Доверие и безопасность в информационном обществе

CONCEPTUAL APPROACH TO PROBLEMS OF SECURITY AND CYBER RESILIENCE ISSUES OF INFORMATION INFRASTRUCTURE OF REGIONAL AND NATIONAL ECONOMIES

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Abstract

The article is devoted to the conceptual study of the security and cyber resilience of the information infrastructure of regional-national economic systems, which is currently considered relevant. The directions of ensuring information security are interpreted and the problems of its sustainable development and resilience are studied. Internal threats for ensuring national and economic security are identified. The methods of ensuring information security are studied. Various purposeful elements and actors of the digital environment are identified. Relevant recommendations are made for reliable provision and improvement of information infrastructure security and cyber resilience of regional-national economies on the 4.0 Industrial platform and in the conditions of the digital economy.

Keywords

sustainable and resilient economic development; digital economy; national-regional economic systems; economic information security; cyber resilience of the economy

Introduction

The current critical stage of socio-economic and socio-political development of the world is mainly characterized by negative factors such as natural disasters, pandemics, and regional conflicts. They could not be predicted or expected in advance. Therefore, their results are characterized by very unexpected and unpleasant consequences for the world. If scientists, experts, and public figures do not find successful solutions to both cases in the near future, the crises will be long-lasting, the planet's economic infrastructure will be severely damaged, and it will be necessary to completely rebuild it.

Analysis and observations show that the development of technology will play a strategic role in international competition and will play a crucial role in maintaining global leadership in developed countries. In this process, China, Russia, and others. Such countries are also trying to rebuild their technological and economic infrastructure and increase the sustainability and resilience of existing economic systems by participating in the division of labor created by the new geopolitical and economic conditions. All these circumstances allow us to conclude that regional economic systems, all relevant countries, and states must accept the need for sustainable socio-economic development. In other words, in a broad sense, the countries and states of the world must first and foremost consider the security, sustainability, and sustainability of their economic development as the most urgent, vital issue.

Along with these problems, it should not be forgotten that in the most general case, information security is one of the components of the national security of the state and the economy. The economy is currently being transformed into a digital economy based on the widespread use of ICT. Therefore, it is necessary to ensure the development of information security in the economy, including the formation of the digital economy. In order to implement the measures envisaged in this direction, the stability and

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security of the information infrastructure, as well as the competitiveness of technologies, tools, and systems used in the field of information security must be ensured. Real threats and dangers in the field of information security indicate the growing level of cybercrime. In the field of information security, such cases are caused by an insufficient level of relevant staff, delays in the development of hardware and software, and the application of relevant ICT, etc. related. It is very important to study the issues of security and sustainability of all such economic information infrastructure on the basis of a conceptual approach and develop appropriate recommendations for their solution.

The main purpose of the study is to determine the nature of the security and cyber resilience of the information infrastructure of regional and national economies and to develop mechanisms to improve it.

The main task of the research is to define the contours of the issues related to the scope of cybersecurity, to provide scientific support for their solution in a conceptual form.

The research methodology is based on systematic analysis approaches and methods, statistical and multifactor analysis methods, multi-criteria decision-making methods and models, risk management theory, modern ICT systems and tools.

The research process was approached at the macro level within certain constraints. No attention was paid to the specific object and process level. Based on the most common cases and information, relevant analyzes were conducted and recommendations were developed. During the research, it was preferred to refer to the most relevant scientific publications.

1 The problem of sustainable, resilient development and sustainability

There are many interpretations of "Sustainable and Sustainable Development" used in the modern scientific-economic and socio-political environment. It can be applied to the state, society, economy, region, enterprise, process, and so on. can be attributed. In 2015, the UN adopted 17 Sustainable Development Goals [1].

According to some scientific approaches, economic development or sustainability of the economy (устойчивость-sustainable) is a way of development in which positive, social, environmental, and other effects are observed. According to another approach, the resilience of development is its resistance to internal and external shocks, influences, interventions, and the ability to recover in the subsequent period, to enter a qualitatively new development trajectory. This state of economic development is described in official documents as "sustainable and resilient." However, sustainable development (устойчивое развитие) is also being developed in options such as sustainable development, resilience, and resilience.

In the second case, which we consider as the main approach to the process, it should be added that under the name of a qualitatively new development trajectory, the previous situation is understood to be not bad (low) in all respects. It is more appropriate to characterize this situation as sustainable and sustainable economic development. The above-mentioned approaches, which are relatively close to this situation, are also based on the scientific-theoretical and methodological work of well-known economists and specialists [2, 3].

From a methodological point of view, the main issue is to measure and assess the level of economic stability of the country/region. At the same time, the difficulty lies in identifying indicators of the sustainability of economic development and making them aggregate. Among the aggregation methods it is possible to use calculated/geometric mean indices, entropy index, equivalent variance/Z-score, portfolio, and main component aggregation methods, and in many cases to apply the mathematical theory of graphs.

From a problematic point of view, the main issue is not the development of any specific method or model. Relevant proposals and recommendations have been developed to study cyber resilience as part of the sustainable development of the regional economy, to determine the parameters that affect it, assess the current situation, and implement countermeasures and preventive measures.

2 Problem research situation

There is no fixed approach to looking at the sustainability of the economy, including cyber resilience. However, there are various studies in this field.

The problems of sustainable development of the regional economy were studied in the [4] . It was noted that the sustainability of development depends on the appropriate economic, political and social institutional security. Thus, in addition to helping to restore previous development trends, they also allow

for the transition to a new model of economic development, characterized by more efficient use of economic, human, financial, and other resources.

The results of the assessment of the level of stability in 83 regions of Russia using the Mahalanobis distance method were analyzed in the [5].

The main issues related to the information security of socio-economic systems were considered in the [6]. The sustainability of the management process in terms of information security is expressed in more detail. Possible methods for ensuring sustainability in relation to automated systems have been proposed.

The economic problems of information security are explained in the [7]. The problem of economic security has been studied at the level of the state, society, and the individual. Information security issues of economic systems were investigated in the [8].

Sustainability is seen in the context of economic security in the [9]. The interactions between them were analyzed. Analysis of all these and other research results shows that there is still a great need to continue researching the problems in this area.

3 Mechanisms to ensure national security

First of all, we must not forget that the state is the main subject of ensuring the economic component of national security. Therefore, in the field of economic security: 1) identification and monitoring of factors that undermine the stability of the socio-economic system and the state in the short and long term; 2) the formation and implementation of economic policies and institutional reforms that eliminate or reduce the harmful effects of these factors within a single program of economic reforms, etc. it should be taken into account that it belongs to the main directions of state activity.

In this regard, the state strategy of economic security can be shown as in fig. 1.

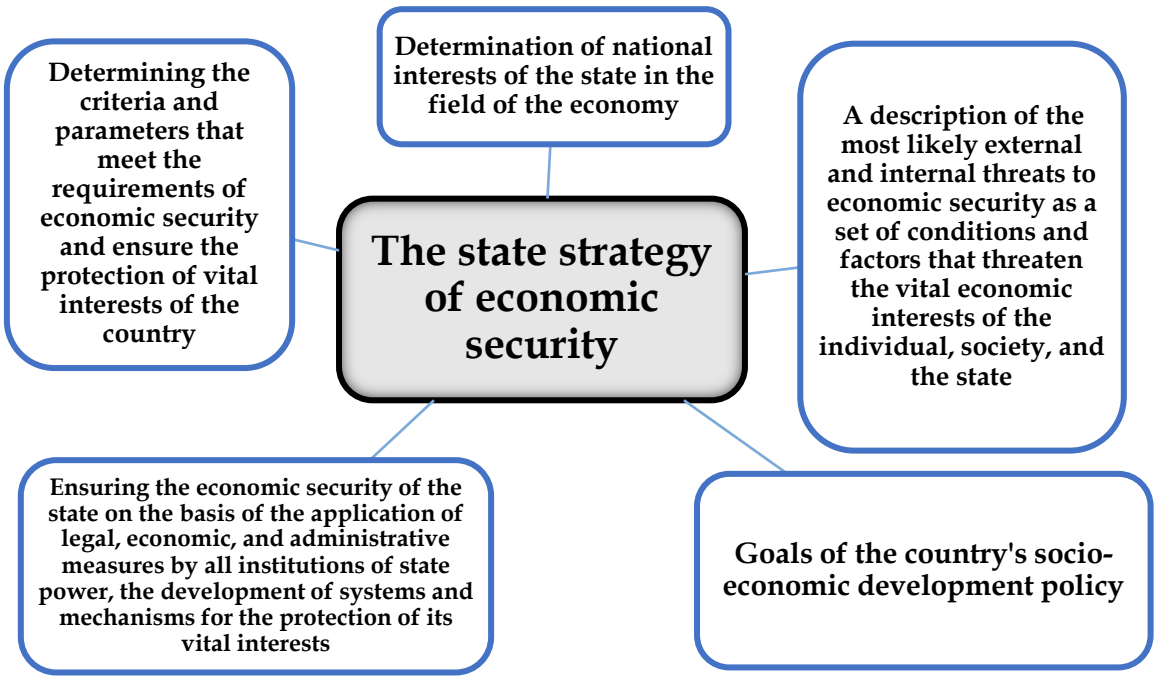

Fig 1. The state strategy of economic security

Economic security is ensured both by purely economic and non-economic means: political, military, and other means. Security in non-economic areas is provided by ample economic means, including the involvement of financial and other economic resources.

The state strategy in the field of economic security must be implemented by all institutions of state power. They must achieve the common goals of national security through the application of legal, economic, and administrative sanctions.

The state strategy of economic security is aimed at 1) ensuring the socio-political security of society, 2) maintaining an adequate standard of living for the population, 3) preserving the foundations of the country's constitutional structure and the formation of a stable system, etc. should be directed.

During the transition to new socio-economic relations, state regulation in the field of economic security is a necessary condition to prevent the collapse of society and the state. The main goals of security must not only be defined but also justified, confirmed, and understood by all socio-political forces of society.

Among the internal threats to the country's security are:

1. Decrease in the birth rate and aging of the population, in the long run, leads to a significant reduction in the labor potential of the state and an increase in the demographic burden of the able-bodied population.

2. Degradation of social institutions; the negative impact of socio-economic living conditions of the population, increase in morbidity of a significant part of the population, uncomfortable living conditions, deterioration of nutrition structure and regime, harmful ecological environment, heavy workload of women in the sphere of production, etc.

3. Criminalization of the economy, high level of legal violations in the information and intellectual sphere of the economy, aggravation of social problems.

4. Protecting the property stratification of the population with a high proportion and possible increase in the number of people living below the poverty line and the unemployed, and leads to public discontent.

5. Increasing the role of information in ensuring the economic security of the enterprise in market conditions. Every person is connected to enterprises in one way or another throughout his life.

These also show that enterprises thrive when they have a sound strategy and use resources efficiently. They are rebuilt when they stop reaching their chosen goal. When they fail to perform their duties, they are sentenced to forced closure.

4 Mechanisms to ensure economic security

In the general context of mechanisms for ensuring economic security in the emerging technological environment, the following should be noted:

1. Creation and sustainable development of promising high-tech sectors of the economy.
2. Support for high-tech small and medium businesses. These measures are aimed at ensuring the development of the innovative sector of the economy, which is mostly related to information technology and information security.
3. Creation of economic conditions for the development and application of modern technologies, stimulation of innovative development, as well as improvement of the regulatory framework in this field.
4. Elimination of critical dependence on the import of scientific, experimental, testing, and production equipment, tools and microelectronic components, computer software, and hardware.
5. Integration of education, science, and production activities in order to increase the competitiveness of the national economy.
6. Providing access to foreign technological solutions in accordance with the interests of the national economy.
7. Development of digital economy technologies that strengthen the country's competitive position in global markets for high value-added products.
8. Regulation of cross-border transmission of local technologies and results of scientific and technical activities, taking into account national interests.
9. Stimulation of inclusion of results of intellectual activity in economic turnover.
10. Improvement of legal regulation and development of markets for new high-tech products.
11. Sustainable development of the national financial and credit system.

12. Improvement of specialized tools to support lending to strategic sectors of the economy, science, and high-tech industries.
13. Improvement of the infrastructure of the national financial market, the national payment system, the national payment card system.
14. Fight against the transfer of non-cash funds to the shadow circulation of cash and the legalization of income from economic crimes. The financial system is quite a large and complex information system, so it is difficult to separate its development from the development of ict. It is necessary to rely on accurate information systems and achieve the creation of their own products to protect against payment systems and fraud and to prevent unauthorized access.
15. Increasing the efficiency of foreign economic cooperation and realizing the competitive advantages of export-oriented sectors of the economy.
16. Assistance to organizations in the transfer and application of advanced technologies.
17. To promote the development of enterprises in the non-resource sector of the economy, to reach the level of global leaders in the world economy. These are measures to support the transfer of imported technologies and the export of most products.

It should be noted that ensuring the country's information security is a key issue in ensuring economic sovereignty. Local companies must independently develop technologies that allow data leakage channels to be blocked and information security systems that prevent data leakage.

5 Sustainability of the regional economy

The definition of the term "sustainability" in various sciences includes three main interpretations of the concept of its formation:

1) Sustainability is defined as the return of a system to its original state. Here we are talking about the speed of the system's return to normal.

2) It is understood as the ability to withstand external influences that can be very harsh and aggressive (strength).

3) Sustainability. It is understood as the ability of a system to retain key elements despite external influences. Ideally, the system does not stop developing, but continues to move forward [4].

The first definition corresponds to the etymology of the word derived from the Latin word "resilire" (to go back, to restore form or position after a violation). The focus is on the speed at which the system recovers or returns to its original state. This definition of sustainability is called "engineering sustainability". It was assumed that the stability of the system is determined by how quickly the unbalanced system returns to its original equilibrium state. In addition, the idea of sustainability is used in economic theory. Here, the normal state of the economy is believed to be the only possible equilibrium. The second definition of sustainability is also widely used in the environmental literature. It is the ability to absorb shocks without changing the structure and function of the system. It is sometimes called "environmental sustainability". Later, this definition became the concept of "expanded environmental sustainability" [10].

A third interpretation, which can be defined as "adaptive resilience," can be described in behavioral psychology as adaptive skills that affect people's ability to maintain or recover quickly after stress or a crisis.

Sustainability of the economy is defined as "the ability of a system to withstand market or environmental shocks without losing its ability to allocate resources efficiently" [11]. Sustainability has been defined in organizational research as "the ability of organizations to anticipate major events and to adapt to change and to maintain their core functions in the face of shocks by recovering quickly from natural disasters" [12].

Indeed, the ability to adapt in response to shocks reflects the ideas of complex adaptive systems theory and the theory of evolution. Thus, although these three definitions or interpretations of sustainability are somewhat different in some respects, they do not completely exclude each other.

There are currently dozens of definitions of the concept of "sustainability" in the scientific literature. The report of the International Commission on Environment and Development defines this concept as sustainable development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

There are many different definitions of regional economic sustainability in the economic literature. In the [13] it is noted that "to some extent, they can be classified as follows:

- According to the first approach, development accompanied by minimization of sustainable or inclusive negative externalities is understood: (environmental pollution, resource depletion, increasing inequality, and poverty);

- According to the second approach, sustainable development means the economy's resistance to external shocks and its ability to restore its balance."

A broader and more objective definition of the sustainability of the regional economy can be proposed as the ability of the regional economy to solve economic, social, environmental, and other problems quickly and effectively. This is not only the restoration of its development trajectory but also its ability to develop in new, more effective ways.

6 Economic aspects of information security

Economic security is a social, economic, political category, economic independence and dependence, stability and weakness, economic pressure, coercion and aggression, economic sovereignty, etc. closely related to the categories. The following levels of economic security can be distinguished (fig. 2).

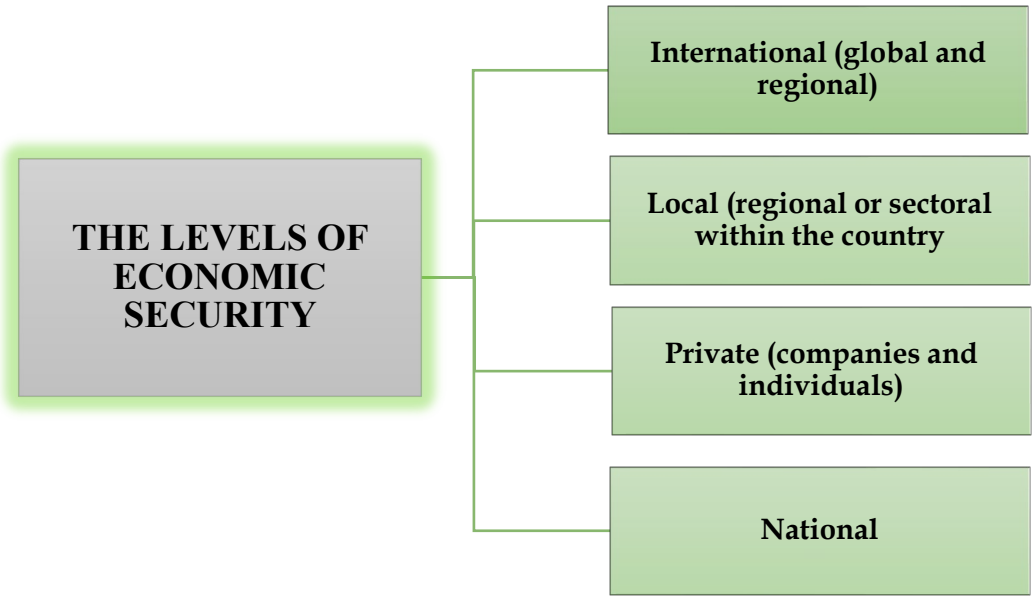

Fig. 2. The levels of economic security

International economic security is a set of international conditions for the joint operation of contractual obligations and institutional structures. Here, each member state of the world community is given the opportunity to independently choose and implement its social and economic development strategy. It relies on non-interference, understanding, and mutually beneficial cooperation by other states.

The path to international economic security is based on the renunciation of economic and political coercion, the recognition of the right of any people to choose their own path, respect for the legitimacy of their existence, and the free application of development models.

National economic security includes the protection of national interests, the harmonious, socially-oriented development of the country as a whole, and the increase of sufficient economic and defense potential. The country's economic security determines the progressive development of the country's economic potential. Increases the level of welfare of all members of society, its individual social groups. The basis of the country's economic development is the security of economic relations [7].

The basis of economic development in the modern world is scientific and technological progress, the transition to advanced technologies. Thus, in modern conditions, the core of economic security is technical and economic independence and technical and economic inviolability.

The economic security of the enterprise implies the stability of its financial and commercial success, the provision of scientific, technical, and social development, and the existence of normal legal, and organizational relations of production relations, material and intellectual resources.

The purpose of the relevant State Strategy is to ensure the development of the economy, which creates the necessary and sufficient conditions for the comprehensive development of the lives and personalities of its citizens. It is also to ensure the livelihood of the population, demographic, socio-economic and political stability, socio-economic and military-political stability of the state as a whole, to maintain its sovereignty and integrity, and to successfully and effectively resist internal influences.

The problem of economic security is both its object and military, social, political, economic, information, and so on. There are objects of intersection and interaction such as. Objects of economic security include the state, the main elements of the economic system and the economic system as a whole, all its natural resources, social institutions, economic entities at all levels of the economy and the individual, as well as their vital economic interests.

7 Economic information security measures

In short, the main measures to ensure the protection of information security in the economic sphere can be expressed as in fig. 3.

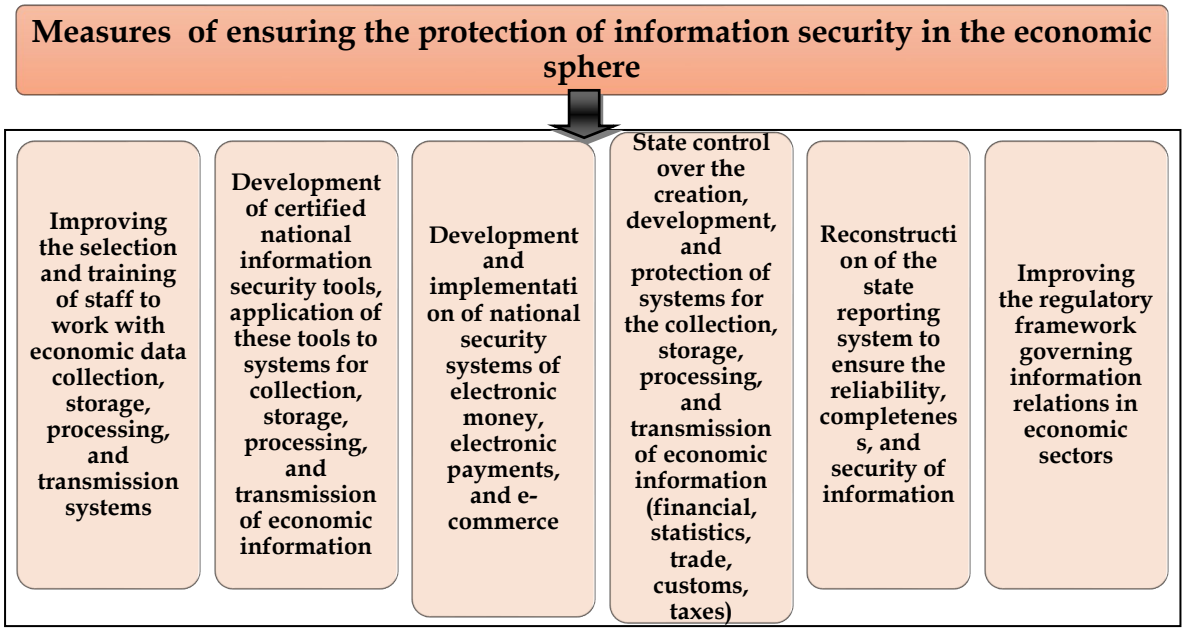

Fig. 3. Measures of ensuring the protection of information security in the economic sphere

It should be noted that in addition to general methods of ensuring information security in the digital economy, special methods can be used. But it should be borne in mind that there are general methods to ensure information security. They also apply to other spheres of life of the state and society.

Thus, the most important objects to be protected in the field of security include:

1. The constitutional rights and freedoms of every person and citizen.
2. The sovereignty and territorial integrity of the country.
3. The constitutional structure, the stability of state power.
4. Mass media, open information resources of executive authorities, etc. can be attributed.

In this case, in the field of technical methods of information security protection:

1. Backup copies of the most important documents.
2. Limiting the possibilities of electromagnetic radiation.
3. Restriction of physical access to objects of computer systems.
4. Prevention of infection with computer viruses.

5. Control over access to computer system processes and information resources (encryption during transmission and storage of information, determination of access control rules).

In general, there are many measures to ensure the security of the country's information space, which must be implemented as a matter of urgency. Thus, insufficient protection of the state's information space leads to many negative consequences, such as loss of important information (economic, political, scientific, and technical), violation of the constitutional rights of citizens, and serious economic losses of enterprises.

8 Issues of economic security of ICT

It should be noted that the sustainability of the economy is of paramount importance for the ICT sector. Because the most promising areas for the development of ICT are related to ensuring economic security.

Import substitution, innovative companies, business transformation, element base development, transition from resource-based economy to innovative economy, digital economy, production informatization, integration of science and industry, technology transfer, etc. is one of such areas.

In addition to ensuring the stability of the regional economy, they also have a significant impact on the information security of ICT. These issues interact.

Thus, many situations that may be related to ICT and information security pose a threat to economic security.

1. The desire of developed countries to take advantage of the level of economic development and use high technology (including information) as a tool for global competition. This threat concerns the technological and economic sovereignty of the country. To minimize this threat, the country needs to create its own electronic database and basic software.
2. Application of discriminatory measures against the main sectors of the economy, restriction of access to foreign financial resources, and modern technologies. We are talking about sanctions, including services for high-tech products. To minimize this risk, it makes more sense to provide critical information systems to local companies.
3. Exposure of the regional financial system to global risks and weakness of the information infrastructure of the financial and banking system. This applies to computer security and the security of banks' information resources.
4. Weakening of the raw material export model of economic development. The sharp decline in the role of traditional factors of economic growth is due to scientific and technological changes. Oil dependence of the economy. One way to reduce this dependence is to develop exports of high-tech products.
5. Weak innovation activity, lag in the application of new and promising digital economy technologies, and lack of sufficient professional skills of local specialists. This is one of the key factors in the development of ICT.
6. Increasing international competition for highly qualified personnel. This is primarily due to the "brain drain" that creates a shortage of qualified personnel in the ICT and information security sectors.

All this indicates that a risk management system must be formed in order to identify challenges and threats to economic security in a timely manner, respond to them promptly, and develop management decisions and recommendations.

9 Elements and actors of various character and purpose of the digital environment

The overall economy differs from the digital one primarily in its environment and infrastructure and is organically complementary. In this sense, it is important to briefly mention the various elements and actors of the digital economy environment (fig. 4).

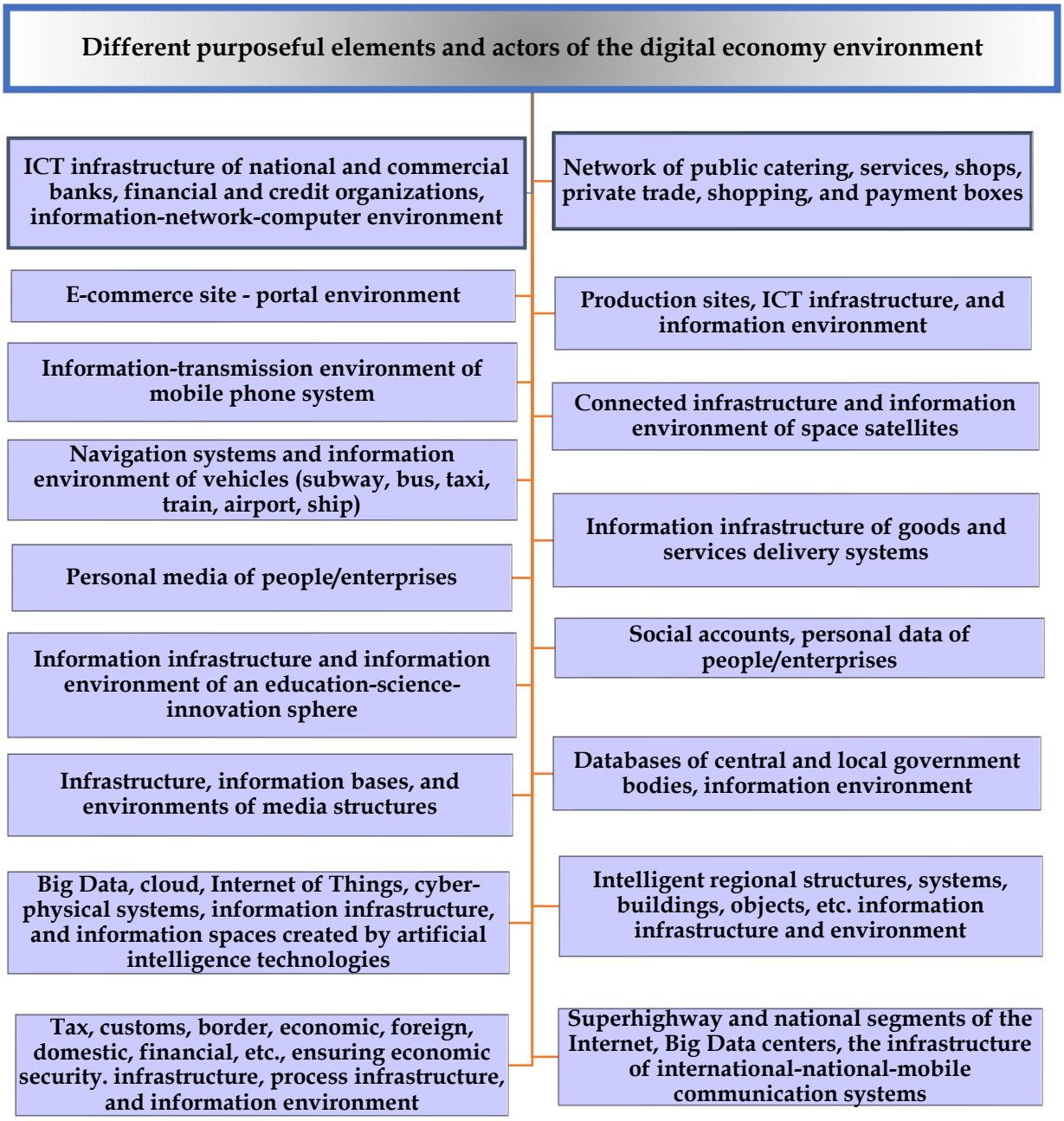

Fig. 4. Different purposeful elements and actors of the digital economy environment

10 Specific features of information security in the digital economy

Information security in the field of economy has its own characteristics. First of all, the following areas are at risk in the economic sector:

- financial credit and state statistics system;
- accounting and planning systems of organizations and enterprises;
- accounting and automated information systems of executive authorities;
- data collection, processing, storage, and transmission systems (information on tax, financial, customs, trade, as well as foreign economic activity).

There are a number of real threats to information security in the digital economy:

- cybercrime (for example, intruders infiltrating bank information systems);
- the current level of the country's technological dependence on other countries (as foreign hardware and software tools are still widely used to protect information;

- commercial structures (domestic and foreign) that are a source and consumer of information in the domestic markets of the country; the essence of the threat is that the activities of these structures in the field of creation and protection of data collection, processing, storage, and transmission systems are poorly managed and there is a high probability of unauthorized access to confidential economic information;
- theft of information that is a trade secret, as well as illegal copying and distortion of information (as a result of accidental or intentional violation of data processing technology).

All these cases show that reliable protection against potential threats in the information space is needed to ensure the normal functioning of the economic sphere. The main objectives of information security tools are to prevent and neutralize accidental and intentional threats to information security.

Conclusion

The coronavirus pandemic has accelerated the use of digital tools in the economic environment. This, in turn, has made cyber incidents more frequent, costly, and destructive. One of the most important outcomes is the transition from cybersecurity to cybersecurity. During the COVID-19 pandemic, digitalization accelerated exponentially. People have used ICT dozens of times. Logically, as the use of digital tools increases, so does the amount of data generated. Over the past year, the total volume of Internet traffic has doubled. (The World Bank estimates that in 2022, total annual Internet traffic will increase by about 50% compared to 2020 levels to 4.8 zettabytes. Of course, it is very difficult to visualize this amount of information. If you store 4.8 zettabytes on DVDs if necessary, their number would be enough to circle the Earth six times).

The pandemic has vividly demonstrated how closely all businesses are interconnected, and how digitalization has taken the world's population to a new level of cyber threats and attacks. In recent years, there have been repeated violations of critical infrastructure and numerous attacks on supply chains. It has become clear to everyone how the cybersecurity of any company can affect many others, from customers to end users.

The World Economic Forum's (WEF) Center for Cyber Security has published the Global Cyber Security 2022 Report, which includes forecasts and critical comments from more than 120 global cyber leaders (https://10guards.com/ru/articles/wef-cybersecurity-2022/ Source: World Economic Forum, 2022). WEF's research focuses on security managers and business leaders 1) Priority of cyber solutions in business, 2) Leadership support for cybersecurity, 3) Recruitment and retention of talented cybersecurity professionals, 4) Cyber sustainability for small and medium businesses, etc. identified key gaps such as. It turned out that the cyber resilience of small and medium-sized businesses is seen as a critical threat to supply chains, partner networks, and systems.

Research has confirmed that certain threats to the economic security of every state, country, and region are always possible. There are objective real internal and external problems of economic security of the state. Preventing or eliminating them is the most important element of the state strategy for the economic security of the country.

Threats in the economic sphere are complex. They are due to the slow pace of formation of the economic potential of the state, the growing backwardness of technological development, and the lack of appropriate measures to improve the quality of life of the population. Redistribution of property, inefficient use of resources, changes in world markets, and reduced ability to adequately withstand the risks and challenges of globalization and informatization are among the factors that seriously affect the level of security.

The main objectives of information security are to ensure the technological independence and security of data processing, storage, and transmission infrastructure. To this end, the state provides constant support to manufacturers of information security tools at the macro level. In this regard, in many cases, government agencies impose legislative restrictions on the acquisition of foreign software and mainly encourage the use of local software.

Research, proposals and recommendations show that the transition from cybersecurity to cybersecurity in the economic sphere is an important step towards a safer and more sustainable future. To ensure a reliable and secure digital economic environment, relevant central governments, enterprises, organizations, users and citizens should better implement cyber security and use all possible means to increase cyber continuity and cyber resilience.

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КОНЦЕПТУАЛЬНЫЙ ПОДХОД К ПРОБЛЕМАМ БЕЗОПАСНОСТИ И КИБЕРУСТОЙЧИВОСТИ ИНФОРМАЦИОННОЙ ИНФРАСТРУКТУРЫ РЕГИОНАЛЬНОЙ И НАЦИОНАЛЬНОЙ ЭКОНОМИКИ

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Аннотация

Статья посвящена концептуальному исследованию безопасности и киберустойчивости информационной инфраструктуры регионально-национальных экономических систем, которое в настоящее время считается актуальным. Интерпретируются направления обеспечения информационной безопасности и исследуются проблемы ее устойчивого развития и отказоустойчивости. Выявлены внутренние угрозы для обеспечения национальной и экономической безопасности. Изучаются методы обеспечения информационной безопасности. Определены элементы различной направленности и акторы цифровой среды. Даны соответствующие рекомендации по надежному обеспечению и повышению безопасности информационной инфраструктуры и киберустойчивости региональной и национальной экономики на 4.0 Индустриальной платформе и в условиях цифровой экономики.

Ключевые слова

устойчивое и стабильное экономическое развитие; цифровая экономика; национально-региональные экономические системы; экономическая информационная безопасность; киберустойчивость экономики.

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