

THE DIGITAL ECONOMY AND THE DIGITIZATION OF – PAST, PRESENT, AND FUTURE.

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Abstract: *Currently, the world economic and social development is characterized by a significant impact of the process of digitalization - a new trend of social development based on the digital representation of information. Given the size of the economic and social life of both the individual country and the individual, digitalization ultimately leads to more efficient economic activity and better quality of life.*

But, on the other hand, significant amounts of information received from outside, the frequent need for remote management and rapid decision-making in conditions of incomplete, and in some cases unreliable, information - these are only a few challenges of the new post-industrial, digital economy, which has both positive and negative sides. Also, the unstable external environment is forcing humanity to reconsider its place in the modern global economy.

Thus, as part of the development of digitalization, there is a problem of neutralizing the negative consequences and risk groups. In modern conditions, this is possible only with certain measures, which include the implementation of information security rules, which is the basic element of the security system. In turn, information security involves not only the protection of information from unauthorized access, transformation, and destruction but also the protection of information resources from external and internal influences aimed at violating their stable performance. Thus, the use of information security systems will lay a solid foundation for the formation of a fundamentally new platform for the further global development of the economy and society.

Keywords: *digital economy, digitalization, digital technologies, Internet of machines, Internet of people, Internet of things, Internet of animals, information security.*

I. Introduction

Currently, world economic and social development is characterized by a significant impact of the digitalization process, a new trend in social development, which has replaced informatization and computerization. Digitalization is based on the digital presentation of information, which, on the scale of the economic and social life of both an individual country and an individual, leads to an increase in the efficiency of economic activity and improvement of quality of life indicators.

The modern economy is characterized by active tendencies of the constant increase in the complexity of the various systems in which human activity is carried out: social, technical, economic, environmental, etc. In turn, all of

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them, functioning within their competency frameworks, in addition to solving standard activity tasks, do not require not only the creation of fundamentally new management paradigms but also the preservation of those structures that allow for the establishment of effective interaction between these systems.

Significant volumes of information received from outside, the need for remote management of teams, often with a large number of employees, the frequent need for quick (if not instant) decision-making in conditions of incomplete, and in some cases false information, are just a few challenges of the new post-industrial, digital economy, in which we actually already live, without suggesting such a progressive scenario, only a third of a century ago. Also, we should not forget about the conditions of an unstable external environment, which force mankind to a certain extent to re-examine its place in the modern global economy.

Relatively recently, the world (and after it the Russian) public has actively started talking about a fundamentally new phenomenon, which, as is supposed, should radically change the way of life that is familiar to us. This phenomenon is the digital economy, about which society as a whole, unfortunately, now has a rather vague idea, often identifying the concepts of “digital economy” and “digitalization”. But, paradoxically, this same society is beginning to actively use the innovations directly related to digital technologies, often without suspecting it..

Comparing the concepts of “digitalization” and “digital economy”, we note that digitalization is the basis for the digital economy, that is, it is the trend of global development that not only determines the development of the economy and society as a whole but also forms the digital economy, in particular. In other words, today it's digitalization that is the main modern trend in the development of the economy and society, which is based on the transition to a digital format for providing information aimed at improving the efficiency of economic activity and the quality of life in general.

II. Modality

The novelty of the presented study lies in focusing on the current processes of implementation and dissemination of the digital economy and digitalization, which are becoming the main vector of development within the global economy as a whole. At the same time, the authors took into account not only a retrospective of the development of the digital economy and further prospects for its development but also the possibility of various risks that inevitably arise in the process of functioning of the digital economy. Besides, in the framework of the study, questions of ensuring digital security were additionally posed and considered. All this predetermined the formulation of the corresponding tasks and the choice of the methodology of scientific research..

In particular, the conceptual-categorical apparatus used by the authors is closely connected with the indicated problem areas of research, and the main method is the retrospective analysis method, which has shown high efficiency. Also, other methods were used, in particular, theoretical (analysis, synthesis, concretization, generalization, analogy method) and empirical (the study of national and world experience in implementing digitalization elements and the use of relevant measures related to information security).

III. Results and Discussions

The concept of “digitalization” is used both narrowly and broadly. In a narrow sense, this process means the conversion of information into digital form, which allows reducing costs during its processing, and also contributes to the emergence of substantially new capabilities. Concrete transformations of information into digital form lead to significant positive changes, which determine the application of the concept under consideration in a broader sense -

as a trend ineffective global development. However, such consideration is possible only if the digital transformation process meets the following requirements:

- coverage of production, the business sector, science, the social sphere and the ordinary life of society;
- effective use of the results;
- access of digitalization results to ordinary users of converted information;
- the use of the results of the process not only by specialists but also by ordinary citizens;
- training in working with digital information of end-users.

Also, among the main properties of the information that is presented in digital format, there are:

- the use of various physical principles of the presentation, memorization, and transmission of information, including using the ability to encrypt a message and transmit it in this form;
- information transfer using various material carriers;
- the ability to copy and distribute information without losing its accuracy;
- the use of algebraic properties that contributed to the creation of digital technologies, which are more effective than analog technologies.

The introduction of digitalization is closely related to the background of its occurrence (both at the state and industry levels, as well as at the levels of individual households and the population), which include:

- The active development of modern Internet technologies;
- widespread use of mobile and computing devices;
- deep integration into the daily life of social networks;
- the emergence of digital entrepreneurial projects that create intense competition with the traditional form of management;
- the need for innovative solutions, etc.

Moreover, the spread of digitalization is largely due to its wide capabilities, among which stand out:

- The positive economic and social effect of the use of digital technologies both for the business sector and for society as a whole;
- an increase in the quality of life of the population;
- ensuring transparency of economic operations and ensuring the possibility of their monitoring;
- the emergence of robotic management systems;
- Increase in the productivity of public labor;
- Creation of new types of products or services, improvement of their quality;
- Reducing the cost of searching for information.

Thus, the peculiarities of digital information predetermined the creation of such a scientific direction as digital economics, which includes mathematical methods and models based on the digital format of providing information and its properties. The digital economy is an economy in which the main trend of effective development is digitalization, and the peculiarity of this type of economy is the effective impact of the digitalization trend.

There are various approaches to defining a digital economy. In particular, the simplified approach usually involves the automatic digitalization of all issues related to the distribution of the Internet, the use of mobile communication services, the ability to quickly access information, the development of electronic commerce and bidding, and various distance services. Moreover, all of the above is just a few of what has already firmly taken root

in our lives, but in fact at the end of the twentieth century. smartphones did not exist yet, and the question of the everyday mass use of mobile communications and the Internet was from the category of utopian.

Popular examples of the household level are the ability to record to the doctor without leaving home, i.e. through the appropriate electronic recording systems and portals, the use of distance learning courses, payment of various purchases and services using a bank card, the purchase of various goods in online stores and even the possibility of contactless payment for passage in the subway are all manifestations of the digital economy. Surely we have all come across some of the above, but we are already actively using something in everyday life. Thus, we can assume that in modern society, even though the content of the concept of “digital economy” is still vague (especially in the philistine sense), there are still quite favorable conditions for mass approval of the need to develop this area.

It should be noted that a new social tendency has already been outlined and quite clearly manifested - the stratification between those who are an active creator and participant in the digital economy (in particular, this directly relates to representatives of the so-called “Generation Z »), And those who are not yet able to accept even the very fact of the real existence of the digital economy, although at the same time it takes advantage of its existing achievements. It seems that such a gap will remain in the short term, but under certain conditions, it can be significantly reduced. If we keep in mind the distant future, we believe that this gap can completely be eliminated or it can be reduced to the minimum.

It is generally accepted that the digital economy is a special economic activity that is directly related to the active use of digital technologies in all areas of activity. Moreover, all the leading countries of the world are aware of the fact that a country that has become a leader in this direction will actually play the role of a world leader and will fully ensure both its global competitiveness and the preservation of its economic and national security. Given that the digitalization of the economy is often considered against the backdrop of military confrontation between countries of the world, the issue of leadership in this area is becoming crucial for countries.

The following definitions of the concept of “digital economy” are official and adopted at the state level in the Russian Federation:

- The digital economy is an economic activity in which the key production factor is digitized information, the analysis of the results of which, compared with traditional forms of management, increases the efficiency of various types of production, technologies, equipment, delivery of goods and services. [1]

- The digital economy is an economic activity in which the key factor of production is information in digital format. Thanks to the digital economy, an information space is being formed that takes into account the needs of the population in obtaining high-quality and reliable information, the development of the Russian information infrastructure, the creation and application of domestic information and telecommunication technologies, and the formation of a new technological basis for the social and economic sphere. [2]

At the highest level, the development of the digital economy in the Russian Federation was raised by President of the Russian Federation V.V. Putin in 2016 in a message to the Federal Assembly. Moreover, throughout the entire speech of the president, the relevance and necessity of introducing and further developing the economy of a new technological generation has been repeatedly emphasized. Thus, the Russian government received clear and concrete instruction from the President to develop a program for the development of the economy of a new technological generation..

This confirmed that the Russian Federation, along with other countries, was also included in the so-called. “Technological race”, in which the main emphasis is on the development of advanced industries. A short time later, on July 2017, the national program “Digital Economy of Russia” saw the light of day, which, according to plans,

should be implemented before 2024. The main idea of this program is to create a certain set of conditions for launching and accelerating the digitalization of everyday life and economic structure.

The Digital Economy of Russia program consists of eight areas, which include the legislative and regulatory environment, human resources and education, research and development, information infrastructure, information security, public administration, smart city, and digital healthcare. The price of the implementation of the activities of this program was determined at 200 billion rubles. per year, which is a fairly serious amount for the Russian federal budget. [3, c. 4]

Two years later, in 2019, in the Russian Federation, as part of the determination of the key priorities of socio-economic development of the country, the national project "Digital Economy" was announced, the planned expenditures for which have increased significantly and amounted to 1634.9 billion rubles. At the same time, however, the range of activities of this project has also expanded. In particular, the main goal of the national project is to create safe and stable information and telecommunication infrastructure, which in the long run should ensure high-speed transmission, processing, and storage of large amounts of data.

Russian regions are also beginning to actively engage in relevant projects and developments covering all spheres of society, including cultural aspects. In particular, the Moscow Region has launched the project "Digital Culture of the Moscow Region", the first results of which have been very successful. It is well known that new information is better assimilated in an interactive form so that museums in the Moscow region build their work with this factor in mind. Various exhibitions (both permanent and temporary), interactive thematic programs and state-of-the-art projects using modern equipment are already a reality. It is expected that by 2024 the number of appeals to the regional digital platforms will increase five times, and this is even though the active introduction of technological projects has already begun.

Thus, in the famous many historical and literary museum-reserve of Alexander Pushkin in the Big Vyazemy there appeared interactive pictures of historical personalities who visited the estate - Paul I, M.I.Kutuzov, Napoleon. Various sketches about the life and secrets of the estate are demonstrated to the visitors through the active use of interactive elements. In another, no less famous P.I.Tchaikovsky Museum-Reserve, located in Klinu near Moscow, visitors are greeted by a hologram of the Russian virtuoso pianist, our contemporary Denis Matsuev. The artist welcomes the visitor, plays the piano, and can even give a tour in the form of an audio guide. The presented examples are just a few of the modern technologies that are already being actively implemented, from the interactive presentation of information using multimedia screens to the use of holographic elements. Thus, the use of new technologies allows museum expositions to remain relevant and interesting for all categories of visitors. [4, c.10]

It is assumed that the end-users (and active users) of this infrastructure will be both organizations and households, and the Russian software will be the main basis for this. How can we not recall the main provisions of the theories known to economists, in particular, we mean the theory of economic cycles of S. Kuznets and the theory of economic conjuncture of N. Kondratyev. It is well known that the activity of large economic cycles is directly related to the emergence of new technologies and the subsequent rapid development of new industries. In this case, new branches of industry gradually assume the role of a leader and become locomotives of economic development, i.e. pull other branches connected with them. Thus, not only the development of fundamentally new industries and trends in the economy is achieved, but also the effective functioning of existing industries is ensured, and this is important.

According to the classical tenets of the theory of N. Kondratiev, innovative development plays a key role in the economy, and technological innovations should be introduced into the economy during the economic crisis, thereby creating more than favorable conditions for further economic growth, which, ultimately, will contribute to

the overall improvement of economic conditions. And in this case, priority should be given to the development of digital technologies and support for IT-business, since at the moment it is these areas that are the most advanced.

Thus, investments made today in the development of the digital economy (both private and public) will automatically be able to automatically pull an order of magnitude more money from private companies tomorrow. At the same time, actual expenses incurred will pay off in a relatively short period. It is assumed that the expected high labor productivity, the development of intraregional high-tech clusters for the production of an intellectual product, as well as the increase in the flow of foreign investments attracted by new developments and technologies will play a positive role in this process..

Unfortunately, only a small circle of specialists understands the true essence of the digital economy and its real, rather than imaginary need for further economic development, despite the fact that the history of the digital economy is already approaching a quarter century. It is believed that the term "digital economy" was coined in 1995 by an American scientist from the University of Massachusetts Nicholas Negroponte. In recent years, this term has become a part of the everyday life of economists, politicians, businessmen, and now they are designating a fundamentally new model for the development of the global economic system, as opposed to the existing "analogue economy" based on relations emerging in various phases of social production, starting with the production sphere and ending with the sphere of consumption.

Considering the retrospective of the development of digital technologies, we should first of all note that over the past half-century they have gone through several stages of development. The initial stage is considered to be the so-called Internet machines, initially in 1969 with the closed network ARPANET, conducted by the Office of Advanced Research Projects of the U.S. Department of Defense. A little later, in 1984, the U.S. National Science Foundation created a specialized network, NSFNET, originally designed to communicate between universities and computer centers, i.e., it was based not on the military, but civilian tasks. Connection to NSFNET was quite free and more than 7,500 small networks were connected to it, almost a third of them outside the United States. It is believed that it was with the transfer of the NSFNET backbone network into commercial use that the modern Internet as we know it appeared. [5]

The second stage of development of the Internet - the Internet of people - is characterized as a process that has irreversibly changed modern society and is directly related to the creation of computer technologies, mass use of computer technology, as well as the active spread of the Internet in the world. It is believed that it is the Internet that has contributed to a fundamental change in society through the use of fundamentally new forms of communication, interactivity, exchange, and receipt of information. It can even be argued that this very stage of development of the digital economy has determined what modern society has come to regard as friendship, participation in public life, reputation and relations. [6, c. 101]

Today, without the Internet, it is impossible to imagine a person's daily life. There are almost unlimited opportunities for people today, and our challenge is in many ways how effectively we take advantage of those opportunities. With the help of the Internet, communication between people who are thousands of kilometers away from each other is started and maintained. We can also use the Internet to watch movies, read the news, work or study remotely, learn new languages, develop websites, listen to music, look for tasty dinner recipes, make favorite hobbies and simply communicate. And it's all thanks to the World Wide Web, which has covered almost all spheres of human life.

A striking example of a combination of virtual and personal communication between different people is Postcrossing, a project originally designed to enable postcards from around the world. Postcrossing is believed to have been influenced by book-crossing, another well-known book-exchange project. Two Portuguese students, Paolo

Mogales and Anna Campos, have the idea for Postcrossing. It was they who invented the idea of international postcard exchange, developed the website and the basic principles of Postcrossing mechanism.

The rather simple principle of exchanging postcards is based on a single database of all registered participants in the project, as well as a mechanism for randomly issuing addresses to ensure that the total difference between sent and received postcards for each project participant is minimal. At the same time, there is an indirect exchange system in Postcrossing, that is, a participant sending postcards to one user receives them from others at the same time. Thus, in practice a very simple idea is realized: how many cards I sent - so much I received.

The corresponding site with the same name for the first time earned July 14, 2005. Despite all the fears of developers, post-crossing came to the users' liking and began to develop actively. Thus, the ten-millionth postcard was registered in January 2012. Less than a year later, only 11 months later, the fifteen millionth postcard was sent. In October 2013, the twenty millionth postcard was registered, on June 2015, the thirty millionth postcard was received, and on February 2017. - Forty millionth postcard, and on December 2018. - Fifty millionth postcard. And I think that's not the limit. As of January 2019, more than 756,900 people from 213 countries were registered on the post-crossing website. [7]

It is believed that during the existence of Postcrossing, this project involved people in almost all countries of the Earth, with rare exceptions. Postcrossing is especially popular in Europe, Russia, USA, and China, it accounted for a large part of the sent and received postcards. Moreover, some participants came for various reasons from the project, continue to maintain contacts that were tied with the help of Postcrossing and engage in active personal communication outside of the project. As confirmation, we note that one of the authors of this article was an active participant in the project for seven years, and have come out of post-crossing, supports correspondence with Postcrossing from Australia and the USA, and this communication has a high degree of friendliness and positivity.

Of course, for all the obvious and undeniable merits, there are various problems caused by the Internet. It's no secret that more and more time people (especially youth) spend on social networks, often forgetting about reality. This is due to various reasons, and primarily the fact that the virtual world is more comfortable than the real one. But almost every one of us has an account (and sometimes there are several) in a social network, and this can be both personal and professional contacts and networks.

Another serious problem is the existence of the so-called darknet (from the English *DarkNet* - "*dark Internet*") - a hidden network of Internet connections that exists parallel to the regular Internet. In other words, a darknet is understood as an illegal Internet that operates based on the main one but uses reliably protected proxy servers and Internet connections in its work, making it virtually impossible to track users and sites. At the same time, users of the darknet are quite reliably protected from revealing their identities, have a decentralized and anonymous payment method in cryptocurrency, in which bitcoins are actively used.

The term DarkNet itself was first used as far back as 1970 as a designation of isolated Internet networks, and it became more widely used in 2002, thanks to the publication of the corresponding work of Microsoft programmers. In general, the darknet algorithm is similar to the usual one, i.e. in this case, too, have their search engines, news sites, online stores, and social networks.

But there is a significant difference between darkness and the usual Network: as a rule, most darkness sites are either engaged in illegal trafficking of goods, or provide prohibited services, or place prohibited information. Unfortunately, this is possible because of the availability of special software that provides anonymity to users who have gained access to such a network. The exact number of darkness users is rather difficult to estimate, but it is believed that as of 2013 their number exceeded 4 million people. Moreover, certain popularity of darknet among users

has reached such a level that there has been the creation of a certain subculture of illegal content seekers - so-called netting. [8]

Of course, the majority of active users of darkness are people involved in illegal business, drug trafficking, organ trafficking, forgery of documents, arms sales, people who find certain illegal content, etc. However, on the other hand, along with the abovementioned categories, the users of darknet are both quite law-abiding citizens and organizations that, for various reasons, want to get information that is inaccessible on the visible web. These include servicemen, various governmental and law enforcement organizations that actively use Darknet for professional purposes, as a rule, to preserve the confidentiality of location and information.

The use of darkness is popular with journalists, bloggers, activists and public figures who have reason to fear political persecution, but still, want to post various kinds of sensational political information. In this regard, the shadow Internet is particularly popular in countries with totalitarian regimes and strict censorship. In this case, the Darknet is a free Internet zone where users can receive a variety of information and express their opinions openly without fear of political repression. Dark networks support freedom of expression, so many resources are devoted to truthful political reviews. Also, information can be found on the darknet that, for political reasons, would have been explicitly removed from most public websites.

Moreover, it is believed that the mass and active use of the Internet (and, to a certain extent, the Darknet too) has become a powerful tool of political coordination, which has contributed to the reduction of the high degree of authoritarianism in society, the fall of a number of political systems and the emergence of a new political reality.

The third stage of the development of the Internet of Things - the Internet of Things - involves a radical change in people's lives, ranging from the ability to track objects on-line (for example, tracking postal parcels and other mail) and ending with an explicit penetration into the subject world of people's fundamentally new electronic structures that can both perceive the environment and respond to it. The simplest example of this process is the widespread use of fitness bracelets, which have become an integral part of modern society, both among young people and older people. Whichever action the bracelet user takes, this attribute will always be useful, as it covers various aspects of their owner's activities, from relatively simple operations, such as counting steps and measuring calories burned, to controlling pulse and heartbeat, to fully monitoring sleep to meet individual user needs.

Also, modern models of fitness bracelets support the possibility of synchronized work with personal PCs and smartphones of users, so that it is possible not only to calculate the received data, but also to compare and analyze them, and, also, to compile the relevant statistics. Thus, the user of such a gadget has a great opportunity to regularly monitor their health and monitor the occurrence of adverse changes to quickly contact the appropriate doctor if necessary.

Another example of the Internet of Things is the version of the so-called "smart house", which means the creation and subsequent functioning of an apartment house, but not quite usual in the conventional sense. "A smart house is a modern type of house, which is organized for people to live in using automation and various high-tech devices. In other words, in this case, it means the functioning of a complex system that provides security and resource-saving (including comfort) for all users without exception. The functions performed by the respective systems include heating control, ventilation and air-conditioning control, light control using dimming and light scenes, automatic switching on of light in corridors and staircases, control of blinds and awnings, management of the home theater, etc.

If the smart home has a separate plot of land, the above functions are complemented by pools, fountains and artificial reservoirs management, street lighting management, ice protection in winter, automatic watering of the lawn,

remote control of the garage gate. The owner of such a house can control each of these functions from any room, using wall panels, switches, and wireless remote controls.

Moreover, it is possible to monitor and control the status and functions of all smart home systems from anywhere in the world using a mobile phone and the Internet. In this case, there is an excellent opportunity to remotely change the algorithm of all systems of the house, taking into account various factors, ranging from the day of the week and the level of light, and ending with the current weather forecast and approximate numbers of people who will be in the house. If it is necessary to further modernize or change the algorithm of "smart home" systems does not require significant costs, which is also important for the owner.

Thus, the initial stages of development of the Internet - the Internet of cars, the Internet of people and the Internet of things - have allowed people to come as close as possible to the situation when there is a qualitative change in the controllability of all technological processes. To a certain extent, we can say that we see that we are witnessing not even an information revolution, but an intellectual revolution. Moreover, it should be clearly understood that the question of participation or non-participation of an individual or a country in the digital economy is a question of actual ensuring, first of all, global competitiveness and potential superiority in the technological sectors of the modern economy.

In this regard, I would like to recall one event that took place more than a decade ago, which, unfortunately, was not widely covered by the press and the public, but, at the same time, had an important basis and played a significant role in setting priorities for further development. In 2006, the U.S. National Academy of Engineering convened an international commission. The mission of the Commission was to identify key engineering challenges for the next generation, and its membership was 18 people. Among them is one of the founders of Google L. Page, a famous geneticist C. Venter, one of the leaders of the Asian Development Bank B. Lohaney, former U.S. Secretary of Defense W. Perry and others. Unfortunately, there were no Russian representatives on the commission.

In the course of the work, ideas were accepted from other experts and all comers. For this, a special site was launched where anyone could write their ideas (even the most incredible ones) about priority engineering tasks for the next century. [9, p.11] The results of the commission's work were published on February 2008 and the final list included fourteen tasks that included:

1. Ensuring access to drinking water;
2. Individualization of education;
3. Mass use of solar energy;
4. Securing cyberspace;
5. Development of a carbon dioxide (CO₂) sequestration mechanism;
6. Development of the nitrogen cycle in nature;
7. Prevention of nuclear terror;
8. Creation of more advanced drugs;
9. Use of fusion energy;
10. Recreation of brain function;
11. Improvement of urban infrastructure;
12. Using information technologies in medicine;
13. Development of virtual reality;
14. The invention of tools for scientific discoveries.

Having studied these tasks, it can be concluded that a more detailed consideration of at least half of the declared directions from this list implies that they can be successfully implemented only in the conditions of the digital economy. In particular, this directly applies to the individualization of learning, which is now unthinkable without the use of options for online learning, which most accurately take into account the individual characteristics of the learner. At the same time, the active use of technologies and artificial intelligence systems comes to the fore.

As an example, let us give an example of China's educational experience as one of the most effectively developing world economies. It is well known that currently, it is unlikely that robots will completely replace teachers (teachers) - most analysts agree that the work of a teacher (tutor) is the least susceptible to automation. However, in 2017, Yixue Education, a well-known Chinese tutor algorithm, improved students' math test scores to 36.13 in four days, while classes with ordinary math teachers allowed students to improve their performance by only 26.18 points. This is not about some experimental and limited software, but about real large-scale development. To date, Yixue has already used on-line services of 100,000 customers, and in the coming years, this company is going to open 2,000 more offline centers for training students, in which not people but robots will tutor. [10]

Another not less striking example is the Chinese educational startup Liulishuo, which teaches foreign languages with the help of artificial intelligence, received \$100 million in investments and the number of users of the service exceeded 600,000 people in July 2017. This shows that investors see great potential and prospects for more than efficient investments in the development of such systems.

Certainly, it is necessary to realize accurately that such new intellectual systems will appear more often, especially concerning those countries where there is a lack of teachers. Thus, according to experts' forecasts, in the coming years, educational institutions around the world will need 20.1 million new teachers - and with a very high degree of certainty, it can be said that a significant part of them can be made up not by people, but by algorithms.

Moreover, today's education project specialists face an incredible and fantastic task at first glance: to develop a mechanism for instant learning. Now it belongs to the category of unfeasible. But if we go back 100 years, we will see a similar variant of repeating the current situation. For example, among the most significant inventions of mankind for the twentieth century are those that at the time of their appearance made a real breakthrough, and then began to be perceived as a common phenomenon: electrification and petrochemical technologies, the emergence of a car and an airplane, radio and television, spacecraft and laser optics, the use of nuclear technology and the introduction of the Internet. All this seemed unrealistic in the last century, but as we can see, these days it is widely used by modern society.

Thus, what previously seemed fantastic, after a certain period, can become firmly entrenched in everyday life. Therefore, even the most incredible hypotheses should not be discounted, bearing in mind that they can be realized. In doing so, the possible negative consequences of such plans should also be taken into account. In particular, in the conditions of people and things around us, the problem of digitalization, which consists of restricting human freedom by a kind of dictatorship of various gadgets and networks, is becoming acute.

Of course, one cannot but agree that the techniques and technologies that society has received for use, have radically changed and improved the quality of life of modern man. But, at the same time, the negative side of this process is also observed on a mass scale, which is manifested to a certain extent in the enslavement of man by the machine. For example, nowadays there is a rapid growth of people's dependence on gadgets, and it is a real disease of our time. According to preliminary estimates of experts, dependence on gadgets has all chances to "outpace" the number of patients with drug addiction, alcoholism, and ludomania. It is believed that the main reason for the

development of such a disease is the presence of so-called information hunger. In this case, the point is that an individual is primarily dependent not so much on gadgets as on the information that they provide. [11]

It is of key importance, however, to understand that for people operating in the context of the Internet of Things, it is highly desirable (and even necessary) to have a clear-cut facet to separate the structure of enslavement from the structure of autonomy. In other words, it is enough for a user of any gadget (or a member of any network) to define certain rules of use (participation) for himself and then, if possible, to follow them strictly. Only in this case, a person will be able to fully retain his or her autonomy from the machine or network structure. And, strange as it may seem, animals can help people in this.

Despite the fact that the achievements of the first stages of development of the Internet - the Internet of Machines, the Internet of People and the Internet of Things - have become commonplace for many of us, it is necessary to consider both the options for further prospects for the development of the Internet and to predict the possible role of society in it. In modern conditions, the most probable variant of the new stage of development of the Internet is the so-called Internet of Animals (the Internet of Nature), the initial manifestations of which we also observe, but not in too obvious form, compared to other stages. In this case, the Internet of animals means the functioning of an intellectual and distributed wireless sensor network, which has developed in the process of evolution, and now connects animals and with humans. [6, c. 8-9]

Since humanity is a major part of the global biosystem, there is every reason to believe that there is some kind of interactive connection between animals and the problem environment (to which, by the way, a man has actively applied his hand), in which there is a modern society. In other words, under the conditions of the functioning of the Internet of animals, both people's perception of nature and the animal world, and understanding of the role of animals for humans changes dramatically. The key feature of the new stage of the Internet, unlike the previous stages, is the complete absence of anthropocentricity, which implies a radical change in the role and place of man in the structure of the new Internet.

There is a widespread belief that the Internet of animals is just a modernized form of human Internet, which additionally includes animals in its structure. In this case, we are talking about a more significant process of transferring the functions of full-fledged Internet subjects to animals, and not species and classes of animals as a whole, but animals as separate individuals who are both data generators and data carriers. Moreover, the functioning of the Internet of Animals raises complex questions about the limitations of human society, which for the entire period of its existence, unfortunately, has not used to the full extent the knowledge accumulated by the animal world for a long process of evolution.

The Internet of animals, its structure and principles of functioning are still poorly studied, but it is already obvious that it will become a radically new stage of development and will have a significant impact on human society. It should be recognized that we are witnessing the formation of both a radically objective and radically subjective Internet. This process not only creates prerequisites for appropriate scientific discussions and the basis for new knowledge but also contributes to the transformation of animals from a biological entity into a full-fledged subject of relations. Thus, it seems to us that the Internet of animals in the future will be a central element of the planetary digital culture, which will become an integral element of social relations.

Taking into account the fact that we live in the epoch of Anthropocene (human era), it is assumed that human activity prevails over the ongoing ecological and geochemical processes, i.e. nature is considered as a system directly involved in human activity. And at the same time, people using the latest achievements of technology, as well as many centuries ago, remain, collectors and hunters, only now their activities are aimed at other objects and more

advanced tools are used. In other words, it is possible to raise the question of the appearance of the preconditions that the Internet of animals will follow to a certain extent the Internet of machines, the Internet of people and the Internet of things, and thus logically complete the overall picture of the virtualization of the modern world. However, we believe that the full effect of such a process is not yet to be seen soon.

Having considered the retrospective of the development of digitalization, digital technologies and the digital economy and their impact on the modern world community, we cannot but touch upon the pressing issue of digital security. Despite all the positive features, the digital economy, unfortunately, also has negative consequences, including the reduction of the total number of jobs, digital fraud, "piracy" and the spread of harmful content, the activities of unscrupulous users of services, etc. These consequences can be described in terms of the risk parameters associated with possible damage from digitalization or a certain probability of its occurrence.

The use of digital technologies can lead to the emergence of new risk groups, including

- Inadequate and unprepared legal and regulatory frameworks that accompany and ensure the efficient conduct of the digitalization process;
- Abuse of new technologies and new opportunities directly related to the use of other people's information or resources;

The application of digitalization parameters, as well as the neutralization of negative consequences and risk groups, is possible only with certain measures, namely: the implementation of information security rules. It is information security, due to the development of information technologies and wide dissemination of information, that is one of the most important basic elements of any modern state's security system. Information security presupposes mandatory protection of information from an unauthorized acquaintance, transformation and destruction, as well as protection of information resources from external and internal impacts, which are aimed at the violation of their stable performance. [12]

Information security is influenced by various factors. In this case, the data sets used are the main resource that supports the effective viability of the state in the political, social, economic and military spheres. Thus, the challenges posed by information security have additional complexity, as the information space has no borders.

Taking into account the quality of state or corporate governance, the degree of information security is determined by the following capabilities of the state:

- Ensuring the functioning of information resources and flows sufficient for efficient life and development;
- Protection of commercial and state secrets from unauthorized interference;
- Resistance to technical and psychological threats, protection of users from negative impact when using information technologies;
- Use of methods and means to protect the information sovereignty of the state or corporate values that do not infringe on the rights and freedoms of the population.

In particular, various government agencies, including the Federal Service for Technical and Export Control (FSTEC), the Federal Service for Supervision in the Sphere of Communications, Information Technologies and Mass Media (Roskomnadzor), specialized subdivisions of ministries and agencies, as well as the interdepartmental commission under the Security Council are currently responsible for the information security of the Russian Federation. However, participants in the process of combating cyberattacks (and not only) believe that at the present stage it is necessary to combine the disparate functions performed by each of the participants separately. This is possible through the creation of a separate regulator of information security at the level of the federal service with independent resources and significant powers. [13, c.155-163]

It should be noted that currently the Russian information security system is undergoing a stage of growth and does not fully meet the requirements to ensure information security. Nevertheless, it is necessary to take into account that ensuring information security is an integral element in the formation of a strong state. However, the absence of legal norms (both at the national and international levels), as well as mechanisms and procedures for their application that take into account the specifics of information technologies, make it very difficult to form a stable information security system aimed at achieving strategic stability. This, in turn, leads to several problems that need to be solved as soon as possible. In particular, in this case, we mean:

1. Humanitarian problems (information security problems that arise in connection with the uncontrolled use and dissemination of personal data, invasion of privacy, identity theft, etc.);
2. Problems of economic and legal nature (problems that arise in the event of distortion and loss of commercial and financial information about the financial situation of the population, industrial espionage, and dissemination of information that damages the reputation of economic entities);
3. Problems of political nature (problems arising as a result of information wars, electronic intelligence in the interests of various political groups, compromising state secrets, information attacks on important industrial and circulating objects, etc.).

To effectively solve problems and ensure optimal information infrastructure necessary for building an integrated system of activities, using modern information technologies and products. In our view, should not only increase the security of critical information infrastructure and the stability of its functioning but also ensure the development of mechanisms aimed at detection and prevention of cyber threats, thus eliminating the eventual consequences of their application. Also, an important step in ensuring information security will increase the degree of protection of the population from the consequences of emergencies in case of possible information technology impacts on infrastructure. The main directions of ensuring information security are presented later in Fig. 1:

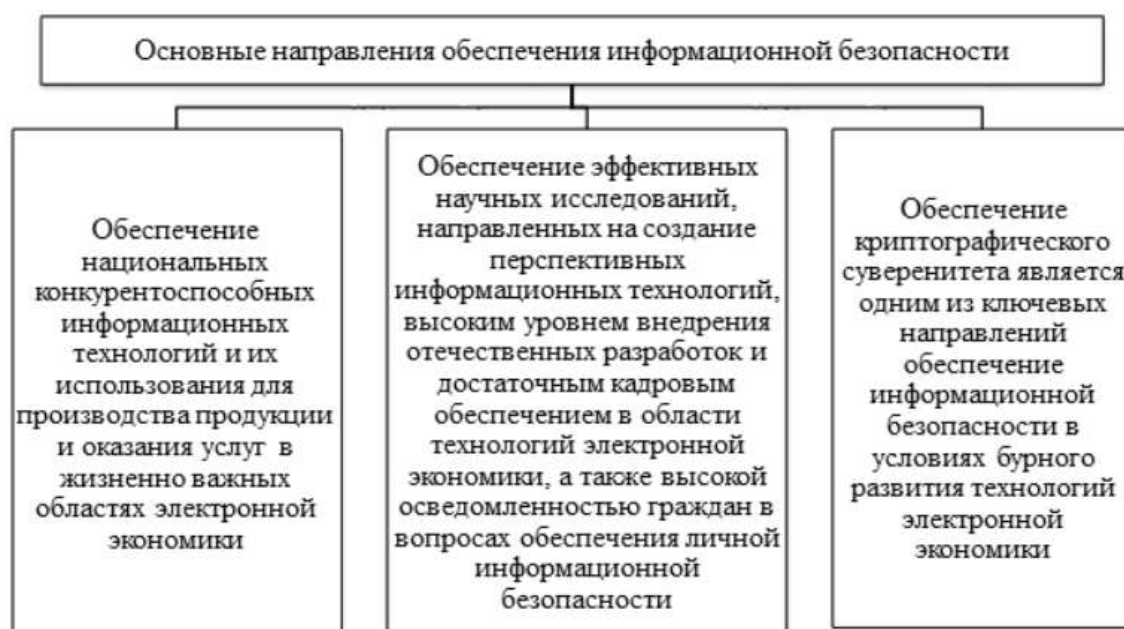


Fig. 1 The main directions for ensuring information security:

1. The main directions for ensuring information security
2. Provision of national competitive information technologies and their use for production and services in vital areas of the electronic economy

3. Ensuring cryptographic sovereignty is one of the key areas of ensuring information security in the conditions of the rapid development of electronic economy technologies

To ensure the security of the information infrastructure, it is necessary to create an appropriate system of measures, involving both an increase in the effectiveness of the prevention of offenses committed with the help of information technologies and tools and the protection of information. And in the first place, this refers to information that has a limited range of access and is a state secret. [14, c.84-86]

The solution to problems related to information security, should be comprehensive and be formed at all levels. On the first, normative - level, competent public authorities must create a consistent regulatory framework that takes into account all the problems arising from the digitization process and the digital economy. The second level, - institutional, - in turn, involves the coordinated activity of different social institutions that are connected with social development the population and society as a whole. And on the third - personal level deals with such processes as self-education, self-education, and formation of information culture of the individual as an integral part of an overall culture of the population.

Thus, the main directions of ensuring information security in the modern conditions of digitization and digital technologies can be considered:

- innovative development of the information technology industry and electronic industry, increasing the share of the industrial products in GDP and export structure of the state;
 - elimination of dependence of domestic industries from foreign information technologies and means of information security through the development and successful introduction of own developments;
 - increase the degree of competitiveness of the enterprises operating in the country focused on information technology and electronics industry, by creating favorable conditions of conducting production activities;
- the increase in the degree of development of competitive electronic component base and technology of production of electronic components and the needs of the domestic market in these products and its subsequent release to the global market.

Also, in ensuring information security, in our opinion, it is necessary to improve methods and methods for the production and safe use of products or services, using information technologies, which are based on developments that fully satisfy the requirements for information security. [15, c.93-99] Here, special attention should be paid to the protection of scientific and technological developments, where the strategic goal is to support the innovative and accelerated development of the information security system and the electronic industry as a whole. The main directions of ensuring information security in the field of scientific and technological developments are presented in Fig. 2:



Fig. 2 The main directions of ensuring information security in the field of science, technology, and education.

1. Achievements of competitiveness of Russian information technologies and development of scientific and technical potential in the field of information security
2. Creation and implementation of information technologies that are initially resistant to various types of exposure
3. Conducting research and experimental development to create advanced information technologies and state funds

IV. Conclusion

Thus, having considered the retrospective of the development of the Internet and the role of man in it, it can be stated that at all times the Internet has been actively developing in parallel with the new, sufficiently high, requirements that were set by time and society, and with which it was necessary to take into account. At the same time, we, already on the threshold of the next stage of the Internet, should clearly understand that the further development of digitalization, digital technologies, and the digital economy of the future is closely linked to the effective development of such areas as biotechnology, artificial intelligence, and IT-technology. This will make it possible not only to transform the algorithms of rationalization of public thinking but also to effectively resolve existing problems and contradictions. At the same time, it is necessary not only to take into account the emerging problems (in particular, it concerns information security) but also to react promptly to them. All this, in the end, will lay a solid foundation for the formation of a fundamentally new platform for the further global development of economy and society.

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