiative to conduct a dialogue, the system consistently receives from the user the information for it to perform with embedded functionality in it. In this case, the analysis of the user's phrases is more accurate, but the dialogues may seem long, unnatural, and even unfriendly.

There are two main strategies dialogic models [2]: a communication act can be considered as a process focused on the implementation of the partners intentions and the achievement of the goal; on the other hand, as a process of information exchange between participants. There are two ways to model a dialog:

– Use of dialog grammar. In this case, the interaction is based on the hypothesis the dialogue has the form of consecutive expressions of the form: «Greeting» – «Greeting», «Question» – «Answer», «Offer» – «Rejection». In this case, to analyze a speech, it is sufficient to use the types of said phrase like pattern. If we find presence of keywords like Where, What, What, means we work with Questions.

– Intent-based methods. This approach considers the context of the communication act, the potential for changing the agent in the process of dialogue. Each of the participants is obliged to understand their partners, for example, by clarifying the information. That is, the bot asks us to lead questions, determining our goal.

Algorithms and implementation. The idea of question-answering systems is to extract information directly from a document, conversation, online search, or any other place that meets the user's needs. Instead of forcing the user to read the full text, QA systems prefer to give short and concise answers. Today, QA systems are easily combined with chatbots, go beyond the search for text documents and extract information from a set of images. A powerful deep learning architecture, the Dynamic Memory Network, has been created and optimized specifically for QA tasks. Trained on a training set of input data and questions, DNM generates episodic memories and uses them to generate suitable responses. DNM consist of [1]:

– Input Module: The input module encodes raw text inputs from the task into distributed vector representations.

– Question Module: Like the input module, the question module encodes the question of the task into a distributed vector representation.

– Episodic Memory Module: Given a collection of input representations, the episodic memory module chooses which parts of the inputs to focus on through the attention mechanism. Each iteration provides the module with newly relevant information about the input.

– Answer Module: The answer module generates an answer from the final memory vector of the memory module.

The next algorithm natural language processing is the extraction of short content (Text Summarization) [5]. An example of using such algorithms is Push-notifications and article digests. The algorithm for such summarization is assumed to be as follows:

– Count the frequency of occurrence of a word in a full text document.

– Select the N most frequent words.

– Found words are saved and sorted.

– Each sentence is matched with a hash that reflects the value of the sentence in terms of the frequency of words mentioned.

– The first X sentences are sorted according to the position in the original text.

There are two fundamental approaches to text reduction: extractive and abstract. The first one extracts words and phrases from the original text to create

a resume. The latter studies the internal language representation to create a human-like presentation, paraphrasing the original text. Methods based on the selection of a subset. This is achieved by extracting phrases or sentences from the article to form a summary. LexRank and TextRank are well-known representatives of this approach, which use variations of the Google PageRank page sorting algorithm. The second method uses deep learning, an example of which is the Tensor Flow technology from Google [4], the mechanism of which allows you to study the text of the article, highlight keywords, thereby focusing on the facts.

The most modern representative of natural language processing technologies is GPT-3 (Generative Pretrained Transformer 3) is an autoregressive language model that uses deep learning to produce human-like text. It is the third-generation language prediction model in the GPT-n series (and the successor to GPT-2) created by Open AI [3], san Francisco-based artificial intelligence research laboratory. As of September 2020, this is the largest and most advanced language model in the world. The model, according to the developers, can be used to solve «any tasks in English». The quality of the text generated by GPT-3 is so high that it is difficult to distinguish from that written by a human, which has both benefits and risks.GPT-3 is used in chatbots to create texts-stories, poems, instructions, texts of advertising messages, scripts, blog ideas, etc.

Conclusion. Despite the huge stack of technologies that allows to solve a variety of tasks in NLP contact with users remains an urgent and popular task. First, because machine is more difficult to train due to the presence in it of an unambiguous logic of established connections, while the human brain, which is formed all life, does not have such logic. Second, there are algorithms that can generate text that is indistinguishable from a written person, and modern virtual assistants have become so much a part of our lives that we do not think about saying «Ok, Google!» ust in our daily speech. But if you think about it, architecturally, all possible solutions are built the same way and structurally still represent a «Question» – «Answer». And the development involves only improving this approach, which is only able to determine more quickly what exactly the user wants to know.

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The influence of the Saxons on the English language

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Abstract. *The article follows the historic events leading to the establishment of Old English and Saxons' influence over it. It also describes the actions taken by king Alfred the Great of Wessex to consolidate the Saxon dialect as the domineering one in formation of the English language as the foundation of the English identity.*
Keywords*: heptarchy, saxons, renaissance, Danelaw, conquest.*

Влияние саксонцев на английский язык

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Аннотация. *В статье рассматриваются исторические события, приводящие к зарождению английского языка, и влияние саксонцев на него. Также описываются действия, принятые, в частности, Альфредом Великим, королем Уэссекса, приводящие к консолидации саксонского диалекта как доминирующего при формировании английского языка и зарождению английской национальной самобытности.*
Ключевые слова*: гептархия, саксонцы, ренессанс, Денло, завоевание.*

In the year of 407AD Constantine III mounted the rebellion against emperor Honorius and had initial successes by withdrawing Roman military from the Province of Britain. This move left the British Romans defenseless against the raids of Picts, Caledonians and Saxons. Citizens of the harassed land requested help from the empire but in 410 the Rescript of Honorius was issued which meant that the province was to be abandoned. The unrelenting attacks by the Germanic peoples known as the Saxons, Jutes and Angles slowly pushed the Britons back, eventually forcing most of them out of the modern-day England.

As the various kingdoms settled in the rule of the Heptarchy (meaning the rule of Seven due to there being seven major Anglo-Saxon kingdoms, but it should be remembered that there were many more) was established across Great Britain. The Jutes established the Kingdom of Kent, the Angles founded Northumbria, Mercia and East Anglia and the Saxons created Wessex, Sussex and Essex. Thus, the islands were split between the German invaders and the Britonic people.

As the decades passed by, new Anglo-Saxon dialects appeared establishing what is nowadays known as Old English. It was comprised of 4 main dialects, associated with particularAnglo-Saxon kingdoms: Mercian, Northumbrian, Kentish and West Saxon. Their alphabet represented a combination of the Latin letters and Nordic runes, which leaned more towards the former with the passing of time and continued Christianization of the British peoples.

By the year 835 the number of the original powerful kingdoms was reduced from 7 to 4, them being Wessex, Mercia, East Anglia and Northumbria. Then the power balance changed again in 878 when the Danes conquered most of those realms and established the Danelaw (the law of the Danes in Great Britain). After splitting the lands with the Vikings, Alfred the Great, king of Wessex, noted how the constant Viking raids on churches reduced the literacy level. He started inviting the most learned men across the kingdom to fix that issue and it resulted in TheAlfredian Renaissance.

Unlike The Carolingian Renaissance under emperor Charlemagne, Alfred was personally involved in the production of some of his literature. Much of this Renaissance was centered around language, specifically whether a person should use Latin or English. It was decided that most people should learn to read and write in English with only the clergy needing to study Latin.

Alfred was himself learning Latin during the period of peace with the Vikings and he used his newfound knowledge to translate some of works into English. He sums up his reasoning for translating some documents as such: «It seems better to me that we should turn into language that we could all understand some books which may be most necessary for all neb to know».

He was referencing religious works, which would teach good morals to his subjects. It is important to remember that many saw invasions by the Viking Invasions as the punishment by God for bad behavior and to Alfred reinvigorating learning was one way to counter this. One aspect of Anglo-Saxon culture which differentiates it from its continental European contemporaries is the prevalence of the Vernacular (local) language, that is, Old English and its use instead of Latin. Other kingdoms such as Frankia had their own local languages but things like law codes and treaties were always written in Latin whereas in Anglo-Saxon England a significant number were written in Old English. One such document was Alfred's Law Code produced some time in the latter half of his reign. Interestingly, he starts his law code demanding that all men keep the oaths they have made which may imply that it has been an issue.

The Alfredian Renaissance did not just copy old works but also saw the creation of new ones. The first ones were Asser's «The life of Alfred» and «The Anglo-Saxon Chronicle» which is essentially an annual list of major events. «The Anglo-Saxon Chronicle» was kept and updated for many years and the

version of the chronicle found in Medeshamstead (modern-day Peterborough) was updated well into the XII century. The Chronicle alongside Bede's «Historia Ecclesiastica» are by far the two most important sources for Anglo-Saxon England and without them very little would be known about the years between the Roman withdrawal and the Norman Conquest.

Through reforms and diplomacy by the time of Alfred's death in 899 Wessex turned from a Saxon's kingdom struggling to resist the Vikings to the Sole Anglo-Saxon power. It was on top of the foundations built by this king that the royal house of Wessex would go on to be the first royal house of England. Therefore, it was under the influence of the Saxon dialect that the Old English we know today took in many of its defining features:

- strong and weak verbs;
- a dual number for pronouns (for example, a form for*we two*as well as for*we*);
- two different declensions of adjectives;
- four declensions of nouns;
- a shift towards being more of a synthetic language;
- the four main grammaticalcases (Nominative, Accusative, Genitive and Dative);
- pronouns;
- a two-tensesystem (present and past);
- grammatical distinctions of gender.

Conclusion

Great Britain housed many different peoples across its Early Medieval Period; some left a greater mark than the others, but most of them pale in comparison to the Saxons who managed to resist the domineering force of the Danish military. In their crisis they saw an opportunity to rally others behind the Wessex banner to establish unity through religion, language and mutual disdain for the Viking invaders. And even though William the Conqueror would overtake England it was the migrating Germanic tribes that laid foundation to the lingua-franca of the modern world –the English language.

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La historia de los primeros dispositivos mecánicos de grabación de sonido y las primeras grabaciones de voz

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Anotación. *Este artículo examina la historia de las primeras grabaciones de la voz humana. Se da el principio de funcionamiento del fonógrafo, el predecesor del fonógrafo inventado por Edison. Se considera la relación entre el fonautógrafo y el sistema auditivo humano. También se consideran tecnologías para decodificar representaciones gráficas de grabaciones de sonido.*
Palabras clave: *fonautógrafo, primeras grabaciones de sonido, fonógrafo, fonautograma, sistema auditivo humano.*

История первых механических звукозаписывающих устройств и первых голосовых записей

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Аннотация. *В данной статье рассматривается история первых записей человеческого голоса. Приведен принцип работы фоноавтографа, предшественника фонографа, изобретенного Эдисоном. Рассматривается связь между фоноавтографом и слуховой системой человека. Также рассмотрены технологии расшифровки графических представлений звукозаписи.*
Ключевые слова: *фоноавтограф, первые звукозаписи, фонограф, фоноавтограмма, слуховая система человека.*

Desde la antigüedad, las personas han estado utilizando la comunicación verbal para transmitir información. La transferencia de información por el boca a boca está presente en todos los pueblos del mundo. Pero fue hace poco más de 150 años que aparecieron los primeros dispositivos de grabación y reproducción. Los dispositivos de grabación modernos realizan las mismas tareas que sus predecesores, pero son más avanzados y están en línea con los requisitos de la sociedad moderna.

Destaquemos cuatro funciones principales de los dispositivos modernos en el campo de la grabación y reproducción de sonido:

1. Grabación de sonido.
2. Procesamiento de sonido.
3. Generando sonido.
4. Reproducir sonido.

Durante más de 100 años, se creyó que Thomas Alva Edison fue la primera persona en grabar una voz humana. En 1877 inventó el fonógrafo, un dispositivo para grabar y reproducir sonido, que fue el resultado del trabajo en el teléfono y el telégrafo. El fonógrafo fue el primer dispositivo mecánico de grabación y reproducción de sonido. Bajo "grabación de sonido" nos referimos a la posibilidad de transferir vibraciones de sonido a un medio material, y bajo «reproducción», la posibilidad de convertir una vibración de sonido grabada en un medio material en vibraciones de aire (vibraciones de sonido), es decir, el proceso inverso. de grabación de sonido.

Las áreas de aplicación previstas del fonógrafo, según Edison, eran:

1. Reproducción de música.
2. «Libros parlantes» para ciegos.
3. Fines educativos, por ejemplo, la grabación de material de clase por parte del alumno.
4. Un dispositivo auxiliar conectado a un teléfono para transmitir información múltiple corta.
5. Caja de música y juguetes.
6. Preservación de idiomas con la transmisión de la parte fonética exacta del discurso.

Como podemos ver, todas estas áreas de aplicación son relevantes para nosotros ahora:

1. Reproducción de música (computadora, reproductores mp-3, teléfonos, etc.)
2. Audiolibros.
3. Dictáfonos para material de grabación.
4. Contestador automático.
5. Bloque musical en juguetes infantiles.
6. Plataformas para el aprendizaje de lenguas extranjeras con capacidad para escuchar el habla de un hablante nativo.

A pesar de la similitud, a diferencia de los dispositivos modernos, el fonógrafo realizaba solo las funciones de grabación y reproducción. Se utilizaron otros dispositivos para generar sonido: instrumentos musicales mecánicos como pianol y órganos mecánicos. El hombre no se propuso la tarea de procesar el sonido en el siglo XIX.

Las desventajas del fonógrafo eran: mala calidad de grabación, suficiente para una pequeña cantidad de reproducciones y un tiempo de grabación corto (el tiempo máximo de reproducción después de varias mejoras del dispositivo fue de 4 minutos). Con el tiempo, estos problemas se han solucionado gracias a los dispositivos de registro electromecánicos y eléctricos.

A pesar de las deficiencias, el fonógrafo causó sensación en su época y conservó la música para nosotros, las voces de la gente del siglo XIX. Pero no fue el primer dispositivo en grabar sonido.

En 2008, dos miembros del grupo de iniciativa First Sounds, cuyo objetivo es preservar y poner a disposición del público las primeras grabaciones de sonido, descubrieron y digitalizaron la grabación de sonido más antigua que se conserva, que data de 1860. En él, Edouard-Leon Scott de Martinville, un inventor francés, grabó la canción «Au clair de la lune» con la ayuda de su invento, el fonautógrafo.

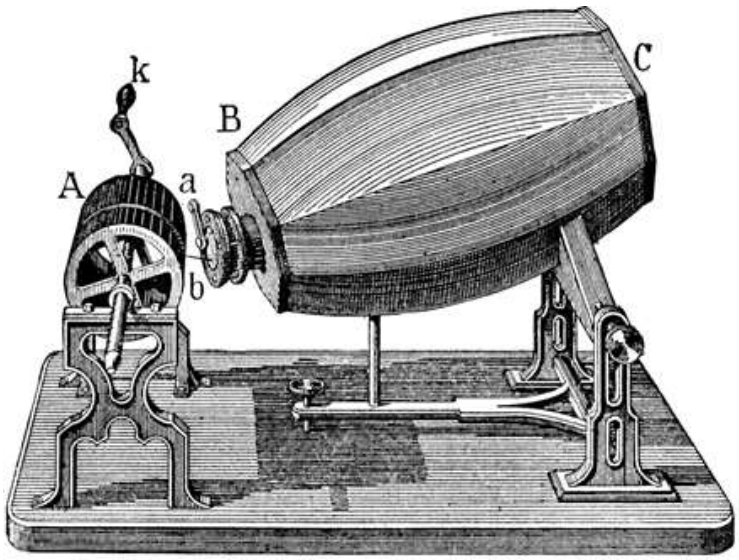

Figura 1. Dispositivo fonoautógrafo.
C - cono acústico, B - membrana, b - aguja, a - humo o papel,
A - cilindro de vidrio, k - mango.

¿Cómo funcionó el fonoautógrafo? El sonido pasaba a través de un cono acústico, que servía como un "receptor" de vibraciones sonoras, una aguja o cepillo hecho de cerdas duras conectadas a una membrana vibratoria tocaba la superficie de un cilindro de vidrio girado a mano cubierto con papel u hollín. Las vibraciones sonoras al pasar por el cono hacían vibrar la membrana, transmitir vibraciones a la aguja, que dibujaba en el hollín las marcas correspondientes a estas vibraciones.

Durante siglos, la gente ha estado observando la naturaleza y obteniendo inspiración para sus inventos: el prototipo del avión era el pájaro, el prototipo de la cámara era la retina del ojo. El oído humano fue la inspiración para de Martinville.

Nuestro sistema auditivo se compone de la parte periférica y las partes superiores del sistema auditivo. La parte periférica es un sistema acústico que recibe, convierte (amplifica) una señal de sonido, la localiza y enfoca, consta de: el oído externo, el oído medio y el interno.

El oído externo está formado por el pabellón auricular, el conducto auditivo y el tímpano. En un fonoautógrafo, el «oído externo» que capta el sonido son el cono y la membrana acústicos.

El oído medio es una cavidad llena de aire, conectada a la nasofaringe por una trompa de Eustaquio para igualar la presión atmosférica, así como un martillo, un estribo y un yunque. El oído medio realiza las funciones de protección contra sonidos fuertes, amplificación, coordinación de impulsos del ambiente aéreo con el ambiente fluido de la cóclea, en el que se encuentra el órgano de Corti, que transmite impulsos nerviosos al cerebro. Así, la aguja en el fonoautógrafo es un sistema de estribo, martillo e yunque en el oído medio y el órgano de Corti en el oído interno, papel y un cilindro de vidrio son nuestro cerebro humano.

Así, su comprensión inicial del funcionamiento del sistema auditivo humano le permitió a de Martinville desarrollar su modelo mecánico capaz de grabar sonido.

El cerebro recibe información del sistema auditivo periférico a través de la indicación de ubicación (análisis de frecuencia) y la información de la forma de onda del sonido (análisis temporal). La forma visual de la onda sonora fue representada por de Martinville en fonoautogramas.

Dado que el cilindro se giraba a mano y se podía girar a diferentes velocidades, de Martinville realizó decenas de grabaciones de poesía, fragmentos de canciones, representaciones teatrales en diferentes idiomas y a diferentes velocidades. Y precisamente por esto, surgieron problemas con la decodificación de fonoautogramas en el dominio del tiempo.

El dispositivo solo mostraba vibraciones de sonido, pero no sugería una forma de reproducirlas, como el fonógrafo de Edison, que tiene transformaciones inversas para la reproducción. De hecho, Scott ni siquiera intentó reproducir sus cintas. Su intención era mostrar el sonido, soñaba que la caligrafía, escrita en negro carbón, algún día la gente leería con tanta facilidad como las letras que habíamos inventado.

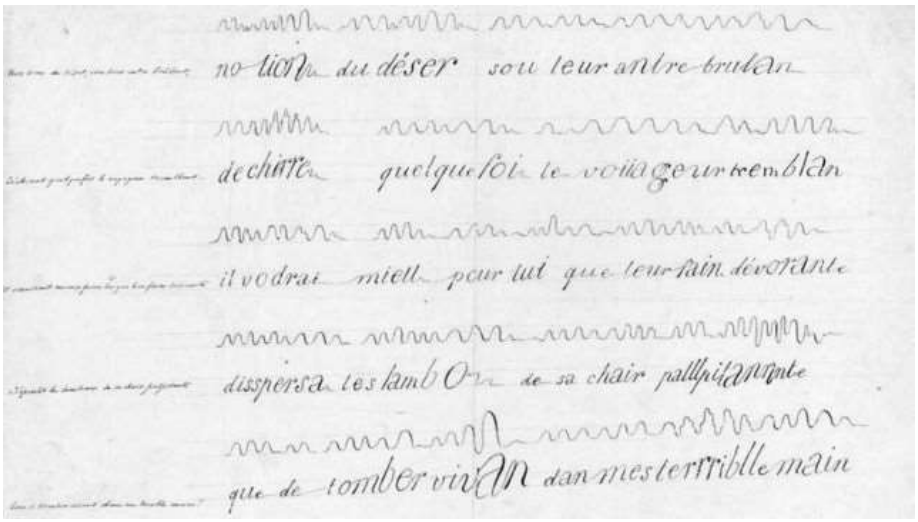

Figura 2. Interpretación de De Martinville de bandas sonoras realizadas con fonautógrafo.

Aunque el fonógrafo de Martinville no encontró una aplicación tan práctica como el fonógrafo de Edison, ya que solo tenía una función de grabación, todavía se considera el primer dispositivo de grabación de sonido, que luego sirvió como prototipo del gramófono. Martinville también recibió apoyo financiero para mejorar su invención, patentada en 1857, de la asociación de expertos SEIN (Société d'encouragement pour l'industrie nationale) y colaboró con Rudolf Koenig para comercializar el fonoautógrafo.

Al decodificar la grabación de sonido encontrada, el principal problema fue la transformación de la imagen en sonido. Después de encontrar la grabación bien conservada, Giovannoni viajó extensamente por todo el mundo para digitalizar la imagen de alta resolución. Earl Cornell convirtió las imágenes de Giovannoni en sonido utilizando un software desarrollado en el Laboratorio Nacional Lawrence Berkeley y modificado para esta aplicación. Giovannoni recopiló los archivos de audio y trabajó con Richard Martin para procesar la señal, mientras que Patrick Feester ajustó manualmente la señal en el dominio del tiempo.

En el proceso de trabajo, surgió un problema: los fonoautogramas no cumplían con los requisitos de reproducción modernos. La aguja de escribir manchó tinta en algunos lugares, no llegó al papel o viceversa, dejó rastros en varios lugares; todo esto fue el resultado de distorsiones en el dominio del tiempo de la señal, creó ruido y no permitió escuchar la grabación.

El problema fue resuelto por Patrick Feaster, quien desarrolló un enfoque que transforma gráficamente la pista en una señal de diferentes anchos que se puede leer como una banda sonora de película óptica. Este enfoque no puede solucionar problemas graves de reproducción, pero ha demostrado ser lo suficientemente confiable como para permitirnos escuchar algo de los fonoautogramas. Así se obtuvo la primera versión de «Au clair de la lune», en la que se escuchó la voz de la niña. Probablemente la hija de De Martinville.

Pero los métodos de procesamiento han mejorado. Se ha desarrollado un análisis de señales en el dominio del tiempo mejorado. Al mismo tiempo se descifraron tanto el fonoautograma como la grabación de un diapasón vibrando a frecuencia constante, grabada por Martinville como referencia para facilitar la decodificación de las grabaciones. El diapasón de Scott anticipó el tono experimental del siglo XX y las soluciones de código de tiempo para la estabilización de la señal. Esto hizo posible averiguar la velocidad a la que debería reproducirse la señal y garantizar su estabilidad durante la reproducción.

Después de analizar «Au clair de la lune» utilizando un método mejorado, los investigadores concluyeron que antes de que hubieran reproducido la grabación demasiado rápido, la versión actualizada de la grabación sonaba en la voz del propio de Martinville.

Así, gracias a una iniciativa de grupo de investigadores en 2008, el mundo reescribió dos veces la historia de quién fue el primero en grabar la voz humana. La formulación del problema del procesamiento del sonido por parte de una persona permitió descifrar el primer tipo de grabación de sonido: analógico-

mecánico. Actualmente, se están mejorando los métodos de procesamiento, se está mejorando el software para resolver problemas relacionados con la reproducción de fonoautogramas, las capacidades musicales por computadora están llevando la industria del audio, el proceso de creación de sistemas para grabar, transmitir y reproducir sonido a un nuevo nivel. Pero el juez final del proceso fue y sigue siendo el sistema auditivo humano, cuyos principios de reconocimiento de la imagen auditiva no se han estudiado completamente, lo que lo hace prometedor para una mayor consideración del campo de la acústica.

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Global Warming - Peace or Terrible Reality...

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Abstract. *The article tells about the problem of modern ecology - global warming, since ancient times. Examples of theories about the causes of this phenomenon are given, and the main danger – the greenhouse effect, which is created by a person himself, regardless of natural phenomena – is discussed. The factors that increase the concentration of greenhouse gases in the atmosphere and the ways of combating global warming are considered.*
Keywords: *global warming, ecological disaster, greenhouse effect, atmospheric temperature.*

Глобальное потепление – мир или ужасная реальность…

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Аннотация. *В статье рассказывается о проблеме современной экологии – глобальном потеплении, начиная с давних времен. Приводятся примеры теорий о причинах данного явления, а также говорится о главной опасности – парниковом эффекте, который создает сам человек, независимо от природных явлений. Рассмотрены факторы, увеличивающие концентрацию парниковых газов в атмосфере, и направления борьбы с глобальным потеплением.*
Ключевые слова: *глобальное потепление, экологическая катастрофа, парниковый эффект, температура атмосферы.*

Global warming is the process of a gradual increase in the average annual temperature of the surface layer of the Earth's atmosphere and the World Ocean.

Paleontological research suggests that the Earth's climate was not constant. Warm periods were followed by cold glacial periods. In warm periods, the average annual temperature of the Arctic latitudes rose to 7-13°C, and the January temperature was 4-6 degrees, i.e. climatic conditions in our Arctic differed little from the climate of modern Crimea. Warm periods were replaced by cold snaps, during which ice reached modern tropical latitudes.

Historical chronicles indicate that in the 11-13th centuries, a large area of Greenland was not covered with ice (which is why Norwegian sailors dubbed it «green land»). Then the Earth's climate became harsher, and Greenland was almost completely covered with ice. In the 15-17 centuries, severe winters

reached their climax. A slight warming was noted in the 18th century, which peaked in 1770. The 19th century was again marked by another cold snap, which lasted until 1900, and from the beginning of the 20th century, a rather rapid warming had already begun. By 1940, the amount of ice in the Greenland Sea had halved, and in the Barents Sea by a third. A significant increase in the temperature of the Arctic seas was recorded, and a significant retreat of glaciers in the Alps and the Caucasus was noted [5].

Since 1979, a rapid rise in the temperature of the surface layer of the Earth's atmosphere began, which caused another acceleration in the melting of ice in the Arctic and Antarctic and an increase in winter temperatures in temperate latitudes. The habitat of many living organisms has shifted northward following rising average winter temperatures.

In general, over the past hundred years, the average temperature of the surface layer of the atmosphere has increased by 0.3–0.8 ° C, the area of snow cover in the northern hemisphere has decreased by 8%, and the level of the World Ocean has risen by an average of 10 centimeters.

In recent years, an abnormal heat wave was recorded in Russia in 2010. In terms of its range, duration and severity of heat effects, the heat had no analogues in more than a century of weather observation history. The head of Roshydromet, Alexander Vasilyevich Frolov, said that there had not been such a hot summer in Russia since the time of Rurik, that is, over the past more than 1000 years [8].

But, if you remember June and July 2017 in Moscow (≈ 15 ° C), which were the coldest between 1999 and 2017, then any hint of global warming sounds like a mockery.

What's going on with the climate? Alexei Kokorin, head of the Climate and Energy Program of the World Wildlife Fund (WWF) in Russia, believes that not only Russia, but the entire planet is unambiguously warming. «In all oceans of the planet, the upper layer of water is gradually warming up to a depth of 700 - 1000 meters. And the ocean is one of the main elements of the climate system. The atmosphere, in contrast to the ocean, is very mobile and changeable. But there is also a climate change in it» [9].

Until now, scientists cannot say with 100% certainty what is causing climate change. Many theories and assumptions have been put forward as the causes of global warming.

Theory number 1. Change in solar activity. All ongoing climatic processes on the planet depend on the activity of the Sun. Therefore, even the smallest changes in the activity of the Sun affect the weather and climate of the Earth. There are 11-year, 22-year, and 80-90-year (Gleisberg) cycles of solar activity. It is likely that the increase in solar activity in the future may decline again.

Theory number 2. Changing the angle of the Earth's axis of rotation and its orbit. The Yugoslav astronomer Milutin Milankovich suggested that cyclical climate changes are largely associated with a change in the Earth's orbit around the Sun, as well as a change in the angle of inclination of the Earth's axis of rotation in relation to the Sun. Such orbital changes in the position and motion of the planet cause a change in the radiation balance of the Earth, and hence its

climate. Guided by his theory, Milankovich quite accurately calculated the times and extent of ice ages in the past of our planet. Climatic changes caused by changes in the Earth's orbit usually occur over tens or even hundreds of thousands of years. The relatively rapid climate change that is observed at the present time seems to be due to the action of some other factors.

Theory number 3. The culprit of global climate change is the ocean. The oceans largely determine the direction and speed of movement of warm oceanic and air masses on Earth, which greatly affect the planet's climate. At the moment, the nature of heat circulation in the ocean water column has been little studied. It is known that the average temperature of ocean waters is 3.5 ° C, and the land surface is 15 ° C, therefore, the intensity of heat exchange between the ocean and the surface layer of the atmosphere can lead to significant climatic changes. In addition, a large amount of CO2 (about 140 trillion tons, which is 60 times more than in the atmosphere) and a number of other greenhouse gases are dissolved in the waters of the ocean. These gases can enter the atmosphere, affecting the Earth's climate.

Theory number 4. Volcanic activity. It is a source of sulfuric acid aerosols and a large amount of carbon dioxide entering the atmosphere, which can also significantly affect the Earth's climate. Large eruptions are initially accompanied by a cooling due to the entry of sulfuric acid aerosols and soot particles into the Earth's atmosphere. CO2 (carbon dioxide) released during the eruption causes the average annual temperature on Earth to rise. A long-term decrease in volcanic activity contributes to an increase in the transparency of the atmosphere, and hence an increase in temperature on the planet.

Theory number 5. Unknown interactions between the Sun and the planets of the solar system. The relative position of the planets and the Sun can affect the distribution and strength of gravitational fields, solar energy, and other types of energy. All interactions between the Sun, planets and the Earth have not yet been studied and it is possible that they have a significant impact on the processes occurring in the atmosphere and hydrosphere of the Earth.

Theory number 6. Human activities. The high rate of climatic changes can be explained by anthropogenic factors, which have a noticeable effect on the chemical composition of the atmosphere of our planet towards an increase in the content of greenhouse gases in it. Indeed, the increase in the average air temperature of the lower layers of the Earth's atmosphere by 0.8 ° C over the past 100 years is too high a rate for natural processes. Earlier in the history of the Earth, such changes took place over the course of millennia. The last decades have added even more weight to this argument, since changes in the average air temperature have occurred at an even greater pace - 0.3-0.4 ° C over the past 15 years [2].

The greenhouse effect is an increase in the average annual temperature of the surface layer of the atmosphere of the Earth and the World Ocean due to an increase in the concentration of greenhouse gases (carbon dioxide, methane, water vapor) in the atmosphere. These gases play the role of a greenhouse film, they freely let the sun's rays to the Earth's surface and trap the heat that leaves the planet's atmosphere.

The greenhouse effect is caused by the fact that the flux of energy in the infrared range of the spectrum, rising from the Earth's surface, is absorbed by the molecules of gases in the atmosphere, and is radiated back in different directions. As a result, half of the energy absorbed by the greenhouse gas molecules returns back to the Earth's surface, causing it to warm up. It should be noted that the greenhouse effect is a natural atmospheric phenomenon. If there were no greenhouse effect on Earth at all, then the average temperature on the planet would be about -18 ° C. The implication lies in the fact that human activity over the past few decades has led to a significant increase in the concentration of greenhouse gases, and, consequently, to an increase in climate temperature.

The number one greenhouse gas is water vapor, and its contribution to the greenhouse effect is 20.6 ° C. CO2 is in second place, its contribution is about 7.2 ° C. The increase in the content of carbon dioxide in the atmosphere is of greatest concern, as the active use of hydrocarbons by humans will continue in the future. Over the past two and a half centuries, the content of CO2 in the atmosphere has already increased by about 30%. Ozone is in third place, its contribution to warming is 2.4 ° C. Unlike other greenhouse gases, human activities, on the contrary, cause a decrease in the ozone content in the Earth's atmosphere. This is followed by nitrous oxide, its contribution to the greenhouse effect is 1.4 ° C. A large amount of nitrous oxide enters the Earth's atmosphere as a result of the incineration of various wastes. Methane, its contribution to the total greenhouse effect is 0.8 ° C. The growth of methane in two and a half centuries was 150%. The main sources of methane in the Earth's atmosphere are decaying waste, cattle, and the decay of natural compounds containing methane. Of particular concern is the fact that methane's ability to absorb infrared radiation per unit mass is 21 times higher than that of carbon dioxide. [4]

The greatest role in global warming is assigned to water vapor and carbon dioxide. They account for more than 95% of the total greenhouse effect. Anthropogenic activity has the greatest impact on the growth in the concentration of carbon dioxide in the Earth's atmosphere, and the content of water vapor in the atmosphere grows following the temperature on the planet, due to an increase in volatility. The total technogenic emission of CO2 into the Earth's atmosphere is 1.8 billion tons / year. The total amount of carbon dioxide that binds the vegetation of the Earth, as a result of photosynthesis, is 43 billion tons / year, but almost all of this amount of carbon as a result of plant respiration, fires, and decomposition processes again ends up in the planet's atmosphere. Only 45 million tons / year of carbon is deposited (accumulated) in plant tissues, land marshes and the depths of the ocean. [3] These figures indicate that human activities can be a tangible force affecting the Earth's climate.

A greenhouse catastrophe is the most «unpleasant» scenario for the development of global warming processes. The author of the theory is the Russian scientist Aleksey Valerievich Karnaukhov.

Its essence is as follows. An increase in the average annual temperature on the Earth, due to an increase in the content of anthropogenic CO2 in the Earth's atmosphere, will cause the transfer of CO2 dissolved in the ocean into the atmosphere, as well as provoke the decomposition of sedimentary carbonate

rocks with additional release of carbon dioxide, which, in turn, will raise the temperature on Earth even higher. This will entail further decomposition of carbonates lying in deeper layers of the earth's crust. Glaciers will melt intensively. Such a rapid rise in temperature will contribute to the intense influx of methane from the melting permafrost, and an increase in temperature to 1.4–5.8 ° C by the end of the century will contribute to the decomposition of methane hydrates (icy compounds of water and methane), concentrated mainly in the cold places of the Earth. If you consider that methane is 21 times more potent greenhouse gas than CO2, then the rise in temperature on Earth will be catastrophic. To imagine what will happen to the Earth, it is best to pay attention to our neighbor in the solar system - the planet Venus. With the same parameters of the atmosphere as on Earth, the temperature on Venus should be higher than Earth's by only 60 ° C (Venus is closer than Earth to the Sun), i.e. be around 75 ° C, in reality the temperature on Venus is almost 500 ° C. At present, the atmosphere of Venus is 98% CO2, which leads to an increase in the planet's temperature by almost 400 ° C. If global warming follows the same scenario as on Venus, then the temperature of the surface layers of the atmosphere on Earth can reach 150 degrees. An increase in the Earth's temperature even by 50 ° C will put an end to human civilization, and an increase in temperature by 150 ° C will cause the death of almost all living organisms on the planet.

According to Karnaukhov's optimal scenario, if the amount of CO2 entering the atmosphere remains at the same level, then the temperature of 50 ° C on Earth will be established in 300 years, and 150 ° C in 6000 years. According to a realistic scenario, according to which CO2 emissions will grow at the same rate, doubling every 50 years, the temperature of 50 ° C on Earth will already be established in 100 years, and 150 ° C in 300 years. [12]

Factors that significantly increase the concentration of greenhouse gases:

• Heavy industry (the main source of carbon dioxide emissions is the extraction and combustion of oil, gas and other minerals).

• Agriculture (when the soil is intensively fertilized and treated with insecticides, nitrogen dioxide is released from it, which is a greenhouse gas).

• Deforestation (destruction of the «lungs of the planet» leads to an increase in the concentration of carbon dioxide).

• Overpopulation (to meet the needs of the world's population requires a huge amount of natural resources).

• Landfills (most of the waste is not recycled, but incinerated or buried, which leads to a radical change in the biological system).

No matter how pessimistic the scenarios for the development of global warming may be, humanity is still able to take measures so that the Earth does not become similar to Venus. The most promising today are considered two main areas of combating global warming:

• enhanced emission reduction;

• use of environmental technologies.

With the growth of economic activity in developing countries, it will be more difficult to radically reduce the amount of emissions. To ensure the rapid growth of GDP (gross domestic product), colossal energy resources are needed,

the sources of which are oil, gas and coal. Combustion of natural resources is the main reason for the emission of large amounts of carbon dioxide. Due to the scale and financial costs, it is not possible to re-equip old industrial plants to modern environmental standards. International agreements to control greenhouse gases are failing.

The second direction in the fight against global warming is associated with the use of bioengineering technologies. Currently, installations are being created to pump carbon dioxide into special mines. Scientists are working on extraordinary solutions, such as using aerosols to alter the reflectivity of the upper atmosphere upward. Whether this will be effective is still unknown.

The use of alternative energy sources will help to significantly reduce emissions, but at the moment these technologies require large financial investments. An important fact remains that the production of solar panels and windmills is also accompanied by colossal emissions.

Less ambitious, but no less significant measures to eliminate global warming include:

- increase in green spaces;
- use of energy-saving devices and devices;
- waste recycling;
- creating laws to prevent global warming [1].

Reducing the impact on the planet's climate system is the responsibility of all countries, without exception.

For example, at the Paris Conference on Global Warming (2015), Russia announced its intention to reduce greenhouse gas emissions from 25% to 20% by 2030 compared to 1990. Speaking at the summit, Russian President Vladimir Putin said that «Russia is taking active steps to tackle the problem of global warming. Our country took one of the first places in the world in terms of the rate of decrease in the energy intensity of the economy - 33.4% for the period from 2000 to 2012». According to the head of the country, Russia has exceeded its obligations under the Kyoto Protocol, not allowing emissions into the atmosphere equivalent to 40 billion tons of carbon dioxide. «We can say that Russia's efforts have made it possible to slow down global warming for almost a year», the president said.

The United States of America, the world's second-largest greenhouse gas producer, has partnered with China to reduce its emissions by 26-28% by 2025 (up from 2005).

The 28 countries of the European Union, which account for about 10% of the planet's emissions, have pledged to reduce their greenhouse gas emissions by 40% by 2030 compared to 1990 levels. The main goal in the long term is to reduce emissions by 80-95% by 2050 [10].

All countries that have signed the agreements must adopt national targets for reducing greenhouse gas emissions and corresponding technological reequipment. The agreement pledges to keep the global temperature rise at 1.5 degrees Celsius.

But it is important to note that the Agreement does not provide for any form of liability for breach of promises. The Paris Climate Agreement has been

signed by 192 countries. Only two countries did not sign - Nicaragua and Syria. 147 states have ratified the document. Russia signed the document, but did not ratify it, although it ranks third in greenhouse gas emissions from 15 leading countries (according to the UN). In the summer of 2016, the business community called on President V.V. Putin will not approve the document, as the implementation of the agreement will negatively affect the rate of economic growth. And Russia has already exceeded its obligation to bring atmospheric emissions below the 1990 level.

China is the leader in terms of emissions, the second place is occupied by the United States. The two countries account for up to 40% of the world's carbon dioxide emissions.

On June 1, 2017, US President Donald Trump officially announced the US withdrawal from the Paris Climate Agreement. According to Donald Trump, the fulfillment of the terms of the Paris Agreement is incompatible with his promise to increase the number of jobs in industry [11].

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Environmental pollution by natural radionucleides: overview

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Abstract. *In this article, we examined the features of environmental pollution by natural radionuclides. The main radioactive elements are identified. Their main groups are designated. The main sources and pollution pattern are identified. On the example of Kazakhstan, the main types of radioactive contamination and the features of some of the most common natural radioactive substances are reflected. It has been established that natural radionuclides do not directly affect the environment and only an increased level of radiation begins to negatively affect the environment and changes the lifestyle of all living things, which confirms the importance of addressing the issues of protecting the environment from radioactive substances, including those obtained from natural sources.*
Keywords: *natural sources, radionuclides, isotopes, radioactivity, environment.*

Загрязнение окружающей среды природными радионуклеидами: обзор

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Анотация. *В данной статье нами рассмотрены особенности загрязнения окружающей среды природными радионуклеидами. Установлены основные радиоактивные элементы. Обозначены их основные группы. Определены основные источники и схема загрязнения. На примере Казахстана отражены основные типы радиоактивных загрязнений и особенности отдельных наиболее распространенных природных радиоактивных веществ. Установлено, что природные радионуклиды напрямую не воздействуют на окружающую среду, и только повышенный уровень радиации начинает негативно воздействовать на окружающую среду и меняет образ жизни всего живого, что подтверждает важность занятия вопросами защиты окружающей среды от радиоактивных веществ, в том числе полученных и из природных источников.*

Ключевые слова: *природные источники, радионуклиды, изотопы, радиактивность, окружающая среда.*

The analysis of the literature sources showed that many scientists were engaged in problems in the field of the influence of natural radionuclides on the environment, international and national research programs are devoted to them, of which the following can be named: E.V. Mikheeva, L.G. Byazrov, M.G. Nifontova, Yu.A. Israel, E.V. Kvasnikova, I.M. Nazarov, E.D. Stukin, D.G. Matishov, E.A. Shchipa, G.G. Matishov, L.G. Pavlova, White R.G., Yu.Sh. Fridman, A.A. Moiseev, A.M. Troitskaya, A.P. Ramzaev A.A. Moiseev and others.

Studies of these and other scientists allow us to determine that Radionuclides of natural [1] or natural [2] origin, since the creation of our planet, are present in all objects of living and inanimate nature. At the same time, the radiation background in different regions of the Earth may differ significantly. Natural radionuclides in relation to the environment cause natural radioactivity, it is usually observed on soils, since natural (natural) radioactive substances are present in soils or are observed in soil-forming rocks, in certain quantities [3].

There is a different division of radionuclides into groups. Usually, the following radionuclides[1] are classified as naturally occurring radionuclides, divided conditionally into groups:

- radionuclides are cosmogenic, they include such as: 24Na; 22Na; 14C; 3H; 7Be and others;
- radionuclides detected in environmental objects usually include: 238U; 40K, and others [4].

Natural radionuclides are also divided into the following three groups:

- chemical elements in which all the isotopes are radioactive. These include the following: uranium (under the symbol 238U and under the symbol 235U), radium (under the symbol 226Ra), thorium (under the symbol 232Th) and radon (under the symbol 222Rn, and the symbol 220Rn);
- chemical elements, as isotopes of «ordinary» non-radioactive elements, but having some radioactive properties. This group usually includes the following: potassium (under the symbol 40K), calcium (under the symbol 48Ca), rubidium (under the symbol 87Rb), zirconium (under the symbol 96Zr) and others;
- radioactive isotopes formed under the influence of rays from space, in the atmosphere and then deposited on the ground. These include the following: tritium (under the symbol 3H), beryllium (under the symbol 7Be and under the symbol 10Be) and carbon (under the symbol 14C).

There is also such a division of natural radioactive substances into the following categories:

- long-lived;
- short-lived;
- long-lived, while solitary;
- substances produced by the interaction of the atoms of the nuclei of terrestrial substances with the nuclei of cosmic elements [5].

[1] Radionuclides – these are groups of atoms that have the property of radioactivity, with a certain mass number, atomic number, and energy status of the nucleus.

The main sources of radioactivity from natural pollutants are some elements of the food chain.

With wind or rain, radionuclides fall on the soil and from there, plants, animals and, of course, the human body are most often infected. In total, there are currently more than 300 natural radionuclides and the amount of natural radioactive elements usually depends on what rocks are observed in soils, acidic rocks have more radioactive elements, and heavy soils have more of them compared to light ones [7, p. 157-164.].

In the Republic of Kazakhstan, a significant part of the territory is characterized by a fairly high natural radiation background, both soils and rocks, this is especially noted in the areas of thorium, uranium and other rare metal ore areas and sites, as well as regions with a large distribution of natural underground and ground water, having high indicators for the content of radionuclides, within: 5 - 7, in some 11 and even 12. These regions primarily include: the North Kazakhstan region, the Betpakdala-Chu region, the Shu-Sarysu region, the ore provinces of Syrdarya and Ili, and the uranium-ore regions of the Caspian and Eastern Kazakhstan [8].

In Kazakhstan, natural types of pollution are caused, primarily by the fact that the country is a region where a unique uranium ore complex is located, where, according to estimates, about 30% of the world's uranium reserves are concentrated, as a result of which the country's territory (a significant part of it, about 13%) is characterized by the following indicators:

- high background of natural radiation of the earth's surface in the regions where uranium[2] and thorium rare metal deposits are located;
- high content of radionuclides in natural waters, especially in the uranium ore provinces [9].

At the same time, it should be noted that natural uranium, for example, being outside of a living organism, poses only a minor threat, based on relatively small gamma radiation (provided that it does not affect a living organism, not for a long time). But it should be borne in mind that when ingested, most often even when breathing, it increases the risk of disease, since releasing alpha particles contributes to the development of lung cancer or is deposited in bone tissue. Additional threats are usually caused not by natural uranium itself, but by its decay products. Thorium-234 also has the ability to break down into radioactive isotopes, already in place, in addition, thorium-230 tends to accumulate a certain concentration in bone tissues. Radium, which usually accumulates on the surface of bones, has the same properties as radioactive potassium, and later they are noted in bone matrices. It should be recalled that it is radium that is considered the most well-known causative agent of such a disease as bone cancer. Polonium also has the ability to accumulate in bones and in soft tissues.It is also necessary to pay attention to such natural radionuclides as radium iodine-Iodine-131 (has a half-life of about 8 days), the minimum dose, which is particularly dangerous to living organisms, since it gets inside a person causes muta-

[2] Uranium – it is a radioactive chemical element that can be found in nature. It is mainly used for the production of electrical energy.

tional changes in cell structures, which usually lead to the fact that living cells begin to die and primarily affects the human thyroid gland, which absorbs more substances when it enters the body. Strontium-90 affects the bone tissue and affects the bone marrow, exposure to Strontium-90 causes leukemia and leads to radiation sickness. Caesium-137 enters the cells through the respiratory and digestive systems and accumulates in the skeleton and muscles. Cobalt-60 comes through the upper respiratory tract, skin, digestive organs and has a toxic effect on the respiratory, circulatory, digestive and of course the nervous system.

Thus, we have established that natural radionuclides do not directly affect the environment and can safely exist in the conditions of their presence, provided that the optimal level of radiation, which should correspond to the natural environment. This is also due to the fact that radioactive elements entering the environment become part of nature, including the biosphere. And only an increased level of radiation begins to negatively affect the environment and changes the way of life of all living things and often lead to their death. Therefore, it is important to address the issues of protecting the environment from radioactive substances, including those obtained from natural sources.

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The ecological calamity is on

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Abstract. *The article raises the problem of neglect and attitude towards the environment and deals with some recent environmental disasters of global importance. The ways of possible change of the situation in terms of changing the attitude of a person to this problem, raising his ecological consciousness are considered. It is noted that for the farther solution of the problem, it is of paramount importance to continue the widespread discussion of this problem and, as a consequence, to attract people to it, to encourage them to take action.*
Keywords: *ecology, disaster, pollution, environment, influence.*

Экологическая катастрофа уже свершилась

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Аннотация. *В статье поднимается проблема небрежного отношения к окружающей среде и рассматриваются недавние экологические катастрофы мирового значения. Рассмотрены пути возможного изменения ситуации в плане изменения отношения человека к данной проблеме, поднятия его экологического сознания. Отмечено, что для дальнейшего решения проблемы первостепенно важно продолжение повсеместного обсуждения данной проблемы и, как следствие, привлечения к ней людей, побуждения их к действиям.*
Ключевые слова: *экология, катастрофа, загрязнение, окружающий мир, влияние.*

In the 21st century, no one is to doubt that environmental problems have already become one of the major concerns of humanity, and it is becoming obvious that even ordinary people such as students can play an important role in shedding light on these issues and the steps that are to be taken to cope with these problems. Whereas people's whole society lives on Earth, it cannot not be important to pay attention to the environment and care for it. By that, it is stated that the problems are fundamentally social: they are results of human social behaviour, they are viewed as problematic because of their influence on people as

well as other species on our planet, and to solve them, some effort is required. Therefore, it is no surprise that scientists have shown a growing interest in environmental issues recently. So, I cannot help looking upon this problem.

The issue of environmental pollution can be considered in the examples of many countries, but I would like to pay attention to the problem in mine. For the last months, there have been some ecological disasters in Russia which have a great effect not only on Russia, but on the rest of the world. Some of them, such as the water pollution near Norilsk and the environmental disaster by the shores of Kamchatka, still have had a place in the journalistic works of the BBC.

As for the first catastrophe, it is the worst accident of its kind in modern times in Russia's Arctic region. Diesel oil from a huge spill in the Arctic north of Russia has polluted a large freshwater lake near Norilsk and Dudinka and, therefore, there is a risk that it could spread into the Arctic Ocean. It has already travelled about 20km north to the Arctic from a collapsed fuel tank. So, the oil pollution got into the Pyasina lake be the stream of the Pyasina river. All both fish and a good biosphere are now dying of the poisonous chemical substance. The pollution will definitely have a negative effect on the water resources, on the animals that drink that water, on the plants growing near both the river and the lake. Now it is important to prevent it from spreading farther. All the world just could not help noticing this serious problem which will get to its doors sooner or later [1].

The spill now threatens a huge, pristine area of Arctic wilderness [1].

Another catastrophe which I am to look upon has its place by the shores of Kamchatka. At the beginning of November of this year, there has been a collapse of tanks delivering fuel and chemical agents. About all the Pacific coast of Kamchatka was covered with dead fish, clams, octopuses, seals, other mammals, and even birds. When the rest of the world saw what had happened to nature, people got frightened and sorry for what had been done. Many dead sea creatures washed up on beaches in Kamchatka, in Russia's far east, in what is being treated as a major marine pollution incident. Photos of dying of poison

blue whales had a great influence on people, on me in particular. The local who used the Pacific beaches complained of vomiting, fever, rashes, and swollen eyelids. All of them were taken to hospitals and are now having a cure there. So, one of Russia's remotest regions, famous for its pristine nature and active volcanoes, are now not like what it was [2].

A dead octopus - among many dead sea creatures washed ashore in Kamchatka [2].

Also, there is one ecological problem in my country. It is chucking the woods of Siberia. The people of Russia generally and inhabitants of Siberia particularly were shown the scale and where active deforestation is taking place. Once I came across the video which appeared on the Internet, the author of which tells in an accessible way what is happening with the Siberian forests these days. If this continues, then Siberia may soon turn into a plain. According to the author of this video, nowadays the public needs to become more active and disseminate this video in all possible ways, so that the population of the entire globe assesses the situation and the authorities begin to act. Otherwise, an ecological catastrophe is possible [3].

Besides, poor ecology is a payment for a high contribution to the country's industrial production, rapid development and comfortable living conditions for people. For example, there is Cherepovets, the northern, but not too far, city of Russia. There are many plants polluting air, water, and soil. People of this city who see the Sun few times a year now have to suffer from living in such conditionals.

It must be added that I cannot avoid mentioning the Belgorod region where I live when it comes to discussing environmental problems. The environment of the Belgorod region is under an increasing impact of economic activities, technogenic, and anthropogenic factors. Slope lands are plowed up, the soil is exposed to contamination and pollution, thereby the habitat of many animals and birds is disturbed. The quality of the air in the Belgorod region is greatly influenced not only by natural factors, such as forest fires and dust storms, but also by man-made ones which include emissions of harmful substances into the atmosphere by industrial enterprises of the region. The greatest

pollution of the atmosphere is carried out by the enterprises of the mining and metallurgical industries, as well as those engaged in the production and distribution of gas, electricity, and water [4].

Spoilt air in Stary Oskol, the city in Belgorod region [4].

Coming to the conclusion, I must say that all the disasters given in the work are not only problems of Russia, but problems of the whole Earth because of the interconnection of the nature. People have to admit that they have to change their ecological and social behaviour.

Thus, despite the fact that there are people having an opposite point on this issue, I am convinced that the environmental problem is significant nowadays. To add, we are living in a period when people's relationship to nature is being dramatically transformed in the negative direction. This is surely not the world which we would like to live in. The threat of ecological collapse means that there is an urgent need for some serious actions and, at least, a discussion on how we can prevent farther negative impact.

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The role of microorganisms in nature and their significance

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Abstract. *The article discusses issues related to environmental pollution. It also describes in detail how microorganisms help to come with different types of environmental pollution. The characteristics of microorganisms, their distribution, role and significance in nature have been studied in detail.*
Keywords: *environment, pollution, microorganisms, nature, global problems, substances, single-celled organisms, substances.*

Роль микроорганизмов в природе и их значение

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Аннотация. *В статье рассматриваются вопросы, касающиеся загрязнения окружающей среды, а также подробно описывается, как микроорганизмы помогают справляться с разными видами загрязнений окружающей среды. Подробно исследуется характеристика микроорганизмов, их распространение, роль и значение в природе.*
Ключевые слова: *окружающая среда, загрязнения, микроорганизмы, природа, глобальные проблемы, одноклеточные организмы, вещества.*

Introduction

In the modern world, the problem of environmental pollution is one of the most important problems. Human influence on the environment increased dramatically with the emergence of an industrial society, which led to irreversible consequences. Environmental pollution is of several types: mechanical, chemical, physical and biological.

Let's take a brief look at each type of pollutant. Mechanical pollutants include industrial facilities, landfills, dust from cement plants, etc. Many enter-

prises dump production waste (coal, oil) into water bodies, which leads to waterlogging of the water body, the disappearance of many types of vegetation and the death of aquatic inhabitants. When a huge amount of garbage decomposes in landfills, a lot of toxic substances are released that poison the atmosphere. Chemical pollutants include heavy metal salts, synthetic compounds and others. Chemical pollutants are the largest and most harmful to all living things, including the biosphere. The fact is that chemicals are very difficult to biodegrade and release harmful vapors into the atmosphere.

Biological contaminants include microorganisms created in the laboratory by humans. The danger of microorganisms is that they cause dangerous diseases and epidemics. These microorganisms are dangerous to all life on the planet. Of course, the main physical polluter is man. Unfortunately, people do not take care of their home, their planet at all. Deforestation, poaching, construction, neglect of nature and much more leads to climate change, melting glaciers, depletion of soil, the disappearance of many species of animals and plants, and much more.

Of course, not everything is as bad as it seems. The man nevertheless understood that it was necessary to preserve and protect his home, his planet. Ways have been invented to deal with pollutants. Each type of pollutant has its own way of fighting. Purification of water and air, the creation of various filters in industries, fertilization of soils, the use of microorganisms from environmental pollution are carried out. In the modern world, microorganisms have been studied in great detail by man. Now scientists are using them for useful purposes. For example, cleaning up soil, waste water and the atmosphere. Thanks to biotechnological knowledge, methods for growing microorganisms have been invented, which has a positive impact on the environment.

General characteristics of microorganisms:

Microorganisms are living organisms that can only be seen under a microscope. All microorganisms have different biological properties. Microorganisms are negligible and very simple in structure.

In 1676, the founder of microscopy, Anthony Van Leeuwenhoek[1] was the first to see microorganisms.

All microorganisms are unicellular. In modern science, microorganisms are divided into two types: eukaryotes and prokaryotes. Eukaryotes are living cells that have a nucleus, while prokaryotes are non-nuclear organisms.

Viruses occupy a special place among microorganisms. Viruses are the simplest form of life, the smallest particles. Almost all viruses are capable of infecting living cells.

There are still bacteria. Bacteria are the domain of microorganisms. Most often, bacteria are single-celled organisms, they are the earliest form of life on Earth. There are many types of bacteria.

[1] Anthony Van Leeuwenhoek – Dutch naturalist, microscope designer, founder of scientific microscopy.

Microorganisms are found throughout the world. They inhabit water, soil, atmosphere. The role of microorganisms is great. They have an impact on humans, nature, participate in the cycle of substances in nature, and much more. Life on the planet is impossible without microorganisms. Microorganisms are not always harmful to humans, for example, there are microorganisms in the human stomach that facilitate the digestion of food. Microorganisms are widely used in agriculture, industry and medicine. An important role of microorganisms is in the production of drugs, biologically active compounds and many feed additives.

All microorganisms can be divided into 3 types: non-pathogenic, opportunistic and pathogenic. Non-pathogenic microorganisms include those microorganisms that do not cause infectious diseases[2]. Opportunistic pathogens include microorganisms that can cause disease, but under certain conditions. Pathogenic microorganisms are those that cause disease and epidemics.

Microorganisms play a leading role in the decomposition processes. These processes are important for higher organisms, because in nature there is a symbiotic relationship between higher plants and microorganisms. For example, lichens, bacteria in the rumen of cattle and others.

Without many of the processes that microorganisms carry out in nature, life on Earth would have long ceased or taken on other forms.

Habitat of microorganisms:

The habitat of microorganisms is air, soil and air. Microorganisms can exist under different external conditions. For example, many microorganisms exist at 40 degrees Celsius, and some at 100 degrees Celsius. Habitats can be divided into 2 groups: biogenic and abiogenic.

The biogenic environment for microorganisms is the organisms of animals, plants and humans. Microorganisms infect tissues and organs of animals, plants and humans, as a result of which the organisms feel very bad, and sometimes die. But living organisms have learned to protect themselves from infections by using barriers. Human barriers are: skin, mucous membrane of the nose and eyes, blood, and more.

The abiogenic habitat is soil, water, air. Soil, water and air are reservoirs for the preservation, reproduction and spread of pathogenic microbes.

Some types of microorganisms can inhabit both abiogenic and biogenic environments.

Microorganisms have completely populated our planet. They are found absolutely everywhere, in every corner of our planet. The most interesting thing is that microorganisms are not afraid of high temperatures, lack of oxygen or light, high concentrations of salts or acids.

[2] Infectious diseases are a large group of diseases caused by exposure of the human body to various pathogenic agents.

Microorganism nutrition:

Microorganisms can be fed in two ways: photosynthesis and chemosynthesis.

There are microorganisms that themselves create nutrients from carbon dioxide and water, using the energy of sunlight. This process is called photosynthesis. Such microorganisms are called autotrophs. And there are microorganisms that feed on what is created by others, they are called heterotrophs.

In the past, sunlight energy has not yet been used to build nutrients. Instead, they used the energy of chemical reactions (chemosynthesis): they absorbed methane, hydrogen sulfide and other substances rich in energy. Such microorganisms are mainly found in the ocean depths, volcanoes and hot springs.

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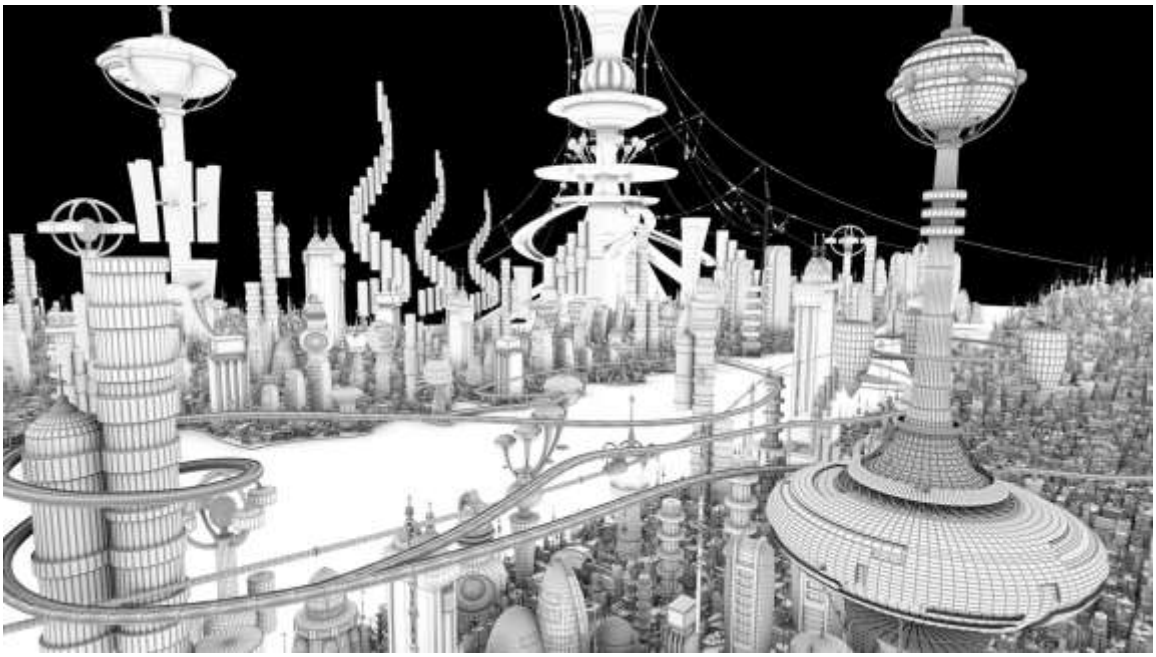
Некоторые аспекты технологического развития страны в студенческом восприятии



Intercambiadores de calor: sus tipos, clasificación y aplicación

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***Anotación**. Este artículo está dedicado a la descripción de los intercambiadores de calor y su uso en varios campos de producción. El material contiene los principales tipos de intercambiadores de calor y su descripción.Palabras clave: intercambiador de calor, Recuperador, regenerador, mezclador.*
***Palabras clave:** intercambiador de calor, Recuperador, regenerador, mezclador.*

Теплообменные аппараты: их виды, классификация и применение

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***Аннотация**. Данная статья посвящена описанию теплообменных аппаратов и их использованию в различных сферах производства. В материале приведены основные виды теплообменников и их описание.*
***Ключевые слова**: теплообменник, рекуператор, регенератор, смеситель.*

¿Qué es un intercambiador de calor?

Un intercambiador de calor o intercambiador de calor es un dispositivo especial cuyo propósito es proporcionar intercambio de calor entre dos o más medios. Los medios involucrados en el intercambio de calor se llaman portadores de calor. Como refrigerantes pueden utilizarse diversas sustancias, gases, líquidos y metales líquidos. El refrigerante que emite calor y tiene una temperatura más alta se denomina refrigerante, mientras que el refrigerante que detecta calor con una temperatura más baja se denomina refrigerante secundario.

Según lo previsto, los intercambiadores de calor se dividen en calentadores, evaporadores, condensadores, refrigeradores, etc.

De acuerdo con el principio de funcionamiento, los intercambiadores de calor se dividen en cooperativos, regenerativos y mezcladores.

¿Qué son los intercambiadores de calor regenerativos(o regeneradores)? Los regeneradores son intercambiadores de calor en los que dos o más flujos de intercambio de calor se lavan alternativamente una superficie o masa que se acumula y da calor. Como ejemplo-calentadores de aire de los altos hornos

Los intercambiadores de calor regenerativos o recuperadores son aquellas aplicaciones en las que los flujos de intercambio de calor están separados entre sí por la parte superior del intercambio de calor, es decir, el calor del refrigerante caliente al refrigerante se transfiere a través de la pared. Ejemplos de tales aparatos son calentadores o calderas de vapor.

En los intercambiadores de calor de mezcla, el intercambio de calor se produce mezclando refrigerantes calientes y fríos en un tanque. Las torres de enfriamiento son la medida de este intercambiador de calor.

Según el tipo de superficie de intercambio de calor, se distinguen los siguientes dispositivos: tubulares (dispositivos de carcasa y tubo con tubos lisos, aletados o profesionales) y aparatos de placas, en los que la superficie de intercambio de calor está formada por láminas planas o corrugadas.

Características de los intercambiadores de calor en sistemas criogénicos

Los ciclos criogénicos están literalmente «construidos» sobre la regeneración del calor y siempre tienen al menos un intercambiador de calor. Los intercambiadores de calor criogénicos proporcionan una alta intensidad de intercambio de calor debido a la necesidad de una pequeña diferencia en la temperatura del flujo, tales sistemas deben funcionar a temperaturas mucho más bajas que la temperatura ambiente, lo que se logra mediante un aislamiento térmico especial.

Además, para el intercambio de calor en un sistema criogénico, un momento muy importante, como el transporte de calor a través de «puentes térmicos», es necesario reducir el calor a través de tales lugares.

La peculiaridad de los procesos de intercambio de calor a temperaturas criogénicas consiste en un cambio significativo en las propiedades físicas de los cuerpos de trabajo de los sistemas criogénicos y los materiales estructurales de las instalaciones criogénicas. En tales instalaciones, el estado de la sustancia de trabajo a menudo se encuentra cerca de lo crítico. Incluso las pequeñas fluctuaciones de temperatura pueden provocar un cambio en las propiedades termofísicas y termodinámicas de la sustancia varias veces, lo que complica enormemente el cálculo del intercambio de calor.

Intercambiadores de calor en refinerías

En la refinería (refinería de petróleo), como parte de cualquier línea tecnológica, hay un intercambiador de calor. La refinación de petróleo es precisamente una esfera en la que es imposible prescindir de tales dispositivos.

El número de intercambiadores de calor utilizados en la refinería depende, en primer lugar, del volumen de producción y de la cantidad de

tecnologías de transferencia. En promedio, una refinería utiliza alrededor de 400-500 dispositivos de intercambio de calor. La temperatura del ambiente de trabajo en una refinería varía de 50 a 450 grados centígrados.

Intercambiadores de calor para pasteurización de cerveza y enfriamiento de mosto

Con el fin de aumentar la resistencia biológica, la cerveza se presta a un proceso de pasteurización, como resultado de lo cual la cerveza se libera de la levadura. En el proceso de pasteurización, se eliminan los gérmenes de la cerveza, que pueden afectar negativamente el sabor de la cerveza. Cuando se utiliza un termoob-mennik de placa, el procesamiento de la cerveza es delicado, rápido y cuidadoso. El Tamaño de los sellos en el intercambiador de calor crea un sistema de canales en todo el paquete de placas por los que pasan dos medios de intercambio de calor (sección I – mosto de cerveza y agua de refrigeración, sección II – mosto de cerveza y refrigerante, generalmente mezclas de glicol o agua helada).

Entonces, para resumir: los intercambiadores de calor son ahora una parte integral de nuestra vida y se utilizan en muchas áreas de producción. Los intercambiadores de calor son muy simples y complejos, y el número de intercambiadores de calor utilizados en la empresa varía según los objetivos de producción.

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The device and the principle of operation of an industrial boiler plant

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Abstract. *This article discusses the principle of operation of an industrial boiler plant. The types of boiler houses and the types of heat carriers used are described. The design and scope of application of a gas industrial boiler house, as well as the types of industrial gas boilers, their design and operating principle are considered. The description of automation and control system is presented.*
Keywords: *boiler room, furnace, boiler, heat carrier, device, operating principle.*

Устройство и принцип работы промышленной котельной установки

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Аннотация. *В данной статье рассматривается принцип работы промышленной котельной установки. Описаны виды котельных и типы используемых теплоносителей. Рассматриваются конструкция и сфера применения газовой промышленной котельной, а также виды промышленных газовых котлов, их устройство и принцип действия. Представлено описание автоматики и системы управления.*
Ключевые слова: *котельная, топка, котел, теплоноситель, устройство, принцип работы.*

Types of industrial boiler plants

Industrial gas boilers are classified by capacity into units of small, medium and large capacity. The first group includes hot water, steam and condensation generators with a capacity of up to 20 MW and an efficiency of up to 96 % [4]. They are usually used for heat supply of small enterprises.

For integrated heat supply with the output of the load for heating, hot water supply and ventilation, enterprises install boiler houses with a total capacity of up to 100 MW. Such equipment is installed on large quarterly boiler houses that can provide heat not only to industrial, but also to residential consumers. Gas boilers with a capacity of 600 MW or more are used to supply hot water and steam to large plants and district urban enterprises of heating networks [1].

According to the purpose of gas boiler houses in the enterprise are divided into:

1. Heating-for centralized supply for the needs of heating, ventilation and hot water for domestic and industrial consumers.

2. Production – for the technological supply of heat in the form of steam and hot water to industrial enterprises.

3. Heating and production – for the integrated supply of heat to heat supply systems and technological processes.

4. According to the scheme, boiler houses are divided into a closed type, when all the domestic water is returned to the source through the main heating networks, and an open system, when part of the hot coolant is used for technological or household needs.

5. In industry, technological consumers of heat energy in the form of steam are paper, chemical and metallurgical industries, petrochemical complexes, rectification and chemical reactors, sorption and desorption units of the purification gas process, electroplating lines and devices for laminating surfaces.

A promising direction was the installation of combined boiler houses of steam-hydrogen boiler houses, autonomous block modules, roof heat supply systems.

Good mobile systems are considered to be block-modular, assembled at the factory and transported to the installation site in assembled form. On-site launch of such systems is carried out under an accelerated «turnkey» program, taking into account that the installation and commissioning work is carried out at the production site.

Scope of use of gas boiler equipment

It forms an important part of the engineering design of residential, industrial, agricultural, public, and construction projects. Catering companies, sauna and bath complexes, laundries, dry cleaners-the group of users includes companies of almost any profile. In the agricultural sector, a gas boiler house is used for drying grain, heating greenhouses, and heating livestock farms.

Gas boiler equipment has found wide application in a wide variety of processes:

1. technical and technological; hot water supply;

2. heating system;

3. ventilation.

Among all types of equipment for a gas boiler house (for solid, liquid fuel and gas), gas systems are the most widespread. Against the background of the dynamic development of the coldest regions of northern and eastern Russia, the demand for them is constantly growing. And the efficiency of gas in terms of heat generation is fully justified by the cost-effectiveness of modern thermal equipment for the boiler house and low costs for their operation.

Construction

Structurally, the boiler room is a functional structure designed to bring the temperature of the coolant to a given level for the purpose of heating, hot water supply or power supply [3]. All the equipment for the gas boiler house is located in one technical room. Water is usually used as a heat carrier. Depending on the scale and operating conditions, the set of equipment for a gas boiler house may differ, but the basic elements are always:

1. boilers (steam, hot water, fire tube);
2. elements of connection of equipment for the boiler plant;
3. gas pipeline fittings.

Types of industrial gas boilers

Industrial gas boilers are divided into several types.

Hot water pumps

Such boilers are characterized by a symmetrical arrangement of heat exchangers and operate on the multi-pass principle of the movement of combustion products. They are used for heating the heat carrier and heating the room. The maximum water pressure in the circulation circuit is 16 bar. The capacity of serial boilers varies from 0.7 to 35 MW [1]. This is enough to heat large workshops and industrial buildings. For hot water, a boiler with heating from the chimney is connected to the boiler. An industrial boiler of the hot water type is shown in Fig. 1. Such devices are used for heating rooms.

Fig. 1. Industrial gas boiler of hot water type.

Steam engines

The steam boiler is designed to work with a high temperature of the coolant. Steam generation takes place in two stages. The first is the heating of the

water to 100 degrees and the formation of primary steam, which is passed through the separator for dehumidification. The second stage is to reheat the already dry steam to the desired temperature. After that, the steam is ready for use. Steam generators perform two tasks at once: they heat the heat carrier for heating buildings and produce steam. To increase the efficiency of such an installation, additional smoke turns are used, which heat the water circulating in the pipes. A gas boiler of the steam type is shown in Fig. 2.

Fig. 2. Industrial gas boiler of steam type.

There are significant differences in the basic schemes of steam and hot water boiler plants. The steam boiler plant (fig. 3a) consists of two steam boilers 1, equipped with individual water 4 and air 5 economizers, includes a group ash collector 11, to which the flue gases are approached by a combined boiler 12. For the extraction of flue gases in the area between the ash collector 11 and the chimney 9, smoke pumps 7 with electric motors 8 are installed. For the operation of the boiler house without smoke pumps, gates (dampers) 10 are installed.

Steam from the boilers through separate steam lines 19 enters the general steam line 18 and through it to the consumer 17. After giving off the heat, the steam condenses and returns to the boiler room via the condensate pipeline 16 to the collecting condensation tank 14. Through the pipeline 15, additional water is supplied to the condensation tank from the water supply or chemical water treatment (to compensate for the volume that has not returned from consumers).

In the case when part of the condensate is lost to the consumer, a mixture of condensate and additional water is supplied from the condensation tank by the pump 13 through the feed line 2 first to the economizer 4, and then to the boiler 1. The gorenje air required for combustion is sucked in by the central blast fans 6 partly from the boiler room, partly from the outside and through the air ducts 3 is first supplied to the air heaters 5, and then to the boiler furnaces.

The hot water boiler plant (fig. 3b) consists of two hot water boilers 1, one group water economizer 5, serving both boilers. The flue gases at the outlet of the economizer through the common collection hog 3 enter directly into the chimney 4. The water heated in the boilers enters the common pipeline 8, from which it is fed to the consumer 7. After giving up heat, the cooled water through the return pipeline 2 is first sent to the economizer 5, and then again to the boilers. Water in a closed circuit (boiler, consumer, economizer, boiler) is moved by circulation pumps 6.

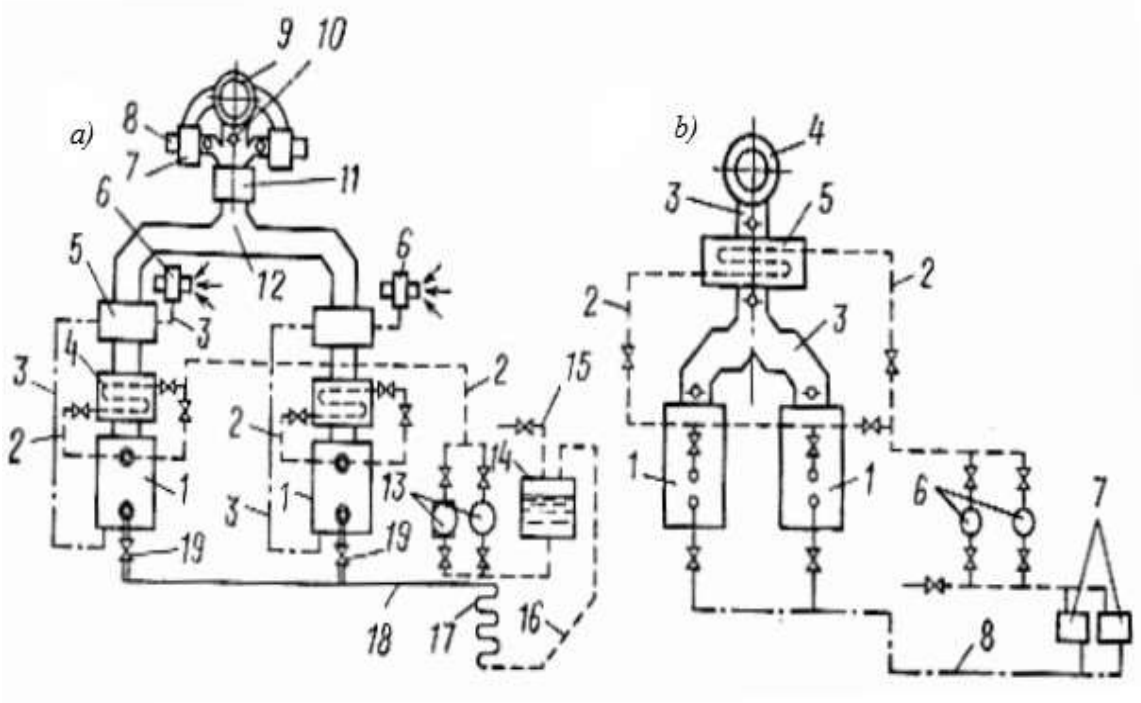

Fig. 3. Schematic diagrams of steam and hot water boiler houses.

According to the relative movement of heat-exchanging media (smoke gases, water and steam), steam boilers (steam generators) can be divided into two groups: water-tube boilers and fire-tube boilers. In water-tube steam generators, water and a steam-water mixture move inside the pipes, and flue gases wash the pipes outside. In Russia in the XX century, Shukhov water-tube boilers were mainly used. In heat pipes, on the contrary, flue gases move inside the pipes, and water washes the pipes outside.

Heat generators of medium and high power

The average capacity of gas boilers reaches 2 MW. This is enough for heating a small production or village.

Heating and water supply of individual urban microdistricts and large industrial enterprises is provided by high-capacity hot water boilers (from 2 to 30 MW) [2]. Such installations have several heating circuits and are designed for the most efficient use of the thermal energy obtained from the combustion of gas.

Cogeneration systems

Installations of this type (Fig.4.) are able to consistently release thermal energy for heating and water supply, and then electric energy to provide production or microdistrict with electricity.

The equipment is used for heating and hot water supply. The advantage of cogeneration (the production of different energy from a single fuel) is a high efficiency, which reaches 90% [4]. To generate electricity, a gas piston engine is used, the excess heat from which is used to heat the coolant. The main heating of the water takes place in hot water boilers. This technology is used in mini-thermal power plants to work in remote areas.

Fig. 4. Two cogeneration gas boilers.

Device and operating principle of industrial gas boilers

The principle of operation of the heating device is based on the combustion of gas in the furnace with the accompanying heating of the coolant. On this basis, boilers are divided into two groups:

1. with hot air circulation (fire-tube);
2. with the liquid heated almost to the boiling point (water-tube).

Steam boilers are installed in enterprises that use steam in industrial production.

Reference. The cost of natural gas and its calorific value have no competitors among other natural fuels. Therefore, the use of natural gas provides significant economic benefits.

Gas burner

The main part of any boiler is the burner. They are divided by the type of gas supply:

1. for injectors that suck in gas together with the air jet;

2. on inflatable ones that use forced air injection by a powerful fan;

3. on diffuse ones, which supply gas to the combustion site through special diffusion channels.

The device is equipped with a supercharged gas burner (fig.5). The extended design of the burner is a set of several parallel rod devices that are located evenly throughout the entire volume of the furnace. They are equipped with holes for the exit of a mixture of gas and air and provide uniform heating. To increase efficiency, a pipeline with a coolant is placed between the rods. Such installations are capable of achieving an efficiency of 98-99% [1].

Another popular version of the burner of an industrial boiler with a capacity of 100 kW and above has a flare device. On one of the walls of the unit, a special nozzle is arranged, into which the gas-air mixture is injected. Flare gorenje has proved itself well in two and three-way boilers, used to produce a coolant with a temperature of 115-120 degrees or steam [3].

Fig. 5. Industrial boiler with gas of the Entroros brand.

Furnace chamber

For the furnace of a powerful boiler, it is important to withstand high temperatures for a long time. Heat resistance is ensured by the use of special steels with the addition of manganese, chromium and other alloying components

The walls are reinforced by corrugation and surrounded by a heat-insulating shell.

In hot water boilers, one or two heat-exchange circuits are placed in the furnace, through which the coolant circulates.

In steam or high-pressure boilers, furnace screens and a heat exchanger are used to generate heat, and steam is generated in the flue, where the temperature of the flue gases is reduced to 600-800 °C [4].

In the furnace chamber of the steam boiler, a separator and a steam superheater are placed.

The safety of operation is ensured by the explosion valve, which must be installed on one (usually the rear) wall of the boiler. The mechanism is activated in case of excess pressure in the furnace.

Automation and control system

The complexity of controlling an industrial boiler is associated with constantly changing water temperature and pressure, instantaneous gas flow, air intake for the burner, and other factors.

To eliminate the human factor, all control is carried out with the help of special controllers.

The data for their operation comes from temperature, pressure, air and gas flow sensors. For greater reliability in modern boilers, automation is divided into two parts:

1. Automatic fuel supply, which is responsible for the operation of the circulation burner and maintaining the stable operation of the entire system.

2. Safety automation takes into account the critical operating conditions of the boiler, the presence of a flame in the furnace, the gas supply, and the heating of the heat carrier. In the event of a malfunction, the boiler is switched off and the fuel supply is interrupted. Some models of boilers are equipped with self-diagnosis systems.

Attention! Natural gas is commonly used: methane. It is lighter than air and is the optimal fuel

In some cases, the propane-butane mixture may be burned. This gas is heavier than air and requires appropriate equipment settings.

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Analysis of coolant flow patterns in boiler plants

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Abstract. *This article is devoted to the comparison and description of the three most popular flow patterns of the coolant in hot water boilers and steam generators. The material discusses their designs, advantages and disadvantages.*
Keywords: *boiler plant, heat carrier movement, steam generators, hot water boilers.*

Анализ схем движения теплоносителя в котельных установках

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Аннотация. *Данная статья посвящена сравнению и описанию трех самых популярных схем движения теплоносителя в водогрейных котлах и парогенераторах. В материале рассматриваются их конструкции, преимущества и недостатки.*
Ключевые слова: *котельная установка, движение теплоносителя, парогенераторы, водогрейные котлы.*

Properly organized movement of water, steam-water mixture and steam in the pipes of the boiler unit ensures the necessary productivity of the boiler unit. As a result, intensive heat removal from the heating surface is ensured and local stagnation of steam and gas is eliminated, which prevents the heating surface from unacceptable overheating and corrosion. The continuous movement of water by the cooling heating surface is called circulation.

Boilers as technical devices for the production of steam or hot water are distinguished by a variety of design forms, principles of operation, types of fuel used and production indicators. According to the method of organizing the movement of water and steam-water mixture, all boilers can be divided into the following three groups:

- boilers with natural circulation;
- boilers with forced movement of the heat carrier (water, steam-water mixture);
- direct-flow boilers.

In boilers with natural circulation (Fig.1), the movement of water and steam mixture in the evaporation system is carried out due to the pressure created by the mass difference between the water column in the downpipes and the steam-water mixture column in the heated lifting pipes of the systems. In this case, the multiplicity of circulation, i.e., the ratio of the mass of water circulating in the system per unit time to the mass of steam generated over the same period of time: K = Gc/D is 15...100 [2]. In order for a natural water circulation to occur, a closed circuit consisting of a drum and a collector connected by lifting and lowering tubes is necessary. When heat is supplied to the lifting pipe, the water in it partially turns into steam and a steam-water mixture is formed, the density of which is less than the density of water in the non-heated lowering pipe. As a result, in a closed loop, a pressure is created, thanks to which the water and the steam-water mixture come into motion: the water moves down to the collector, and the mixture moves up to the drum, where the steam is separated from the water.

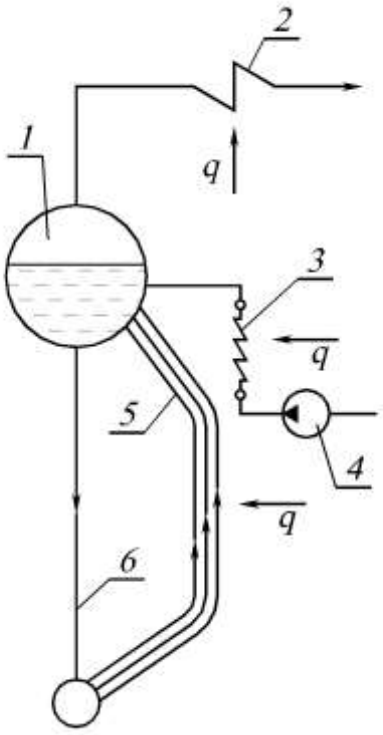

Fig. 1. Flow diagram of water, steam-water mixture and steam in a drum boiler with natural circulation.
1 - drum, 2 - superheater, 3 - water economizer, 4 - feed pump, 5 - heated pipes, 6 -downpipes.

The wide distribution of boiler installations of the screen type is explained by their undeniable advantages. The temperature inside the furnace chamber of a modern, powerful boiler unit reaches 1500 °C or more [1]. Such a high temperature has a destructive effect on the walls of the furnace chamber, despite the fact that they are made of fire-resistant material, mostly of refractory bricks. In addition, the fuel ash that melts at such temperatures has a corrosive

effect on the refractory brick. There is a need to protect the walls of the furnace chamber. The most successful method of protection is the device of screen surfaces that protect the walls of the furnace from the destructive effects of high temperature and melting fuel ash.

Boilers with forced circulation: with multiple forced circulation (Fig. 2) and direct-flow. In boilers with multiple forced circulation, the movement of water and steam-water mixture in the steam system is carried out by means of a circulation pump. Feed water from the water economizer is fed into the boiler drum, from which it is taken by a circulation pump and directed to the lower collector of the screens and the collector of the convective heating surface, distributed along the lifting pipes connected in parallel, through the pipes of the steam-water emulsion enters the boiler drum, in which the steam is separated from the liquid. Then the steam enters the superheater and is then sent to consumers.

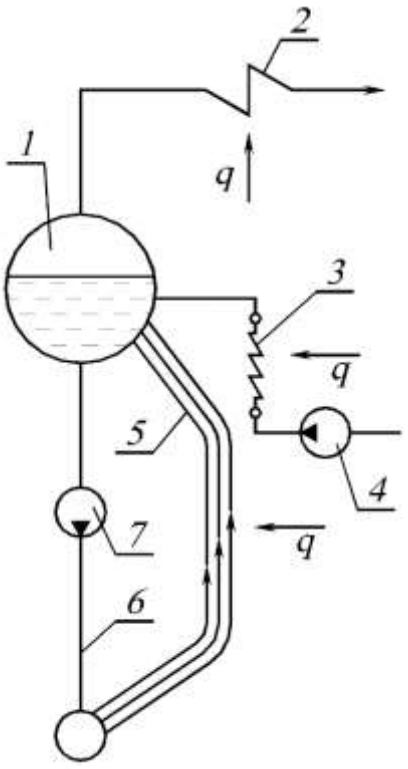

Fig. 2. Flow diagram of water, steam-water mixture and steam in a drum boiler with multiple forced circulation.
1 - drum, 2 - superheater, 3 - water economizer, 4 - feed pump, 5 - heated pipes, 6 - downpipes, 7 - circulation pump.

As a rule, forced circulation in steam and water boilers is used in cases where it is impossible to ensure reliable natural circulation of water in the boiler. This occurs with an increase in pressure, since the difference in the density of water and steam decreases with an increase in pressure. It is considered that at pressures above 18 MPa, the density difference is not sufficient to create a reliable natural water circulation in the boiler circuit.

The speed of water entering the lifting pipes of the heating surface usually does not exceed 2 m/s. The multiplicity of circulation in steam and hot water boilers with multiple forced circulation is 4...6.

In the water economizer, the water is heated to a temperature 50...60 ^{0}C lower than the saturation temperature, and then enters the radiation part. This ensures a uniform distribution of it over separate parallel coils of the radiation heating surface.

In the radiation heating surface, water is converted into a moist saturated steam with a degree of dryness of about 80%. With this humidity, the steam enters the transition zone, where it first turns into dry steam, and then into slightly superheated steam (at 50...60 ^{0}C). In the superheater, the steam is superheated to the set temperature [4].

Direct-flow (Fig. 3) steam boilers do not have a drum in their design. Water passes through the evaporation pipeline one-fold, turning into steam gradually. The vaporization process is terminated in the transition zone. The steam-water mixture coming from the evaporation pipe goes to the superheater, in which the steam temperature is adjusted to the required parameters. The direct-flow steam boiler is an open hydraulic system. Such coal plants can operate at both supercritical and pre-critical pressures.

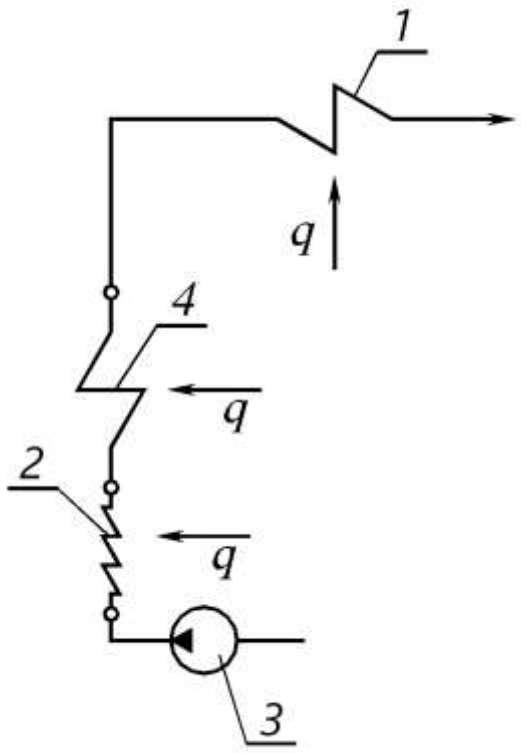

Fig. 3. Flow diagram of water, steam-water mixture and steam in a direct-flow boiler.
1 - superheater, 2 - water economizer, 3 - feed pump, 4 - heated pipes.

The main advantage of direct-flow boilers is the minimum time required to bring it into working condition and the shortened heating time. Taking into account these characteristics, direct-flow boilers are used as backup installations, used during peak load hours and in case of failures and malfunctions of the main boiler units. In order for the fire-tube boilers to be always ready, it is necessary to keep them heated for a long time, which is extremely inefficient.

Boilers that are not in regular daily operation have large losses in the idle state. In order to avoid unprofitable use of fuel and energy in cases of irregular operation, the use of direct-flow boilers is justified.

In modern heating and heating-production boilers for steam production, boilers with natural circulation are mainly used, due to lower electricity consumption in the absence of a circulation pump, and for the production of hot water – boilers with forced movement of the coolant, working on the direct-flow principle.

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Current state and problems of alternative energy development

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Abstract. *The article is devoted to the current state and analysis of factors affecting the use of alternative energy sources on a global scale. There is a constant increase in energy consumption, which is associated with the stability of the global economy, the increase in heating and cooling costs in various parts of the world. At the same time, in the most densely populated areas (China, India), coal accounts for up to 80% of the energy balance, which leads to an increase in CO2 emissions. In this regard, there is a need to switch to the use of alternative energy sources (wind, solar, hydrothermal, geothermal and biomass, nuclear energy).*
Keywords: *energy sources, emissions, alternative, growth, forecast.*

Современное состояние и проблемы развития альтернативной энергетики

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Аннотация. *Статья посвящена современному состоянию и анализу факторов, влияющих на использование альтернативных источников энергии в глобальном масштабе. Наблюдается постоянный рост объемов энергопотребления, что связано со стабильностью мировой экономики, увеличением затрат на отопление и охлаждение в различных частях мира. В то же время в наиболее густонаселенных районах (Китай, Индия) уголь составляет до 80 % энергетического баланса, что приводит к увеличению выбросов CO_2 . В связи с этим появляется необходимость перехода на использование альтернативных источников энергии (ветровой, солнечной, гидротермальной, геотермальной и биомассы, атомной энергии).*
Ключевые слова: *источники энергии, выбросы, альтернатива, рост, прогноз.*

The development of energy in modern conditions is characterized by an increase in the share of alternative energy sources, especially solar and wind. According to the International Renewable Energy Agency, the use of renewable energy sources is accompanied by a multiplier effect: doubling the share of re-

newable energy in the global energy balance by 2030 will lead to GDP growth of 0.6-1.1% ($1.3 trillion), as well as welfare will increase by 3.7%, employment in the renewable energy sector will increase by 6% annually [1].

In this regard, it is relevant to study issues related to global trends in the use of alternative energy sources, to analyze the factors affecting their development, as well as barriers to their wider distribution.

In the modern world, regions and countries depend on each other both in terms of sustainable economic development and energy security, and in terms of ensuring effective measures to combat climate change.

Global energy consumption in 2020 has almost doubled from the average growth rate since 2010, driven by a resilient global economy and higher heating and cooling needs in some parts of the world. As a result of higher energy consumption, CO2 emissions increased by 1.7% in 2020 and reached a historic high of 33.1%. At the same time, China, India, and the United States account for 85% of the net increase in emissions [2]. Global energy demand and CO2 emissions are expected to increase by about 60% by 2030 and more than double by 2050. In 2050, almost 3 times more coal will be consumed than in the early 2000s, gas consumption will increase by 138%, and oil-by 65% [3].

The basis of the world's energy is currently made up of hydrocarbon reserves (coal, oil, gas), which produce about 70% of the world's energy [4].

The world is at a critical stage when it is necessary to review the structure of traditional energy based on hydrocarbon sources. In addition to the depletion of these renewable energy sources, the environmental crisis plays a significant role. Annual carbon dioxide emissions increase by an average of 100 tons. Scientists predict that if the critical situation continues at this rate, then humanity faces a global catastrophe [5].

Global electricity consumption is projected to increase over the next two decades. At the same time, the global community is concerned about global climate change, rising fossil fuel prices, and political instability in major supplier countries. In this regard, renewable energy sources have become an important object of research to increase their share in total energy consumption. The widespread use of renewable energy sources and increased competitiveness are also hindered by continued subsidies and other government support measures for the oil production and refining industries.

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Elektromobilität heute und morgen

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Annotation. *Der Artikel enthält Informationen über Elektrofahrzeuge in unserer Zeit und über die möglichen Perspektiven ihrer Nutzung sowie die Entwicklung dieser Richtung der Automobilindustrie. Prüfen Sie die Arten von Fahrzeugen auf die Art der Nutzung von Energiequellen und die Möglichkeit, bekannte Energiequellen durch alternative zu ersetzen. Die wichtigsten Vor-und Nachteile von Elektroautos sind angegeben.*
Schlüsselwörter: *Elektroauto, Batterie, Batterie, Verbrennungsmotor, Elektromotor, Energiequelle.*

Электромобиль сегодня и завтра

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Аннотация. *В статье представлена информация об электромобилях в наше время и о возможных перспективах их использования, а также тенденции развития данного направления автомобилестроения. Рассмотрены типы автомобилей по способу использования источников энергии и возможности замены известных источников энергии на альтернативные. Указаны основные преимущества и недостатки электромобилей.*
Ключевые слова: *электромобиль, аккумулятор, батарея, двигатель внутреннего сгорания, электродвигатель, источник энергии.*

Seit einigen Jahren lässt sich das große Interesse zum Thema Elektromobilität in den meisten Maßmedien zu beobachten. Elektrofahrzeuge machen unsere Zukunft und können gewöhnliche Autos total ersetzten.

Es ist zu betonen, dass einige Länder haben schon feststehende Plane der E-Autos Entwicklung. Norwegen hat sich zum Ziel gesetzt, ab 2025 keine Verbrenner mehr zuzulassen. Der britische Premierminister Boris Johnson will von 2030 an den Verkauf von Dieselwagen und Benzinern verbieten. Der Verkauf von Hybrid-Modellen soll bis 2035 erlaubt bleiben. Der demokratische Gouverneur Gavin Newsom hat im September per Dekret verfügt, dass in Kalifornien von 2035 an keine Autos mit Verbrennungsmotor mehr verkauft werden dürfen.

Frankreich will den Verkauf von Verbrennungsmotoren noch bis zum Jahr 2040 erlauben.

Verschiedene Fristen wurden genannt, aber die Tendenz ist allgemein: überhaupt keine Verbrennungsmotoren. Und was ist die Besonderheit von diesen Autos? Das Herz des Elektroautos ist der Akku. Weitere Komponenten sind der Elektromotor, die Leistungs elektronik sowie die Kühlsysteme beziehungsweise das Temperaturmanagement. Aggregate wie Lenkung, Bremsgerät und Heizung/Klimaanlage werden elektrisch betrieben (Abb.1). Auch das 12-Volt Bordnetz wird über einen Spannungswandler aus der Hochvoltbatterie versorgt. Das "Gehirn" der Batterie ist das Batterie managementsystem, welches stets den Zustand der Batterie kennt und Ladevorgänge und Leistungen während des Betriebes regelt. Bei der Anordnung der Komponenten im Fahrzeug hat sich die so genannte "Skateboard"-Architektur durchgesetzt: Der Akku liegt zwischen den Achsen im Unterboden, der Elektromotor und die Leistungselektronik an Vorder- und/oder Hinterachse. Die Karosserie wird dann über dieses Skateboard «gestülpt». Diese Unterflur-Architektur garantiert einen niedrigen Schwerpunkt und ermöglicht eine etwas bessere Raumnutzung als bei Fahrzeugen mit Verbrennungsmotor.

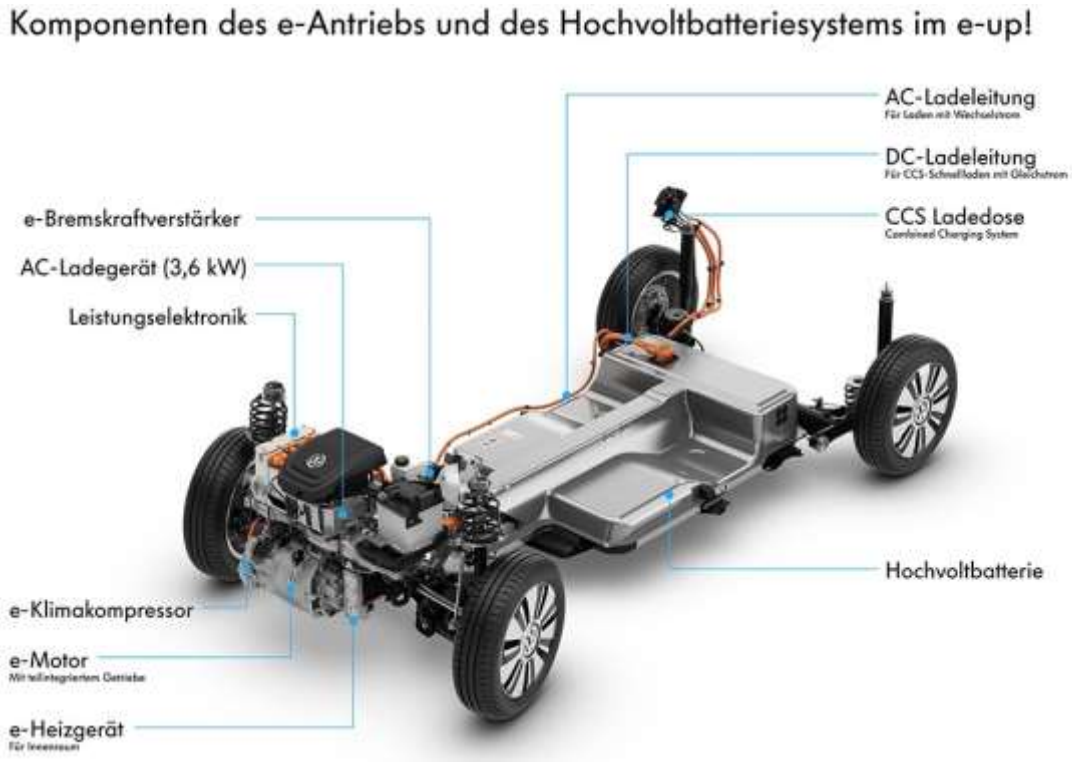

Abb. 1. Komponenten von Elektrofahrzeug.

Elektrofahrzeuge haben Vorteile aber Nachteile gibt es auch. Zu den Vorteilen kann man folgende zuordnen:

1. Ein Elektroauto tatsächlich nur so sauber wie der geladene Strom. Zudem ist die Produktion von Lithium-Ionen-Batterien sehr energieintensiv.

2. Elektromotor funktioniert unter der Einwirkung von Elektro-Magnetischen Feldern, deshalb die Reibungs- und Wärmeverluste niedrig sind.

3. Im Vergleich zum Verbrennungsmotor ist der Wirkungsgrad von über 90 Prozent

4. Vom Start weg steht bei einem Elektromotor das volle Drehmoment über einen großen Drehzahlbereich zur Verfügung. Deshalb reicht für die meisten Anwendungen ein Getriebe mit fester Übersetzung (nur ein Gang) aus.

5. Elektroenergie kostet momentan weniger als die Brennstoffe.

Was betrifft die Nachteile:

1. Produktion von Lithium-Ionen-Batterien ist sehr energieintensiv. Ein neues Elektroauto beginnt seinen Lebenszyklus im Vergleich zu einem Verbrenner-PKW mit einem "ökologischen Rucksack", dessen Größe von der Batteriekapazität abhängig ist.

2. Im Elektroautos werden Lithium-Ionen-Akku verwendet, genauso wie in den meisten Kleingeräten wie Handys, Laptops usw. Es ist bekannt, dass ihre Zyklenfestigkeit (beziehungsweise Lebensdauer) begrenzt ist.

3. Die Batterien funktionieren gut nur in engen Temperaturbereichen, die nicht überall in der Welt zur Verfügung stehen.

4. Im Vergleich zu den gewöhnlichen Autos ist die Reichweite bei e-Autos kurzer, mit existierenden Akku-Technologien.

5. Nicht genug Ladestationen und Reparaturen fur e-Autos.

6. E-Autos sind viel teurer als vergleichbare gleichklassige gewöhnliche Autos.

Abb. 2. Stromverbrauch bei dem Elektromotor und beziehungsweise Brennstoffverbrauch.

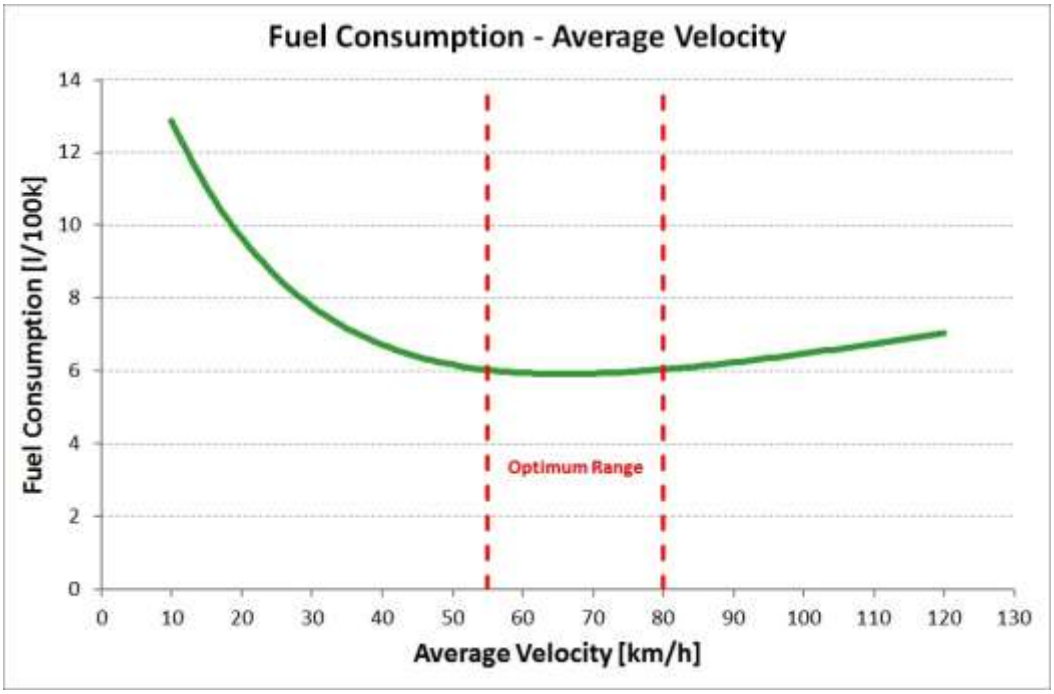

Abb. 3. Brennstoffverbrauch und Geschwindigkeit.

Die Abbildung 2 und 3 liefern Informationen zu, wie der Stromverbrauch bei dem Elektromotor und beziehungsweise Brennstoffverbrauch bei Verbrennungsmotor von der Geschwindigkeit abhängt. Diese Kurven zeigen deutlich, dass der Verbrauch des Elektromotors wird aktiv mit der Geschwindigkeitszunahme angestiegen, während der Kraftstoffverbrauch des Verbrennungsmotors bei den konstanten Geschwindigkeiten fast auf gleichem Niveau bleibt.

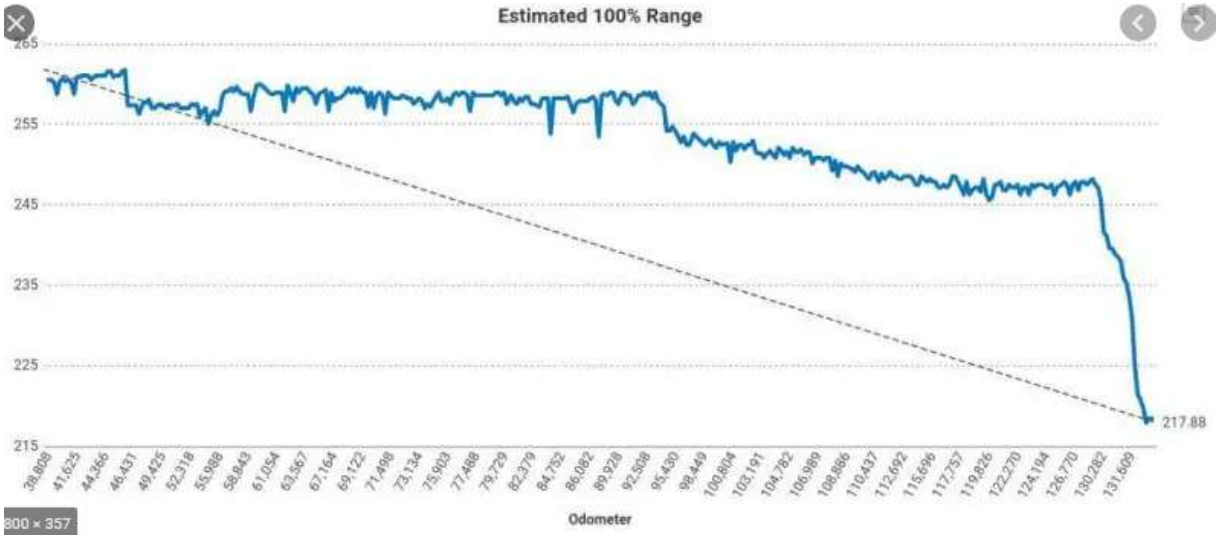

Abb. 4. Akku Kapazitätsveränderung.

Wie gesagt wurde, die Lebensdauer des Akkus begrenzt ist. Es lässt sich daraus schließen, dass mit dem Alter 5-6 Jahre wird die Batteriekapazität fast um ein Viertel reduziert. (Abb. 4) Laut der offiziellen Anweisungen von Batterieherstellern müssen die Batterien nach 8 Jahren ersetzt werden.

Unter anderem sind Elektroautos sehr temperaturanspruchsvoll. (Abb. 5) Vor allem natürlich, weil der Akku nur in einem bestimmten Temperaturbereich

gut funktionieren kann. Diese Grafik zeigt, dass die Reichweite des E-Autos offensichtlich von Außentemperaturen abhängig ist. Aus der Grafik ist es zu sehen, dass die günstigen Temperaturbereiche für Elektroautos 15-25 Grad Celsius sind, aber bei den Temperaturen unter null wird die Reichweite unumkehrbar um ein Drittel oder sogar mehr reduziert. Bei den höheren Temperaturen beispielsweise über 30 Grad wird die Reichweite auch gesenkt wegen der Batterie Überhitzung.

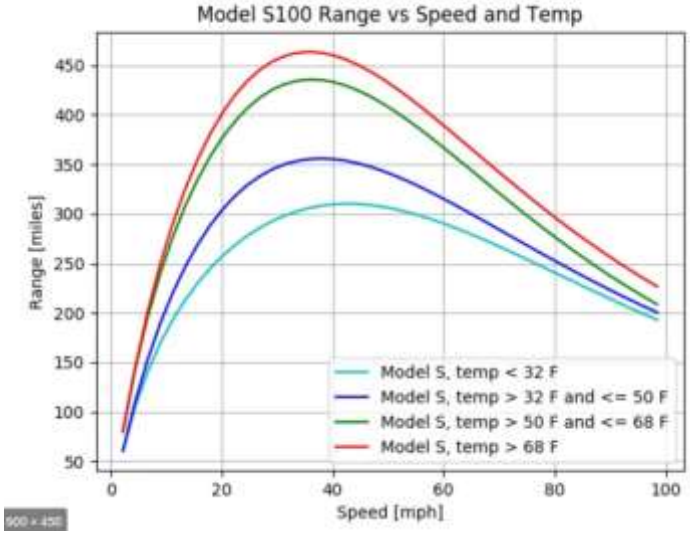

Abb. 5. Reichweite des E-Autos.

Elektroautos entwickeln sich schnell, immer mehr neue Modelle von verschiedenen Herstellern kommen auf den Markt. Diese Autos haben große Zukunft in Großstädten, und würden benutzt als kompakten, Umweltfreundlichen, billigen Verkehr für kurze Strecke, niedrige Geschwindigkeiten und keine großen Belastungen. Zum Beispiel um jeden Tag zur Arbeit und zurück zu fahren. Ohne Batterien mit großer Kapazität und starken Motor würden sie aber keine Konkurrenten zu den gewöhnlichen Autos.

Die Verbrennungsmotoren können nicht nur Benzin oder Diesel benutzen, wie gewöhnlich. Es gibt vielfältige Brennstoffe, die billig und Emissionsfrei sind, zum Beispiel Erdgas oder Wasserstoff. Den Aufbau der Motoren in diesem Fall unterscheidet sich fast nicht von gewöhnlichen, und diese Antriebe sind genauso billig und relativ einfach. Deshalb haben alternative Brennstoffe alle Schanzen, in der Zukunft den Wettbewerb auf dem Automarkt zu gewinnen.

Und Natürlich lassen sich „alte, gute“ Diesel und Benzin wagen nicht vergessen, weil in der Welt gibt es Orte, wo kein anderer Motor funktioniert.

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Le carburant au caramel: l'effet du soufre sur les performances

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Annotation. *Des compositions optimales du carburant de fusée au caramel contenant du soufredisperséproposéessontbasées sur l'analyse de l'expérience et des données pratiques. L'influence du pourcentage de soufre sur la structure et les caractéristiquesénergétiques du carburant estindiquée. Enoutre, uneévaluation de l'efficacité et de la faisabilité de l'utilisation du carburant au caramel à base de sorbitol employéenfusées amateurs estégalementdonnée.*
Mots clés: *carburant de fusée, carburant au caramel, sorbitol, fusées amateurs, fusée, nitrate de potassium, soufre.*

Карамельное топливо: влияние серы на характеристики

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Аннотация. *На основании анализа и практических данных предложены оптимальные составы карамельного топлива, содержащего дисперсную серу. Показано влияние содержания серы на структуру и энергетические характеристики топлива, а также дана оценка эффективности и целесообразности использования карамельного топлива на основе сорбита в любительском ракетостроении.*
Ключевые слова: *ракетное топливо, карамельное топливо, сорбит, ракетостроение, калиевая селитра, сера.*

La recherche se poursuit pour améliorer la performance environnementale du carburant. De nombreuxcomposants du carburant de fusée le plus courammentutilisésonttoxiques (par exemple, UDMH, hydrazine, amyle). De plus,

l'émission de gazd'échappement dans l'atmosphère a des effetsnégatifs sur la santé des gens et l'environnement.

En raison de la disponibilité des composants et de la facilité de production, il existeune alternative – un carburant au caramel à base de sorbitol ou de saccharose pour les fusées amateurs et certainesentreprisesprivées de l'industriespatiale (le termeanglaisest «rocket candy»). Pour la première foisle carburant au caramel a étéutilisé par Bill Colburn en 1948, et en 1960, ce carburant a acquis unegrandepopularité aux États-Unis avec la publication du livre de Bertrand Brinley qui a popularisé le terme «rocket candy». Les fusées qui utilisentce mélange sontsouventappelées K/S pour KNO3/Sucre. L'émission de substances nocivesestminimisée, car la calcination du nitrate de potassium et du sorbitol (saccharose) ne conduit pas à la formation de gaztoxiques. Enconséquence, le carburant a un bon respect de l'environnement. L'équationthéorique de la combustion du carburant au caramelest le suivant:

$$C_6H_{14}O_6 + 4KNO_3 \rightarrow 4CO_2 + CO + 4H_2O + 2H_2 + 2N_2 + K_2CO_3 + 2KOH$$

Le rocket candy estconstitué de:

1. nitrate de potassium, utilisécommeoxydant;
2. sorbitol ou saccharose, utiliséscomme combustible;
3. pour améliorer les capacités du carburant, il est possible d'ajouteren petites proportions un additifutilisécommecatalyseur: l'oxyde de fer (III) Fe_2O_3 et quelquesautres.Mais le passionné de fuséeressentsouvent le besoin de l'améliorer. C'estici que commence l'invention de diverses compositions.

Le nitrate de potassium utilisé dans cetteexpérienceestconnu pour son utilisation dans la production dupoudre noire (parfoisdénomméepoudre à canon oupoudre à fusil) qui se compose de 75% de nitrate de potassium, 15% de charbon de bois et 15% de boutures de soufre. Dans les compositions combustibles d'un type similaire, estutiliséela libérationd'oxygèneencas de forte calcination, l'une des propriétésimportantes du nitrate de potassium:

$$2KNO_3 \rightarrow 2KNO_2 + O_2 \ (t = 400 - 520°C)$$

Celapermet aux mélanges à base de nitrate de potassium de brûler dans le vide. Ainsi, le soufre dans le carburant au caramel ne sertqu'àenflammer et à soutenir la combustion de la composition, participant à la réactionen tant que catalyseur. Les caractéristiquesénergétiques du carburant au caramel ne sontcertainement pas comparables à celles des carburants industrielssolides de fusée. L'impulsionspécifiquethéorique du carburant au caramel à base de nitrate de potassium est de 153 kgf×s/kg et l'impulsionspécifiquepratiquementréalisable ne dépasse pas 125 kgf×s/kg. Parallèlement, l'impulsionspécifique de composition de perchlorate d'ammonium avec de l'aluminium et des caoutchoucs, qui estutilisé dans les moteurs à combustible solidemodernes, peutatteindre 250-280 kgf×s/kg. Enfin, l'hygroscopicitéimportante du carburant fusée au caramel limite son utilisation.

De cettefaçon, les principauxinconvénients de ce carburant sontl'hygroscopicité et unegrandequantité dephase condensée dans les produits de combustion.En plus, endépit de safaibletoxicité, les produits de combustion de carburant au caramel peuventirriter les muqueuses et les organesrespiratoires, car le carbonate de potassium K_2CO_3 estlibéré sous uneformehautementdispersée et peutprovoquerunebrûlurechimique.

Cependant, cela ne signifie pas que l'impulsionspécifique du carburant au caramel ne peut pas êtreaugmentée. Au cours de l'expérience, la vitesse de combustion de cinq échantillons de carburant au caramel a étémesurée. Les échantillons de carburant au caramel à base de sorbitol contiennentdifférentspourcentages de $_{soufre}$ (Tableau 1).

Tableau 1. La composition des échantillons de carburant au caramel à base de sorbitol

Numérod'échantillon	Contenu des composants, %			
	Nitrate de potassium, KNO_3	Sorbitol	Oxyde de fer (III), Fe_2O_3	Soufre (dispersé), S
Échantillon №1	65	34	1	0
Échantillon №2	65	31	1	3
Échantillon №3	65	29	1	5
Échantillon №4	65	27	1	7
Échantillon №5	65	24	1	10

Puisque le nitrate de potassium est la base, une diminution de sateneur quantitative dans le mélange n'est pas souhaitable. Le carburant a étéobtenu par évaporation. L'oxyde de fer (III) Fe_2O_3 estutiliséenqualité de catalyseur. Il est à noterque le mélange de carburant doit êtrechauffé au-dessus du point de fusion du soufre ($T_f = 113$) de 20°C à 40°C pour obtenirunehomogénéité.

Au fur et à mesure que le pourcentage de sorbitol diminuait et que le pourcentage de soufreaugmentait, les échantillonschangeaient de structure. Ainsi, l'échantillon №1 avait la consistanced'une pâte à modeler visqueuse, alors que l'échantillon №5 avait déjà tendance à s'effriter, ce qui nécessitaitune pression supplémentaire du mélange pour former un bâton de carburant. Une telle transition estassociée à une diminution du matériel de liaison, le sorbitol. La vitesse de combustion a augmentécommeprévulors du passage de l'échantillon №1 à l'échantillon № 5 (Tableau 2).

Tableau 2. La vitesse de combustion des échantillons

Numérod'échantillon (m = 80 grammes)	La vitesse de combustion (mm/s)
Échantillon №1	2,7
Échantillon №2	3,0
Échantillon №3	3,2
Échantillon №4	4,1
Échantillon №5	5,3

L'échantillon №1, lors de la combustion, a donnéunecolonne de fumée blanche dense, cesont des particuleshautementdispersées de carbonate de potassium K_2CO_3.

L'échantillon №2 en structure ressemble à l'échantillon №1, pendant la combustion, il a donnéunecolonne de fumée blanche avec des étincelles, après quoi une petite quantité de cendre poreuxestrestée.

L'échantillon №3 a une structure moins plastique que les deux premiers échantillons et a donnéunecolonne de fumée blanche avec uneflammerougeâtre. Il faut noter une combustion extrêmement intense, après laquelleune petite quantité de cendre estégalementrestée.

L'échantillon №4 a montré un résultatsimilaire à celui de l'échantillon №3, mais avec unevitesse de combustion plus élevée.

L'échantillon №5 avait la structure la moins plastique parmitous les échantillons, il avait la tendance à s'effriter et, lors de la combustion, a donnéunecolonne de fumée blanche avec uneflammerougeâtreprononcée et une abondance d'étincelles.

D'après les résultats de l'expérience, il estévident que le soufre, en tant que catalyseur, accélère la combustion du carburant. Toutefois, malgré unrésultatapparemment bon, l'augmentation de la vitesse de combustion du carburant n'est pas toujoursbénéfique pour des petites fusées. Par exemple, le carburant peutbrûler trop rapidement, empêchant la montée à la hauteur désirée.

Enconséquence, l'échantillon №3 et l'échantillon№4 ont des compositions les plus optimalescontenant du soufre dans l'application pratique. Ilsmontrentunevitesse de combustion plus élevée que l'échantillon №1 sans soufre et ontégalementuneconsistanceconvenant à la formation de bâtons de carburant, contrairement à l'échantillon №5.

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Determination of Fluoride in Various Samples Using a Fluoride Selective Electrode

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Abstract. *Fluoride is widespread in the environment, water, air, vegetation and Earth's crust which can entre ground and surface water by natural process. Fluoride in minute quantities is essential component for human health and help in normal mineralization of bone and formation of dental enamel. The determination of fluoride in some species was performed by using fluoride ion-selective electrode by direct measurement and standard addition method. The concentration of fluoride ion was determined in drinking water (from different place at Kathmandu), toothpaste, various brand of tea and coffees. The range of fluoride concentration in water sample was 0.16 to 0.39 mg/l, tea and coffee samples were 0.011 to 0.084 mg/l and its value of toothpaste was 0.026 to 0.75 mg/l. The concentration of fluoride ion obtain from different sample was compared with the legitimate value given by the world health organization.*
Keywords: *fluoride, ITSAB, water, tea, coffe, toothpaste, fluoride ion selective electrode.*

Определение фторида в различных образцах с помощью фторид-селективного электрода

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Аннотация. *Фторид широко распространен в окружающей среде, воде, воздухе, растительности и земной коре, которые могут захватывать грунтовые и поверхностные воды естественным путем. Фтор в незначительных количествах является важным компонентом для здоровья человека и помогает в нормальной минерализации костей и формировании зубной эмали. Определение фторида в некоторых разновидностях было выполнено с использованием фторид-селективного электрода методом прямого измерения и стандартного добавления. Концентрация фторид-иона определялась в питьевой воде (из разных мест в Катманду), зубной пасте, различных марках чая и кофе. Диапазон концентрации фторида в образце воды составлял от 0,16 до 0,39 мг / л, в образцах чая и кофе – от*

0,011 до 0,084 мг / л, а его значение для зубной пасты – от 0,026 до 0,75 мг / л. Концентрация фторид-иона, полученная из другого образца, сравнивалась с допустимым значением, присвоенным Всемирной организацией здравоохранения.
Ключевые слова: *фторид, ITSAB, вода, чай, кофе, зубная паста, селективный электрод по ионам фтора.*

1. Introduction

Fluoride ion is the ionic form of fluorine which is mostly found in various sample and play Vitol role for human health and environment, but consumption or presence of large amount of fluoride harmful for health and environment. The higher concentration of fluoride is toxic. The optimal range of fluoride is 0.05 - 0.07 mg per kg body weight has been considered. Fluoride ion is mostly formed as the by-product in certain process and entre in the human body by means of food chain (water, juices, tea, and coffee), toothpaste and pollution (air, water). The main source of fluoride in toothpaste, water is sodium fluoride, stannous fluoride and sodium monofluorophosphate. It has indispensable role in prevention of dental caries. However, the beneficial effect of reduced dental caries is balanced by an increased prevalence of dental fluorosis. Fluorosis is defined as an abnormal condition caused by excessive intake of fluoride as from fluoridated drinking water, characterized chiefly by mottling of the teeth. Fluorosis appears as marking of the enamel surface of the teeth (enamel defects). Mostly fluorosis appears barely visible white flecks on the tooth surface; with the more sever cosmetically unacceptable form being rather uncommon. Dental fluorosis occurs during tooth development, especially between the ages of 6 month to 5 years. The British Fluoridation Society considers fluorosis as a cosmetic rather than a health problem. Several determination technique of fluoride in various sample such as direct measurement, standard addition, titration method and anion-chromatography, Ion-Selective electrode etc. are use in this present work. Ion-Selective method is selected for the determination of Fluoride ion in various samples. Health Hazards of fluorideFluoride is an important element for all tissues in the body. Appropriate fluoride consumption is beneficial to bone and tooth integrating and it has important positive impact on oral health and overall health. However, high level of fluoride has been associate with various adverse effects in living being. The permissible does to human being, according to WHO, is 1.5 mgL−1 as a safe limit of fluoride in drinking water. High levels of fluoride in childhood were associated with a reduction in IQ. The author noted that this research is not applicable to the safety of artificial water fluoridation because the adverse effect on IQ were found with fluoride level that were much higher than typically found in artificially fluoridated water. Consumption of fluoride at level beyond those used in fluoridated water for a long period of time causes skeletal fluorosis. In some areas, particularly the Asian subcontinent especially India, Pakistan and Bangladesh skeletal fluorosis is endemic. It is known to cause irritable bowel symptoms and joint pain. Early stages are not clinically obvious and may be misdiagnosed as rheumatoid arthritis or anklos-

ingspondylitis. Fluoride causes nephrotoxicity in kidney due to toxic level of serum fluoride, commonly due to release of fluoride from fluoride containing drugs, such as methoxyflurane. Fluoride induced nephrotoxicity is dependent on the serum fluoride level, typically serum fluoride level exceeding 50 micromoles per liter (about 1 ppm) to cause clinically significant renal dysfunction. The only generally accepted adverse effect of fluoride at level used for water fluoridation is dental fluorosis, which can alter the appearance of children's teeth during tooth development; this is mostly mild and usually only on aesthetic concern. As a Compared to unfluoridated water, fluoridation to 1 mg/L is estimated to cause fluorosis in one of every 6 people (range 4 - 21), and to cause fluorosis of aesthetic concern in every 22 people.

2. Experimental

2.1. Determination of Fluoride in Drinking Water and Bottled Water Sample

A combination fluoride electrode was used to determine the fluoride content in drinking water and bottled water. The solution which contained 25 ml of the sample and 25 ml of TISAB solution were mixed with a magnetic stirrer for 3 minute.

The electrode potential of the solution is measured by using fluoride selective electrode. The potential of the sample solution were directly compared with those of fluoride standard solution. Then 1 mL of the 0.1 M fluoride standard solution was added in to the text solution and placed in magnetic stirrer. Then new electrode potential was measured. Similarly this process was carried out up to 5 mL. The mean concentration of fluoride was determined.

2.2. Determination of Fluoride Content in Toothpaste

For the determination of fluoride in toothpaste, 1 g of the sample was weighted in to the 100 mL beaker. After 25 mL of TISAB solution was added to the sample, the mixture was boiled thoroughly for 2 min. The suspension was completed to 50 mL with distilled water and placed in magnetic stirrer. The electrode potential of the solution is measured by using fluoride selective electrode. The potential of the sample solution were directly compared with those of fluoride standard solution.1 mL of the 0.1 M fluoride standard solution was added in to the text solution and placed in magnetic stirrer. Then new electrode potential was measured. Similarly this process was carried out up to 5 mL. The mean concentration of fluoride was determined.

2.3. Determination of Fluoride in Tea and Coffee Sample

1 gm of dried tea sample was placed in to a beaker. Then 100 mL of boiling de-ionized water was poured in to the beaker and 25 mL of the tea liquor was taken after the 5 minute. Then 25 ml of TISAB solution was added and placed in magnetic stirrer. The electrode potential of the solution is measured by using fluoride selective electrode. The potential of the sample solution were directly compared with those of fluoride standard solution.1 mL of the 0.1 M fluoride standard solution was added in to the text solution and placed in magnetic stirrer. Then new electrode potential was measured. Similarly this process was carried out up to 5 mL. The mean concentration of fluoride was determined.

3. Results and Discussion

3.1. Results of Fluoride Analysis

3.1.1. Fluoride Concentration of Water and Bottled Water at Kathmandu

The fluoride level was determined in drinking water samples collected from cite at Kathmandu by direct measurement and standard addition method. A total of 4 different water samples are collected. In the drinking water from all the sample location, the fluoride content was less than 0.40 mg/L. As can be seen from table, the highest fluoride level was observed in tap water about 0.399 mg/L. The natural concentration of fluoride in ground water depend on such factor as the geological, chemical and physical characteristic of the water supplying area, the consistency of soil, porosity of rocks, the pH and temperature. The complexing action of other element and depth of wells. The result obtain indicate that the fluoride level of the drinking water and bottled water are generally low regarding drinking water standards. This lack of fluoride content in the drinking water which are one of the main source of fluoride nutrition for human, may causes health problem for human health especially teeth and bone structure.

3.1.2. Fluoride Concentration in Toothpaste

Fluoride Concentration in ToothpasteThe fluoride content of 7 different brands of toothpaste was analyzed by direct measurement and standard addition method. Toothpaste is an ideal form of administration of F as it is routinely used by a very large part of the world's population. For better comparison of divergent formulation as well as for sound interpretation and comparison of data from different laboratories, a potentiometric method for F determination in toothpaste is required. The total fluoride determination was made on sample by fluoride selective electrode. Analysis shows that all fluoride in toothpaste were in the form of NaF, SnF2, Na2PO3F. Seven brand of toothpaste were analyzed for their fluoride content by this method. This toothpaste can be classified in to 4 group's non-fluoridated, fluoridated, sodium fluoride, sodium monofloro-phosphate and fluoridated with stannous fluoride but there is no independent indication of their quantitative composition. One of these samples was non-fluoridated. In all probability, concentration is naturally occurring fluoride impurity level in the component of the toothpaste. Out of these other toothpaste were identified on their packaging as containing fluoride added as sodium fluoride and sodium monoflorophosphate. All this group had a fluoride concentration between 0.026 to 0.75 mg/g.

Fluoride Concentration in Tea and CoffeeThe concentration of fluoride ion in 5 different sample of tea and 2 sample of coffee were analyzed. All samples of tea and coffee were purchased from local market at Kathmandu. The analyzed tea and coffee are commonly used by local people. Tea and coffee infusion were prepared on a customary way of tea.

4. Conclusions

Measuring performed potentiometrically using a fluoride selective electrode is simple and inexpensive. The fluoride selective electrode has gained

prominence over the traditional chemical and colorimetric method due to its sensitivity, specificity, speed of use and ability to response to a wide range of concentration. A possible matrix effect can be easily eliminated by the addition of TISAB. Traces of fluoride can be determined directly in the liquid media studied (no laborious and time consuming operation of sample preparation such as analytic enrichment are required). According to WHO, the optimum fluoride intake for human ranges from 2 to 4 mg per days. The total daily intake of fluoride that may causes fluorosis in adults in over 13.0 to 14.5 mg per days. We can see from the results, if daily tea consumption is too high and intake of fluoride from another source is excluded, tooth fluorosis due to the uptake excessive of fluoride may result.

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Les matériaux composites pour satellites

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Annotation. *L'articletraite des matériaux composites pour les applications spatiales et de leurutilisation dans les réflecteurs et les structures de satellites. Une comparaison des propriétés des matériaux composites par rapport aux matériauxmétalliques de construction estprésentée, ainsi que les avantages de leurutilisation.*
Mots clés*: science des matériaux, matériau composite, satellite, construction, réflecteur.*

Композиционные материалы в конструкции спутников

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Аннотация. *В статье рассматриваются композиционные материалы для космического применения и их использование в рефлекторах и конструкциях спутников. Показано сравнение свойств композиционных материалов по сравнению с конструкционными металлическими материалами, а также преимущества их применения.*
Ключевые слова*: материаловедение, композиционный материал, спутник, конструкция, рефлектор.*

De nosjours, les matériaux composites ontatteint un telniveaud'utilisationqu'ilest déjà impossible de se passer de cettefamille de matériaux sur les applications spatiales.

Qu'est-cequ'unmatériau composite? C'est un assemblage d’aumoins deux matériaux non miscibles qui possède des propriétés que les composantsseuls n'ont pas (Fig. 1).

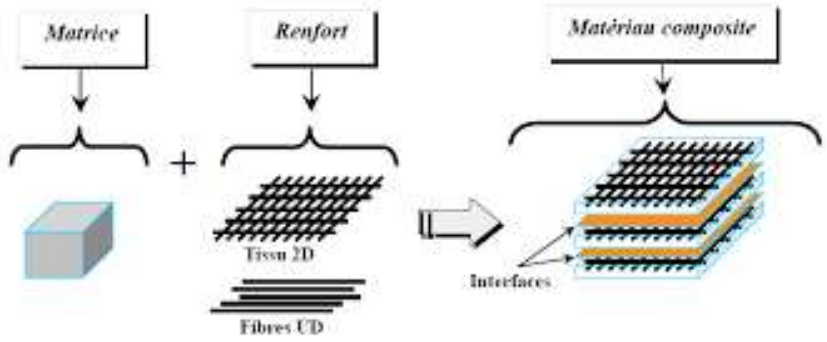

Fig. 1. Structure composite.

1. Description des propriétés des matériaux composites

Les premières pièces composites ontétéintroduites dans les satellites à la fin des années 1970. Des fibres de carbone à module élevé avec unerésineépoxyontétéutiliséescommematériaux.

Le tableau 1 présenteunecomparaison des caractéristiquesobtenues entre le composite et l'alliaged'aluminium. Désignations dans le tableau 1: σ^+ – résistanceen traction; σ^- –résistanceen compression; E – module d'Young; γ – densité.

Tableau 1. Comparaison des performances entre le composite à fibres de carbone et l'alliaged'aluminium [2]

	σ^+, MPa	σ^-, MPa	σ_{-1}, MPa	E, GPa	$\gamma, \frac{kg}{cm^3}$	$\frac{E}{\gamma}$
Composite carbon anisotrope	1700	1400	1100	145	1600	90,6
Alliagealuminium	450	450	130	72	2700	27

Le gain de masse apporté tout enconservantd'excellentescaractéristiquesmécaniquesestgénéralement la principale motivation d'utilisation des matériaux composites pour la réalisation de structures sur les produitsspatiaux. Aussi bien, les matériaux composites sontpratiquementinsensibles à la fatigue encomparaison par rapport aux matériauxmétalliques qui nécessitenten maintenance un suivirégulier de la propagation des fissures de fatigue dans les pièces de structure. De plus, les matériaux composites ne se corrodent pas.

Les techniques de fabrication de matériaux composites permettentd'obtenir des formes complexes avec la possibilité de fabriqueruneseule pièce d'assemblage, ce qui nécessiteraitplusieurs sous-éléments dans le métal.

2. Application dematériauxcomposites

Pour les satellites, la chasse au kilogrammegagnéestvitale. Le tauxd'échangepeutatteindre pour certainespièces de satellite des valeurs de l'ordre de 40 000 € parkilogrammegagné [1].

La Fig. 2 présenteune structure composite de formetubulaire, qui estutilisée dans les satellites.

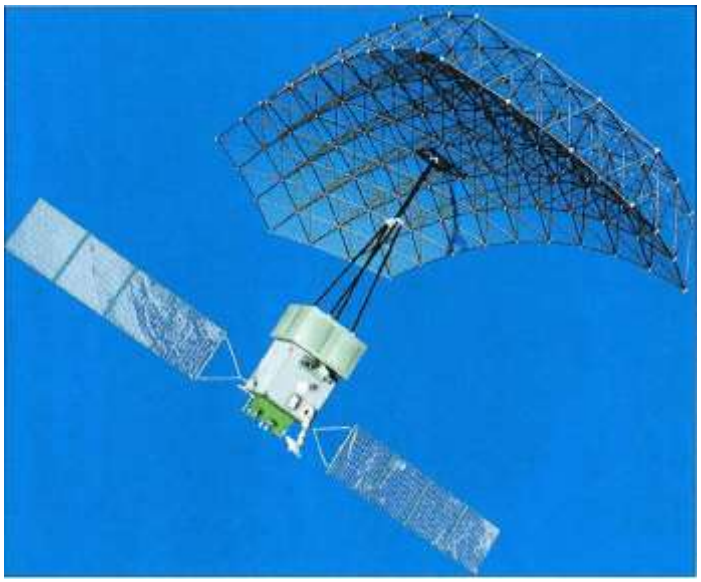

Fig. 2. Structure tubulaire de satellite en composite.

La structure composite estégalementutilisée sous forme de tube central de plus gros diameter, qui présente sur la Fig. 3. Sur la structure proprementdite, le gain de masse par rapport à une solution métalliqueest de l'ordre de 50 %.

Fig. 3. Structure centrale monotube de satellite en composite [1].

Les réflecteursd'antennesont des piècesd'unetrès haute technicité (Fig. 4).

Fig. 4. Réflecteurd'antenneen composite sur satellite.

Un des principauxproblèmes pour les satellites de télécommunication et d'observationest la stabilitégéométrique de la structure des antennesd'émission et de réception. La moindre variation géométrique des antennesinduituneperte de qualité du signal transmis et fait doncchuter les performances du satellite. Les structures sandwichenmatériaux composites à matriceorganiquepeuvent, avec une orientation optimisée des différentes couches constituant la structure, présenterglobalement un coefficient de dilatation thermique (CDT) proche de zéro pour l'ensemble de la structure. Un CDT proche de zéropermet de réduire le changement de structure du satellite et d'augmentersa durée de vie [1]. Sur la Fig. 5 estprésentéecette structure.

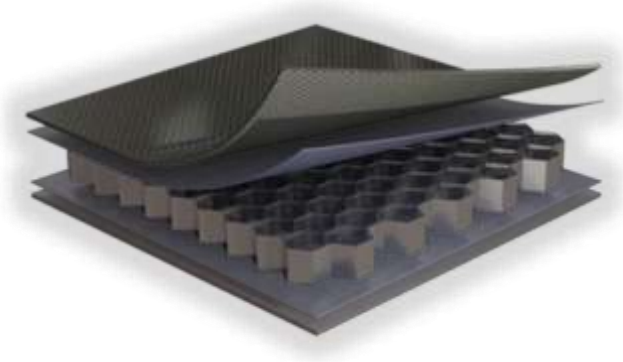

Fig. 5. Composite à structure sandwich.

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Numerical simulation of self-oscillations during milling processing

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Abstract. *The article deals with the issues of determining the area of occurrence of self-oscillations in the space of technological parameters of the system and evaluating the quality of the treated surface. It is shown that the calculation results determine the frequencies of the resulting oscillations, which in the future should be used to identify the areas of self-oscillations in experimental studies.*
Keywords: *self-oscillations, numerical modeling, oscillations, milling, cutting.*

Численное моделирование автоколебаний при обработке фрезерованием

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Аннотация*. В статье рассматриваются вопросы определения области возникновения автоколебаний в пространстве технологических параметров системы и оценки качества обработанной поверхности. Показано, что по результатам расчета определяются частоты возникающих колебаний, что в дальнейшем целесообразно использовать для идентификации областей автоколебаний при экспериментальных исследованиях.*
Ключевые слова: *автоколебания, численное моделирование, колебания, фрезерование, резание.*

In most cases, fluctuations in the material treated by cutting adversely affect the quality of the surface, as a result of which there are roughness and ripples, deviations in shape, wear of tools and equipment.

Due to the interruption of the cutting process, the tool and parts undergo periodic oscillating movements resulting from the interaction of the tool with the material to be processed. Most importantly, the frequency of this vibrational motion does not coincide with the usual frequency of the elastic system of the device, which leads to a sharp increase in the amplitude of the resonant vibration.

Through cutting, self-vibration often occurs, the appearance of which usually leads to insufficient quality of the working surface, sometimes leading to breakage of the tool, damage to the workpiece.

There are several reasons for self-vibration, such as low cutting force characteristics, cutting force lag, and cutting along the track. The most noticea-

ble effect of cutting on the track, which occurs in almost all cutting of different materials-metal, stone, polymer.

The occurrence of automatic CAD vibration in the system leads to a violation of constant periodic movement of the tool center, which occurs in the absence of stability.

To assess the stability of periodic motion during grinding, it is necessary to solve the problem of studying differential equations with periodic coefficients and expiring arguments.

In practice, often use different criteria to evaluate the stability, you can ignore Solve the equation and use the parameters of the load of the system This method allows to prove the stability of the system during the cutting process and during the movement of mechanical parts, evaluate the impact of a single mechanical part, cutting process and displacement on the stability of the entire system It is also possible to use the following methods:

To find areas of vibration stability during grinding, the harmonic linear method is widely used, which reduces the study of the stability of periodic motion during grinding to the study of the stability of equilibrium positions during rotation [1, p. 286]. In [2, p. 47-57], we study a system of differential equations with period coefficients and propose a way that we can reduce differential equations with delay arguments by rounding the delay to use the fluquet theorem.

By these methods, the region of the stability parameter of the system can be approximated. However, it is very real to evaluate the influence of vibrational motion on the magnitude of the vibration amplitude of the tool center, cutting force, resulting surface quality and other technical characteristics, it is also important to emphasize the field of machining parameters that can ensure stable cutting and obtain the desired surface quality. To achieve these results, numerical modeling should be used [3, p. 89-109].

Based on the grinding process simulation model, the vibration motion of the tool in the grinding process was studied by numerical modeling, and the parameters of the dynamics of the tool and the unevenness of the surface to be cut were analyzed. Poincare maps were used to analyze the results of the simulation.

The prediction of cutting force for Bull and Oy is written as follows:

$$F_{xj} = -F_{rj}\sin(\varphi_j) - F_{tj}\cos(\varphi_j)$$
$$F_{yj} = F_{rj}\cos(\varphi_j) - F_{tj}\sin(\varphi_j)$$

The forces in the radial and circumferential directions in the simplest case can be approximated by the dependencies:

$$F_{rj} = g_r y_e b^2 \left(\frac{S_z}{b}\right)^q \left(\frac{h_j}{S_z}\right)^q$$

$$F_{tj} = g_t y_e b^2 \left(\frac{S_z}{b}\right)^q \left(\frac{h_j}{S_z}\right)^q$$

Where g_r, g_t are dimensionless coefficients that characterize the state of the cutting edges of the tool; b - axial depth cutting operations; y - strength of the processed material; S_z - feed to the tooth; h_j - instantaneous thickness of the material cut off by Jm teeth; q-non-linear coefficient of dependence of the cutting force on the thickness of the cutting layer. It should be noted that from the perspective of size theory, this form of writing is preferred and is invariant in relation to the value system used.

The main parameters of the system are: cutter radius R, the number of teeth Z, feed per tooth S_z, axial depth of cut b. Elastic characteristics of the tool attachment: stiffness k, linear damping coefficient d. Natural frequency of the system P0.

A complete system of equations describing the kinematics and dynamics of the system:

$$\begin{cases} x_c = x_0 + S_z Z t + u(t) \\ y_c = y_0 + v(t) \\ x_0 = x_c + R\sin(\varphi_j) \\ x_0 = y_c - R\cos(\varphi_j) \\ \ddot{u} = -p_0^2 u - 2o\, p_0 \dot{u} + \\ + \frac{1}{m}\sum_{j=0}^{Z-1} -F_r \sin(\varphi_j) - F_t \cos(\varphi_j) \\ \ddot{v} = -p_0^2 v - 2o\, p_0 \dot{v} + \\ + \frac{1}{m}\sum_{j=0}^{Z-1} F_r \cos(\varphi_j) - F_t \sin(\varphi_j) \\ h_j \leftarrow A(x_0, y_0, S) \end{cases}$$

In the presented model, the instantaneous thickness of the cutting layer is determined, taking into account the formation of the surface s. If the fit curve intersects a surface boundary polygon, points located on the cutting edge path are added to the surface array. The points"should be cut off", will be removed from the array. The thickness of the cutting layer is defined as the distance from the cutting edge to the intersection of the line segment connecting the center of the cutter and the cutting edge and the line segment belonging to the surface.

Use points on the Poincaré map to perform stability studies. If the phase orbitals of a system are composed of some non-tangent intersections, then the vertical axis of the phase plane is fixed. Thus, the stationary periodic motion corresponds to n points on the Poincaré graph. If stability is lost, the number of points on the display will change.

The proposed approach also makes it possible to evaluate the quality of the treated surface.

By the proposed method, it is possible to determine the region of self-vibration in the system technology parameter space and to evaluate the quality of the machined surface. This method makes it possible to identify the nature of the loss of stability. The calculated results will determine the frequency of the generated vibration, and will be applied to determine the self-vibration region in future experimental studies.

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Robotertechnik in einem modernen Betrieb

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Zusammenfassung: *Der Artikel beschreibt die Hauptanwendungen von Robotersystemen in der modernen Produktion. Es wird berichtet, wofür die Automatisierung gedacht ist und in welchen Branchen sie am häufigsten verwendet wird, sowie welche Arten von Robotern vorhanden sind. Es werden Vor- und Nachteile dieser Technologien festgestellt. Anschließend werden auch Probleme Russlands in diesem Bereich und Aussichten für die Entwicklung dieser Technologien in unserem Land untersucht.*

Stichworte: *Automatisierung, Roboter, Vor- und Nachteile, Produktion, probleme bei der Umsetzung in Russland.*

Робототехника в современном производстве

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Аннотация. *В статье рассматриваются основные применения роботизированных систем в современном производстве. Рассказывается для чего предназначена автоматизация и в каких отраслях чаще всего применяется, какие виды роботов существуют и для чего. Показаны плюсы и минусы данной технологии. А также рассматриваются проблемы России в данной сфере и перспективы развития данной технологии в нашей стране.*

Ключевые слова: *автоматизация, роботы, преимущества и недостатки, производство, проблемы реализации в России.*

Mit dem Wort Robotik haben wir eine Assoziation mit einem Roboter, der dem Menschen ähnlich ist, aberin diesem Artikelwird über Roboter in der Produktionund ihre Auswirkungen auf die Wirtschaft berichtet, denn Roboter, die dem Menschen ähnlich sind, sind heute kein Spielzeug mehr. Solche Roboter sind in Japan verbreitetund am häufigsten zur Unterhaltung.

DieAutomation durch Roboterin der Produktionsherstellung hat folgende Vor-und Nachteile.

Vorteile:

1. Roboter erhöhen die Gesamtproduktivität. Auf diese Weise wird mithilfe der Roboter viel Arbeitszeit gespart und die Arbeitsbelastung vermindert.

2. Hochwertige Qualität. Mit Automation durch Roboter entsteht ein Mehrwert für die entsprechende Anlage in Bezug auf Qualität, Verfügbarkeit und Leistung. Roboter werden so programmiert, dass sie immer wieder die gleiche Aufgabe ausführen und dabei im Laufe der Zeit nur einen Bruchteil der Qualität verlieren.

3. Roboter können zusätzlich die „schmutzige" Arbeit erledigen. Jede Arbeit, die für Menschen gefährlich sein könnte, kann von Robotern ausgeführt werden.

4. Automatisierung durch Roboter kann zu besseren Geschäftsergebnissen führen. Zum Beispiel führen Roboter oft zu effizienteren Arbeitsabläufen und niedrigeren Lohnkosten.

Nachteile:

1. Abbau von Arbeitsplätzen

Wie bereits erwähnt, optimieren Roboter die Produktion und ersetzen den Menschen. Das führt zu einem Stellenabbau.

2. Die Anschaffungskosten für Roboter sind hoch. Neben der Roboter-Hardware und anderen Betriebskosten fällt ein großer Teil der Kosten auf die Neuprogrammierung und Anpassungen des Roboterpfades. Diese Programmierkosten sind auch wiederkehrende Kosten, denn bei geringfügigen Änderungen in der Produktion muss der Roboter neu programmiert werden.

3. Ein weiterer Nachteil ist, dass Automation fehlschlagen kann. Wann immer Unternehmen ein Automatisierungswerkzeug einsetzen, können Dinge auch schief gehen.

4. Ein weiterer möglicher Nachteil der Technologie ist, dass die wirtschaftlichen Ergebnisse ungewiss sind. Obwohl mit der Automation Kosteneinsparungen, weniger Fehler und eine höhere Effizienz erzielt werden können, gibt es keine Garantie dafür, dass alles wie geplant funktioniert.

Aber wo kanndie Robotisierung benutzt werden? Sowohl das Schweißen und Schneiden als auch die industrielle Kunststoffverarbeitung sind typische Einsatzgebiete für Roboter in der modernen Produktionstechnik.Aber die moderne Anwendung von Robotersystemen ist nicht darauf beschränkt. Beispielsweise werden Robotersysteme in der Landwirtschaft, Logistik, im Baugewerbe, Elektrotechnik und in anderen Bereichen eingesetzt.

Zunächst betrachten wir den Aspekt der Industrieroboter.Als Industrieroboter werden programmierbare Maschinen bezeichnet, die zur Handhabung,

Montage oder Bearbeitung von Werkstücken im industriellen Umfeld eingesetzt werden. Diese Roboter bestehen zum Großteil aus einem Roboterarm, einem Greifer, diversen Sensoren sowie einer Steuerungseinheit. Sie können Aktionen entsprechend ihrer Programmierung auch autonom ausführen.

Auch werden oft in der Produktion verschiedene Förderer verwendet, um Güter, Werkstücke oder Fertigware zu transportieren und zu sortieren.

Interessanterweise gibt es Wettbewerb im Roboterschweißen, wosich Teilnehmer an Programmieren, Maschinenteachen und natürlich Schweißenbeteiligen.

Der nächste Industriezweig, in dem Roboter erfolgreich eingeführt werden, ist das Baugewerbe.Wenn es sich um Robotik im Bauwesen handelt, zählen vor Ort eingesetzte Roboter zu den bekanntesten Vertretern. In den letzten Jahren entstand eine ganze Reihe von Prototypen für verschiedene Anwendungen. Ein Beispiel sind Maurer-Roboter, die aus Ziegeln eigenständig Mauern errichten. Ein anderes Beispiel ist der Roboter-Schweißer, der eine Vielzahl von Schweißaufgaben bewältigen kann. Ebenfalls am Vormarsch sind Roboter, die im 3D-Druck Objekte oder Gebäudeteile errichten. Roboter zum Abbau von Gebäuden und verschiedenen Strukturen sind mittlerweile auch weit verbreitet.

Der nächste Bereich, wo Roboter heute sehr häufig eingesetzt werden, ist die Logistik.Dasgrößte Problemder Logistik ist und bleibt der Zeitdruck: weil Kunden eine immer schnellere und genauere Auftragsabwicklung verlangen, könnenVerteilzentren, die nach wie vor auf manuelle Arbeit setzen, kaum mithalten. Hier hilft die Automation der Logistik immens – mit dem Einsatz von mobilen Robotern im Lager, die teilweise auch autonom funktionieren und kaum überwacht werdenmüssen. Das heißt die innerbetriebliche Logistik funktioniert sich quasi von selbst.

Unternehmen wie Yandex, Amazon, DHL verwenden solche modernen Lagerhallen, in denen es fast keine Menschen gibt, und die ganze Arbeit von der Maschine erledigt wird. Das spart Strom und Arbeitskosten.

In Russland ist die Robotisierung der Produktion allerdings sehr schlecht entwickelt. Laut der Statistik kann man sehen, dass Russland nach dem Grad der Robotisierung hinter den anderen Ländern zurückbleibt, und zwar sehr wesentlich.

Also, was sind die Probleme Russlands in diesem Aspekt?

1. Das Hauptproblem ist die Entwicklung der Wissenschaft, d.h. es gibt keine klaren und transparenten Finanzierungsmechanismenfür Forschungen.
2. Mangel an Finanzierung in diesem Bereich.
3. Technisch schlecht entwickelte Industriebetriebe.
4. Fachkräftemangel.
5. Billige Arbeitskräfte.

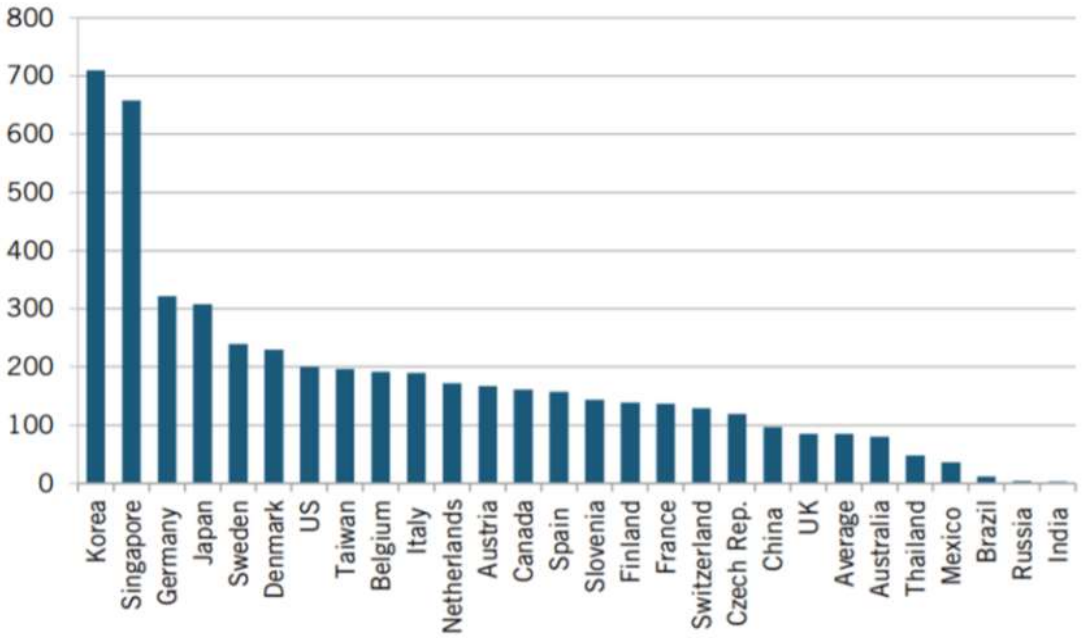

Bild 1. Anzahl der Roboter pro 10.000 Mitarbeiter im Jahr 2017.

Trotz alledem wird Russland irgendwann früher oder später zur Robotisierung kommen. Dafür gibt es wirtschaftliche Gründe: Die Bezahlung der Arbeitnehmer wird höher; die Robotertechnik ist billiger, und junge Menschen wollen in diesem Bereich zunehmend studieren.

Trotz der gegenwärtigen Schwierigkeiten gibt es in Russland moderne Unternehmen, die Robotik einsetzen. Z.B. Ozon, Yandex, Gazpromneft und andere.

Also, trotz seiner Nachteile ist die Robotisierung der Produktion sehr perspektiv und ein sich schnell entwickelndes Gebiet.

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