Tretyakov Oleg Vladimirovich

DIGITAL ECONOMY AS A NEW DEVELOPMENT PARADIGM: OPPORTUNITIES, CHALLENGES AND PROSPECTS

Monograph

AUS PUBLISHERS
Melbourne, 2022

Tretyakov Oleg Vladimirovich

DIGITAL ECONOMY AS A NEW DEVELOPMENT PARADIGM: OPPORTUNITIES, CHALLENGES AND PROSPECTS

Monograph

AUS PUBLISHERS
Melbourne, 2022

Tretyakov Oleg Vladimirovich. DIGITAL ECONOMY AS A NEW DEVELOPMENT PARADIGM: OPPORTUNITIES, CHALLENGES AND PROSPECTS – Melbourne: AUS PUBLISHERS, 2022. - 112 p.

Reviewers:

Doctor of Economic Sciences, Full Professor **Vasilenok Viktor Leonidovich,** Professor at the Faculty of Technological Management and Innovation of ITMO University

Doctor of Economic Sciences, Full Professor **Trunin Viktor Ivanovich,** Professor at the Department of Economic Theory and Applied Economics of the North-West Institute of management, Branch of the Russian Presidential Academy of National Economy and Public Administration.

Abstract. *The monograph presents the results of a study of the digital economy as a new paradigm of economic development, a system of economic relations implemented through the use of digital information computer technologies. It is noted that the main problem in the formation of sustainable economic growth and the successful introduction of digital technologies are the challenges of digitalization of the economy. New digital technologies, innovative business models penetrate into all spheres of the economic life of society, influencing the very essence of the economy, forming qualitative structural changes in it. As a result, a digital economy is being formed as a subsystem of the traditional economy, characterized by the active use of digital technologies and the circulation of specific electronic goods.*

The monograph is intended for researchers, teachers, graduate students, undergraduates, as well as a wide range of readers interested in topical issues of digitalization of the economy.

ISBN 978-1-922756-13-8

Table of content

INTRODUCTION

In the era of the development of information and innovative technologies, new digital tools have covered all spheres of society. Digital technologies have a significant impact on the economy, forming fundamental changes in it. According to most researchers in the field of economics and digital technologies, it is digitalization and other technological transformations that are the processes that contributed to the development of the era of global change. The digital economy is not a tool for solving the entire spectrum of problems in the sphere of the economy. The development of the digital economy must be considered in the context of other transformational processes that are taking place in all spheres of modern society. And in this situation, a systematic approach is needed to assess the development of the digital economy, as a form of organizing the economic activity of society and socio-economic relations within it, which appeared as a result of scientific and technological progress, aimed at transforming industries in all sectors of the economy to generate increasing returns with the help of technologies of the sixth technological order, accelerating the processes of the exchange of information in time and space.

The purpose of this study - is substantiation of the position that the transition to a digital economy (digital revolution) is not just a change in the technological order and/or another technological (industrial) revolution, but is a change in the paradigm of economic development.

The change in the paradigm of economic development is characterized by a change in the nature of the division of labor, a change in the leading mode of interaction between economic entities and a change in the basis of economic power. The change in the nature of the division of labor is expressed in the separation of intellectual and organizational centers from production and service units. The change in the leading way of interaction between economic entities is manifested in the gradual displacement of the free market as the leading way of intercompany interaction by value creation networks. Property in the classical sense ceases to be the main basis of economic power, its place is increasingly occupied by a position in the hierarchy of the field of interaction, which makes it possible to establish rules for interaction and distribution of added value. Along with huge opportunities, the digital revolution will inevitably give rise to many problems, the totality of which can be divided into two classes: problems associated with the development of the digital economy, and problems of the digital economy itself.

The main theoretical approaches to the essence of the digital economy (technocentric, resource-oriented, business-oriented, ecosystemic, reproductive, evolutionary, cyber-systemic, institutional, ideological) allow us to discover the facets of the complex phenomenon of the digital economy in the context of modern technological development, which may be associated with civilizational changes

in society in general and in the economy in particular. Based on the analysis of theoretical provisions, it follows that digitalization - is not a goal, but a means, and the digital economy cannot be considered separately from the rest of the economy and should be interpreted as a segment of activity when the materialization of value added in the production of goods and services is carried out using digital technologies, especially for industries that are Internet dependent. At the same time, it makes sense and value if digital technologies and infrastructure contribute to cooperation in all spheres of the economy and levels of management.

CHAPTER 1. THEORETICAL AND METHODOLOGICAL FOUNDATIONS OF DIGITAL ECONOMY RESEARCH.

Despite a significant number of works devoted to the discussion of the phenomenon of "digital economy", there is still no clear understanding of what the digital economy is as a socio-economic system. The transition to a digital economy is not another change in the technological order (option - fourth industrial revolution), but is a change in the paradigm of economic development, entailing changes in the nature of the division of labor, the way economic entities interact and the basis of economic power. The change in the nature of the division of labor is expressed in the separation of intellectual and organizational centers from production and service units. The change in the leading mode of inter-firm interaction is manifested in the gradual displacement of the free market by value networks. Property ceases to be the main basis of economic power, its place is taken by a position in the hierarchy of the field of interaction (firm, market or network).

Information and communication technologies today penetrate into almost all spheres of human life, cyber-physical systems capable of autonomous exchange of information, independent initiation of actions and independent control of operations are becoming more widespread. According to the President of the World Economic Forum in Davos, Klaus Schwab, the nature of the ongoing changes is so fundamental that world history has not yet known such an era - a time of both great opportunities and potential dangers[1]. Today, most researchers do not have a clear understanding of what the digital economy is as a social system, what socio-economic consequences of the ever-deepening technological changes taking place before our eyes can lead to.

1.1. Digital revolution and fundamental changes in economic relations

From a technological point of view, the digital economy is the result of the mutual superposition of fundamental breakthroughs in the development of many branches of intellectual activity, including: the creation of cyber-physical and cyber-biological systems, fundamentally new materials, new means of production, information technology, genetic engineering, renewable energy sources, etc.

The transition to a digital economy is characterized by technological explosions, which are understood as a combination of technologies that make it possible to create new products and services that, on the one hand, create and form new areas of activity, and on the other hand, destroy or radically change existing sectors of the economy.

Technical development is exponential: every year new science-intensive technologies become more and more perfect, and their physical embodiment is getting

[1]See: Schwab K. The fourth industrial revolution. - M.: Eksmo, 2016. - 138 P.

better (material storage media become smaller and cheaper, and their capacity and speed of information processing increase many times). With regard to the information accumulated in the world, the situation is even more explosive: the time intervals required for a doubling of information are constantly decreasing.

The active development of information and communication technologies (ICT), coupled with the spread of the Internet, led to the emergence of a new concept - Big data (a set of approaches, methods and tools for analyzing huge amounts of structured and unstructured data).

Revolutionary changes in many traditional industries and the simultaneous emergence of new areas and opportunities for the development of human activity make it unrealistic to accurately predict the future, which depends not only on the level of radical technological changes, the speed of their improvement and spread, but also on the institutional support of these processes. At the same time, some significant characteristics of the digital economy can already be identified[1]:

- transformation of ICT into technologies of wide application. Technology of wide application is a technology that allows many improvements, has various use cases, is applicable in many sectors of the economy and can be combined with other technologies, significantly increasing their effectiveness;

- improving the information support of the decision-making process through remote access to information in real time and the creation of systems for processing large amounts of data. This changes the logic of the organization of the management process both at the business level and at the state level;

- increasingly active transition of the population and business to online interaction and online service;

- displacement of human labor by robotic labor. Transfer of a significant part of production to a digital format;

- replacement of a significant part of machine tools with 3D printers for various purposes - for home, industrial, medical, construction and other uses. Computer production of new types of goods, including human organs;

- a decrease in the role of office, production and retail space, the territorial dispersion of participants in economic interaction, from online transactions to intracompany remote interaction;

- reduction of the asymmetry of information by increasing the possibilities of access to it and advanced technologies for its processing;

- the emergence of the internet of things - objects with built-in electronic devices that exchange information about the state of the object of the outside world or the consumer itself without human intervention;

- the emergence of fundamentally new products on the market (unmanned vehicles, energy storage devices);

- the emergence of new, electronic types of money;

[1]See: Polyanin A.V., Sinitsyna K.I. Digital Economy: Concept and Essence // Bulletin of the Automobile and Highway Institute 2020. № 3 (34). P. 96-124.

- the growing role of sharing goods (consumers do not acquire the goods themselves, but the rights of access to the goods and the rights to use them);

- strengthening of the role of digital platforms in the economy connecting suppliers (sellers) and consumers (buyers);

- gradual displacement of hydrocarbons by renewable energy sources, development of energy-saving technologies;

- implementation of the idea of a "digital city" - integrated informatization of transport, housing and communal services, etc.;

- development of innovative biotechnologies and pharmaceuticals that provide effective rejuvenation and treatment of the body;

- reduction of transaction costs by replacing intermediaries with automatic network services;

- implementation of the e-government concept;

- real globalization of social ties;

- the emergence of a new form of interaction between companies and end consumers through the creation of personalized production chains, which is sometimes referred to as the "economy on demand".

Of course, the listed characteristics are not exhaustive and do not provide an accurate definition of the concept of "digital economy".

The pace of change is so great that it is very difficult to make predictions and try to predict exactly which path the development of technology will take.

The most famous examples of change in recent years are: digital cameras have destroyed film cameras; smartphones have almost replaced push-button mobile phones; the "Uber-revolution" has taken place in the taxi market - the digital platform has not destroyed traditional taxi services, but has radically changed the architecture of the market, sharply increasing competition.

At the moment, many innovations have been developed, the mass distribution of which should lead to radical changes in the markets. However, in order for these inventions to become technologies of wide application, it takes time to reduce the cost of their production and realize a two-way network effect - a significant reduction in costs for producers and an increase in value for consumers at the same time[1].

The transformation of socio-economic relations associated with the widespread dissemination of information and communication technologies is interpreted differently by different scientific schools. The most common is the technical and technological approach, which explains what is happening as another technological revolution. At the same time, the designations of the stage of technological development may differ: a new (sixth) technological order, a new (fourth) industrial revolution, a new industrialization, etc.

[1]See: Comparative Analysis of Pricing Policies in the Market for Network Goods / S. Evsukov, A. Sigarev, E. Ustyuzhanina, E. Zaytseva // Journal of Internet Banking and Commerce. 2016. V. 21. № 6. P. 2-18.

The technical and technological approach is based on the idea that ICT marks the next stage in the development of the production method, the foundations of which were laid during the Great Industrial Revolution. The Industrial Revolution itself usually dates from the second half of the XVIII century. The symbolic countdown is from the opening in 1771 of Arkwright's textile factory in Cromford. The factory is considered the first example of an industrial one - the combination of machine production and water energy into a single system, which made it possible to move from single manual production to mass machine production.

According to the concept of uneven development of scientific and technological progress[1], the period that can be called the era of industry (originating from the time of the Great Industrial Revolution and continuing to this day) is characterized by a regular change in technological patterns, which are based on technological revolutions that radically change the structure of social production. At the same time, fundamentally new technologies become technologies of wide application not immediately after their appearance, but with some delay[2].

Adherents of the theory of technological patterns currently distinguish six patterns - "industrial eras". The first begins, in their opinion, along with the industrial revolution in the 1760-70s. This is the era of the use of water energy and the first machines that replaced manual labor. The second way is positioned as the era of steam and railways. Its symbolic beginning is usually dated to 1829 - the testing of the "Rocket" steam locomotive for the Manchester - Liverpool railway. The era of electricity, steel and heavy engineering is the third technological order. Its beginning is timed to coincide with the opening in 1875 of the Carnegie steel plant in Pittsburgh (Pennsylvania). The launch in 1908 of the production of a cheap "Model-T" car (Ford) with an internal combustion engine (Daimler & Benz) is considered to be the symbolic beginning of the fourth technological order (the era of oil and automobiles) - the transfer of the automotive industry to mass production. Finally, the fifth technological order is called the era of microelectronics and computer science and its beginning is associated with the advent of a computer on microchips (1971 - Intel). There has not yet been a consensus on the main content and starting point of the sixth technological order. Some researchers focus on NBIC technologies (Nanotechnology, Biotechnology, Information, Cognitive Science), others talk about robotics and new energy.

The developers of the concept of technological orders believe that technologies inherent in different technological orders can dominate in different countries at the same time. Moreover, it is possible to simultaneously combine different technological structures in different fields of activity in one country. At the same time, countries lagging behind in terms of technological development have a chance to

[1]See: Perez C. Technological Revolutions and Financial Capital: The Dynamics of Bubbles and Golden Ages - M.: Delo, 2011. - 231 P.

[2]See: Dementiev V.E. Variability of long waves of economic development // Problems of theory and practice of management. 2016. № 6. P. 41-46.

get ahead when changing technological patterns[1].

A slightly different point of view in terms of periodization, but not very different in essence, is held by the German technological school, which believes that we are talking about the beginning of the fourth industrial revolution. According to the German tradition, a sequence of industrial revolutions that began in the second half of the XVIII century stands out[2]. According to this approach, the first industrial revolution lasted from the 1760s to the 1840s. Its trigger was the construction of railways and the invention of the steam engine, which contributed to the development of mechanical production. The second industrial revolution, which began at the end of the XIX century and lasted until the beginning of the XX century, led to the emergence of mass production thanks to the spread of electricity and the introduction of the assembly line. The third industrial revolution began in the 1960s. It is usually referred to as the computer or digital revolution, as it was catalyzed by the development of semiconductors, the use of mainframe computers in the sixties of the XX century, personal computers in the seventies and eighties, and the Internet in the nineties[3].

According to Klaus Schwab, the fourth industrial revolution is characterized by the universal spread of the mobile Internet, the reduction in the size and cost of means of production, artificial intelligence and learning machines, as well as the synthesis of physical, digital and biological innovations. Obviously, here, as in the case of the last and penultimate technological modes, there is a certain intersection of the basic technologies of the third and fourth stages.

A different, alternative technological approach can be called structural-sectoral. These are numerous concepts of the end of an industrial society, starting with the post-industrial society of D. Bell[4] and ending with of E. Toffler's[5] third wave. According to the structural approach, the classification of various types of society is based on such a criterion as the field of activity with the largest share of employees. Accordingly, an agrarian, industrial and post- or superindustrial society is distinguished, a characteristic feature of which is the transfer of most of the activity to the service sector and intellectual (innovative) activity, the transformation of scientific knowledge into an independent factor of production.

Today this point of view is actively criticized. Supporters of the idea of a "new industrial society" pay attention to the fact that the concept of denying the leading role of material production is not confirmed by practice. Material production has not disappeared anywhere - it has simply moved to other countries. Moreover, a powerful wave of industrialization unfolded in the world South and East, which

[1]See: Glazyev S.Yu. Theory of long-term technical and economic development. - M.: VlaDar, 1993. - 310 P.

[2]See: Brennen S., Kreiss D. Digitalization and digitization. Culture digitally. 2014. September. URL: http://culturedigitally. org/2014/09/digitalization-and-digitization/.

[3]See: Schwab K. The fourth industrial revolution. - M.: Eksmo, 2016. - 138 P.

[4]See: Bell D. The coming of post-industrial society. - M.: Academia, 1999. - 783 P.

[5]See: Toffler A. The Third Wave - M.: AST, 1980. - 795 P.

led to a sharp increase in the share of industrial production in the respective regions and, as a result, to an increase in the share of workers and engineers employed in a purely industrial sphere in the world "total worker"[1]. However, the proportion of people employed in one or another type of activity, as well as the type of engine (water, steam, internal combustion, or electric) can hardly be a weighty argument in a dispute about the nature of ongoing processes. Just as the industrial revolution did not eliminate the agricultural sector, but simply significantly reduced its scale in the national economies of countries leading industrialization, so the new wave or new economic revolution (if it takes place) does not imply the withering away of the industrial sector, but a decrease in its role in social production, in particular, a reduction in the share of added value created in this sector.

Another thing is that in itself the transfer of industrial production to the periphery of the world economic system - is an extremely significant phenomenon. But the answer to the following question is important: is territorial expansion and the accompanying change in price proportions a natural way for the development of the existing world economic system[2] or a manifestation of some new deep processes that change the very paradigm of economic development?

When they talk about the economic revolution, it is not about a change in the technological structure and/or another technological (industrial) revolution, the consequences of which are major structural shifts in the economy, changes in price proportions and the emergence of new markets, but about a change in the paradigm of economic development - the economic revolution, comparable in importance to the Neolithic (transition from an appropriating to a reproductive type of management) and industrial (transition from a predominantly agricultural economy to factory production) revolutions.

The use of the term "economic revolution" does not speak of the spasmodic nature of the changes (which in all three cases are cumulative in the gradual transition of quantity into quality), but of their radical nature - the formation of a new model of the economic structure of society. In this sense, economic revolutions differ significantly from political revolutions, during which first there is a sharp change in the conditions of life (the social paradigm of development), and then a partial restoration of the past begins.

To substantiate the thesis about the formation of a new paradigm of economic development, it is necessary to study the fundamental changes associated with economic revolutions, to which the following can be attributed: a change in the nature of the division of labor, a change in the way economic entities interact, and a change in the basis of economic power.

[1]See: Bodrunov S.D. The Coming of New Industrial Society: Reloaded - M.: Cultural Revolution, 2016. - 328 P.

[2]See: Wallerstein I. World-systems analysis and the situation in the modern world. - SPb.: University book, 2001. - 416 P.

Change in the nature of the division of labor. The change in the paradigm of economic development is characterized, first of all, by a change in the nature of the division of labor. So, the first (Neolithic) economic revolution is associated with the formation of stable areas of division of labor - the division of the community into those who are constantly engaged in valiant activities (cattle breeding, hunting, war), and those who are engaged in low-prestige work in the household, including agriculture[1].

The second (industrial) revolution is characterized not only by the transition from manual labor to machine labor, the formation of industry as an independent sphere of production and the redistribution of most of the created social wealth into it. Simultaneously, there is a massive separation of production (enterprises) from households. A predominantly subsistence economy, in which the economy includes the institution of exchange (market), but most of the products are produced to meet their own needs (including the need for luxury[2]), gives way to a market economy, where goods are produced mainly for exchange, and profit-making becomes the target function of economic organizations.

Finally, the third (digital) revolution marks the separation of organizational and intellectual centers from production and service departments, the localization of individual components of the production process in different parts of the world - another great unbundling[3].

The change in the nature of the division of labor that is taking place before our eyes is distinguished by such features as:

- redistribution of most of the social wealth created in the sphere of intellectual and organizational activities (generation and commercialization of ideas, control over value chains);

- expanding the scale of remote interaction, which allows not only coordination and cooperation of geographically distributed participants, but also remote control of robotic systems;

- customization and return of the production of a significant part of consumer goods and services to the household through the improvement of household appliances; in the future, this trend is likely to increase: 3D printers will allow households to produce many goods on their own;

- gradual replacement by computers and robots of specialists in many professions, including those requiring high qualifications: training, health diagnostics, surgical operations, control of complex technical devices and, as a result, increased differentiation of the nature of work;

- displacement of human labor by robots due to computerization and automa-

[1]See: Veblen T. Theory of the idle class. - M.: Progress, 1984. - 367 P.

[2]See: Sombart W. Bourgeois. Etudes on the history of the spiritual development of modern economic man. - M.: Iris-Press, 2004. - 245 P.

[3]See: Baldwin R. Trade and industrialization after globalization's 2nd unbundling: how building and joining a supply chain are different and why it matters // Working paper 17716, NBER Working Paper Series. 2011. - 39 P.

tion of the vast majority of operations, including those related to decision-making. As a result, if the institutional conditions of employment do not change, there may be an increase in unemployment and the problem of "surplus population".

Change in the way of economic interaction - forms of building relationships between business entities and ways of coordinating their activities.

The industrial revolution, as noted, was accompanied by a transition to the market as the main means of coordinating economic (intercompany) interaction. K. Polanyi believed that the pre-industrial economy included the institution of market exchange, but was not controlled by the market[1]. To describe the pre-industrial economy, he introduces such types of transactions as transactions of reciprocity, redistribution, housekeeping and exchange.

The market way of coordinating economic activity assumes that the interaction of economic agents is regulated by the mechanism of free pricing - the balance of supply and demand based on the competition of independent sellers and buyers seeking to maximize their own benefit (in this sense, it is more correct to use the term "price method of coordination"). However, even in market-type economies, price regulation is by no means the only way to coordinate economic interaction. Almost always and everywhere it is supplemented by standardization (in the form of both formal norms and routines and traditions), administrative regulation (in particular, in the form of redistribution transactions) and mutual agreement (for example, in the form of reciprocity transactions)[2].

If we talk about economies of the pre-industrial type, we also find a combination of several ways of coordinating economic interaction. At the same time, in communal-type economies, transactions of reciprocity and their inherent mechanism of mutual agreement (consultative coordination) prevail, and in hierarchical-type economies, which include not only feudal, but also planned economy, - redistribution transactions and the administrative method of coordination prevail.

The question arises: if the transition from an agrarian type of economy to an industrial one was accompanied by a transition to the market as the leading way of coordinating economic interaction, then what way of coordinating economic interaction can claim to be the leading one in the digital economy?

Apparently, we are talking about network forms of economic interaction, which are based on the formation of stable ties between economic entities based on the constant exchange of information and building relationships of trust. Just as the market is born in the depths of pre-industrial economies, network forms of economic interaction are born in the depths of the industrial economy.

Here we are talking about a return to a communal form of government based

[1]See: Polanyi K. Primitive, archaic, and modern economies: Essays / Of Karl Polanyi; Ed. by George Dalton. - Boston: Beacon press, 1971. - LIV. - 346 P.

[2]See: Dementiev V.E. Hybrid forms of business organization: to the question of the analysis of interfirm interactions / V.E. Dementiev, S.G. Evsyukov, E.V. Ustyuzhanina // Russian journal of management. 2017. V. 15. № 1. P. 89-122.

on expanding the possibilities of information exchange[1]. In other words, the development of ICT makes it possible to solve the problem of the direct exchange of information, and, consequently, the establishment of direct links and relationships of trust between a very wide range of people. Today there is a gradual displacement of the market as a universal way of inter-company interaction of independent producers by network forms of cooperation, within which the leading method of coordination is mutual agreement.

It should be emphasized that network forms replace predominantly market rather than intra-company interaction, since the weakening of the problem of information asymmetry gives rise to opportunities not only for the formation of stable inter-company relations, but also for the consolidation of corporations, as well as for strengthening the intra-corporate vertical of power[2].

Change in the basis of economic power. Usually, when analyzing various socio-economic formations (modes of production), researchers focus on what is for them the main factor of production (the main object of ownership). According to popular belief, under feudalism (agrarian economy) this factor is land (natural resources), under capitalism (industrial economy) - the means of production (capital), and in the new economy - knowledge (information).

In our opinion, this approach somewhat simplifies the problem of economic power, reducing it to the problem of property. This formulation of the problem seems to be explained by the temptation to study past and future institutions on the basis of today's analogies. This is most clearly manifested in relation to the broad interpretation of the concept of "property".

Describing the modern economy, we also expand the understanding of the category of "property", identifying it, in fact, with the possibility of restricting the rights of others. Meanwhile, in today's economy, power relations are not always based on property relations. Even if we are talking about the power to dispose of resources or the power to regulate access to a resource, including electronic (Skype, Torrent), we are faced with complex phenomena, for the study of which it is necessary to distinguish between operational rules and rules of collective choice[3], and also take into account the possibility of dispersal of individual ownership rights[4]. But the most important thing is that the power to dispose of resources, which is usually called power-property, is far from the only basis of economic power. No less important is the power of status, which can be based on estate privileges, official position, clan (family) hierarchy, tradition, etc.

Another basis of economic power is monopoly. Power-monopoly is based on

[1]See: Parinov S.I. On the theory of network economy. - Novosibirsk: IEIE SB RAS, 2002. - 168 P.

[2]See: Dementiev V.E. Hybrid forms of business organization: to the question of the analysis of interfirm interactions / V.E. Dementiev, S.G. Evsyukov, E.V. Ustyuzhanina // Russian journal of management. 2017. V. 15. № 1. P. 89-122.

[3]See: Ostrom E. Governing the commons. The evolution of institutions for collective action. - M.: IRISEN: Mysl, 2010. - 445 P.

[4]See: Kapelyushnikov R.I. Economic theory of property rights. - M.: IMEMO, 1990. - 90 P.

the inequality of the negotiating power of the parties due to the limited space of choice... This provision can be due to both control over a unique resource, including intellectual property, infrastructure facilities (pipeline, the only road); access to the market, as well as a unique place in a particular value chain[1]. In other words, a monopoly can be conditioned both by the ability to regulate access to a resource, including an intangible one (and in this case, some analogy with the rights and rules characteristic of property relations is appropriate), and by locking the counterparty in a certain system of relations. The best illustration of the second type of monopoly is a fundamental transformation[2], when the negotiating power of the parties changes as a result of one of the counterparties investing in specific assets, and power is transferred not to the owner of these assets, but to its counterparty.

The next important source of power can be called economic coercion - power-temptation[3]. It is beneficial for suppliers to cooperate with large retailers, as such cooperation enables them to realize economies of scale and drastically reduce transaction costs. Even though, you have to pay for this by agreeing to dictate the terms of interaction on the part of the counterparty (prices, delivery times, product quality, packaging).Taxi drivers who work with platforms like Uber or industrial companies that supply components to Boeing are in a similar situation. In all cases, we are not talking about the monopoly of one of the parties to the transaction, but on its position in the hierarchy of its market field[4]. In other words, if power-monopoly is based on the limitation of the space of the current choice, then power-temptation is based on the current profitability of cooperation. Satellite companies focused on maximizing current benefits (minimizing current losses) voluntarily agree to a dependent position in the value chain, exchanging their freedom not only for today's subordinate position, but also for limiting the space of future choice[5].

It should be noted that in real life the power of one subject over others is almost always based on several grounds. However, we can also talk about the dominant basis of economic power, characteristic of each paradigm of economic development. In our opinion, in an agrarian society, economic power was based mainly on status (position in the class hierarchy), in industrial society - on property (in its classical sense), and in digital society - on economic coercion (position in the hierarchy of the market field and/or the value networks).

[1]See: Dementiev V.E. The problem of power in terms of institutional approach / V.E. Dementiev, E.V. Ustyuzhanina // Journal of institutional studies. 2016. V. 8. № 3. P. 91-101.

[2]See: Williamson O. The economic institutions of capitalism. Firms, Markets, Relational Contracting. - SPb.: Lenizdat 1996. - 702 P.

[3]See: Dementiev V.E. The problem of power in terms of institutional approach / V.E. Dementiev, E.V. Ustyuzhanina // Journal of institutional studies. 2016. V. 8. № 3. P. 91-101.

[4]See: Fligstein N. The Architecture of Markets: An Economic Sociology of Twenty-First-Century Capitalist Societies. - M: Higher School of Economics Publishing House, 2013. - 392 P.

[5]Here, there is a direct analogy with a free employee who voluntarily agrees to exchange his economic freedom for a guaranteed remuneration in the form of wages.

Thus, the analysis carried out indicates the inevitability of the digital transformation of social production and, as a result, a fundamental change in socio-economic relations. This is not just about another industrial or technological revolution (a change in the technological order), but about a change in the paradigm of economic development, comparable in importance to the Neolithic and industrial revolutions. The change in the paradigm of economic development is most clearly manifested in three areas: a change in the nature of the division of labor, a change in the leading mode of interaction between economic entities, and a change in the basis of economic power. The change in the nature of the division of labor is expressed primarily in the separation of intellectual and organizational centers from production and service units. Gradually, an increasing part of the social wealth created will move into the sphere of innovation. The free market as the leading mode of inter-firm interaction is likely to be replaced by relatively stable value networks, both in terms of the composition of participants and the internal structure. Finally, property in its classical sense will cease to be the main basis of economic power. Its place will be taken by a position in the hierarchy of the field of interaction (firm, market, network), which makes it possible to establish rules for interaction and distribution of added value.

1.2. Methodological issues of interpretation of the term "digital economy"

The digital economy is a new socio-economic phenomenon that is developing at a rapid pace - so fast that economic theory lags far behind in studying this phenomenon. Currently, the term "digital economy" theorists and practitioners understand completely different phenomena and processes.

The term "digital economy" appeared in the scientific literature not so long ago, at the end of the XX century, and became widespread. For the search query "digital economy", Google produces more than 600 thousand results. This is quite natural, because digital technologies in the 21st century are rapidly developing and have a major impact not only on the economy, but also on the development of society. Interest in the digital economy is shown not only by scientists, but also by such authoritative organizations as the World Bank, which published the results of several of its own studies on this topic, the Organization for Economic Cooperation and Development (OECD), which, since 2002, has regularly distributed scientific and methodological materials on the digital economy , European Parliament, International Monetary Fund and other governmental and intergovernmental organizations. In the Russian Federation, the digital economy is being translated into practice in the form of a national program.

However, despite such activity in the field of digital economy research, there are a number of unresolved theoretical and practical problems. The first is the lack of a generally accepted definition of the digital economy. It is difficult to find another branch of economics in which there would be so many different definitions

of the term. It can be said without exaggeration that almost every researcher of this topic gives his own definition of this concept. This is evidence of insufficient methodological study of the issue of the essence of the digital economy.

The term "digital economy" itself is new and unsettled. Dozens of definitions can be found in the economic literature. It makes no sense to dwell on the analysis of all these definitions. This issue is well elaborated on in both in Russian[1], and in English[2] literature. However, we consider it necessary to dwell on the methodological side of the issue of defining the digital economy.

Considering the many definitions of the digital economy, two methodological approaches can be distinguished. The first one (of course, the dominant one in the economic literature) is that one or another part of the economy is recognized as a digital economy. The allocation of this part is most often carried out according to the criteria for belonging to certain industries or types of economic activity. The second approach, which is extremely rare, is to recognize the digital economy as a special kind of economy as a whole, regardless of sectoral affiliation, while the definition of the economy as digital is sometimes seen as a new stage in the development of the economy[3]. Another definition has become quite widespread, which cannot be directly attributed to either the first or the second approach. In this definition, digital refers to an economy based on digital technologies. Since the concept of digital technologies, as a rule, is not disclosed, the position of the authors using this definition becomes clear not from the definition, but from the context of the article or study.

Let's consider the definition of the digital economy as part of the modern economy. This direction arose among practicing economists and is actively supported by government agencies.

At the beginning of the XXI century, it became quite obvious that the economy is undergoing revolutionary changes under the influence of the rapid spread of various digital technologies. Naturally, economists were faced with the task of determining the contribution of the digital economy to overall economic development, the share of the digital economy in the economies of different countries, and the dynamics of the development of the digital economy itself. Similar tasks have arisen for government agencies: to promote the development of the national digital economy, develop support programs and apply incentive measures. Naturally, for these purposes, the ideas of separating the digital economy from the entire economy according to some complex criteria are not suitable. Calculations of the contribution of the digital economy to economic development in this situation be-

[1]See: Allen R. Global Economic History: a Very Short Introduction. - M.: Publishing House of the Gaidar Institute, 2017. - 221 P.; Basaev Z.V. The Digitalization of the Economy: Russia in the Context of Global Transformation // World of the New Economy. 2018. № 12-4. P. 32-38.

[2]See: Belousov Yu.V., Timofeeva O.I. Methodology for Defining the Digital Economy // The world of the new economy. 2019. V. 13. № 4. P. 79-89.

[3]See: Goloventchik G.G. Digitalization of the Belarusian Economy in the Modern Conditions of Globalization. - Minsk: BSU Publishing Center, 2019. - 257 P.

come impossible. Analysis can only be carried out when statistical data are available. Such data is readily available in the sectoral context, which is why there is a separation of several industries from the economy, which are called the "digital economy". In this case, dynamics, share, contribution and many other indicators are easily calculated. But there has been heated debate over which industries should be classified as part of the digital economy. Various researchers attribute the following to the digital economy: the Internet, digital multimedia, robotics, cloud computing and big data analysis, non-cash financial transactions using the Internet, network effects, online platforms, information and telecommunication technologies, online commerce, the Internet of things, etc.

This approach to the definition of the digital economy has the right to exist, but the definition itself should be expressed more clearly. It is known that definitions can be of two main types: extensional and intensional. The former are formed by enumerating the objects described by a certain term (in this case, the term "digital economy"). There are two words in this term: "economy", which indicates a generic trait, and "digital", which indicates a specific trait.

A specific trait must clearly distinguish this object from other objects belonging to this genus. A specific trait can be specified by enumeration of objects that are combined by definition. For example, we can give the following definition: the digital economy is an economy that includes two industries: the Internet and information and telecommunication systems. By the way, based on the analysis of the content of digital economy research, this definition can be considered the most common. However, in this case, two problems arise.

First problem. Since we are not talking about the entire economy, but only about its part, it would be logical to use the term "digital sector of the economy". Recently, this problem has begun to attract the attention of economists. Thus, a study by the International Monetary Fund distinguishes between the digital economy and the digital sector of the economy[1].

The second problem of this direction is that there is a need to justify the list of industries related to the concept of "digital economy". Almost all researchers adhering to this approach include information and telecommunication technologies (ICT) and the Internet in the list of industries. But robotics is very rarely included in the list. Why? What criteria are used to select industries that are included in the digital economy?

There are practically no such studies, although some economists paid attention to this problem for a long time. So, R. Atkinson and A. McKay noted that in 2006, 70% of microprocessors were not connected to the Internet, but were used offline[2], while the digital economy usually comes down to the Internet. A dilemma

[1]See: The main trends in the development of the digital economy in the financial sector. Legal aspects of regulation and practical application. - M.: Publishing house of the State Duma, 2019. - 160 P.

[2]See: Atkinson R., McKay A. What is the digital economy? Government technology. 2007. April. URL: https://www. govtech.com/dc/articles/What-Is-the-Digital-Economy.html.

arises: either microprocessors do not belong to the digital economy, or industries in which microprocessors are used massively should be included in the digital economy. By what criterion do most economists do not attribute a digital camera, in which there are many sensors and microprocessors, to the digital economy?

Faced with these problems, individual researchers try to get around them or move away from the sectoral approach. A number of researchers believe that the digital economy is a part of the total production generated by various "digital" resources. These resources include digital skills, digital equipment (hardware, software and communications) and intermediate digital goods and services used in production. 13 industries are identified and analyzed using statistical data from 11 countries[1].

Other researchers, such as reputable scientists in the field of digital economy R. Bukht and R. Hicks, have proposed their own version of the definition of the digital economy. As a basis, they used the study by S. Brenen and D. Kreis "Digitization and digitalization"[2], which distinguishes between these concepts. On this basis, R. Bukht and R. Hicks build a three-level model of the digital economy[3]:

- first level: the digital sector, which includes telecommunications, software, IT consulting, computer technology, etc.;

- second level: digital economy, which includes the digital sector, as well as platform solutions, digital services, etc.;

- third level: digitalized economy, which includes the digital economy, as well as network business, e-commerce, etc.

As a result, the authors give the following definition: the digital economy - is the part of the total output that is wholly or mainly produced on the basis of digital technologies by firms whose business model is based on digital products or services. This definition is rather vague, but it is flexible enough to take into account the development of digital technologies and digital business in the future[4]. The last remark is important for the authors, since, in their opinion, the essence of the problem lies not so much in the fuzziness [*of the definitions of the digital economy* - O.T.], but in the scale of the phenomenon: as more and more service providers, manufacturers of finished products, and even suppliers of raw materials are using ICT in their activities, the digital economy in the current definitions becomes just "economy"[5].The last phrase quite clearly expresses the peculiarity of the position of not only these authors, but in general the entire first approach to the definition

[1]See: Lee K.-F. Ai Superpowers: China, Silicon Valley, and the New World Order. - M.: Mann, Ivanov, Ferber, 2019. - 233 P.

[2]See: Brennen S., Kreiss D. Digitalization and digitization. Culture digitally. 2014. September. URL: http://culturedigitally. org/2014/09/digitalization-and-digitization/.

[3]See: Bukht R. Defining, Conceptualising and Measuring the Digital Economy / R. Bukht, R. Hicks // Bulletin of international organizations. 2018. V. 13. № 2. P. 143-172.

[4]See: Bukht R. Defining, Conceptualising and Measuring the Digital Economy / R. Bukht, R. Hicks // Bulletin of international organizations. 2018. V. 13. № 2. P. 143-172.

[5]See: Belousov Yu.V., Timofeeva O.I. Methodology for Defining the Digital Economy // The world of the new economy. 2019. V. 13. № 4. P. 79-89.

of the digital economy. In the term "digital economy" in the understanding of researchers who support the methodological first approach, the key word is "digital", and the word "economy" is of secondary importance. In terms of R. Bukht and R. Hicks, the digital economy may someday become just an economy (which means that it is not an economy today). But if the digital economy is not an economy, does it make sense to call it that?

Thus, we can conclude that the methodological disadvantage of the first approach is the incorrect establishment of generic and specific characteristics in the definition of "digital economy". The word "economy" should not be a specific element, as is often practiced when using the first approach, but a generic one. The digital economy is, first of all - an economy. But these two expressions are not identical: in addition to the digital one, there is another, non-digital economy. This is recognized by almost all researchers of the digital economy, but the term "traditional economy" is more often used. It seems to us that the term "non-digital economy" is more accurate, since some criteria will be required to separate the digital economy from the non-digital, and perhaps others to separate the traditional from the non-traditional.

Consider the second methodological approach. It is based on the recognition of the word "economy" as a generic element in the expression "digital economy". The word "digital" in this case is a specific element. That is, the digital economy is an economy, but of a special kind (there is also a non-digital economy). The digital economy can be part of the economy as a whole. However, in this case, we recommend using the term "digital sector of the economy". This is done so that the term "digital economy" does not denote two different phenomena: the digital economy as part of the economy and the digital economy as a whole as a certain characteristic or a new stage in the development of the economy. However, in any case, it is necessary to separate the digital economy from the non-digital. This is understood by many researchers, while noting the complexity of this action.

When considering the digital and non-digital economy, we proceed, firstly, from the recognition of the economy as a generic element in the expression "digital economy", and secondly, from the fact that there should be a criterion by which one type of economy (digital) can be unambiguously separated from another type of economy (non-digital).

For all definitions of the digital economy, this criterion is the main methodological problem. Most researchers simply bypass this problem. To find a criterion for distinguishing the digital economy from non-digital, it is advisable to start with the concept of "economy". Note that the term "economy" also has many definitions. We use one of the most common definitions, according to which the economy - is "the economic activity of society, as well as the totality of relations that develop in the system of production, distribution, exchange and consumption"[1].

[1]See: Belousov Yu.V., Timofeeva O.I. Methodology for Defining the Digital Economy // The world of the new economy. 2019. V. 13. № 4. P. 83.

In the vast majority of cases, when distinguishing the digital economy from the entire economy, researchers analyze the "totality of relations of production" from the above definition. As a result, there are as many researchers as there are positions on the issue of the digital economy. This seems to indicate a dead end in the analysis. We believe that to highlight the digital economy, the key element in the above definition is not production, but activity. It is necessary to find such characteristics in activities that will clearly separate the digital economy from other types.

Activity, including economic activity, - is the process of purposeful influence of the subject on the real world (object) to meet the needs of the subject. The purposefulness of the impact, in turn, means that the subject of economic activity has a certain purpose. A goal is an ideal image of the end result of an activity. The end result is concrete, and its ideal image is naturally abstract. In other words, the goal is a model of the end result[1].

Models can be divided into three groups according to the way they represent reality[2]:

- empirical (other names: heuristic, ideal, imaginary, speculative, iconic, etc.);
- natural (analogue, physical, material, etc.);
- mathematical (digital).

Depending on the type of model used in the goal-setting activities of people, the economy can be classified as digital or non-digital.

An analysis of the ways in which the subject influences the objects and means of labor allows us to distinguish three types of economic activity that form the basis of three types of economy[3]:

1. Empirical economics, which is based on the impact of the subject of production on the objects of labor using tools. The target orientation of activities is based on empirical models.

2. Analog economy, which is based on the management of the subject of production by the means of labor, and those, in turn, perform operations with the objects of labor. The target orientation of activity in this case is based on analog models.

3. The digital economy, which is based on the impact of the subject of production on the management systems of labor means. The target orientation of activity is based on mathematical models.

This classification is based on the criterion: the way the subject of production influences the means and objects of labor. Each of these methods has its own form of goal-setting in the implementation of production activities.

The first two types of economy are not digital. The third type is digital. However, this type has specific features that are not characteristic of the first two.

[1]See: Mises L. Human Action: A Treatise on Economics. M.: Economics, 2000. - 875 P.

[2]See: Belousov Yu.V., Timofeeva O.I. Methodology for Defining the Digital Economy // The world of the new economy. 2019. V. 13. № 4. P. 83.

[3]See: Belousov Yu.V., Timofeeva O.I. Methodology for Defining the Digital Economy // The world of the new economy. 2019. V. 13. № 4. P. 84.

The digital economy assumes that labor management systems have been developed and created. This means that various sensors, processors and other digital devices are selected and combined with specially created software. But such software still needs to be created, and this is a completely different type of economic activity that does not fit into the definition of the third type of economy. Digital (mathematical) models are the result of this type of activity, and the target orientation itself exists in a conceivable form, similar to the empirical one, which is inherent in the first type. But it is fundamentally different from the empirical one. The empirical model is based on experience. In this case, the idea of the future result is based primarily not on experience, but on knowledge. Therefore, it is advisable to call such a target activity model heuristic, while understanding that it generally belongs to the same class as empirical models.

Summing up, we can say that the digital economy is a complex phenomenon that includes two interrelated processes: the process of creating digital systems for managing labor tools and the process of using digital management systems in production activities. It is important to note that the two named processes impose completely different requirements on the qualifications of subjects of labor activity. The development of control systems requires highly qualified developers: scientists, engineers, designers, programmers. This is creative intellectual work. Moreover, the more complex the control system being created, the higher the requirements for the qualifications and level of knowledge of developers. On the contrary, the process of using labor means management systems in production activities practically does not require qualifications and any special knowledge. An employee of such a mass profession as a cashier-seller in modern stores does not even need to know the multiplication table. Cash register management systems allow you to work effectively even without such knowledge. The more perfect the management system, the lower the requirements for the qualifications of people who use these systems.

Thus, it should be noted that at the present stage of economic development, the functions and role of the subject of production and management are fundamentally changing. In the transition from the use of empirical models to analog models, changes in the means of labor played a key role. The emergence of specialized equipment, mechanical and electrical energy sources required changes in the activities of production entities. Empirical models are not suitable for specialized equipment, they are replaced by analog models. Modern changes have affected not so much the means of labor themselves, but the processes of managing them. And this is the function of the subject of production. Many functions previously performed by a person are beginning to be carried out automatically, using sensors, processors and software. Analog models are not suitable for such production, they are replaced by mathematical (digital)[1] models. Of course, the subject of

[1]We identify numerical and mathematical analyses in this study. With regard to the goals of economic activity, a mathematical model is necessarily digital, and digital data must be formalized by mathematical formulas.

economic activity cannot disappear completely, but it leaves the given production process and is located somewhere else. In any case, there is an owner who makes decisions independently. But in the production process, the subject may disappear or its functions will fundamentally change.

The classification of the economy according to the criterion of the variant of the impact of the subject of production activity on the objects and means of labor is one of the many ways to classify the economy. Such a plurality of classifications is inherent in all objects.

Based on the foregoing, we can draw the following conclusion: it is inappropriate to divide the economy into two parts - digital and non-digital - according to industry criteria. The digital economy, to a greater or lesser extent, has penetrated all sectors of the economy.

The digital economy - is the economic activity of people, a feature of which is the impact of a person as a subject of production not on the objects of labor and means of labor, but on the management systems of means of labor. The non-digital economy is characterized by human impact on the objects or means of labor.

The digital sector of the economy - is, firstly, production, in which a person influences the management systems of the means of labor, and secondly, the development and design of new systems for managing the means of production. Accordingly, the digital sector of the economy is based in its goal-setting activities, firstly, on digital (mathematical) models, and secondly, on heuristic models of the result of economic activity. The term "digital sector of the economy" should be used to analyze the impact of the digital economy on specific socio-economic processes in modern society. The term "digital economy" is more suitable for a general description of the current stage of economic development[1].

Naturally, there is no clear boundary between the digital and pre-digital economy. Similarly, even in the era of post-capitalism, elements of a subsistence economy remain in the economy. However, despite all the conventions, the countries of the world can be divided into three groups depending on the level of development of the digital economy. The first group of countries creates digital production and management systems and uses them in economic activities. This group includes the USA, Japan, Germany, South Korea, China. These five countries account for 74% of the total number of robots in the world[2]. Many countries that are called developed can also be classified in this group with some reservations. The second group includes countries that do not directly participate in the development of digital production and management systems, but actively buy them and use them in the economy: the Czech Republic, Turkey, Mexico, Brazil, India. And, finally, the third group is countries that do not develop digital production and management

[1]See: Castells M. The Information Age: Economy, Society and Culture. - M.: HSE University, 2000. - 606 P.

[2]See: International Federation of Robotics. URL: https://ifr.org/ ifr-press-releases/news/robot-investment-reaches-record-16.5- billion-usd.

systems, and do not use them in the economy. This group includes not only the poorest countries in the world, but also some fairly rich oil-producing countries. Russia, at this point in time, is also one of them. In 2018, 1007 industrial robots functioned in the Russian economy, of which 860 were installed in 2018. Only 4% of them were produced in Russia[1]. The number of robots in Russia is 5 per 10,000 employees, which is significantly lower than the world average (99 robots), not to mention countries like Singapore, where there are 831 robots per 10 000 employees[2].

The analysis carried out allows us to make a forecast about the next stage of economic development. This stage will be based on artificial intelligence. Artificial intelligence will be increasingly used in the process of creating new technologies, products or services. It will be a serious competitor to those who are creating the digital economy today: scientists, designers, programmers. But in any case, artificial intelligence will not force a person out of the economy, only a person is capable of goal setting. One can imagine a programmer robot endowed with artificial intelligence or a manager robot, but an owner robot cannot be imagined. The purpose of economic activity will always be set by a person.

Thus, the question of the definition of "digital economy" is theoretical. But it also has important practical significance, primarily for the development of state policy in the field of the digital economy.

A narrow understanding of the digital economy as several industries related to the Internet and information and telecommunication systems allows us to see the development of these industries, but does not allow us to determine their contribution to economic development. These industries are for the most part tools that can be used to ensure a higher rate of development of the entire economy. However, the presence of a tool does not mean that the tool is being used effectively. One can even imagine a situation where a lot of money has been spent on the development of these tools, but they are not used actively enough. In this case, the development of high technologies will lead to a decrease in the efficiency of the economy, and not to an increase. Therefore, it is necessary to analyze the development of the economy as a whole and then determine what contribution the digital economy has made. On this basis, a state policy to stimulate the digital economy can be built.

A good example for studying the importance of the digital economy is China, which has been actively developing in this direction in recent decades. Two or three decades ago, no one would have called the labor force in China educated and skilled, especially in rural areas. However, China's economic policy has led to a huge shift of workers from agriculture to industry. And these poorly educated and low-skilled workers began to produce Apple computers. Not because their qualifications have increased dramatically, but because modern equipment

[1]See: Lenchuk U.B. Formation of the industrial policy of Russia in the context of the tasks of new industrialization // Journal of the New Economic Association. 2018. № 3 (39). P. 138-145.

[2]See: International Federation of Robotics. URL: https://ifr.org/ifr-pressreleases/ news/robot-investment-reaches-record-16.5-billion-usd.

based on digital technologies does not contain requirements for high qualifications. And China is very actively using modern digital equipment. And if earlier it was mainly imported equipment, now China has become one of the largest manufacturers of industrial robots and other modern digital equipment. Moreover, China seeks to enter a narrow circle of countries - developers of digital systems. To do this, it was necessary to significantly raise the level of education, which is necessary for the development of modern management systems. Thus, according to the authoritative source The World University Rankings in 2019, 5 Chinese universities entered the top 100 best universities, with Tsinghua University taking the honorable 22-nd place. Another 5 universities are located in the second hundred. Unfortunately, there are no Russian educational institutions in the first hundred of the best universities in the world, and only one closes the second hundred. This is the best Russian university - MSU, which is in 199th place[1].

The Russian government has high hopes for a change in the situation as a result of the implementation of the national program "Digital economy of the Russian Federation". How justified are these expectations? Of course, the program will give a certain impetus to the development of the digital economy, but not in all areas. Such a conclusion can be drawn from the analysis of the target indicators of the national program. Target indicators are grouped into three blocks.

The first block determines the need to increase the cost of developing the digital economy in the Russian Federation. In 2017, due to all sources, this indicator was 1.7% of the gross domestic product of Russia, in 2024 it should be 5.1%. Of greater interest would be the indicator of the contribution of the digital economy to the formation of gross domestic product.

The second block of targets includes information on the development of information and telecommunications infrastructure for high-speed data transmission, for example, "an increase in the proportion of households with broadband Internet access" from 72.6% in 2017 to 97% in 2024.

The third block grouped indicators denoting an increase in the share of domestic software in state and municipal authorities, as well as in state corporations and companies with state participation.

As can be seen from the target indicators, the main emphasis in the program is on the development of information and telecommunication technologies (the Internet in particular) and the creation of domestic software. Almost 50% of the funds provided by the program are planned to be directed to "creating a global competitive infrastructure for the transmission, processing and storage of data mainly based on domestic developments". It is planned to allocate about 27% of the funds provided by the program for the creation of Russian software.

At the same time, there are no plans to allocate funds for the creation and use of digital technologies in industry and the service sector. Many economists

[1]See: The World University Rankings 2019. URL: https://www. timeshighereducation.com/world-university rankings/2019/worldranking#!/ page/0/length/25/sort_by/rank/sort_order/asc/cols/stats.

draw attention to this. Commenting on the "Digital Economy" program, they note that "the problems of digitalization of industries and the introduction of advanced production technologies have practically remained out of sight of developers"[1]. It seems that this problem is the most serious shortcoming of the national program. These problematic moments are due, among other things, to the fact that the developers of the national program present the digital economy as part of the economy, consisting of two industries: information and communication technologies and the IT industry. In our opinion, the digital economy is a much more complex phenomenon.

1.3. Digital economy and digital products: typology in system economics.

The digital economy is part of the real economy, its digital sector based on the use of digital technologies. Accordingly, we will conditionally divide the products produced by the traditional and digital economy into traditional and digital (electronic). The views of researchers on the main components of the digital economy diverge. For example, in the paper[2] three components of the digital economy are highlighted: the *infrastructure* required to support e-commerce business processes; *business-processes* carried out with the help of computer networks, and *transactions*, which are understood as an agreement on the transfer of rights to use goods or services, reached between the seller and the buyer through computer networks. A more modern approach is offered by the Bureau of Economic Analysis of the US Department of Commerce. According to this approach, the digital economy is also defined on the basis of three parts[3]: infrastructure that provides the opportunity to use digital technologies; electronic transactions - transactions for the sale or purchase of goods through computer networks and *digital content* created by users on the Internet.

Initially, the *digital economy* was interpreted exclusively as the *internet economy* - an economic activity that allows to create added value through the implementation of projects on the Internet[4], but gradually this understanding has expanded and deepened. In later works[5], the focus of researchers' attention has shifted to digitalization processes, i.e. changes caused by the use of digital technologies in the economy.

[1]See: Lenchuk U.B. Formation of the industrial policy of Russia in the context of the tasks of new industrialization // Journal of the New Economic Association. 2018. № 3 (39). P. 138-145.

[2]See: Mesenbourg T.L. Measuring the digital economy. US Bureau of the Census, Suitland, MD, 2001. - 19 P.

[3]See: Barefoot K., Curtis D., Jolliff W., Nicholson J. R., Omohundro R. Defining and Measuring the Digital Economy. BEA Working Paper. - Washington, D.C., 2018. March 15. - 24 P.

[4]See: The global internet economy / Ed. by B. Kogut. - Cambridge, MA: MIT Press, 2004. - 540 P.

[5]See: STD/CSSP/WPNA(2017)10. Meeting of the OECD Advisory Group on Measuring GDP in a Digitalised Economy. Working Party on National Accounts. Paris, 2017, 14 November. - 17 P.; A Dictionary of Business and Management / Ed. by J. Law. - 6th Edition. - New York: Oxford University Press, 2016. - 656 P.; UNCTAD/DER/2019. - United Nations: New York and Geneva, 2019. - 172 P.

Another view of the digital economy is proposed in the report of the International Monetary Fund[1], where it is proposed not to define the broad concept of "digital economy", but to focus on the digital sector of the economy, consisting of the main producers of "digitalization": online platforms; sharing platforms and crowdsourcing (crowdfunding, crowdinvesting); suppliers of information and communication goods and services. The report also notes that an alternative for defining the digital sector could be the definition of digital transactions[2]. By "digital transaction" is meant a transaction that has at least one of the following characteristics: the product is ordered digitally, the product is delivered digitally, the product is accessed through an online platform. At the same time, any digital transaction can be described using three parameters, answering the questions "how?", "what?" and "who?": *the nature of the transaction* (determined by the signs presented above); *product* (goods, services, information) and *actors* (business, individuals, government). Note that a detailed review of the evolution of the concept of "digital economy" and its main components is presented in the work[3].

One way or another, regardless of the definition of the digital economy, which this or that researcher adheres to, the focus of its attention is on products produced using digital technologies. Even N. Negroponte in his work[4]noted that the products of the new (digital) economy "consist of bits instead of atoms", which gives them advantages that are inaccessible to the products of the traditional (real) economy: these are virtuality, lack of weight, speed of movement. In the work[5], for example, the following characteristics are highlighted that distinguish the products of the digital economy from others: non-competitiveness, the possibility of infinite distribution, discreteness, lack of spatial belonging, artificiality of creation. The article explores[6] the economic nature of the products of the digital economy by constructing a diagram of the interaction of technology, the economic characteristics of these products and consumer behavior. According to this scheme, only three types of digital economy products are distinguished: public (non-competitive, there are no restrictions on consumption), long-term use, and products whose usefulness cannot be determined in advance, until the moment of

[1]See: IMF. Measuring the Digital Economy. International Monetary Fund Report. - Washington, D.C., 2018. - 47 P.

[2]See: Ahmad N., Ribarsky J. Issue Paper on a Proposed Framework for a Satellite Account for Measuring the Digital Economy. STD/CSSP/WPNA (2017)10. Meeting of the OECD Advisory Group on Measuring GDP in a Digitalised Economy. Working Party on National Accounts. Paris, 2017, 14 November. - 17 P.; Fortanier F., Gonzalez J.L. Measuring Digital Trade: Towards a Conceptual Framework. STD/CSSP/WPTGS (2017) 3. Meeting of the OECD Working Party on International Trade in Goods and Trade in Services Statistics. OECD Headquarters. - Paris, 2017, 22-24 March. - 15 P.

[3]See: UNCTAD/DER/2019. - United Nations: New York and Geneva, 2019. - 172 P.

[4]See: Negroponte N. Being digital. - New York: Alfred A. Knopf, 1995. - 243 P.

[5]See: Quah D. Digital Goods and the New Economy. CEPR Discussion Paper, 2003. № 3846. - 47 P.

[6]See: Rayna T. Understanding the Challenges of the Digital Economy: The Nature of Digital Goods // Communications & Strategies. 2008. № 71. P. 13-16.

purchase. Another view is presented in the work[1], which proposes the allocation of three groups of digital products based on the characteristics of their production and consumption. The first group is formed by products that are developed exclusively in electronic form and do not have a material prototype (for example, software). The second group includes digital copies of real products that have a tangible form (for example, a digitized book). And, finally, the third group consists of digital images of real objects. At the same time, the main task of the digital image is to provide more efficient management of real world objects, and not to replace them in consumption processes (for example, online taxi ordering services through mobile applications, such as Yandex Taxi, Uber, etc.). Features of pricing products of the digital economy are disclosed in the work[2]. The problems of the formation of psychological mechanisms and models of user confidence in the products of the digital economy are presented in the work[3].

When developing a typology of economic products, the methodological basis for researchers was *system economic theory, or system economics*[4] - a new scientific direction formed on the basis of the system paradigm[5] and combining the achievements of neoclassical, institutional and evolutionary economic theories. Unlike other concepts, the focus of system economic theory is on socio-economic systems, and the economy is considered as a field of their interaction.

System economic theory takes the results of *the new theory of economic systems*[6] and applies them to the analysis of a wide class of economic formations and structures. A feature of this theory is the approach to the definition of a socio-economic system, according to which the system is distinguished in the surrounding world by an external observer on the basis of its inherent spatio-temporal coordinates (exogenous position), and not on the basis of its internal features and structure (endogenous position). Thus, the existence of only four basic types of socio-economic systems, fundamentally different in their nature and properties, is possible: *object, environment, process* and *design*.

The first type - object systems - are not limited in time, but are localized in space. The second type - environment systems - are not limited either in time or in space. The third type - process systems - are limited in time, but localized in space. And the last, fourth type - design systems - are localized both in time and in space.

Each of these types of economic systems performs a corresponding basic gen-

[1]See: Kozyrev A.N. Modeling of scientific and technical progress, orderliness and digital economy // Economics and mathematical methods. 2011. V. 47. Iss. 4. P.131-142.

[2]See: Laatikainen G., Ojala A. Pricing of digital goods and services // Information Systems Research Seminar in Scandinavia. IRIS Association, 2018. - 17 P.

[3]See: Noakk N.V., Larin S.N., Znamenskaya A.N. Modeling of manifestations of phenomenon of trust to digital economic products // International research journal. 2018. № 3 (69). P. 160-163.

[4]See: Kleiner G.B., Rybachuk M.A. System balance of the economy. - M.: Publishing House "Scientific Library", 2017. - 320 P.

[5]See: Kornai J. The system paradigm // Questions of Economics. 2002. № 4. P. 4-23.

[6]See: Kleiner G.B. A New Theory of Economic Systems and Its Application // Journal of economic theory. 2010. № 3. P. 41-58.

eral economic function. Thus, the main function for object systems is *production*, for environment systems - *consumption*, for process systems - *distribution*, and for project systems - *the exchange function*. Due to the implementation of these functions and the exchange of resources of space and time, systems of four basic types are combined into stable ring-shaped structures of the form "object system - environment system - process system - project system - object system", called tetrads. A schematic representation of a *tetrad* is shown in fig. 1[1].

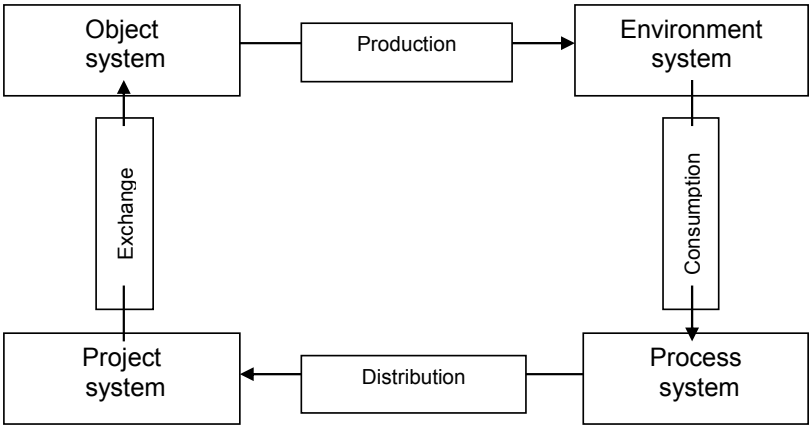

Figure 1. *Schematic representation of a tetrad*

The construction of tetrads is subject to the principle of fractality, thus, any socio-economic system, being a part of an "external" tetrad for itself, can also be represented as a tetrad - a whole consisting of four subsystems of various types. At the same time, depending on the specialization of the socio-economic system, the proportions of subsystems within it, and, as a result, the products that it produces will differ.

As shown in the work[2], each of the types of socio-economic systems produces a corresponding type of product. Object systems produce goods, environment systems provide services, process systems perform work, and project systems transform economic systems. So, for example, an industrial enterprise, in which the object subsystem prevails, produces goods that have a material expression. An operator (provider) providing communication services to subscribers has an increased environment subsystem. A construction company performs work on the repair of apartments, which is expressed in the predominance of the process subsystem. A consulting firm, in turn, carries out projects for the transformation

[1]See: Rybachuk M.A. Phenotype of digital economy products: analysis from position of systemic economic theory // Journal of economic theory. 2020. V. 17. № 1. P. 167. P. 164-175.

[2]See: Kleiner G.B. A New Theory of Economic Systems and Its Application // Bulletin of the Russian Academy of Sciences. 2011. V. 81. № 9. P. 794-811.

(creation of new) economic systems, which naturally affects its project subsystem. Thus, a typical product of an object system is a product, an environment system - a service, a process system - work, and a project system - a purposeful transformation of the economic system itself.

As a rule, there are no problems with the definition of a product as an economic category, however, for an unambiguous understanding of a service, work, and a project for transforming the economic system, it is necessary to provide explanations. A service is an action, the results of which have no material expression and are consumed by the customer at the time of their receipt. In other words, the result of the service becomes useful only if the process of its provision is completed. If the service is not provided to the end, then the completed part of the service is not useful for the customer. As a product of an environment system, a service can also be viewed as a fact of connection and one-time (short-term) use of a technical infrastructure or professional environment, such as calling a mobile phone, accessing the Internet, getting a haircut at a hairdresser or consulting a lawyer. Work is a process, the results of which are material, and each part of this process is useful for the consumer. As an example, we can cite construction and installation works, repair and maintenance works, scientific or engineering developments, etc. The products of the activity of process systems, in our understanding, may also include services related to the movement (distribution) of some objects in space, which are not short-term. The transformation project is aimed at transforming the economic system, acquiring new qualities by this system. On the one hand, certain parts of the transformation project have no utility for the consumer, which distinguishes it from work, and on the other hand, the results of the transformation project are unique, for example, an appendectomy is a medical service, and sex reassignment surgery is a transformation project.

We also note that, unlike a product that can be manufactured, sent to a warehouse and sold in the future, a service, work, and transformation of the economic system cannot be done in advance, since they are *customized products*, i.e. are produced on the basis of the customer's request and must meet his individual requirements.

The development and application of digital technologies in production processes have not left the products manufactured by socio-economic systems unchanged, affecting their characteristics and properties. To identify the features of the products of the traditional and digital parts of the economy, we will consider the stages of their movement through the corresponding tetrad groupings.

A typical example of a tetrad is the combination of a factory, a distribution network, a transport (logistics) company and a shopping center, which ensures that a traditional product passes through the stages of movement from the manufacturer to the end consumer (see fig. 2)[1].

[1]See: Rybachuk M.A. Phenotype of digital economy products: analysis from position of systemic economic theory // Journal of economic theory. 2020. V. 17. № 1. P. 168.

Thus, the company as an object system produces goods, which then enters the distribution network, which acts as an environment system. There is a consumption of goods by the distribution network. After that, with the help of a transport (logistics) company as a process system, the goods are distributed among shopping centers. The shopping center,

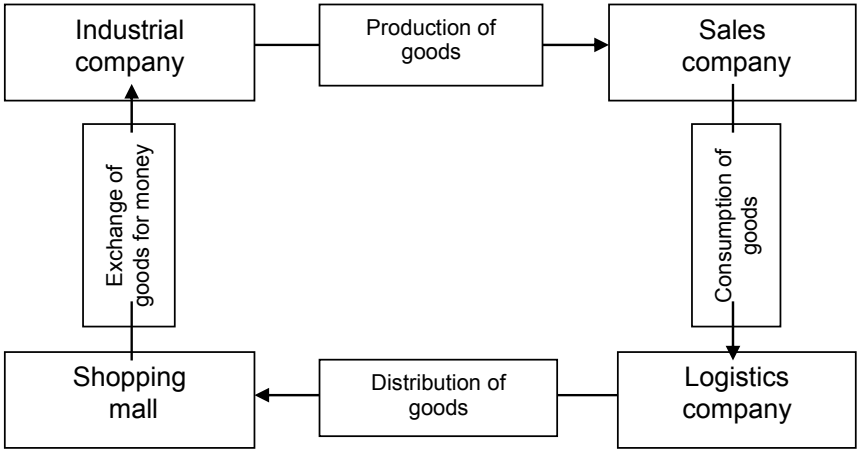

Figure 2. *Stages of movement of a traditional product from the manufacturer to the end consumer in turn, is the place of the transaction (project), the buyer purchases the goods, the goods are exchanged for money*

Let's consider the stages of movement of a digital product, also tracing the chain from the manufacturer to the end consumer (see fig. 3)[1].

The manufacturer (author, publisher, music label, etc.) as an object system carries out *production* of a digital product - an independent digital object or a digital model (copy) of a traditional product. The produced digital product is placed on the manufacturer's website or added to the online store, its *consumption* is carried out by the Internet as an environment system. With the help of website search engine optimization (SEO) mechanisms as a process system, marketing and information and communication processes are launched, dissemination or *distribution* of information about a new digital product is carried out on social networks and other websites. Under the influence of these processes, a buyer is attracted to an online store, where a transaction (project) is carried out on the basis of a payment system, and the *exchange* of a digital product for money occurs.

[1]See: Rybachuk M.A. Phenotype of digital economy products: analysis from position of systemic economic theory // Journal of economic theory. 2020. V. 17. № 1. P. 168.

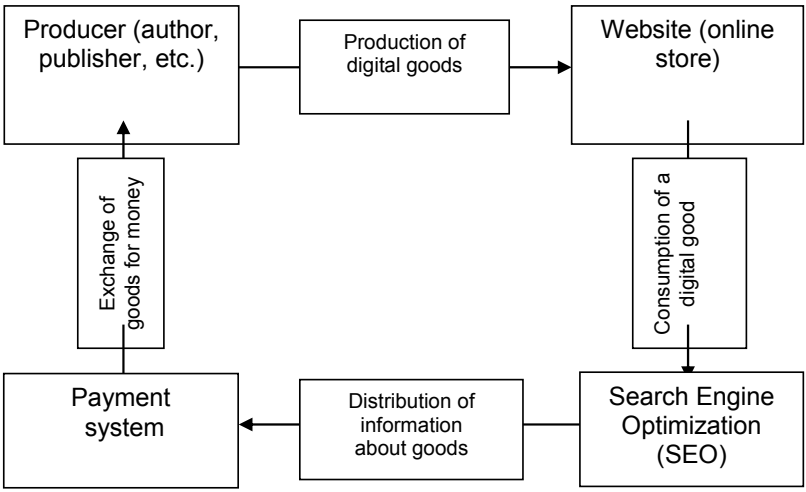

Figure 3. *Stages of movement of a digital product from the manufacturer to the end consumer*

In view of the fact that other types of products - service, work and the project of transformation of the economic system - are customized, of particular interest here is not the movement from the producer to the end consumer (as in the case of a product), but the sequence of their movement from the customer's request until the start of their production by the executor (see fig. 4)[1].

Since the stages of movement of the service, work and the project of transformation of the economic system within the tetrad will be the same, as an example, we will consider only one type of product - a service.

The customer as an object system makes a request containing the parameters of the service and directed to the information field - a set of information sources (newspapers, magazines, opinions, reviews, critique, etc.) that allow the customer to obtain information about the performers of the required service. The generated request is consumed (absorbed) by the information field as an environment system. Based on the information collected, the customer forms a market of performers and, using the mechanisms of "manual" selection as a process system, selects the performer who made the best offer. There is a definition of the final executor, the distribution of the request. At the last step, the executor confirms the performance of the service or exchanges the initial request of the executor for his consent, which is fixed by an oral agreement (contract) as a project system. After that, the direct performance of the service by the executor begins, which is already associated with another tetrad of economic systems.

[1]See: Rybachuk M.A. Phenotype of digital economy products: analysis from position of systemic economic theory // Journal of economic theory. 2020. V. 17. № 1. P. 168.

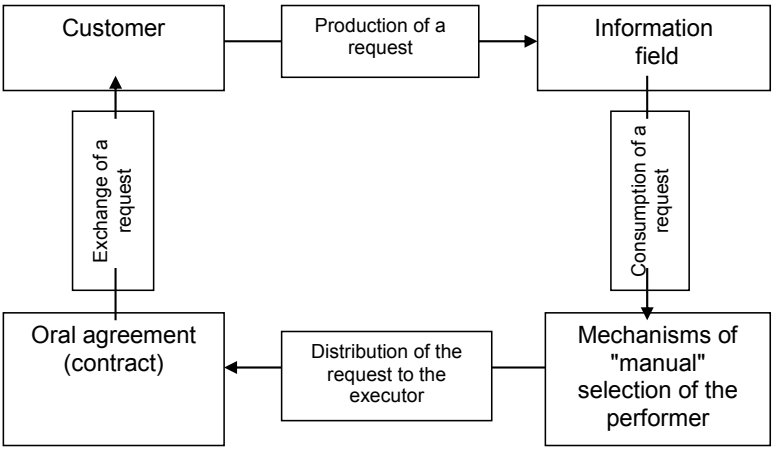

Figure 4. *The stages of the movement of a traditional service, the work and the project of transformation of the economic system from the request of the customer to the moment the executor starts their production*

In a similar way, we will consider the stages of the movement of a service provided with the help of digital technologies, from the request of the customer to the moment the executor starts production (see fig. 5)[1].

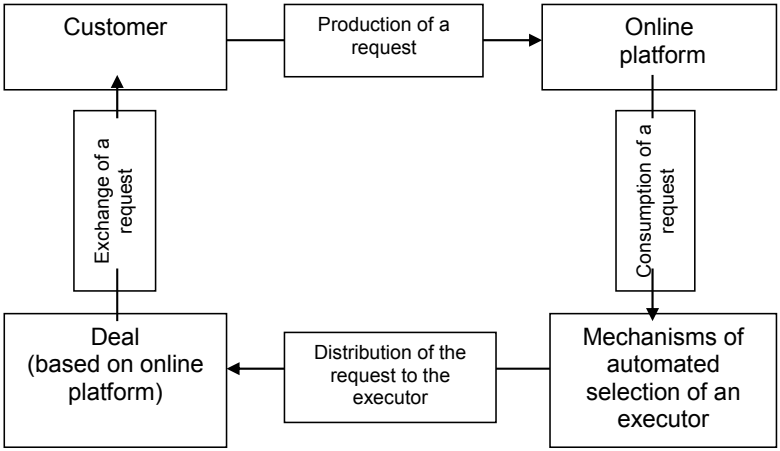

Figure 5. *The stages of the movement of a digital service, the work and the project of transformation of the economic system from the request of the customer to the moment the executor starts their production*

[1]See: Rybachuk M.A. Phenotype of digital economy products: analysis from position of systemic economic theory // Journal of economic theory. 2020. V. 17. № 1. P. 169.

The customer, as an object system, makes a request, which, unlike a traditional service, is directed to an online platform (exchange, site) and has an electronic form, i.e. the request is made using the Internet, a mobile application or other similar means. The online platform as an environment system consumes this request, its card or page is created. Based on the mechanisms built into the online platform as a process system, a market of performers is automatically created, who come up with specific proposals to fulfill the customer's request. A more advanced option is a fully automated selection of performers, carried out by algorithms built into the online platform. Then, from the executors presented by the online platform, the customer selects the most suitable one, based on qualifications, experience, and the proposed cost of providing the service. The request is distributed to the executor. In turn, the executor must confirm the fact of receiving the order, as well as for a traditional service, exchange the request for his consent. At the same time, internal mechanisms of the online platform (project system) are used to complete the transaction, which reserves the control of the quality and timing of the service. Then, as in the previous case, the performer proceeds to provide the service.

Despite the fact that the goods of the traditional and digital sectors of the economy go through the same stages in the course of their movement, the physical properties and features of their movement in space have significant differences. The goods of the traditional part of the economy are made from raw materials, have size and mass characteristics, and are available to the perception of the consumer through the five main senses. As a result, the cycle of movement of goods, as a rule, takes a long time, since the transition from one stage to another requires the actual movement (transportation) of goods in space. In most cases, a digital product is a digital model of a real object[1], is the result of intellectual labor, has no material expression (virtual) and is available exclusively for visual and auditory perception by the consumer, since there is no physical transportation of a digital product in space, only information about it is distributed (less often - an introductory fragment). At the exchange stage, a new digital copy of the product is created on the consumer's computer or other device with virtually zero costs. Thus, the cycle of movement of a digital product from stage to stage can be conditionally instantaneous.

If, when paying for a traditional product at the exchange stage, the buyer has a choice - to make a cashless payment or transfer banknotes to the seller, then the buyer of a digital product has no such choice, since there is no physical meeting between the seller and the buyer. Therefore, cashless payment is the only possible way to pay for a digital product. Another important difference is the difference in the production costs of goods in the traditional and digital economy, which is reflected in their price accordingly. Unlike the goods of the traditional economy, the costs of producing a digital product do not include the cost of raw materials.

[1]See: Kleiner G.B. System bases of digital economy // Philosophy of economy. 2018. № 1 (115). P. 131-143.

Moreover, the re-production of a product of the traditional part of the economy requires the same costs for the production of each of its units, while the creation of a copy of a digital product requires minimal (tending to zero) costs. It follows that the price of a digital product will be lower than the price of its real prototype, and the profitability of producing each new copy will be higher. Comparative characteristics of traditional and digital goods are presented in table 1[1].

Table 1.

Comparative characteristics of traditional and digital goods

№	Characteristic	Traditional goods	Digital goods
1.	Physical properties	Real, has size and weight	Virtual, has no size and weight
2.	Perception by the consumer	Tactile, visual, auditory, gustatory and olfactory	Visual and auditory
3.	Prime cost	Includes raw materials	Includes intellectual work
4.	Goods movement cycle	Long	Conditionally instant
5.	Payment method	Cash and non-cash	Only non-cash
6.	Re-production of each new unit	The costs are the same for every new unit	Costs for each new unit tend to zero

In the case of traditional services (works, transformations of economic systems), the formation of an information field, communication with potential executors and execution of transaction documentation in the traditional economy takes more time than using the built-in functionality of an online platform that allows you to go through these stages faster in the digital economy. So, for example, in the traditional economy, transaction documentation is drawn up manually, while in the digital economy it is generated automatically based on the data entered by the user.

If a real business has a set working time and lunch breaks, you can make a request on the Internet around the clock, and the executor will respond to it immediately after reception and processing. The mechanisms of online platforms simplify the connection between the customer and the executor, regardless of the form (traditional or digital) of the service (work, transformation of the economic system). For example, when calling a taxi through a mobile application in electronic form, a driver is selected, to whom data about the trip is transmitted, and after that the actual provision of the transportation service in the real world is carried out.

When comparing traditional and digital services (works, transformations of economic systems), the same results are obtained as when comparing traditional and digital goods, with the exception of the last characteristic (№ 6 in the table

[1]See: Rybachuk M.A. Phenotype of digital economy products: analysis from position of systemic economic theory // Journal of economic theory. 2020. V. 17. № 1. P. 170.

- "re-production of each new unit"), since services (works, projects of transformations of economic systems) are customized. At the same time, characteristic № 4 - "product movement cycle" - changes to the characteristic "speed of service provision (performance of work, project implementation)". Let's give some examples. Information service - submission and publication of an advertisement in a newspaper and placement of an advertisement on a profile site on the Internet. Repair and maintenance work - repair of a machine mechanism at the factory and optimization of the procedure in the corporate information system. Implementation of projects - building a house and creating a three-dimensional model (visual three-dimensional image) of a house. Thus, the main difference between traditional and digital products is that they are produced in different spaces.

The comparative analysis of traditional and digital products, carried out above, can be subjected to reasonable criticism. In particular, any digital product has a volume expressed in units of measurement of the amount of information (in bytes) and takes up some space on the hard drive of a personal computer or server. Therefore, it is possible to calculate the costs of its storage, expressed in terms of the corresponding energy consumption, even though they will be extremely small. However, in real space, a digital product will not have physical weight and size.

As noted in a World Bank report[1],the application of digital technologies promotes innovation and provides countries with the opportunity to receive "digital dividends" in the form of faster economic growth, expanding business opportunities and improving the quality of life and services provided to the population. But at the same time, the "digital divide" remains, associated primarily with the inaccessibility of the Internet for almost 60% of the world's population. For this reason, "digital dividends" are distributed unevenly, and it is necessary not only to carry out work to spread the possibilities of access to the Internet, but also to improve its analogous additions - the legal framework, user skills and institutions. There are three main groups of risks associated with analog additions, which the authors of the report highlight: the relationship between technology and regulation - there is a risk of natural monopolies in the market, therefore, it is necessary to create a business climate in which traditional firms and Internet companies can compete on an equal footing; competition between technology and skills - skills should contribute to the use of the potential of technology and the growth of labor productivity, otherwise, if such skills are lacking, people will have to compete with other people for less skilled jobs; the gap between technology and institutions - digital technologies, instead of empowering citizens, can become another means of control over them by the state.

The advantages of digital technologies - the increase in the availability and speed of information movement - is also a threat to cyber security. Here it is appropriate to recall the activities of the WikiLeaks company, which releases secret

[1]See: World Bank Group. World Development Report 2016: Digital Dividends. - Washington, DC: World Bank, 2016. - 330 P.

information obtained as a result of leaks or from anonymous sources, and the *Streisand effect*, according to which an attempt to remove information from wide access (on the Internet) leads to its even greater distribution.

Based on a comparison of the stages of movement of products in the traditional and digital parts of the economy, an analysis of the properties of these products and the features of their movement from the manufacturer to the end consumer (from the customer's request to the moment the production is started), results were obtained that allow us to draw a number of conclusions regarding the digital economy as a whole[1]:

1) *For the sphere of economic theory.* The digital economy can be viewed as a kind of "shadow" of the real economy. With the current structure of production, the share of the digital economy in the country's gross domestic product will not exceed the share of the real economy. Consequently, the digital economy has limits to its growth.

2) *For the sphere of economic policy*. No one can satisfy their basic needs only with the help of digital products, for this reason it is impossible to separate the digital economy from the real. This circumstance must be taken into account when developing the country's economic policy and timely provision of measures for the development of both the digital and real economy.

3) *For the sphere of economic management.* The digital economy can be considered as a means of enhancing economic growth only in a system with a real economy. However, if a significant part of the gross value added is produced by the digital economy, a threat to the economic security of the country may arise[2].

4) *For the sphere of economic practice.* The release of digital products along with traditional products will allow companies to enter new market segments and increase business margins.

Thus, in general, for the first chapter, as conclusions, it can be noted that most authors and experts consider the digital economy in two aspects. From the point of view of an extended interpretation, the term refers to a part of the socio-economic relations that are associated with the production, distribution, exchange and consumption of information technologies. First of all, these are modern trends conditioned by so-called fourth industrial revolution. The second, "classical" interpretation considers the digital economy as a special type of economic activity, which is based on new methods of processing, storing and transmitting data. This includes electronic goods and services, as well as the entire spectrum of online business. It should be noted that as new technologies emerge and develop, the list and composition of the digital economy will be supplemented, therefore, approaches to the definition of the term, in our opinion, will change.

[1]See: Rybachuk M.A. Phenotype of digital economy products: analysis from position of systemic economic theory // Journal of economic theory. 2020. V. 17. № 1. P. 171.

[2]See: Popov E.V., Semyachkov K.A. Problems of Economic Security for Digital Society in the Context of Globalization // Economics of the Region. 2018. V. 14. № 4. P. 1088-1101.

CHAPTER 2. DIGITALIZATION OF THE ECONOMY: MAIN DIRECTIONS, BENEFITS AND RISKS.

At the present stage in the global information society, a new economic order is being actively formed - digital. There is a digitalization of economic processes and the penetration of information technologies into all areas of activity. There are new requirements for the sources of competitive advantages of companies and effective concepts of their functioning and management.

The formation of any economy is based on an effective combination of technical, technological, organizational and managerial innovations. The digital economy will not be an exception, any activity for the development and implementation of technical, technological, product and service innovations will not be able to achieve the required results if it is not provided with an appropriate organizational and managerial base. At present, the foundations of radical organizational and managerial innovations are being laid, which will become the management platform of the digital economy.

Taking into account the high dynamics of global digitalization, as well as the development of state targeted programs for the development of the digital economy of the RF, the development and implementation of digital models of corporate governance is becoming increasingly relevant and in demand by the market. Currently, the practical implementation of the established approaches and models is carried out primarily in terms of providing real-time systems (RTS), developing SMM (Social media marketing) analytics, and designing intelligent applications using advanced analytics. The development of digital models of corporate governance will require the allocation of priority digital circuits in a company's information system, as well as overcoming organizational, managerial and technological barriers.

In the new organizational forms of companies, which are often called virtual or networked, service-oriented company architectures and company architectures based on shared resources (sharing economy) come to the fore. The creation of dynamic organizational structures for the joint interaction of participants in the value chains necessitates the development of new methods of organizational management, among which a special place is given to the decentralization of management and the development of consolidated management decisions, as well as the development of methods for self-organization of production and business processes. The subject of engineering is not the object itself (material object, production process, business process, technical, organizational or social system, software product), but intellectual activity to create this object, organization of interaction between the parties involved in the creation of the object.

Informatization of the educational process is characterized by the presence of network effects, which leads to an increase in the value received by the consumer

of educational content, as well as to cost savings for the developer due to the scale of production. Along with the new opportunities that the population receives in connection with the availability of educational products from the world's leading universities, there are a number of threats to the system as a whole that should be taken into account when designing an appropriate development strategy.

The development of the digital economy has a positive effect on economic growth and the ability of economic agents to perform their functions and meet needs. Nevertheless, like any complex phenomenon, the digital economy contains a variety of risks and opportunities for various subjects of economic relations.

The transition to a digital economy, associated with a new round of development of information systems and technological solutions based on them, is the cause of new challenges in the field of information security. It is necessary to create an effective information security system, this is possible when using and developing additional information resources that ensure data security. One of the conditions is the formation of personnel potential in the field of information security, which will include the implementation of advanced training programs in the field of information security. The transition to a digital model of the economy is an objective requirement in the modern conditions of the development of society, but one of the key issues in the implementation of this transition is to ensure a high level of information security.

2.1. Organizational and managerial innovations in the digital economy.

The processes of socio-economic development are largely determined by the state of telecommunications and digital electronic networks[1], which are the technical basis of the information revolution. The latter involves the separation of organizational and intellectual centers from production and service units, localization of individual components of the production process in different parts of the world - another global "division of labor"[2]. The leading way of coordination of economic interaction in the digital economy is its cluster forms, including network ones. The basis of such interaction is the formation of stable ties between economic entities through the constant exchange of information based on modern infocommunication technologies (ICT) and building trust in the electronic environment.

A special place is occupied by the question of correlating the concepts of "innovative economy" and "digital economy". These concepts are not synonyms or different reflections of the same phenomenon. An innovative economy is a system of production relations in the process of creating knowledge capital, fundamental scientific knowledge and/or innovations and economic entities that receive added

[1]Network international electronic systems, electronic mail, information exchange systems on electronic networks, electronic banking and trading systems.

[2]See: Ustyuzhanina E.V., Sigarev A.V., Shein R.A. Digital Economy as a new paradigm of economic development // National interests: priorities and security. 2017. V. 13. Iss. 10. P. 1788-1804.

value through the creation and circulation of knowledge capital.

From a technological point of view, the digital economy is the result of a positive synergistic combination of fundamental and technological "breakthroughs" in the innovative development of intellectual activities in the knowledge sector (creation of cyber-biological and cyber-physical systems, renewable energy sources, genetic engineering, artificial intelligence, ICT, new means of production, fundamentally new materials, etc.).

Based on the fact that the digital economy is currently developing rapidly, it requires an increasing amount of innovation and, accordingly, fundamental scientific knowledge for their production. Any new economy that has been formed in the history of mankind requires a large number of products of the innovative economy, while not merging with the latter. The issue of attributing such entities to the digital economy can be decided on the basis of an analysis of their value chains, depending on whether activities in the digital economy are among the key factors in creation of added value by them.

No technical innovations can become the basis for the formation of a new economy as a system of production relations, including the digital economy, without being combined with organizational and managerial innovations that form the conceptual basis of any economy. Thus, the technical and technological achievements of the third quarter of the XIX century could not be effectively used until the corresponding organizational and managerial innovations were developed and implemented. It was the sharp discrepancy between technical and organizational and managerial capabilities that caused a boom in the creation and dissemination of organizational and managerial innovations in the late XIX - early XX centuries. It is this breakthrough in the creation of organizational and managerial innovations that is qualified by many experts as the emergence in the general management system of a segment called "scientific management".

Organizational and managerial innovations (OMI) - are innovations aimed at the gradual improvement or achievement of significant and rapid changes in the organizational structure and management of a company through the introduction of individual innovative systems, technologies, methods, tools, ways of organizing and managing the production and technological, financial and economic, social personnel, logistics and infocommunication subsystems of a company or a complex of new technologies, methods, tools, manners of organization. The latter should be aimed at improving the efficiency of individual parts of the management system, management of activities and the entire management system of the company as a whole by creating conditions through the introduction of OMI to ensure the ability to meet modern requirements of the internal and external environment, to achieve structural and functional advantages. This opens up opportunities to improve the efficiency of innovation, the economic and general security of the company, improve the use of knowledge, the efficiency of labor processes and the organization of jobs, as well as reduce transaction costs, improve product quality,

performance results, development and competitiveness of the company as a whole.

In a narrower sense, OMI is related to the processes of optimal organization of production, transport, marketing and supply.

Depending on the object, the following types of organizational and managerial innovations are distinguished.

Organizational innovations, which include three main segments[1]:

1) development of new forms and methods of organization and regulation of production and labor;

2) mastering new modeling methods, approaches, control automation; optimization:

- organization of production, marketing and supply logistics;

- forms and methods of development of managerial decisions, control over their implementation;

3) vertical and horizontal optimization of quantitative and qualitative ratios of structural divisions, social groups or individual employees of the company. This is done by the management system, with the help of which management decisions are made and implemented to achieve the goals set by the corporation[2].

Such organizational arrangements focused on innovation, providing a higher flexibility of the company, are necessary due to the fact that the functions of managing innovative development are dispersed in the management apparatus among different departments.

Management innovations - are new methods, technologies and organization of management processes, project and quality management systems, business process management, building an effective relationship between the strategy and tactics of doing business in general and are implemented through structural and functional interest, methods of operation of the management apparatus, automation of management processes. Innovations in management are often associated with the restructuring of business processes and the business as a whole, that is, with a change in the company's business model. The latter is usually associated with the transformation of the organizational and managerial structure of the company for the purpose of its innovative development, including through the establishment of strategic relationships with partners, as well as within the framework of public-private partnership (PPP)[3], PPP- and bank investment in this development of the company[4].

[1]See: Filin S.A., Yakushev A.Zh. Organizational and management innovations as the cornerstone of the digital economy // National interests: priorities and security. 2018. V. 14. № 7. P. 1321.

[2]See: Amosov A. Issues of transition to an innovative type of reproduction // Economics. 2012. № 5. P. 23-32.

[3]See: Zemlyakov D.N., Balakhanova D.K., Kotova L.R. Innovative development of the Russian economy on the basis of PPP-mechanisms of investment // Management and business administration. 2017. № 1. P. 110-117.

[4]See: Bryukhanov Yu.M., Sadykova A.K., Chudrova V.U. Improving the planning and monitoring of high-tech banking product business lines // Marketing in Russia and abroad. 2015. № 5. P. 17-23.

Structural global changes in the XXI century are associated with the increasing role of high-tech sectors in the formation of GDP, the integration and globalization of industrial production, the transition to a digital economy, which leads to a change in the organizational and economic paradigm of competitiveness. An example of this process is the gradual transition to the organization of innovative development in industry on the basis of global research networks, in particular in the form of elements of a network-type innovation infrastructure: virtual network innovation alliances, strategic technology platforms, innovation clusters, etc.

At the same time, the new stage of the fourth industrial revolution (Industry 4.0), also called "digital", is characterized by the convergence of technologies, the blurring of lines between the physical, digital and biological spheres, the emergence of additive manufacturing, new means of communication, cloud computing, cyber security. Corporate culture, as part of the organizational and managerial resources of the company, has always served as the most important strategic resource for its development. With the transition to modern digital technologies, corporate culture will have to transform, accumulating the most important OMI that the management consulting market requires[1].

The currently dominant technological order V is in the stage of maturity (in the transition to dominance) and is characterized primarily by the predominance of ICT in the production and life of the human community, which created the conditions for the formation of a digital economy and the information society on their basis as a whole[2]. At the same time, the VI technological order is being formed, which involves a radical change in the dominant production technologies, which will most likely become nano-, bio- and cognitive technologies and new generation ICT, as well as their convergence[3].

At present, with the current level of development of the digital economy, a number of already established prerequisites for the creation and implementation of OMI, which are necessary to improve its efficiency and quality, can be identified[4]:

1) higher mobility and expansion of information and knowledge dissemination channels associated with new digital communication networks;

2) the transition to a digital standard for information transfer in order to drastically reduce the unit costs of knowledge dissemination, while the knowledge dissemination technologies themselves are radically transformed, which somewhat changes the specifics of knowledge as a special type of product and the nature of

[1]See: Barinov V.A., Eliferov V.G., Pirimova V.R. Process management development of corporate culture // Economics and management: problems, solutions. 2017. V. 2. № 8. P. 86-95.

[2]See: Orekhov S.A. Influence of global tendencies of development of the information society on formation of economy of knowledge // Economics, statistics and informatics. Bulletin of UMO. 2008. № 2. P. 37-40.

[3]See: Filin S.A. The Concept of Technical, Scientific and Technological Cycles // Regional economics: theory and practice. 2014. № 45. P. 29-45.

[4]See: Filin S.A., Yakushev A.Zh. Organizational and management innovations as the cornerstone of the digital economy // National interests: priorities and security. 2018. V. 14. № 7. P. 1323.

the know-how market, making it more and more networked;

3) creation of codified data sets that can be used to improve the efficiency of analysis, planning and control of commercial activities;

4) access of private individuals to communication channels, markets and sources of information previously controlled only by the state or international corporations;

5) a qualitative change in the distribution channels of products, technologies and service delivery in the media sphere;

6) the development of cybercrime in the field of DE, which objectively reflects the patterns of social development. So-called hackers are destabilizing the digital economy in areas of production that are critical for investment and innovation.

Organizational and managerial innovations increase the company's competitiveness by reducing the cost of resources (financial, human, time) and improving the efficiency of management decisions aimed at business development[1].

As world practice shows, OMI, covering all levels of the management system, are carried out by large foreign companies at least once every 3-4 years, and at the intraorganizational level - almost annually. The reason for the implementation of OMI can also be one of the following[2]:

- changes in both the needs of customers and the internal needs of the company;
- development of science, engineering and technology;
- development of public relations;
- actions of competitors;
- directive instructions.

The main directions of development of organizational and managerial innovations

In the conditions of the "explosive" nature of the development of the sphere of the global digital economy and the beginning of the process of transition from the dominance of the economy of the V technological order to the dominance of the economy of the VI technological order, systemic problems of organizing innovation activity in Russian companies[3] and the need to change and supplement the principles of innovation management in companies and in the management of the national innovation system arise, which cannot be done without the OMI complex[4]. In order to respond in a timely manner to ongoing changes, the company's

[1]See: Parfirova A.A., Kryukova A.A. Organizational and managerial innovations in modern business // Problems of modern science and education. 2016. № 26. P. 49-52.

[2]See: Filin S.A., Yakushev A.Zh. Organizational and management innovations as the cornerstone of the digital economy // National interests: priorities and security. 2018. V. 14. № 7. P. 1325.

[3]See: Yakushev A.Zh. Modeling systemic contradictions in the development of the innovative and post-industrial sectors of the economy. In the book: Modernization of the national economy: problems and solutions / ed. N. A. Adamov. - M.: Expert consulting center "Professor", 2014. P. 27-64.

[4]See: Orekhov S.A., Maksimova T.P., Moreva E.L. et al. Transformation issues of the modern Russian economy: Theory and practice of management process and its support: a collective monograph. - M.: Institute of Scientific Information for Social Sciences RAS, 2011. - 420 P.

management system must ensure the high speed of all processes within it. Market relations in the conditions of global fierce competition, inherent in the processes of globalization of the world economy, necessitate rethinking the previously established forms, principles and methods of management and turning to advanced practices that differ from the previous ones. In other words, changing the conditions for functioning in the digital economy determines the corresponding transformation of management systems and the management sphere as a whole.

Based on this, researchers identify the main trends in the development of management systems in their adaptation to the digital economy and the factors that generate them[1].

1. As is known, the management function is implemented through a management decision, the conscious adoption of which is possible only on the basis of information and its quintessence - knowledge. That is why, simultaneously with a radical change in the concept of knowledge, the sphere of management in the digital economy is being transformed, which consists in increasing the role of knowledge and information in solving managerial problems at all levels (the modern - third - stage of the transformation of knowledge is called a revolution in the field of management), information becomes an effective means of organizing and managing social production, science, culture, and education. The quality and timeliness of information is a strategic success factor in the face of global innovation competition.

The modern paradigm of micro-level management can be called a knowledge-based strategic management system with an increasing role of horizontal connections and corporate dynamics (the organization's ability to react flexibly in real time). Knowledge, innovation and the potential of strategic management are the most valuable and sustainable form of capital in terms of improving the effectiveness of an organization[2].

2. The effectiveness of management in the digital economy at all levels essentially depends on the qualifications and availability of innovative thinking among managers and management personnel who support decision-making. In the digital economy, cognitive factors, especially the style of thinking, become the most important factor in strategic management. We are talking about innovative managerial personnel capable of simultaneous and interconnected innovations in scientific, technical, technological, institutional, financial, economic, socio-cultural, socio-political, environmental, organizational and managerial fields of activity and the use of knowledge and risk capital to achieve goals. The organization of a strategic management system must begin with the creation of positive thoughts and images that lead the team to achieving its goals, as well as the creation of a new innovative management culture of thinking.

[1]See: Filin S.A., Yakushev A.Zh. Organizational and management innovations as the cornerstone of the digital economy // National interests: priorities and security. 2018. V. 14. № 7. P. 1326 -1327.

[2]See: Theoretical foundations and methodology of strategic management of innovative development: a monograph. - Tula: Publishing house of the TSU, 2010. - 433 P.

On this basis, the cognitive technology of strategic management should be developed as a derivative of collective managerial thinking, that is, a new quality of thinking at all levels of the economy, especially the digital economy. Only by changing the quality of managerial thinking is it possible to reach a fundamentally new quality of business, improving the welfare of economic entities at all levels.

3. The cluster model is increasingly used as the basis for the organizational structure of management. Due to the changes taking place in the world, which mainly consist in the emergence of new markets, types of business, the development of digital technologies, there is a need, on the one hand, to expand the areas of development (specialization) of basic organizational structures and involve new rapidly growing companies focused on new emerging technological markets, into their own structure, on the other hand, in increasing the interest and, as a result, the activity of their own structural units in the introduction of innovations. The most effective way to solve these problems is activity clustering.

In the digital economy, there are the following differences between management and market and hierarchical forms:

- the manufacturer of the goods is not able to exclude competition from its segment by simple and cheap means based on blocking it. Consequently, the uniqueness of the product is erased. It becomes standardized. The market does not receive price signals about the commodity;

- the marginal cost of replicating "digital" products, as well as the cost of communications[1], is rapidly decreasing and, as a result, the competitive differences between sellers in terms of their costs for servicing additional orders are being erased[2].

4. The requirements for managerial stability, which is understood as the speed of response of the company's management system to external and internal influences, will become significantly tougher. It is a necessary condition for the sustainable development of the company.

The ability to effectively implement developments and introduce new ideas into production is affected by the level of innovative development of a company. A necessary condition for maintaining the sustainable development of the company's management system is their integration with the digital economy, including the optimization of the management system based on OMI[3], the creation of new management technologies, administrative processes and organizational structures.

[1]See: Bryukhanov Yu.M. Methodological approaches to estimating the cost of the communications complex: materials of the IX International Scientific Congress "The role of business in the transformation of society - 2014". - M.: Synergy, 2014. P. 168-169.

[2]See: Bredford De Long, Michael Froomkin. The Next Economy. April 1997. URL: http://law.miami.edu/~froomkin/articles/newecon.html.

[3]See: Kiseleva O.N. Directions for optimizing the management system of domestic enterprises based on organizational and managerial innovations // Economics and management of control systems. 2015. V. 18. № 4-1. P. 160-165.

The results of the implementation of OMI, aimed at adapting the company's management system to the digital economy, in the short term can be[1]:

- a significant reduction in costs without compromising the quality and speed of business processes or improving the quality and speed of business processes at the same costs, bringing the business to a qualitatively new level, optimizing the organizational, functional and organizational and managerial structures of the company, increasing its readiness for change and development;

- ensuring individual and group self-respect of the company's personnel, uniting the team efforts of the company's leaders, achieving overall job satisfaction. This creates the prerequisites for reducing administrative costs or operational costs by improving the order of work. A special place will be occupied by the requirements to ensure the facilitation of the circulation of knowledge within the company, its accumulation and distribution;

- increasing innovation and business activity and employee satisfaction by optimizing the distribution of responsibility and the right to make managerial decisions in the company and coordinating work processes within its divisions and in the interaction of these divisions, as well as other structuring of work[2];

- use of external results of research and development, outsourcing based on new ways of organizing relationships with other companies and government organizations. Improving product quality[3], production profitability, strengthening the company's position in the market, reducing staff turnover, increasing profitability and other positive, including synergistic, effects.

Conditions for the introduction of organizational and managerial innovations forming the conceptual basis of the digital economy

Factors contributing to the implementation of OMI are[4]:

1) flexibility of the organizational structure, democratic management style, the predominance of horizontal information flows, redistribution of powers, independence and self-planning, allowance for adjustments, decentralization, autonomy, formation of target working groups[5];

2) support from the state, improvement of the regulatory framework governing innovation;

3) participation of employees in special trainings, educational seminars;

[1]See: Filin S.A., Yakushev A.Zh. Organizational and management innovations as the cornerstone of the digital economy // National interests: priorities and security. 2018. V. 14. № 7. P. 1327-1328.

[2]See: Karlik A.E., Krechko S.A., Platonov V.V. Organizational and managerial innovations for the modernization of labor relations in information and network economy // Labor economics. 2017. V. 4. № 4. P. 295-308.

[3]See: Levshina V.V., Savchik E.N., Manakova I.A. Organizational and managerial innovations as a tool for quality assurance at enterprises of high-tech industries // Bulletin of Reshetnev Siberian State University of Science and Technology. 2016. V. 17. № 4. P. 1124-1128.

[4]Filin S.A., Yakushev A.Zh. Organizational and management innovations as the cornerstone of the digital economy // National interests: priorities and security. 2018. V. 14. № 7. P. 1319-1332. (P. 1328).

[5]See: Innovation management / ed. P.N. Zavlina, A.K. Kazantseva, L.E. Mindeli. - SPb.: Nauka, 2005. P. 187.

4) preliminary discussion of OMI, involvement of the entire team in the implementation of OMI;

5) implementation and use of OMI by competitors.

The main factor hindering the implementation of OMI is the "ossified" structure of company management, manifested in excessive centralization, authoritarian nature of management, the predominance of vertical information flows, difficulties in inter-industry and inter-organizational interactions, orientation to established markets and short-term horizons of investment design. The consequence of this are[1]:

1) the difficulty of coordinating the interests of participants in innovation processes;

2) absence or deficiency of:

- the necessary methodology, techniques and skills for their development, introduction and effective implementation;

- systems of indicators for determining the degree of their effectiveness;

- theoretical and practical knowledge base in economics, necessary for the development and implementation of OMI in companies.

The factors that ensure the high quality and effectiveness of OMI are[2]:

- providing the managerial decision maker and the company team with high-quality and timely information characterizing the parameters of the "output", "input", "external environment" and "process" of the innovation development system, demonstration of indicators and criteria on the basis of which OMIs are selected, analyzed and evaluated, including ensuring comparability (comparability) of options and multivariance of OMI;

- application of scientific approaches in the development of OMI, analysis of the impact of economic laws on their effectiveness;

- staff motivation in the matters of improving the efficiency of innovation and the mechanism for its implementation.

To accelerate and increase the efficiency of the transition to a digital economy in Russia through the modernization of Russian industry, primarily the outstripping development of modern science-intensive and high technologies in Russian companies, the following measures are required[3]:

1. It is necessary to develop a program for integrating Russia into the global digital economy on the basis of a balanced use of the benefits of globalization, while observing the principle of integration of innovative projects and business processes into the world economy and the conditions of national security and economic efficiency. It is required to introduce organizational, economic and com-

[1]See: Filin S.A., Yakushev A.Zh. Organizational and management innovations as the cornerstone of the digital economy // National interests: priorities and security. 2018. V. 14. № 7. P. 1328.

[2]See: Filin S.A., Yakushev A.Zh. Organizational and management innovations as the cornerstone of the digital economy // National interests: priorities and security. 2018. V. 14. № 7. P. 1328-1329.

[3]See: Filin S.A., Yakushev A.Zh. Organizational and management innovations as the cornerstone of the digital economy // National interests: priorities and security. 2018. V. 14. № 7. P. 1329.

mercial innovations to ensure effective technological exchange and realization of the technological advantages of the business models of Russian companies in the global digital economy.

2. It is necessary to introduce into the management system of the state system for supporting the convergence of digital technologies a planning system based on the principle of "counter planning" and elements built on the organizational and economic principles of PPP.

3. When organizing and managing innovative projects and business processes, it is required to take into account as much as possible the innovative strategy and development policy of the home territory (municipality, subject of the RF) of the company and Russia as a whole.

4. It is necessary to develop both rigid and network, cluster-type structures to solve the problems of innovative development for the strategic convergence of technologies of the digital and traditional economies in companies.

5. It is necessary to develop OMIs aimed at scientific and methodological support for the strategic convergence of companies with the digital economy.

Thus, the development of the digital economy will lead to the creation of the OMI complex, which will ensure radical changes in the entire management system both in the digital economy as a whole and in its industrial sector, which currently dominates in Russia, in the innovation sector[1] and in the knowledge sector. The OMI complex, which will become the managerial basis of the digital economy, should be built on the basis of the need to cluster industrial relations, which will take into account the economic interests of all subjects of the digital economy. Measures of managerial influence based on restriction and coercion are difficult to implement in the digital economy. The development of digital technologies in all types of activities due to the automation of managerial decision-making processes and the possibility of obtaining available information online will provide a significant increase in the efficiency of strategic management of economic entities at all levels while reducing the risk and uncertainty of the results of these decisions[2].

2.2. Development of information and analytical models of corporate governance in the digital economy.

The global geopolitical and informational changes of recent decades are already forcing companies in the corporate sector of the economy to operate in fundamentally new conditions of the external environment, which is characterized by high volatility, deep interconnectedness of market entities, an "information explosion" - the growth of big data that is essential for making managerial decisions,

1See: Theoretical foundations and methodology of strategic management of innovative development: a monograph. - Tula: Publishing house of the TSU, 2010. – 433 P.

2See: Filin S.A. Risk as an element strategic management in innovation sphere // Risk management. 2010. № 3 (55). P. 38-51.

new risks. In modern conditions, the following trends in the further development of the corporate market are distinguished[1]:

1) The use by leading companies of management models that help unlock the potential of collective knowledge and informal networks within the company for further implementation in the growth of productivity and profitability of the company;

2) Gradual transition from traditional means of communication (e-mail, telephone) to the use of social networks and SMM (social media marketing) approaches to establish closer ties with customers, partners and a new generation of employees;

3) Active use of technology to transform organizational structures, expand partnerships and interact with external organizations;

4) Investing in the ability to process data to provide meaningful insights into consumer needs;

5) Increasing demand for more sophisticated business intelligence tools for intelligent data processing that are monitored on the Internet, social media, mobile communications in order to gain new knowledge that improves corporate efficiency of the company.

Thus, one of the serious challenges in the information support of corporate governance in the XXI century is the creation of an adequate system of intra-company planning and forecasting, which will be able to provide the required speed, accuracy and adaptability of management decisions, taking into account new factors and risks of the external environment.

In this case, the key tasks of such a system include:

1) Ensuring the integrity of the corporate-wide strategic and operational planning process;

2) Ensuring the required quality of short-term and medium-term planning and forecasting of the system of operational KPIs in conditions of high uncertainty and risks of the external environment;

3) The transition from the paradigm of "vertical" command management to the "distributed model" of cooperation based on promising business analytics software and tool applications.

Corporate management pyramid - informational approaches to development

In the new conditions, therefore, the classical three-level pyramid of management, successfully used in the corporate sector of the economy of the last century[2], will develop on a new qualitative basis. In this case, the management pyramid is understood as a diagram illustrating the hierarchy of relationships in a company in terms of the functions performed, which goes back to the work of the American

[1]See: Smirnov E.N. Digital transformation of the world economy: trade, production, markets. Monograph. - M.: World of science, 2019. - 95 P.

[2]See: Business Performance Management Systems: textbook for students of higher educational institutions studying in the direction of "Economics" and economic specialties / [N.M. Abdikeev et al.; under sci. ed. N.M. Abdikeeva and O.V. Kitova. - M.: INFRA-M, 2010. - 280 P.

sociologist Talcott Parsons (1902-1979). According to T. Parsons, three levels can be distinguished in a company: the highest - institutional, the middle - managerial, the bottom - technical. As applied to a modern company, such a classification is in good agreement with the three levels of corporate governance: the Strategic level, the Operational level, the Level of current operations, respectively. Taking into account the tasks formulated above, fundamental changes will affect, first of all, the operational level of planning. In place of the canonical budgeting process of the corporation and retro-analysis "Plan-Fact", tied to the accounting cycle of planning, adaptive solutions are already coming, which are being developed within the framework of rolling and flexible budgeting subsystems with elements of scenario analysis, expert support and statistical modeling. The development of such components of corporate governance is most productive on the basis of the development of analytical models for short-term forecasting of the results of the corporation's operating activities[1] using feedback information systems that allow to adjust the model parameters taking into account new data about the forecasting object (fig. 6)[2].

Accordingly, the well-known concept of corporate performance management CPM, proposed at the beginning of the XXI century by Gartner group[3], analysts, is receiving a new impetus for development - towards the creation of adaptive forecasting models[4] based on information and analytical systems for decision making support (IAS DMS).

Currently, the market has accumulated the first positive experience in information support of individual components of corporate planning based on promising business applications. With regard to the considered Operational level (fig. 6), such business applications include[5]:

1) Analytical systems of the CPM class;
2) Systems of statistical modeling and data mining;
3) Analytical systems of BI (Business Intelligence) class;
4) The latest developments in predictive analytics and big data processing[6].

[1]See: David A.J. Axson. Best Practices in Planning and Performance Management: Radically Rethinking Management for a Volatile World. Third edition //John Wiley & Sons, Inc, 2010. - 299 P.

[2]See: Bruskin S.N. Perspective approaches and practical development of financial performance management models for a corporation based on the multidimensional dynamic objects // Scientific works of the Free Economic Society of Russia. 2014. V. 186. P. 159-164.

[3]According to Gartner, the concept of performance management implies a complex that combines all the processes, methodologies and metrics necessary to measure and manage the performance of an organization.

[4]See: Abdikeev N.M., Bruskin S.N., Kitova O.V. et al. Business performance management systems (Sci. ed. Abdikeev N.M. and Kitova O.V.): collective monograph// M.: INFRA-M, 2014. – 280 P.; Bruskin S.N. Perspective approaches and practical development of financial performance management models for a corporation based on the multidimensional dynamic objects // Scientific works of the Free Economic Society of Russia. 2014. V. 186. P. 159-164.

[5]See: Bruskin S.N. Development and implementation of financial performance management systems // Business Informatics. 2010. № 02. P. 50-53.

[6]Predictive analytics - is a set of data mining methods that allow you to predict the future behavior

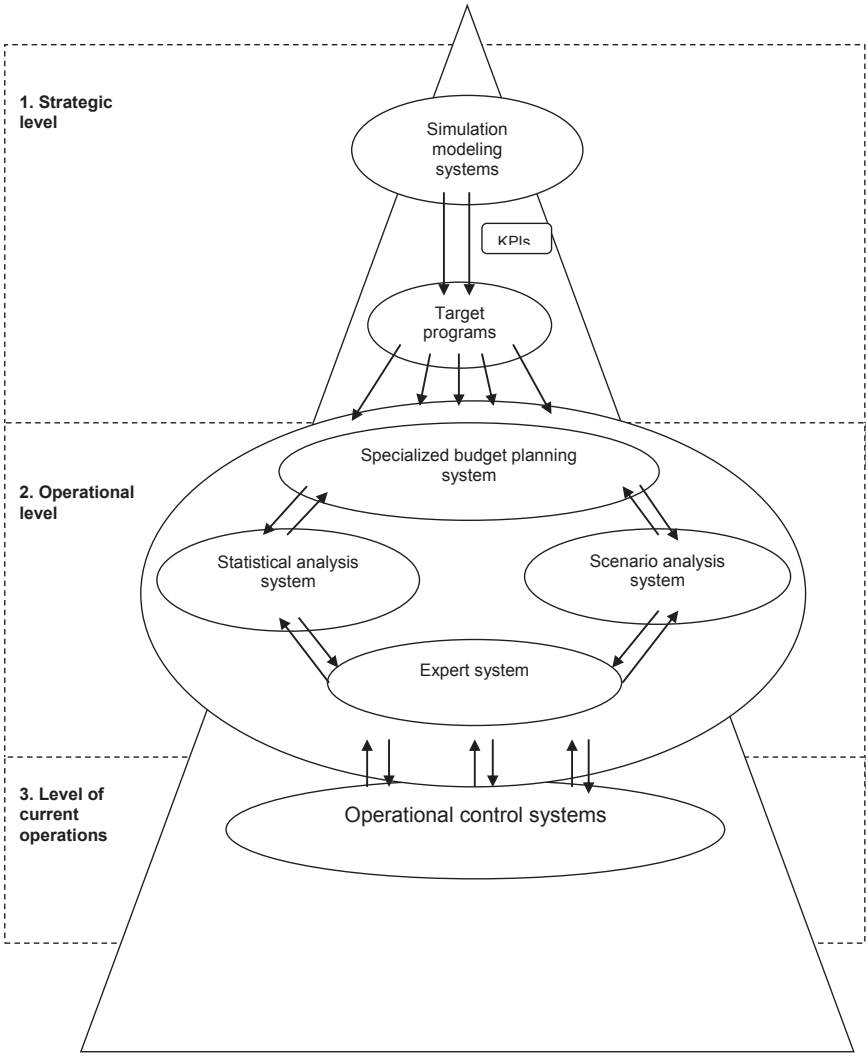

Figure 6. *A promising information model for corporate planning*

In addition to information and analytical systems offered by the world's leading suppliers (IBM, SAP, Oracle, Microsoft, etc.), one should not forget about traditional ERP systems, which in many cases serve as sources of the accumulated historical "fact" of the financial and economic activities of a corporation

of the objects under study. Predictive analytics, as a rule, is based on automated processing of large volumes of data.

and provide the necessary "feedback from the market" for predictive modeling. Successful implementation of an information and analytical solution to support the corporate planning system, taking into account the new management paradigm, requires serious preparatory work for its design based on the following steps[1]:

1) Development of functional requirements for the quality of predictive analytical models;

2) Development of data quality requirements for modeling;

3) Development of a predictive analytical model with feedback (in some cases - a multiloop model with multiple feedbacks);

4) Development of an information-logical scheme for the implementation of modeling (taking into account external information flows);

5) Development of a modeling technique taking into account the chosen analytical platform.

Digital corporate management system

The global digitalization of the world economy, which is taking place before our eyes, is fundamentally changing markets, socio-economic relations, ways and possibilities of doing business. This is most noticeable in high-tech industries (IT, telecommunications, finance, trade), but in the foreseeable future, the processes of the so-called digital transformation will become total. According to IDC research, over the past five years, technology has already significantly changed companies, new players have appeared, and the strategic focus of market participants has shifted markedly towards the customer[2]. Recent technological trends (Internet of things, big data analytics, augmented reality, cognitive and geoinformation technologies, etc.) have quickly become a reality to be reckoned with.

Some experts (for example, the international consulting company Arthur D. Little) consider the digital transformation of business as the basis for corporate strategy for the coming years[3]. A similar opinion is shared by other analysts of global companies that study the global IT market: Gartner, Accenture, IBM, Deloitte, etc.

As a result, as shown in the works[4], the success of the development of most modern companies will largely depend on the effectiveness of mastering digital business tools, the ability of companies to transform and adapt their own strategy, products and business processes to new economic and technological conditions.

[1]See: Bruskin S.N. Corporate financial performance management. Analytical models and tools // Initiatives of the XXI century. 2012. № 4. P. 53-54.

[2]See: URL: http://www.idc.com/events/futurescapes (appeal date: 25.03.2020).

[3]See:ArthurD.Little.DigitalTransformationStudy2015.HowtoBecomeDigitalLeader.-URL:http://www.adlittle.com/downloads/tx_adlreports/ADL_Ho wtoBecomeDigitalLeader_02.pdf (appeal date: 26.03.2020).

[4]See: Rauser A. Digital Strategy. A Guide to Digital Business Transformation. - Create Space Independent Publishing Platform, North Charleston, South Carolina, 2016; Rogers D.L. The Digital Transformation Playbook. Rethink your Business for the Digital Age. - New York: Columbia University Press, 2016; Westerman G., Bonnet D., McAfee A. Leading Digital: Turning Technology into Business Transformation. - Boston: Harvard Business Review Press, 2014.

The digital transformation of the management system affects all the related corporate processes (functions) of the company: marketing, finance, sales, logistics, etc. The information model of the digital corporate management system (macro level) is shown in fig. 7[1].

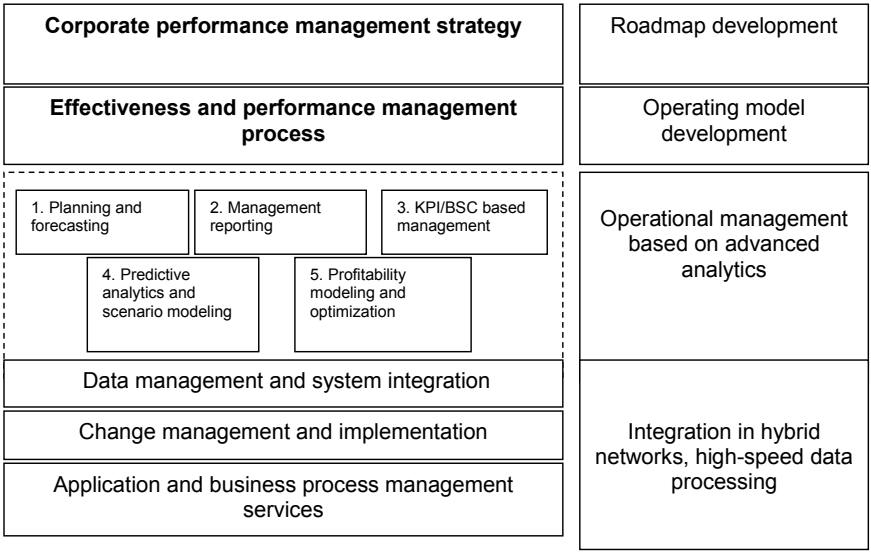

Figure 7. *Digital corporate management system based on predictive analytics*

This information model reflects, as described in the paper[2], the essence of the transition from slow scenario analysis and statistical modeling based on retro data to real-time forecasting and management based on predictive analytics and optimization models working with big data. Compared with approaches based on OLAP modeling[3], the considered information model is primarily distinguished by radical changes in operational management through the use of predictive analytics (blocks 4-5, fig. 7), as well as integration tools for managing big data in hybrid networks.

[1]See: Bruskin S.N. Models and tools of predictive analytics for a digital corporation // Bulletin of Plekhanov RUE. 2017. № 5 (9). P. 135-139. (P. 138).

[2]See: Bruskin S.N. Methods and tools of advanced business analytics for corporate information analytical systems in the digital transformation era // Modern information technologies and IT education. 2016. V. 12. № 3-1. P. 234-239.

[3]See: Bruskin S.N. Perspective approaches and practical development of financial performance management models for a corporation based on the multidimensional dynamic objects // Scientific works of the Free Economic Society of Russia. 2014. V. 186. P. 159-164.

One of the interesting directions in the development of predictive analysis is predictive modeling and the selection of the best solutions based on neural networks and machine learning using high-speed data processing and parallel computing.

Currently, there is a rapid transformation of the global information space that affects the market, society, business and the state. We are witnessing the birth of and participating in the development of the "digital economy", the laws of which are not yet fully understood. What is meant today by the term "digital transformation" for a company means that digital technologies not only significantly affect the efficiency of its work - they radically change its structure, business processes, organization principles and management methods. Ultimately, digital transformation already determines the market prospects and value of companies in the markets for consumer goods and services (FMCG), financial, telecommunications, mass media, e-commerce, etc.

In this regard, for large companies that have fallen into the zone of the digital economy, the quality and speed of information and analytical support for corporate governance are of particular importance. As discussed in the works[1], most modern corporations use accounting and analytical applications based on OLTP and OLAP systems, respectively, for planning, analysis and control tasks. The most common OLTP system in the corporate sector is the modern ERP system. The widely used OLAP systems include business intelligence systems, as well as corporate performance management systems. However, in the new economic conditions, as shown in the work[2], he classic functionality of the mentioned systems is no longer enough to solve new digital problems - due to the fact that ERP systems are focused on retro-analysis "Plan-Fact", BI applications process information about the past or (at best) current situation, while CPM systems do not contain ready-made predictive analytics tools (tab. 2)[3].

[1]See: Business Performance Management Systems: Textbook / N.M. Abdikeev, S.N. Bruskin, T.P. Danko et al.; Under the sci. ed. N.M. Abdikeev and O.V. Kitova. - M.: INFRA-M, 2015. - 282 P.; Bruskin S.N. Decision support systems in corporate planning using information business analytics: practice and perspectives // Modern information technologies and IT education. V. 1 (№ 11). Lomonosov MSU. - M., 2015. P. 593-598.

[2]See: Bruskin S N, Kitova O V 2016 Information business analytics in corporate governance: approaches and tools//International scientific conference "Lomonosov readings-2016. Economic science and development of university scientific schools" // Collection of articles / Ed. A.A. Auzan, V.V. Gerasimenko - M.: Faculty of Economics of Lomonosov MSU, 2016. P. 1349-1358.

[3]See: Bruskin S.N. Methods and tools of advanced business analytics for corporate information analytical systems in the digital transformation era // Modern information technologies and IT education. 2016. V. 12. № 3-1. P. 235.

Table 2.

Approaches the improvement of corporate governance based on business intelligence

Stage of development	Tools	Approaches	Problem being solved
Stage 5	Design not completed	Optimization with probabilistic parameters	How to achieve the best result if the constraints are probabilistic
Stage 4	Data mining optimization models	Optimization	How to achieve the best result under given constraints
Stage 3	Predictive analytics	Forecasting	What will happen in the near future?
Stage 2	- CPM systems - business intelligence - OLAP - Statistical modeling based on retro data	- Scenario modeling "What if?" - Detailing of analytics (drill down) - Methods of econometrics	Modeling the results of the interaction of several factors and their joint influence on the result. Examining how (where, when, how often) this happened in the past. Examining a problem in the past at the deepest levels of detail.
Stage 1	- ERP systems - Reporting on request - Reporting "plan-fact"	- Retro analysis - Reporting - parametric reports (ad hoc) - Regulatory (immutable reports)	What happened in the past?

Currently (beginning of stage 3), it is said that it is necessary to use predictive analytics , which complements and enhances the capabilities of business intelligence and corporate performance management in terms of predicting future events. Predictive analytics uses a variety of data mining, statistics, modeling, machine learning, and artificial intelligence techniques to analyze current data to make predictions for the future.

The patterns found in historical and transactional data can be used to identify risks and opportunities for future events. Predictive analytics models focus on relationships between many factors to assess risk with a specific set of conditions. The successful application of predictive analytics in a company allows you to effectively interpret big data to your advantage.

Data mining, text mining, web mining, social mining combined with statistical analysis allows business users to create intelligent predictive systems by uncover-

ing patterns and relationships in structured and unstructured data. Structured data sources, for example, can be any reference database, corporate transaction systems, and other data that has a clear structure. Unstructured (or semi-structured) data - is data that has been brought to a large extent by the digital economy. It does not have a predetermined structure, or is not organized in a set order. A typical example of such data is the text data of social media content, which is extracted using semantic analysis that takes into account the emotional component, and then used in the model building process.

Gartner analysts believe that the further development of the global business analysis market will follow the path of active development of advanced analytics, including predictive analysis, building simulators and variable models. As can be seen from the scheme proposed by Forrester research (fig. 8)[1], approaches to the implementation of predictive analytics tools imply a continuous data processing cycle that turns them into knowledge, which is in good agreement with the requirements of the digital economy.

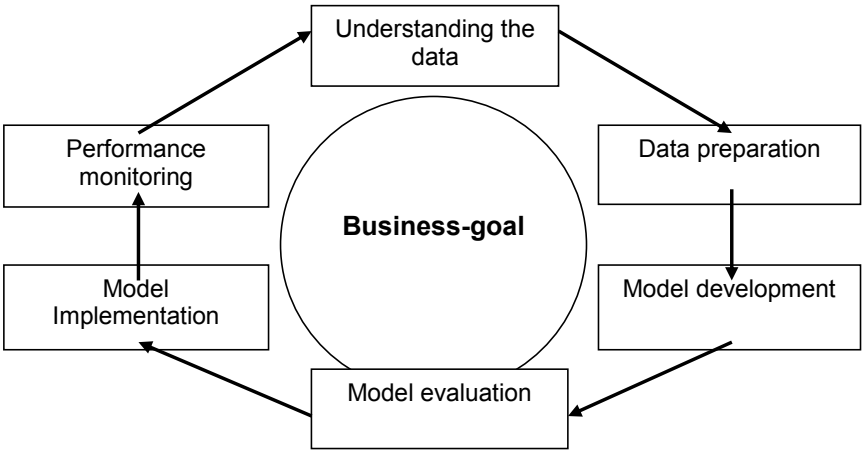

Figure 8. *Approaches to implementing predictive analytics tools*

The central essence of predictive analytics is the task of determining a predictor or several predictors (parameters or entities that affect the predicted event). For predictive analysis to be successful, it is recommended to clearly follow the following stages: setting a goal, obtaining data from various sources, preparing data, creating a predictive model, evaluating the model, implementing the model, monitoring the effectiveness of the model.

[1]See: Bruskin S.N. Methods and tools of advanced business analytics for corporate information analytical systems in the digital transformation era // Modern information technologies and IT education. 2016. V. 12. № 3-1. P. 236.

Along with the requirements for the quality of forecast data, which are necessary for a modern "digital company", the requirement for the speed of their provision is becoming increasingly important. Thus, the "digital" analytical system of the near future, which works with big data, must not only contain intelligent data driven models, but also meet the requirements of real-time systems. As part of predictive modeling, this can be achieved as follows[1]:

1) The statistical modeling engine creates a series of models by analyzing retrospective data;

2) The resulting models are deployed and tested for predictive quality;

3) Unsuccessful models are replaced by more successful ones.

The model building tool provides the creation of models based on historical data. Such models can be executed in batch mode or in real time on streaming data. The results of model execution can be used by the final optimization component to compare the results obtained by different models and select the most successful ones. The predictive modeling module can continuously create hundreds of predictive models, continuously check them against real processes, and optimize these models for optimal results.

Common examples of predictive analytics applications include direct marketing, evaluating the effectiveness of promotional campaigns (based on segments, location, or delivery channels), targeting ads, detecting fraud schemes, modeling political campaigns, developing models of early diagnostics in medicine, and much more. The areas of application of predictive analytics are very wide, and at present we are only at the initial stage of their development.

An important condition for ensuring the effectiveness of predictive modeling of complex dynamic systems is to determine the quantitative and qualitative patterns inherent in these systems. The complexity of this task lies in the fact that such systems are weakly structured, and obtaining the necessary additional knowledge about them is impossible without human participation. Regardless of whether the predictive model uses additional information from an expert (a group of experts) or receives it from other people (a target group of invited respondents), this information is always subjective. That is why, when modeling complex socio-economic systems, not individual mathematical methods are increasingly being used, but complexes of cognitive networks and hybrid models using the theory of fuzzy games, fuzzy sets, fuzzy logic, neural networks, cognitive maps, evolutionary algorithms, etc.

Cognitive analysis methods that are widely used in intelligent decision support systems should also include[2]:

[1]See: Bruskin S.N. Methods and tools of advanced business analytics for corporate information analytical systems in the digital transformation era // Modern information technologies and IT education. 2016. V. 12. № 3-1. P. 236.

[2]See: Bruskin S.N. Methods and tools of advanced business analytics for corporate information analytical systems in the digital transformation era // Modern information technologies and IT education. 2016. V. 12. № 3-1. P. 237.

1) cognitive maps;
2) sign graphs;
3) network models;
4) graphs of causes and effects;
5) causal networks;
6) Bayesian networks;
7) networks of trust;
8) Saaty analytical networks.

Modern digital technologies (blockchain, machine learning technologies, cognitive services, CPM/BI class systems, "smart things", intelligent applications for big data analysis) play an increasing role in corporate governance, gradually expanding their influence and capturing all sectors of the global economy one after another. Large-scale changes are taking place before our eyes: "digitization" (the use of digital technologies) and "digital transformation" (a radical change in business strategy and business processes under the influence of digitalization) are being actively introduced. These processes are becoming not only an objective reality for most companies, organizations and entire industries, but also a necessary condition for survival in the digital ecosystem "state - business - society".

According to Gartner research[1], in 2017 there were 10 technology trends presented in table 3.

Table 3.
Technology trends

Trend	Trend name	Comments on application in management
Trend1	Artificial intelligence and deep machine learning	Smart devices based on intelligent models and deep neural networks
Trend 2	Intelligent applications	Real-time services based on virtual assistants
Trend 3	Smart things	Industrial and consumer devices based on the Internet of Things
Trend 4	Virtual (VR) and augmented (AR) reality	Combination of virtual and real objects based on 3D technologies
Trend 5	Digital "twins"	Digital dynamic models of physical objects using sensors for simulation modeling
Trend 6	Blockchain	Chain data distribution and cryptocurrency
Trend 7	Dialogue systems	Network based dynamic services between people, processes, services and things
Trend 8	Application and service mechanics	Synchronization of devices and technologies on the principle of "smart home"

[1]See: Top 10 Strategic Technology Trends for 2017. - URL: https://www.gartner.com/doc/ 3471559 (appeal date: 29.10.2020).

Trend 9	Digital technology platforms	New platforms that combine information systems, customer experience, analytics and forecasting, Internet of Things and business ecosystems
Trend 10	Adaptive security architecture	Multi-level real-time information security system, including based on blockchain technology

In the future, most companies will have to transform into so-called "digital structures", which should operate on new management and technological principles. Today, the fundamental requirements for building a digital corporation are being worked out, which include a business model, organizational structure, business processes, channels, and the external environment.

Analysis of approaches to digital business transformation

The state of global digitalization is considered in detail in the study by A.D. Little[1], The state of global digitalization is considered in detail in the study by A.D. Little, while the main conclusion is that most industries are already affected by digital transformation or are waiting for its early impact, but most companies either do not know or ignore the potential threats from "digital impact" on their business. Unfortunately, despite the fact that digital approaches to management are in demand, many companies are not ready to implement them. The speed of digital transformation processes of companies is much lower than it is necessary to successfully overcome digital competition. The use of so-called "smart data" and the creation of personalized offers based on them for consumers currently lag behind the capabilities and needs of the digital market. Most companies are at the very beginning of the digital transformation process. Most large Russian companies are not yet ready for the systematic creation of a digital business model that will allow them to gain strategic advantages from digital technologies. However, given the high pace of global digitalization, it is very important to quickly adapt the best practices of digital transformation to the development of domestic business.

Digital transformation affects all aspects of a company's activities, including strategy, operations and technology[2]:

- the digital company strategy focuses on defining the best customer experience, managing a unique business model and ecosystem, and managing change;
- operations are committed to continuous improvement, integrating physical and digital entities, and building a culture that encourages iterative innovation;
- technologies involve flexibility and use of the full modern technological po-

[1]See: Arthur D. Little. Digital Transformation Study 2015. How to Become Digital Leader URL: http://www.adlittle.com/downloads/tx_adlreports/ADL_HowtoBecomeDigitalLeader_02.pdf (appeal date: 26.03.2020).

[2]See: Kitova O.V., Bruskin S.N. Digital transformation of business // Digital economy. 2018. № 1 (1). P. 21.

tential, including analytics, cognition, mobility, etc.

Digital transformation allows a company to gain a set of unique competitive advantages and become more sustainable.

The company begins to evolve with a new focus based on new customer experiences and new ways of working.

Some researchers have managed to formulate the main approaches to building digital models, taking into account the considered technological trends. Of greatest interest is the work of George Westerman, Andrew McAfee (MIT Center for Digital Business) and Didier Bonnet (Capgemini Consulting)[1], which provides practical examples of the successful transition of companies to "digital management". The authors conducted a survey of 157 managers from 50 large companies with an annual turnover of at least 1 billion dollars, represented in 15 countries. The authors developed a conceptual framework for digital transformation (fig. 9). The concept shown in the figure offers three areas of activity for the introduction of digital technologies (each of which has three groups of tasks)[2]: improving the quality of customer service; transformation of operational processes and transformation of business models. Using the example of performance management optimization (block 2.3, fig. 9), we will consider what approaches can be used to transform operational processes in a digital corporation.

[1]See: Westerman G., Bonnet D., McAfee A. Leading Digital: Turning Technology into Business Transformation// Harvard Business Review Press, 2014. - 292 P.

[2]See: MIT Sloan Management Review. George Westerman, Didier Bonnet and Andrew McAfee. The Nine Elements of Digital Transformation. January 07, 2014 // [Electronic resource] // URL: http://sloanrev iew.mit.edu/article/the-nine-elements-of-digital-transformation/ (appeal date: 26.03.2020).

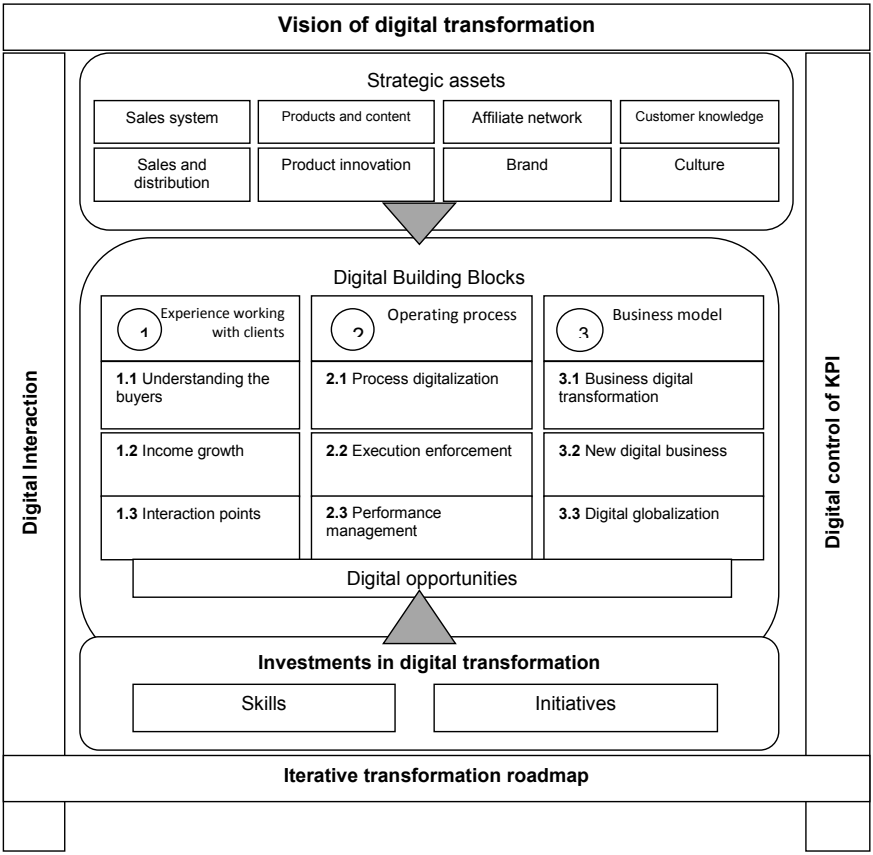

Figure 9. *Conceptual framework for digital transformation*

Concepts and models of digital corporate performance management

Until recently, the information model of company management was well described by Howard Dresner's concept of corporate performance management, (CPM)[1], studied in detail by the authors in the works[2]. However, the digital revolu-

[1]See: Dresner Howard. Profiles in Performance. Business Intelligence Journeys and the Roadmap for Changes // John Wiley & Sons, Inc, 2009. - 174 P.

[2]See: Bruskin S N, Kitova O V 2016 Information business analytics in corporate governance: approaches and tools//International scientific conference "Lomonosov readings-2016. Economic science and development of university scientific schools" // Collection of articles / Ed. A.A. Auzan, V.V. Gerasimenko - M.: Faculty of Economics of Lomonosov MSU, 2016. P. 1349-1358; Bruskin S.N. Decision support systems in corporate planning using information business analytics: practice and perspectives // Modern information technologies and IT education. 2015. V. 1. № 11. P. 593-598; Bruskin S.N. The information-analytical system on the platform of business analytics to support the financial planning

tion and the continued exponential growth of data volumes have created an information gap between the strategic and operational levels of a company's management. A need to build an organization that could be managed in real time (RTE, realtime enterprise) arose. Such a task required further development of the concept of H. Dresner, as shown in figure 10[1].

Let's consider how the information support of the continuous cycle of digital control is changing based on such classical blocks of the CPM system as Analysis, Modeling, Planning and Monitoring.

Analysis. To implement digital corporate governance, a classic CPM solution that provides "Plan-Fact" analysis must evolve from descriptive analysis towards predictive and recommendatory analysis.

Modeling. Modeling is closely related to analysis. Key performance indicators (KPI) modeling based on "What-If" scenario analysis will evolve and is already evolving towards predictive modeling based on predictive analytics.

Planning. In the commonly accepted "Plan-Fact-Forecast" paradigm, planning is a forecasting function based on the fact. In the new digital paradigm, it should not only be based on the results of forecasting and the actual results of the main activity - it should be adaptive and support real time. Obviously, machine algorithms and advisory analytics will play a big role in decision-making, helping decision makers make optimal decisions in real time.

Monitoring will develop through the further development of visualization tools and deeper integration with analytical applications and services for working with smart devices, big data and other components of the digital ecosystem.

of the sales and services corporation // System Administrator. 2016. № 11. P. 86-88; Bruskin S.N. Perspective approaches and practical development of financial performance management models for a corporation based on the multidimensional dynamic objects // Scientific works of the Free Economic Society of Russia. 2014. V. 186. P. 159-164.

[1]See: Kitova O.V., Bruskin S.N. Digital transformation of business // Digital economy. 2018. № 1 (1). P. 22.

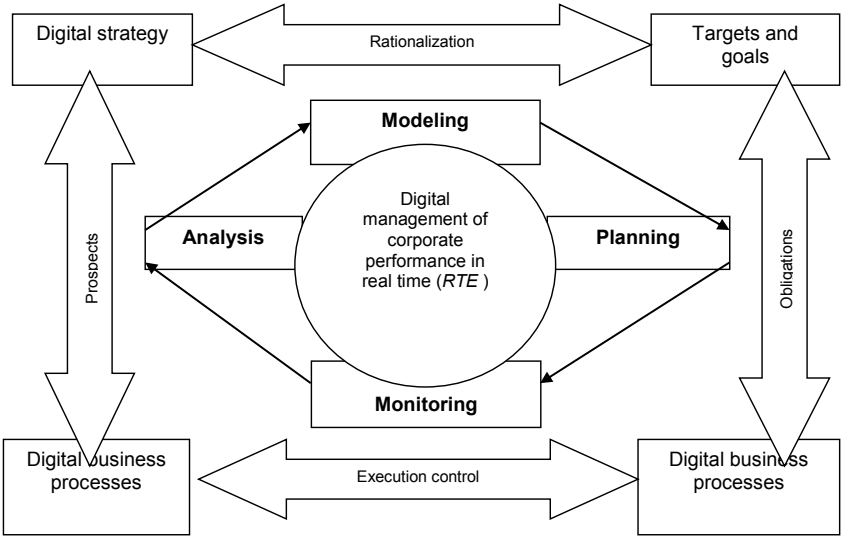

Figure 10. *Digital enterprise performance management*

As follows from fig. 10, the further development of the classic CPM concept is associated with the digitalization of the corporate strategy, business model and business processes, as well as the transition to real-time company management (RTE) for all key components of the control loop (analysis, modeling, planning and monitoring). The described digital control blocks are studied in more detail in the works[1], which is reflected in the figure 11 (levels 3-4)[2], presented below.

At present, blocks, applications and services presented at levels 3-4, and in some cases at level 2 (fig. 11), are commonly referred to as "advanced business analytics". As seen at level 4, advanced analytics is part of a process of modernizing classic business intelligence tools and enriched with new functionality. For example, blocks 4.4, 4.6, 4.7, which were not used in traditional CPM solutions, can be fully attributed to new blocks. Next-generation business intelligence can be embedded in information real-time systems (RTS), it can support both the strategic and operational contour of corporate governance based on statistical data processing, data mining and optimization modeling.

[1]See: Bruskin S N, Kitova O V 2016 Information business analytics in corporate governance: approaches and tools//International scientific conference "Lomonosov readings-2016. Economic science and development of university scientific schools" // Collection of articles / Ed. A.A. Auzan, V.V. Gerasimenko - M.: Faculty of Economics of Lomonosov MSU, 2016. P. 1349-1358; Bruskin S.N. Methods and tools of advanced business analytics for corporate information analytical systems in the digital transformation era // Modern information technologies and IT education. 2016. V. 12. № 3-1. P. 234-239.

[2]See: Kitova O.V., Bruskin S.N. Digital transformation of business // Digital economy. 2018. № 1 (1). P. 23.

The role of analytics in the management of a digital company is very large, since the analysis of customer experience is at the heart of improving operational efficiency and developing new business models. The sources for analysis are network and social analytics, data from CRM and ERP systems, data from mobile applications, and loyalty programs. All this data goes through the stages of collection and cleaning, integration, analysis using modern algorithms for solving problems of classification, clustering, forecasting, such as neural networks, decision trees. Cognitive models, methods and algorithms are used to engage customers more deeply in the company's activities, for proactive marketing and sales, and, ultimately, to build new business models for the company's activities.

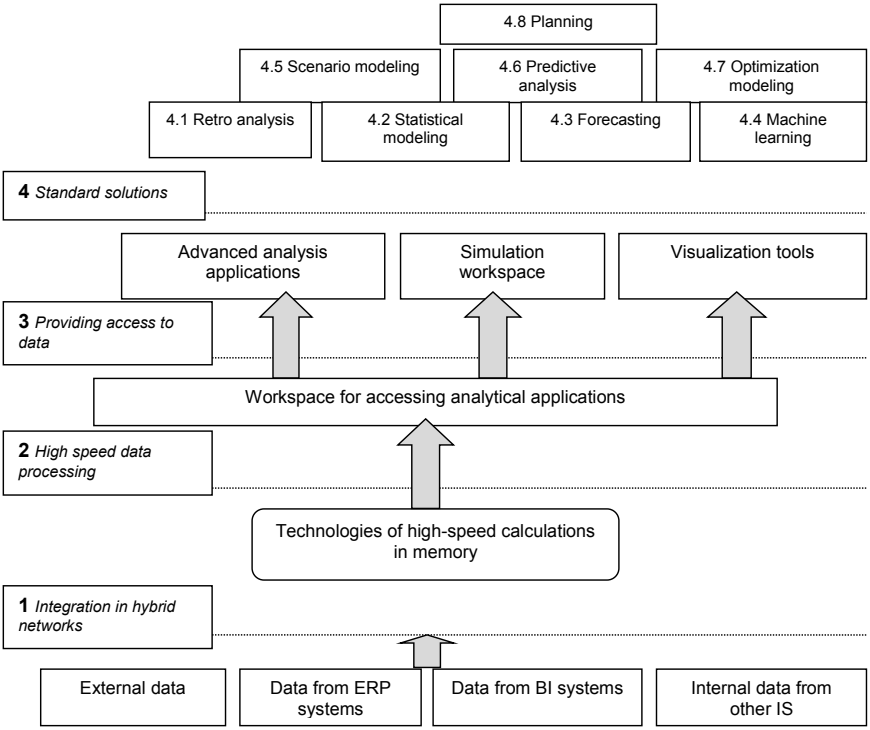

Figure 11. *Conceptual digital model of corporate governance based on advanced business intelligence*

As can be seen from the presented model (fig. 11), technological innovations have affected all levels of system design[1]:

[1]See: Kitova O.V., Bruskin S.N. Digital transformation of business // Digital economy. 2018. № 1 (1). P. 23.

1) the level of integration in hybrid networks is distinguished by new opportunities for processing external data, which include big data (primarily, this concerns unstructured data from social networks);

2) the level of high-speed data processing based on new computing technologies (for example, the use of InMemory technologies, columnar databases, parallel computing);

3) providing access to data based on multi-agent systems and technologies for extracting and cleaning data from specialized storages;

4) standard advanced analytics solutions that include not only statistical and scenario modeling tools, but also cognitive business intelligence technologies based on the predictive modeling described above, as well as optimization tools that will be offered to the market in the coming years.

As shown in level 4, advanced analytics is part of the process of modernizing classic BI tools and is enriched with new functionality. Next-generation business intelligence is able to integrate into information real-time systems (RTS) and can support both the strategic and operational contours of corporate governance based on statistical data processing, data mining and optimization modeling.

The considered scheme and digital model of corporate governance (fig. 10-11) are well aligned with the conceptual framework of digital transformation (fig. 9). Currently, there is no universal strategy for the development of the described digital models, so each company will independently determine the trajectory of its own development. The development of digital models of corporate governance at the same time implies the fulfillment of the following requirements for the construction of these models[1]:

- requirements for a digital development strategy;
- requirements for digital management of operational efficiency;
- requirements for the digital transformation of the organizational structure;
- requirements for digital transformation of business processes;
- requirements for information and analytical support for digital management;
- requirements for the speed of decision-making (real-time models as part of RTS);
- requirements for working with digital data (integration of advanced analytics with corporate digital processes);
- requirements for digital competencies of personnel.

Today, the scientific community has accumulated a certain potential for the implementation of so-called "digital projects", which are already in demand by the real sector of the economy. The joint efforts of business customers, data mining experts and technology partners will certainly lead to the practical implementation of such projects. This means that in the foreseeable future the quality of corporate governance will begin to approach the level of already existing digital technologies.

[1]See: Kitova O.V., Bruskin S.N. Digital transformation of business // Digital economy. 2018. № 1 (1). P. 24.

Thus, the development of advanced business intelligence systems provides corporations with methods, models and technologies of a fundamentally new quality - in accordance with the challenges of the digital economy. However, one should not think that the new generation of analytical applications and services will save corporations from the need for digital transformation. The practice of developing individual components of advanced business analytics, as described in the works[1], indicates that all participants in the digital market will not only have to transform IT systems. Digital transformation also implies the transition of companies to "digital management", a revision of the organizational principles of management, business processes and their analytical support.

2.3. The main directions of engineering of grid companies at the strategic, tactical and operational levels.

Increasing the dynamism of economic interactions between companies under the influence of modern digital technologies creates the preconditions for the formation of organizational alliances or value-creation networks with a non-linear nature of interaction, allowing the production of innovative products and services in accordance with the dynamic needs of the market.

Four out of five small and medium-sized companies worldwide recognize the clear benefits of digital transformation, according to a global study conducted by IDC, a global research and consulting firm, commissioned by SAP SE. These benefits include increased turnover, reduced costs, easier access to information, and improved customer service and employee productivity. However, the potential of digital transformation is not yet fully unlocked: less than 7% of small and medium-sized companies have completed the integration and process data in real time, optimizing processes and workflows to increase operational efficiency[2].

In digital transformation, the key factors for the maturity of companies are not so much the actual introduction of digital technologies, but a fundamental change in the management system under the influence of digital technologies. Moreover, the engineering of the company's business processes based on modern digital technologies should go on an ongoing basis, ensuring a continuous stream of innovations. So, according to a joint study by Gapgemini Consulting and the MIT Sloan School of Management[3], companies that simultaneously implement digital

[1]See: Bruskin S.N. Perspective approaches and practical development of financial performance management models for a corporation based on the multidimensional dynamic objects // Scientific works of the Free Economic Society of Russia. 2014. V. 186. P. 159-164; Kitova O.V., Nefedov V.V., Starovoitov A.V. A simulation development model of retail network on the IBM Cognos TM1 platform // Bulletin of Plekhanov RUE. 2015. № 3. P. 99-105.

[2]See: IDC: the potential of digital transformation of small and medium-sized enterprises is not fully disclosed. – URL: https://www.itweek.ru/idea/news-company/detail.php?ID=192938.

[3]See: URL: https://www.capgemini.com/resources/?search_term&filter_content_type&filter_label&filter_research.

technologies and carry out the transformation of the management system, provide up to 25% increase in profits, and companies that only automate their existing business processes achieve a profit increase of no more than 10%.

Thus, for the transformation of companies, it is characteristic to carry out changes in business models that comprehensively consider business processes, organizational structures, production technologies, and financial flows. Such a transformation is unthinkable without the use of engineering methods for designing architectural models of companies, which are reflected in the concept of engineering of companies. Under the engineering of companies, we understand the continuous design and innovation activities of a company to implement digital transformation based on the application of a set of engineering principles, methods and tools[1].

The basis of modern business models of companies is a network model of partnership and cooperation, and companies produce services to a greater extent than products[2].

Modern engineering of companies is based on the principles of the 4th generation Industry, which include[3]:

- individualization of production and provision of services, i.e. realization of the capacity for efficient unit production. Business processes become fully customer-centric;

- decentralization of management, which ensures the company's ability to self-organize, including using cyber-physical devices as part of the implementation of the concept of the Internet of things;

- providing self-control of efficiency based on the ability to analyze and predict the performance of processes in real time due to the processing of large amounts of data;

- implementation of open innovation by developing new product concepts based on the systematic involvement of experts, customers and suppliers in the development;

- implementation of service-oriented business models in terms of ensuring the multiplicity of channels for sending orders to the production system, the formation of production processes "on the fly";

- ensuring transparency of product lifecycle management (PLM) in real time using the technological capabilities of the Internet of things.

In order to reach the level of the Industry of the 4th generation, the company must go through the development path in 6 stages of digitalization[4]:

[1]Schaeffer E. Advantages of digital technologies for production / Eric Schaeffer: Transl. from Eng. - M.: Publishing group "Tochka", 2019. - 320 P.

[2]See: Digitization: Practical recommendations for the transition of business to digital technologies; Transl. from Eng. - M.: Alpina Publisher, 2019. - 252 P.

[3]See: Sheer A.-V. Business administration drivers for I4.0: logistics and new business models. – URL: http://i-love-bpm.ru/scheer/drayvery-biznes-administrirovaniya-dlya-i40-logistika-i-novye-biznes-modeli.

[4]See: Telnov Yu.F. Actual directions of enterprise engineering in the digital economy // View of the

1. Computerisation - automation of all business and production processes.

2. Connectivity through the use of the Internet of people, the Internet of things, the Internet of services based on the use of CAD/CAM, MES, ERP, SRM, SCM technologies.

3. Visibility through the creation of a digital display of the state of all production and business processes using a system of sensors and BPM systems.

4. Transparency through extracting knowledge from data by applying big data processing methods and tools.

5. Predictive capacity based on the use of predictive analytics technologies adapted to production, cognitive and neural network methods and tools.

6. Adaptability to changing external conditions based on multi-agent systems and knowledge management technologies.

Moreover, the implementation of 4-6 stages is unthinkable without the use of artificial intelligence technologies, neural network and cognitive technologies.

The central aspect of the engineering of companies that ensures digital transformation is the creation of network structures for the interaction of business partners, which are called network companies. Thus, a network company is understood as a company that performs dynamic interaction with business partners (customers, suppliers, subcontractors, etc.) and its geographically distributed divisions in the main business processes (development, production and promotion of products and services), widely using knowledge management methods within the framework of an integrated information space in the Internet environment on the principles of service implementation of needs in the creation of products and services. Moreover, the needs, as well as the products/services themselves, have a digital form of representation, and the dynamic interaction of participants in network business processes should ensure business decision-making at the pace of business requests or opportunities[1].

The following requirements are imposed on the modern architecture of a network company[2]:

- network value models of partnership and cooperation of companies form chains of interrelated business processes that are established dynamically depending on the innovative idea of a new product or service;

- the key characteristic of grid companies is the ability to quickly access knowl-

generation of the XXI century on the future of the digital economy: a collection of articles of teachers of the IX International scientific and practical conference "Modern economics: concepts and models of innovative development". February 15-16, 2018 - M.: FSBEI HE "Plekhanov RUE", 2018. P. 33-34.

[1]See: Telnov Yu.F. Actual directions of enterprise engineering in the digital economy // View of the generation of the XXI century on the future of the digital economy: a collection of articles of teachers of the IX International scientific and practical conference "Modern economics: concepts and models of innovative development". February 15-16, 2018 - M.: FSBEI HE "Plekhanov RUE", 2018. P. 34.

[2]See: Telnov Yu.F. Actual directions of enterprise engineering in the digital economy // View of the generation of the XXI century on the future of the digital economy: a collection of articles of teachers of the IX International scientific and practical conference "Modern economics: concepts and models of innovative development". February 15-16, 2018 - M.: FSBEI HE "Plekhanov RUE", 2018. P. 34.

edge about the market situation and adapt the business processes of the companies' functioning in accordance with them, which ensures an increase in their competitiveness in the market;

- the architecture of a network company becomes intelligent due to the ability to flexibly combine company design elements depending on the state of business processes and the external environment using feedback mechanisms;

- it is proposed to use ontological models, multi-agent technologies and service-oriented architectures as a technological basis for network companies.

To create a dynamic network company, its architecture must be flexible and adaptive, allowing you to combine different components of value chains on a dynamic basis. In this regard, a need arises, on the one hand, for the systematization and informational description of the provided components of the architecture, which is achieved through the use of the mechanism of ontological conceptualization of knowledge sources (information resources), and on the other hand, the development of a mechanism for dynamically linking activity counterparties that can be effectively implemented. using intelligent multi-agent technology and service organization of interaction procedures.

The service-oriented architecture of a network company is built on three levels: strategic, tactical and operational[1].

At the *strategic level*, the task of identifying and developing key competencies (types of activity) of the company that has a significant impact on its position in the market is solved. In the long term, key competencies (types of activity) unfold into a system of values created for consumers, implemented in the form of strategic plans for the production of products and services, for which targets and measures are set for achieving them.

At the *tactical level*, the task is to determine a set of business processes in the value chain, which, in accordance with key competencies (activities) and critical success factors, are either performed by the company itself or outsourced to partners, and attracting partners is the same as developing one's own competencies is carried out on a dynamic basis. At the heart of building such a value chain is a chosen business model that links together a set of different business processes.

At the *operational level*, in accordance with the key features of the selected business model and key performance indicators, as well as specific emerging and changing circumstances in the business environment, the task of configuring online business processes is solved.

Monitoring the execution of business processes leads to the accumulation of real statistics, on the basis of which the business model is corrected from the position of selecting its specific components. Controlling the achievement of key performance indicators at the business model level, in turn, may necessitate a correction in the company's strategy.

[1]See: Telnov Yu.F., Fedorov I.G. Enterprise engineering and business process management. - M.: Unity-Dana, 2015. - 207 P.

To solve the listed tasks of engineering of the company's architecture, it is advisable to use and develop the following methods and means of intelligent technologies[1]:

- ontological engineering, the application of which leads to the construction of an ontology that allows structuring and displaying goals, processes, resources, organizational structures at different levels of presentation (strategic, tactical and operational), making transitions between them in order to detail and specify the planned actions;
- fuzzy calculations that allow solving multi-criteria problems of choosing design solutions based on a qualitative interpretation of quantitative indicators in order to substantiate key competencies, business models and participants in business processes;
- multi-agent technologies that implement the construction of effective dynamic interactions of intelligent agents in joint business processes of network companies.

The central component of the engineering of a network company is an ontology that ensures the effective interaction of all interested participants in joint activities in the information space. For the implementation of intensive information exchanges between participants of network companies, the following are distinguished as the main factors that determine the need to use the ontology of the company[2]:

- dynamic attraction of clients and experts from the company's ecosystem in the "on demand" mode;
- fast integration of agents as subcontractors and partners into dynamically formed business processes;
- integration in one multi-professional team of agents-experts representing different subject areas;
- support for semantic interoperability of systems within the framework of the general business process being formed.

To organize the information space of interacting subjects of a network company, the ontology should reflect[3]:

1. At the strategic level - goals, critical success factors, key competencies and

[1]See: Telnov Yu.F. Actual directions of enterprise engineering in the digital economy // View of the generation of the XXI century on the future of the digital economy: a collection of articles of teachers of the IX International scientific and practical conference "Modern economics: concepts and models of innovative development". February 15-16, 2018 - M.: FSBEI HE "Plekhanov RUE", 2018. P. 35-36.

[2]See: Telnov Yu.F. Actual directions of enterprise engineering in the digital economy // View of the generation of the XXI century on the future of the digital economy: a collection of articles of teachers of the IX International scientific and practical conference "Modern economics: concepts and models of innovative development". February 15-16, 2018 - M.: FSBEI HE "Plekhanov RUE", 2018. P. 36.

[3]See: Telnov Yu.F. Actual directions of enterprise engineering in the digital economy // View of the generation of the XXI century on the future of the digital economy: a collection of articles of teachers of the IX International scientific and practical conference "Modern economics: concepts and models of innovative development". February 15-16, 2018 - M.: FSBEI HE "Plekhanov RUE", 2018. P. 36.

their combinations, key performance indicators and business model requirements.

2. At a tactical level - a business model for implementing value chains.

3. At the operational level - the distribution of roles between interacting agents of activities and corresponding resources.

In the ontology of the company at the strategic level of the company, strategic goals are formalized, which are organized in accordance with four layers of the balanced scorecard and form the financial, marketing, process and resource-technological layers of goals.

Each strategic goal is specified by a set of critical success factors identified in accordance with the SWOT analysis method: internal opportunities and limitations (based on a general analysis of the state of resources and technologies) and external benefits and threats. In the following, these critical success factors are considered when analyzing specific business models aimed at achieving goals.

On the basis of critical success factors, key performance indicators and their boundary values are formalized, which the company should strive for, and key competencies (activities) that ensure the achievement of strategic goals are determined.

In the ontology of the company at the tactical level, value propositions and the ability to form them in accordance with the business model are formalized. The value proposition reflects a set of characteristics of the products and services provided, which for the consumer will correspond to the opening opportunities (capabilities).

To implement the value proposition, a chain of creation is built, in which each process included in it with a set of resources used is associated with the capabilities of the implementation. In accordance with A. Osterwalder's classification[1], it is proposed to formalize abilities: integrate external and internal resources, use various distribution channels, create new types of products and services, combine products and services at the request of consumers.

In the ontology of the company, activities are formalized at the operational level, agents (actors), their roles in activities, as well as the resources used are defined. According to J. Dietz, there are two main roles of agents[2]: the coordinating role of the customer agent in the process of forming/monitoring the fulfillment of value requirements and the production role of the agent-executor that creates value. For all activity components, semantic templates of attributes and actions are defined.

A key characteristic of network companies is the ability to quickly search for information about value propositions in the market and their resource provision and, accordingly, quickly and adaptively configure business processes to meet

[1]See: Osterwalder A. et al. The Business Model Ontology - a Proposition in a Design Science Approach. Thesis PhD., - 2004.

2See: Dietz J.L.G.: Enterprise Ontology - Theory and Methodology, Springer-Verlag Berlin Heidelberg, 2006.

emerging needs, which is ensured by the use of a dynamic multi-agent system.

As a method of organizing a multi-agent system, it is proposed to use a transactional approach to configuring business processes, which ensures the effective implementation of the dynamic interaction of intelligent agents in the integrated information space of network companies.

From the point of view of software implementation, intelligent agents must have a set of service procedures that generate requests, check their feasibility, select and configure a business process, execute them, check compliance with output requirements, and respond to exceptional conditions. The state of transactions is represented in a dynamic database ("bulletin board") available to interacting agents. The knowledge base contains sets of decision rules that are applied depending on the characteristics of a particular subject area.

Since the process of implementing the transaction involves intelligent agents who perform their roles for companies that are not related at the initial stage, then in the process of concluding an agreement between the participants in the process, risks associated with the insolvency of counterparties may arise. These risks may be due to the insufficiently good financial position of the network company participants, the unreliability of information sources about the technologies and resources used. From this point of view, counterparty companies must provide each other with the necessary information for mutual verification of the viability and ability to perform the necessary services. In this regard, interacting intelligent software agents make decisions based on the knowledge base of the rules for assessing the economic condition of business partners using open sources of information in the Internet environment. The functions of assessing the reliability of partners are assigned to specially dedicated intelligent agents that carry out competitive intelligence.

For a dynamic analysis of the effectiveness of service maintenance on the part of agents-executors, it is advisable to accumulate statistics on the interaction of agents and the occurrence of problem situations in the information storage and subsequently process it with business intelligence software. In this regard, there is an opportunity for continuous engineering of business processes, which allows for timely localization of problems, diagnosis of the causes of occurrence and the formation of recommendations for improving the components of the business model for effective digital business transformation.

2.4. Digitalization of the educational environment: opportunities and threats for the economy.

In the near future, the educational environment is expected to undergo major changes associated with digitalization. The e-education system generates new opportunities and new challenges. The main opportunities include solving the problems of accessibility of education, expanding the possibilities of choosing

the form of education, increasing the variety of tools for transferring knowledge. The problems of the e-education system can be divided into two classes: current (transitional) and immanent. Currently, e-education is facing such problems as the desire to imitate full-time education, poor quality control of educational products, low interactivity, and primitivization of competencies. The most significant inherent shortcomings of the e-education system are the problems of socialization and transfer of implicit knowledge. Digitalization will inevitably lead to the transformation of the educational services market. The main players will be leading universities (generation of new knowledge, development of fundamentally new educational products, training of scientific personnel); companies - manufacturers of electronic educational products and global educational platforms (transmission of finished educational products to the consumer).

The present time is characterized by a radical modification of the educational environment, expressed in the following main trends[1]:

- transformation of educational organizations into scientific and educational complexes;
- transition to mass higher education, which necessitates a differentiated approach to building a system of higher education in the direction of both increasing the number of levels of such education and expanding the ways of obtaining it;
- transformation of education into a continuous process as a result of the exponential growth in the volume of new knowledge and, as a result, the need to constantly update the knowledge and competencies of employees;
- commercialization of the education system by expanding the range of paid services and changing the methods of its budgetary financing (transition from budget to custom, including per capita, method of financing);
- development of distance education based on the use of information and communication technologies (ICT);
- globalization, the consequence of which is increased competition between educational institutions for students, teachers and funding, including in the form of orders for research work;
- development of educational platforms (Coursera, Edx, Universarium, Lectorium, etc.) that create competition for traditional educational organizations;
- possibility of introducing artificial intelligence into the educational process.

The combined impact of these factors on the education system determines the need for a fundamental change in the existing forms and methods of educational activities. Attempts to respond piecemeal to certain challenges can only lead to short-term results and at the same time create threats to future development. Most clearly, such threats are manifested in the field of creating a digital educational environment.

[1]See: Ustyuzhanina E.V., Evsukov S.G. Digitalization of the educational environment: opportunities and threats // Bulletin of Plekhanov Russian University of Economics. 2018. № 1 (97). P. 4.

New opportunities and challenges created by the digitalization of the educational environment

Digitalization of the educational environment can occur in various forms[1]:

1) transfer of existing educational materials, including lectures, presentations, textbooks, assignments for independent work and knowledge control tools, into an electronic environment;

2) formation of an interactive electronic environment for interaction between a teacher and students, including the creation of electronic classrooms for teachers, hosting webinars, discussion forums;

3) creation of new types of educational tools: electronic textbooks, electronic problem books, video lectures, quests, computer games;

4) creation of fundamentally new forms of education through the use of the possibilities of the electronic environment - expanding the range of imaginative transmission of information, modeling various situations in the course of role-playing games, imitation of competitive games;

5) inclusion of artificial intelligence capabilities in the learning process.

Today, the process of digitalization of education in the vast majority of educational organizations is carried out mainly in the first two forms.

This makes it easier for students to access educational materials, to reduce the amount of teaching load that has no meaningful value (lecturing in the form of retelling a textbook, seminars in the form of independent problem solving, checking tests by a teacher), to facilitate control over the content of the academic discipline and the educational process. In addition, this process allows you to significantly expand the range of distance learning services.

However, following in the wake of this trend, you can sooner or later lose your place in the education system (in the educational services market), since in this case we are not talking about creating a competitive system of e-education, but about introducing certain computer-based learning opportunities into the educational process. Meanwhile, one cannot but agree with the thesis of Johan Wissema that e-education is "a disruptive innovation that will inevitably weed out inefficient universities, after which a relatively small number of winning universities will benefit from this new technology"[2].

As is known, a disruptive innovation is an innovation that initially seems to most market participants to be niche (significant for a specific niche and has no prospects for the entire field of the market), since the characteristics of a new product that are important for consumers are significantly inferior to existing analogues[3]. But as traditional features improve, new options become more valuable to

[1]See: Ustyuzhanina E.V., Evsukov S.G. Digitalization of the educational environment: opportunities and threats // Bulletin of Plekhanov Russian University of Economics. 2018. № 1 (97). P. 4.

[2]See: Wissema J. Towards the Third Generation University: Managing the University in Transition. - M.: Olimp-Business, 2016. P. 20.

[3]See: Christensen C. The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail. - Boston, MA: Harvard Business School Press, 1997.

consumers, disruptive innovation drives substitute products out of the market, and the companies that make these products become outsiders.

It is to this type of innovation that e-education belongs. Currently, it is significantly inferior to offline education in terms of a number of characteristics that are significant for consumers. However, only those educational organizations that can take their place in the online education market in time and offer the market an ever-improving quality of relevant services have a chance to stay in the educational space in the future.

The benefits of online education include[1]:

1. *Solving the problems of accessibility of education:*

- overcoming territorial barriers to access to knowledge;
- removal of time restrictions - access at a convenient time for the user;

the possibility of fractional access due to the division of classes into blocks;

- access to knowledge from highly qualified teachers.

2. *Expansion of possible choices*:

- the ability to choose a teacher and a way of presenting the material - an emphasis on logic, images (associations) or practice (cases, tasks);
- the ability to choose the method of mastering the material: auditory, visual, through motor skills or interactive participation;
- the ability to choose the depth of assimilation of the material - a wide range of courses;
- the ability to choose a comfortable way to control knowledge: tests, tasks, free essays, projects, interactive interviews with artificial intelligence.

3. *Expansion of forms and tools of knowledge transfer*: the use of project work, group debates, role-playing and competitive games, including with virtual participants, along with traditional lectures-performances and seminars.

4. *Socio-economic benefits:*

- the possibility of forming social intellectual networks according to interests;
- relative cheapness (large investment and low current costs).

The disadvantages of the e-learning system can be divided into two classes:

1) problems inherent in the current level of development of the digital educational environment;

2) immanent shortcomings of the distance learning system.

The main problems of today, which determine the low quality of the existing system of online education, are[2]:

1. *The desire to imitate full-time education, resulting in a deterioration in the quality of the copy compared to the original.*

Digital goods can be divided into 4 groups. The first group includes goods that

[1]See: Ustyuzhanina E.V., Evsukov S.G. Digitalization of the educational environment: opportunities and threats // Bulletin of Plekhanov Russian University of Economics. 2018. № 1 (97). P. 5.

[2]See: Ustyuzhanina E.V., Evsukov S.G. Digitalization of the educational environment: opportunities and threats // Bulletin of Plekhanov Russian University of Economics. 2018. № 1 (97). P. 6-7.

are initially developed in digital format and do not have offline prototypes (software, text, audio and video files that are immediately created in digital format). Replication of these goods occurs by cloning, and each clone is equivalent. The second group is digital copies of already existing goods (digitization of books, films, documents, works of art). In this case, even the most perfect copies are usually valued below the original. The third group consists of digital forms of access to information, including knowledge, and services (registration of rights, online payments, online purchases). Finally, the fourth group is the use of digital images of ordinary goods that do not replace their prototypes, but allow them to be managed more efficiently (flow and stock management based on tracking quantity, placement, speed of movement).

Currently, most of the content included in the electronic educational environment belongs to the second group and is significantly inferior to the best examples of its offline prototype.

2. *Weak quality control of educational products.*

Unfortunately, some modern online courses reflect the low qualifications of the teachers preparing them. Since the educational services market is characterized by a high degree of information asymmetry (education is a typical type of trusted commodity), the consumer cannot always assess the quality of the knowledge offered to him. As a result, instead of transferring knowledge, ignorance is being replicated. This problem can be solved by creating special filters that check the content of educational products before they are placed on the educational platform, including through the use of artificial intelligence or an internal review (expertise) system.

3. *Low interactivity.*

To date, it can be considered proven that the traditional education system based on the triad "understanding - repetition - memorization" is significantly inferior in effectiveness to active teaching methods based on the involvement of the student in the learning process. Studies show that with predominantly passive perception of information, learners retain in memory 10% of what they read, 20% of what they hear, 30% of what they see, and 50% of what they see and hear at the same time. At the same time, with the active perception of information, they retain in memory about 80% of what they said themselves, and 90% of what they did themselves[1].

Unfortunately, at present, the electronic educational environment does not offer very wide opportunities for interaction. The exceptions are specialized forums that appear on certain platforms. However, this drawback is not a consequence of the immanent properties of the electronic educational environment, but of the existing ways of using it.

Technically, nothing prevents the formation of remote interactive communication within the electronic environment, including in real time. Moreover, the

[1]See: Meichner H.E. Corporate trainings. - M.: UNITI, 2002. P. 122.

use of the capabilities of artificial intelligence will allow in the future to organize interactive learning without the participation of other individuals.

4. *Primitivization of competencies.*

This is a general disadvantage inherent in the use of digital technologies as such. The point is that electronic assistants, including calculators, navigators, spellers, dictionaries, accounting and legal programs, atrophy many of the competencies of their users, wean them from building their own holistic picture of the world.

As a result, the roles are changing: former electronic assistants become the central link in the process, and former specialists are gradually turning into operators in the corresponding programs (taxi drivers, accountants, translators, lawyers and even doctors).

Similarly, the possibility of constant use of hints in e-learning reduces the incentives for independent search and aggregation of knowledge, the formation of one's own vision. This problem can lead to disruptive selection - the division of the education system into two streams: the education of generators capable of forming and complicating their own picture of the world, the creation of new knowledge, on the one hand, and the training of operators who skillfully use existing knowledge and software products, on the other. At the same time, it is very important that the task of mass training of operators does not obscure the much more difficult task of growing generators.

At the same time, the most significant inherent shortcomings of the e-education system are[1]:

1. *The problem of socialization.*

Even with the use of interactive forms of education, there is still the problem of educating students, transferring them the skills of social interaction, embedding them in the institutional environment of public life. If formal norms can be taught remotely, then the translation of conventional norms and social values requires the student to be immersed in social interaction, personal example and emotional coercion. Education is a form of teaching conventional norms and conventional roles. A conventional norm is an informal norm (model, custom) of behavior adopted in a given community that allows members of the community to understand each other and coordinate their actions. A conventional role is a representation of a prescribed pattern of mutual behavior that is expected and required from an individual in a particular situation, if the position he occupies in a joint action is known.

Apparently, it is disciplining, including the psychological support of students, that will be the main function of the teacher of the future. In other words, gradually the center of gravity in primary and secondary education will shift from the task of transmitting information to the task of socializing students.

[1]See: Ustyuzhanina E.V., Evsukov S.G. Digitalization of the educational environment: opportunities and threats // Bulletin of Plekhanov Russian University of Economics. 2018. № 1 (97). P. 7.

2. *The problem of transferring implicit knowledge.*

As is known, Michael Polanyi divided knowledge into two categories: explicit (verbalized) knowledge, which can be transferred from one person to another using a system of codes, and implicit knowledge, which is inseparable from a person, but can be transferred to another person in the process of joint activity[1].

The student adopts from the teacher a way of seeing the world, approaches to solving problems, a culture of working with information, the art of generating ideas. All these skills are passed on through personal example in the process of teamwork from teacher to student. Teaching is not only the transmission of facts, but also the art of intellectual search, which requires face-to-face communication with students[2].

Of course, the main part of the context of any course, which is the systematization of accumulated knowledge, can be studied online. But the methods of solving complex problems are better to "learn live". No wonder good teachers prefer to solve problems on the board, refusing to use slides. Even more effective is the method of learning through independent problem solving with the help of a teacher, when the teacher not only helps the student with auxiliary questions and corrects his mistakes, but also evaluates new approaches to solving the problem offered by students.

The problems of socialization and transmission of tacit knowledge make it inexpedient to completely replace traditional education with an electronic educational environment. However, it is obvious that the field of offline education will constantly shrink.

Main characteristics of the digital education market

E-education is a combination of ICT-based distance learning with artificial intelligence. E-learning services are a network good. Network goods have two pronounced economies of scale: the scale of production and the scale of consumption. The scale effect of production for e-education is obvious (the main part of the costs is the investment in the creation of the first copy). As for the economies of scale of consumption, it is more subtle and manifests itself in such factors as improving the quality of educational platforms and the courses presented on them as the number of users of these platforms grows; expanding the possibilities of forming social networks based on subject interests on the basis of educational platforms; enhancing the image of education through a first-class educational platform.

The study of the patterns of functioning of markets for network goods is currently in its infancy. However, some of their characteristic features can already be noted[3]:

[1]See: Polanyi M. The Tacit Dimension. Garden City. - New York: Doubleday, 1966. - 102 P.

[2]See: Bromwich D. Trapped in the Virtual Classroom // The New York Review of Books. 2015. July 9.

[3]See: Ustyuzhanina E.V., Evsukov S.G. Digitalization of the educational environment: opportunities and threats // Bulletin of Plekhanov Russian University of Economics. 2018. № 1 (97). P. 8.

- high investment costs act as barriers to entry into the market, determining its oligopolistic nature;

- high investment and current fixed costs necessitate the achievement of significant sales volumes to ensure the level of payback;

- the increase in the value of a network good as the number of its consumers increases contributes to actively stimulating its distribution at the initial stage of bringing the good to the market, including through dumping prices. As the critical mass of consumers is approached, the price of the network good increases;

- a high level of competition requires the constant development of new improved versions of the product, constant updating of content;

- the rapid obsolescence of goods due to the appearance of substitutes leads to the deployment of competition in terms of product quality.

All these features are also characteristic of the e-education market. Therefore, timely entry into this market with a competitive product is so important. In doing so, two questions need to be answered:

1. Which structures will be the leading players in the future market of educational services: universities or independent educational platforms?

2. What characteristics of the product will become decisive during the intensification of competition?

Currently, educational platforms exist in two main forms: local (intrauniversity) and independent (interuniversity). At the same time, most universities consider independent educational platforms as a way to promote their courses and their brand. Meanwhile, the process of uberization, i.e. the transformation of platforms into leading market players, may become the main one for the education system in the not too distant future.

According to J. Wissema, the leading universities of the future will turn into centers of international research hubs, cooperating with other universities, research organizations and the state, as well as commercial companies in terms of applied research[1].

At the same time, it is possible that in the future, not universities, but digital educational platforms will become the central links of educational networks. However, their market power may be significantly less than the power of digital platforms in the field of trade or the provision of conventional services, since the courses presented on them will need to be constantly updated due to the permanent increase in knowledge. In other words, the most likely future of the education system is presented in the form of a division of three core competencies between leading universities, global educational platforms and companies producing ready-made educational products[2]:

[1]See: Wissema J. Towards the Third Generation University: Managing the University in Transition. - M.: Olimp-Business, 2016. P. 36.

[2]See: Ustyuzhanina E.V., Evsukov S.G. Digitalization of the educational environment: opportunities and threats // Bulletin of Plekhanov Russian University of Economics. 2018. № 1 (97). P. 9.

- leading universities generate new knowledge, develop fundamentally new educational products and implement the training of research personnel mainly in the form of joint creative work;

- manufacturing companies offer lines of ready-made educational products that differ not only in the subject and depth of presentation of the material, but also in the way it is transmitted (audience segmentation according to preferences in perception);

- global educational platforms broadcast finished educational products, including in the field of higher education, for the consumer.

The position of the educational platform in the hierarchy of the educational space will be determined by such factors as the quality and variety of educational products (specific courses), the breadth of choice, the ability to design the content of the educational program, ease of navigation and interface, and the prestige of the certificate. At the same time, along with educational platforms offering a line of prestigious high-quality education, there will be platforms that meet the demand for lower-quality educational products. Similarly, along with leading universities that are centers of international research hubs, there will be local educational organizations that are part of the network of one or another hub.

As already noted, the currently offered digital educational products are mostly copies of their offline prototypes. On the best educational platforms, the corresponding copies have certain advantages over the average level of conventional educational products[1]:

- as a rule, lectures by first-class teachers are offered;

- lectures are divided into mini-blocks, allowing you to master complex topics in stages and manage the time of mastering the material;

- there is the possibility of multiple viewing to clarify obscure places;

- there is a choice for studying the same discipline with different teachers;

- the competent use of visual effects, including animation and excerpts from films for illustration, helps to better assimilate the material.

At the same time, at present, even the best online courses are significantly inferior to the best face-to-face educational products due to the lack of the effect of introducing creativity. Digital imitation of traditional courses leads to the impoverishment of communication tools, the exclusion from practice of such forms of obtaining knowledge as its personal processing in the process of taking notes, discussion of contentious issues among students and with the teacher, individual adjustment by the teacher of the knowledge and skills of the student in the process of solving problems, playing role-playing games. That is, in order to occupy a significant market share and compete with their offline counterparts, not only in terms of accessibility, digital educational products must change dramatically. Own

[1]See: Novikova E.S., Sigarev A.V. Education in the digital age: opportunities and threats for the economy // Economics: yesterday, today, tomorrow. 2019. V. 9. № 6A. P. 171-179.

means and own languages of knowledge transfer, own forms of material presentation, own ways of including students in the educational process should be created.

This can be done through the division of labor. At present, a good teacher must simultaneously play several roles: a scientist who generates new knowledge; a writer who systematizes and presents knowledge in an accessible way for his students; theater director, staging performances of classes; actor playing the main role (lecture); discussion moderator (seminar); artist (slide production); editor (selection and combination of excerpts from an existing film library). Naturally, some roles are better for one person, while others are worse. At the same time, if part of the numerous functions of preparing and conducting a good course is divided among different specialists, the quality of the final product can be significantly improved.

Problems and challenges for the Russian education system

The main threat of digitalization of education for Russia is to be on the periphery of the global educational environment. This threat can be realized as a result of several factors: belated entry into the global market; inadequate product quality; language barrier; voluntary inclusion of leading Russian universities into the orbits of already existing global networks as satellite partners.

Delay in entering the global market.

It may be a consequence of the illusion of the significance of the scale of the domestic market, the possibility of maintaining educational autarchy. Today, the majority of Russian households are in demand for domestic education. The argument in favor of this position is the poor knowledge of the English language by our population. However, it is already possible to find free language courses on the Internet, and in the future the offer of the relevant educational service will only expand. For English-speaking educational organizations, this product will be a stimulating good that will ensure an increase in demand for their main products.

Thus, with the development of e-education, the market for educational services is becoming increasingly global. At the same time, it is necessary to understand that an untimely entry into any market causes enormous difficulties in achieving a significant position in its hierarchy. And we are talking not only about the fact that it is always much easier to conquer a significant market share at the stage of its formation (growth), but also about the fact that the dominant players set their own standards and their own rules of the game in their field of the market, preventing changes in the hierarchy of this field[1].

Inadequate quality of existing products. It is due to the underestimation of the opportunities created by the joint use of ICT and artificial intelligence. So far, even the best Russian courses are an imitation of face-to-face classes, a way to expand the audience using the Internet. If work on creating our own e-learning language does not begin soon, we risk being at the forefront of this trend.

Meanwhile, it is in the direction of the creative expansion of tools for creat-

[1]See: Fligstein N. The Architecture of Markets: An Economic Sociology of Twenty-First-Century Capitalist Societies. - M: Higher School of Economics Publishing House, 2013. - 392 P.

ing educational products that we can have obvious advantages. Due to its cultural identity, Russia has always been distinguished by innovation in the fields of art, including painting, theater, cinema and literature, as well as significant achievements in the field of abstract sciences, especially mathematics.

Language barrier. Even teachers who know English well, which is gradually becoming the common language of elite education (an analogue of Latin for medieval universities), in most cases are inferior to native speakers both in terms of ease of use and in terms of perception by listeners (emphasis, intonation errors, humor quality).

Voluntary acceptance of a peripheral position. In the Russian intellectual community, two ideas amazingly coexist with each other: a sense of one's own uniqueness and reverence for Western models. For more than 20 years, the leadership of the system of Russian education and science has been constantly trying to reform the system of domestic education by implanting Western institutions and introducing a system for assessing domestic achievements using dubious measurement techniques (number of publications in Scopus & WOS systems, Hirsch indices). In other words, we ourselves accept the rules of the game, obviously beneficial to those who are their developers. In such a system of coordinates, many Russian educational organizations, realizing the globalization of the educational environment, can begin to "line up" to take the place of satellites in international educational hubs, and eventually turn into another "assembly site" of transnational corporations.

Meanwhile, one cannot but agree with Academician S.Yu. Glazyev that the transition to a new technological order gives our country unique chances to change its position in international value chains[1]. The education system is the field where we still have chances. The education system is the "bridge" that should provide not only the Russian economy, but the whole society with a confident transition to the digital era, associated with new types of labor and a sharp increase in the creative capabilities of a person, a rise in his productivity.

2.5. Risks and chances of the digital economy for subjects of economic relations.

As already noted, the digital economy as a new qualitative phenomenon is still not fully studied and understood, although it has been developing for more than 30 years. From the standpoint of theoretical research, such slowness is common and not surprising, but from the standpoint of the legal regulation of the economy, the delay is not only extremely unacceptable, but also dangerous. Unfortunately, it is the lag in the development of modern economic theory, the insufficient assess-

[1]See: Glazyev S.Yu. Economy of the future. Does Russia have a chance? - M.: Knizhny Mir, 2016. - 640 P.

ment of the risks and chances that accompany the digital economy, that create the prerequisites for making erroneous decisions in the field of its legal regulation.

In this regard, it is advisable to analyze the risks and chances that the development of the digital economy brings.

So, let's consider the risks of the digital economy.

• *Extreme dependence of economic agents on the Internet.* Violation of the normal functioning of the telecommunications infrastructure can completely paralyze the functioning of various systems at all levels of the economy. The Global Report of the World Economic Forum notes that one of the most dangerous risks for humanity is a critical failure of the information infrastructure[1] .

In the financial sector, digitalization has gone very far. Therefore, it is one of the most vulnerable elements of the economic system for the implementation of this risk. In addition, it should be noted the formation of the psychological dependence of the population on the network, the emergence of the phenomenon of "clip thinking", the difficulty in perceiving reality in a huge amount of information, much of which is false and/or manipulative.

• *Digitalization, involving the development of robotics and artificial intelligence technologies*, creates risks for workers, especially for people with low and medium skill levels. A number of professions are expected to disappear, unemployment will rise, and social guarantees for workers will be reduced.

The PWK report, released in 2017, cites the share of jobs at risk of automation in different countries by 2030: in the US - 38%, in Germany - 35%, in the UK - 30%, in Japan - 21%. World Bank experts cite even more ominous figures for developing countries - up to 2/3 of all jobs in the coming years can be automated[2]. Domestic scientists predict that by 2030 57 "traditional" professions will disappear in our country, but 186 new ones will appear[3] .

• *The backlog of the education system from the needs of the digital economy.* Standardization of the educational process, on the one hand, ensures the unification of educational programs and the training of specialists with a predictable set of knowledge, skills and abilities. On the other hand, the education system remains extremely inertial, unable to respond to the constant and significant changes caused by digitalization and other results of scientific and technological progress. There is a need for a transition to a more flexible system of personnel training, adaptation of educational programs to the modern realities of the rapidly transforming labor market.

An important element in the training of young specialists should be the formation in them of the habit and need for constant self-education, obtaining not only

[1]See: The Global Risks Report 2019. The World Economic Forum. URL: https://www3.weforum.org/docs/WEF_Global_Risks_Report_2019. pdf (appeal date: 02.10.2020).

[2]See: Sadovaya E.A. Digital Economy and a New Paradigm of the Labor Market // World economy and international relations. 2018. V. 62. № 12. P. 35-45.

[3]See: The Atlas of New Professions. Agency for Strategic Initiatives and MSM "Skolkovo". 2019. URL: https://www.atlas100. ru/index/ (appeal date: 02.10.2020).

skills, but also knowledge, as well as readiness to change professions during a long working life. One of the most valuable qualities is the worker's adaptability to rapidly changing working conditions.

• *Digital Divide.* As in the result of previous industrial revolutions, the development of the countries of the world within the framework of the Fourth Industrial Revolution will occur unevenly. As a result of the development of digital technologies, the division of the world into the center and the periphery will further intensify. Inequality in development will continue to increase at the regional level due to differences in the quality of regional human capital, financial opportunities, and the level of infrastructure development. Similar phenomena are observed in China, where the level of development of the digital economy in the eastern and southwestern regions differs by a factor of two[1]. The state of California can be cited as an example, which surpasses the rest of the US states in terms of GRP and is the center of information technology development[2].

At the micro level, digital inequality manifests itself between citizens, taking into account their age, gender and educational characteristics.

• *Oligopolization in the information market.* At each stage of the development of the economy and society, there are key economic resources and dominant social groups. In a post-industrial society, such roles have been acquired, respectively, by information, as well as the owners and top management of companies associated with data processing. They enter into confrontation with the "old" industrial and especially financial elite. In a post-industrial society, the main advantage of modern high-tech companies is the ability to accumulate and process huge amounts of information about the most diverse aspects of the activities of individuals and legal entities using the Internet in one way or another. This opportunity has emerged as a result of the widespread use of telecommunication technologies and personal electronic devices with constant online access[3]. As a result, IT companies have tools to actively influence the decision-making process of economic entities. Such companies are able to offer potential customers those goods and services, the desire to possess which may not even be fully realized by the consumer. These companies have the ability to shape public opinion and influence political processes. Thus, a class that has intellectual dominance acquires power over other citizens, who in certain cases lose their subjectivity in decision-making.

Based on historical experience, it can be assumed that the information market (as an economic resource) will undergo oligopolization processes, which will manifest itself in the concentration of production factors in the hands of a relatively small number of owners of huge and powerful IT companies, as well as in the

[1]See: Zhang D. The current state of the digital economy in China and the prospects for cooperation between China and Russia in the field of the digital economy // Power. 2017. V. 25. № 9. P. 37-43.

[2]See: California - territory of vanishing middle class. Vesti. Economy. 26.10.2018. URL: https://www.vestifinance. ru/articles/109254 (appeal date: 02.10.2020).

[3]See: Linnikov A.S. Some features of information as an economic resource in modern society // Education and law. 2018. № 4. P. 52-60.

concentration of data (and, accordingly, processed information) in the data centers of these companies. In our opinion, a negative scenario for the development of the digital economy may also be the excessive use of technology by the state to control and suppress citizens.

• *Reduction of possibilities of state control of the digital economy,* given the trend towards the formation of horizontal links between economic entities, bypassing the traditional channels for the exchange and consumption of goods and services. Decentralization and anonymity, which are characteristic features of many relations in the information society, tempt economic agents to avoid fulfilling obligations to the state, create a false illusion of its uselessness, and provoke behavior according to the "free rider" model. The state should stop such facts, but at the same time, prohibitive regulation will be ineffective, as it will create difficulties for law-abiding citizens and entrepreneurs, but will not solve the problem of circumvention of the law by violators. Therefore, it is necessary to look for new ways to determine the tax base for entrepreneurs who build their business through direct horizontal links. Also, the state should ensure maximum transparency in the process of spending budget funds, which will lead to the awareness of the population of the need and social utility of paying taxes.

• *The use of modern technologies for analyzing big data,* as well as the active collection of a wide variety of information about users by various companies, leads to them obtaining significant advantages over consumers. The result of this is personalized advertising, the artificial formation of public opinion, the imposition of services. Also dangerous is the diversification of citizens in terms of their level of well-being and solvency based on the analysis of their digital identity, which leads to a selective approach in providing them with services and even rights. An example is the experience of the PRC in using a social rating system that divides people into groups whose members have different rights and opportunities. Such experiments are completely anti-democratic in nature and demonstrate the possibility of using modern technologies to return to an archaic type of society.

• *Attempts to establish prohibitions on the use of financial technologies themselves,* rather than legal regulation of their use as a consistent development of previously formed legal approaches. The complexity of the problem creates a temptation to solve it by simple and crude methods, primarily of a prohibitive nature, which ultimately creates new problems, worsens the general conditions for doing business in the country, and leads to the growth of the shadow sector of the economy. An example is the prohibitive regulation of the cryptocurrency market. Nevertheless, it should be recognized that their regulation should be carried out in a civilized manner and reflect a clear pragmatic position.

• *The backlog of legislation and law enforcement practice from the rapidly changing realities of the digital economy.*

Of course, a significant part of crimes is currently committed using information and telecommunication technologies, but they are quite traditional in nature

(fraud with bank payment cards, distribution of drugs through the network, etc.). But digitalization has led to the emergence of crimes in which the impact is aimed directly at automated computer systems, the classification of acts in which (for example, as fraud) is significantly difficult. It can be assumed that as the development of digital technologies and their application in the economy accelerates, this gap will only increase, expanding the opportunities for actual criminal activity in the time lags that form between the start of the criminal use of new technologies and the emergence of legislative tools to prevent such activity.

• *Increasing risks of cybercrime in the context of the development of the digital economy.* Of particular note is the importance of developing information security technologies. The widespread use of information technologies and the digitalization of various fields of activity create the effect of "cumulation" of risks in the conditions of the functioning of many interconnected complex systems. The already mentioned report "The Global Risks Report 2019" notes that there are quite probable and serious risks: "critical destruction of information infrastructure", "IT fraud and data theft", as well as "cyberattacks". The activities of cybercriminals are dangerous for several reasons.

Firstly, it is transnational in nature, which makes it much more difficult to combat it even without taking into account the factor of multi-level anonymization of the criminal's personality, which is achieved using modern technologies. Secondly, the object of attacks by cybercriminals is information, which is an important "resource" of a post-industrial society. Destruction, theft and compromise of information can lead to extremely negative consequences for both citizens and companies, as well as for states. Thirdly, infrastructure and production facilities are increasingly being targeted by cybercriminals and cyberterrorists. The spread of cyber-physical systems and the high level of interaction and interconnectedness of various objects through information and telecommunication technologies make them extremely vulnerable to cyberattacks. Fourthly, the cost of resources for committing cybercrime is incomparable with the possible damage from them. Fifthly, often the activities of cybercriminals are not of a pronounced institutional nature, they may not be built into the system of "traditional" organized crime, which complicates the activities of law enforcement agencies.

Management of challenges and threats, further risks, is an integral element of the overall management system for the development of the digital economy. The complexity of managing this element lies in the fact that it is necessary to develop and have a clear forecast at what stage in the development of the digital economy the direct appearance of challenges and threats is possible and, most importantly, which ones. This process is called risk identification and includes:

- analysis of plans and the current state of development of the digital economy of the object;
- identifying the nature of the manifestation of economic, technological, social and organizational factors in the development of digitalization;

- analysis of the composition of participants of all interested parties, the consistency of their actions to develop the digital economy;

- determination of the degree of integration of organizational, financial and labor resources of all participants in the development of the digital economy

- identification of existing and forecasting potential risks associated with the state of the facility or plans for the development of the digital economy.

An assessment of the likelihood of manifestation and consequences of the impact of each type of risk, the development of proposals and measures to eliminate the negative impact on the development of the digital economy are the next steps when choosing a risk management scheme. For this, various groups of risk management methods can be used: risk avoidance, dissipation (distribution), retention with subsequent risk reduction, risk transfer, compensation, and others. The developed risk management scheme is further coordinated with the program (plan) for the development of the digital economy of the object and is divided into three levels of management - strategic, operational and tactical.

Let's also consider the chances of the digital economy:

• *Favorable processes in the labor market.* As already mentioned, digitalization leads not only to the disappearance of jobs and professions, but also to the emergence of new ones. Opportunities for remote work are also expanding, which will lead to greater employment opportunities for residents of remote and depressed areas, as well as for people with limited mobility. The creation of network structures that function distributed and do not need offices will lead to companies saving on rent and will reduce the time spent by employees on the road. Such transformations in the labor market require reforms in the field of labor legislation, for example, in terms of accounting for working hours, control over its duration, working hours, part-time work.

Researchers also note an interesting phenomenon of returning the production of a significant part of consumer goods and services to the household through the improvement of household appliances[1]. Such an observation is also evidence of some decentralization of the modern economy within the framework of the concept of joint consumption.

• *Using the concepts of the Internet of things and big data to improve the efficiency of economic activity and reduce uncertainty.* The creation of "smart" systems, automation of processes in various fields of activity, which consists in the collection and processing of significant amounts of data by machines, as well as the exclusion of a person from routine activities, will increase the efficiency of using economic resources and reduce the impact of uncertainty in decision-making. The use of industrial Internet technology will have a positive impact on the functioning of most sectors of the national economy. The development of the concept of "smart cities" and "smart houses" will ensure more efficient use of resource-

[1]See: Ustyuzhanina E.V., Sigarev A.V., Shein R.A. Digital Economy as a New Paradigm of Economic Development // Economic analysis: theory and practice. 2017. V. 16. № 12. P. 2238-2253.

saving technologies, favorably affect the quality of the urban environment and the lives of citizens, and increase the level of public safety.

• *Development of security and risk management technologies.* The development of digital identity technologies and blockchain will ensure the security of the activities of economic entities, reducing transaction costs, reducing the impact of asymmetric distribution of information, reducing the uncertainty factor. The use of drones, robots and artificial intelligence systems will reduce the need for human participation in hazardous activities, reduce the risk of the "human factor", and automate public security systems.

• *Automation of industry and services, as well as the development of 3D printing and other additive manufacturing technologies.* Robotics and artificial intelligence are reducing the need for labor resources in an environment of mass production and standardization of service delivery. At the same time, the development of additive manufacturing technologies opens up opportunities for product customization, which is likely to lead to a return to the creative approach to production, increasing the demand for highly skilled workers capable of creating unique products in accordance with the specific needs of the customer.

• *Possibilities of almost endless segmentation and restructuring of the digital economy due to the constant emergence and disappearance of its elements (niches).* Such flexibility expands citizens' opportunities for self-realization and self-sufficiency, which contributes to economic growth and reduces the social burden on the state. In addition, the emergence of new niches creates additional opportunities for the development of small and medium-sized businesses, as well as the implementation of start-ups. In this regard, an important postulate of legal creativity should be the creation of favorable conditions for the emergence and development of new niches of the digital economy.

• *Reduction of transaction costs*. One of the characteristic features of the digital economy is the reduction of the role of intermediaries through the creation of digital services (for example, electronic trading platforms) that provide direct contact between the supplier and the buyer of goods or services. At the same time, the location of counterparties, language barriers, currency differences cease to have a significant impact on the economic relations of various entities.

• *Improving the quality of public electronic services for both business and the public.*

Governments around the world are increasingly moving to digital technologies, and in developing countries, the number of IT-intensive jobs is higher in the public than in the private sector. By 2014, all 193 member states of the United Nations (UN) had national websites: on 101 of them, citizens could create online personal accounts, on 73 - to file income tax returns, on 60 - to register a company. In terms of the most common core government administrative systems, 190 UN Member States have implemented automated financial management, 179 have used such systems for customs clearance, and 159 for tax administration. Of these,

148 have implemented some form of digital identity, and 20 have established multipurpose digital identity platforms[1].

Thus, the above list of risks and opportunities that accompany the process of formation and development of the digital economy is not exhaustive. Ignoring the above risks and chances for the development of the digital economy is accompanied by the threat of errors in planning and decision-making in the field of economic regulation, both at the legislative and executive levels of government. It is also necessary to pay close attention of scientists from various fields of science to the changes in society that accompany the development of digital technologies.

2.6. Technologies for ensuring information security of economic systems in the context of digitalization of the economy.

In the modern economic system of any country, the most important aspect is the digitalization of the economy and ensuring its security at all levels. The digital economy is an economic activity focused on digital and electronic technologies. As world experience and international practice show, in terms of ensuring economic and information security, special attention is paid to protecting public and private interests (fig. 12)[2].

At this stage of time, in many countries of the world, work is underway to adopt laws on electronic commerce and electronic documents, since one of the most important areas for ensuring information security is the protection of electronic documents and electronic commerce. The main tasks in this area include[3]:

- expansion of the legal field;
- equal use of electronic forms of information along with other types of media;
- reduction of the number of restrictions and barriers to the creation, dissemination and use of information products and technologies.

[1]See: World Bank World Development Report "Digital Dividends". 2016. URL: https://openknowledge.worldbank. org/ (appeal date: 04.10.2020)

[2]See: Bareiko S.N., Kozhukhina K.A. Economic and information security of Russia in the digital economy // Krasnoyarsk Science. 2019. V. 8. № 5. P. 14.

[3]See: Bareiko S.N., Kozhukhina K.A. Economic and information security of Russia in the digital economy // Krasnoyarsk Science 2019. V. 8. № 5. P. 14.

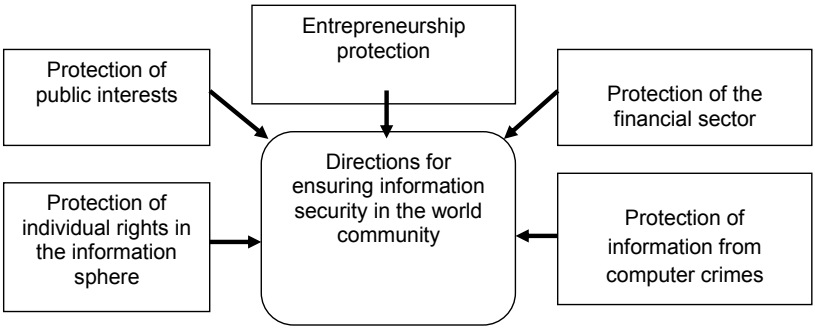

Figure 12. *Directions for ensuring information security in the world community*

The modern competitive economy, based on the use of new information systems and technologies, the development of control systems based on digital platforms, the use of blockchain technologies and the Internet of things, the analysis of big data, generates a variety and number of information security threats[1].

Analysts at IDC predict that spending on information security (IS) will grow more and more every year in the world. This is often associated with the following[2]:

- commercial companies and other organizations are aware that information security is just as much of a resource as technology and means of production, so the cost of building an information security system will now be considered as an investment;

- the financial stability of the company is ensured by information security, therefore, companies are constantly required to make more and more active investments in ensuring the security of both information and infrastructure;

- expenses are needed to develop a comprehensive information security strategy, inventory and improve their assets in information technology, threat response strategies, and fight ransomware epidemics;

- the growth rate of spending on information security is related to the internal policy of the state, which has proclaimed a course towards the development of the digital economy, which includes all areas: from healthcare and education to transport and finance;

- a continuing shortage of skilled professionals and regulatory changes such as the General data protection regulation (GDPR) are fueling further increases in cyber security spending;

- one of the key factors driving the increase in information security spending is the introduction of new methods of detecting and responding to threats;

[1]See: Udalov D.V. Threats and challenges of digital economy // Economic security and quality. 2018. № 1. P. 12-18.

[2]See: Makhalina O.M., Makhalin V.N. Digitalization of business increases the costs of information security // Management. 2020. № 1. P. 136.

- the main driving force behind the rise in cyber security spending is IS risks (cyberattacks and information leaks) that can harm companies associated with the costs of restoring their normal functioning.

Experts predict a more active annual growth in companies' spending on information security. At the same time, reasonable questions arise: what is the limit of this growth; what level of average costs for information security will be optimal for large companies; what is the average damage to companies from various cyber security incidents; how much companies should spend on their information security.

Experts predict a more active annual growth in companies' spending on information security. At the same time, reasonable questions arise: what is the limit of this growth; what level of average costs for information security will be optimal for large companies; what is the average damage to companies from various cyber security incidents; how much companies should spend on their information security. These can be both absolute and relative indicators that characterize the global costs of large commercial companies, banks, financial organizations and other global costs for information security, which experts can represent in various segments (directions)[1].

The costs of information security are formed under the influence of many factors, the most important of which are cyber threats. Cybercriminals, depending on the object of attack, set goals and objectives, determine the type, ways and methods[2]. Let's consider this process on the example of industrial companies. Ensuring the cyber security of industrial companies is currently the most acute problem. This is due to the growing number and complexity of cyber threats and the lack of clear ways to deal with them. The most significant options for cyber threats, depending on their goals and the specifics of the company's activities, are as follows[3]:

- company computer network hackers are trying to steal technical and economic information about the product being developed from a competitor company;

- criminals, using an encryption virus, can try to stop the work of the company, disable emergency protection;

- cybercriminals can manipulate the price of securities quotes of the required company on exchanges;

- industrial fraud, which is fraud in the field of information technology, in particular, unauthorized actions and unauthorized use of resources and services in networks;

[1]See: Udalov D.V. et al. State policy in the field of ensuring national security: economic and legal aspect: monograph / Gen. ed. S.Yu. Naumova, B.V. Chernyshev. - Saratov: Saratov Socio-Economic Institute (branch of the Plekhanov RUE), 2016. - 284 P.

[2]See: Makhalin V.N., Makhalina O.M. Management of calls and threats in the digital economy of Russia // Management. 2018. № 2. P. 57-60.

[3]See: Ivanov O. Information security in numbers // Anti-Malware.ru [Electronic resource]. – Access: https://www.anti-malware.ru/analytics/Threats_ Analysis/2018-cybersecurity-statistics (appeal date: 12.02.2020).

- other cyber threats, such as: hidden cryptocurrency mining in the technological segment, the presence of malicious software waiting for an activation order from a command center from another country.

Let's consider what types of cyberattacks are most common in the world, how they are carried out, where they come from and what damage they cause to companies and organizations[1]:

- a higher percentage of ransomware detections was recorded in countries with the most accessible Internet for the population. The USA holds the first place among them with 18.2% of all malware attacks of this type;
- the famous Ramnit trojan has largely affected the financial sector. In 2017, 53% of Ramnit attacks targeted this industry;
- the majority of malicious domains (about 60%) are associated with spam campaigns;
- 74% of companies have more than 1000 outdated sensitive files;
- malicious programs and network attacks - two types of attacks, most financially damaging for companies. Organizations have spent an average of 2.4 million dollars to protect against them;
- the financial services industry values everything related to cybercrime to the maximum; on average, the company is charged 18.3 million dollars.
- Microsoft Office files (for example, Word, PowerPoint and Excel) represent the most common group of malicious extensions - 38% of the total;
- about 20% of malicious domains are completely new, they are used about a week after they were registered;
- more than 20% of cyberattacks in 2017 were committed from China, 11% from the USA and 6% from Russia;
- the largest percentage of applications with cyber security problems are the so-called lifestyle applications. Of these, 27% are malicious. Among music and audio apps, malicious are 20%;
- most often, malicious applications leak phone numbers to attackers (63%), the second place is the location of the device (37%);
- in the period from 2015 to 2017, the USA suffered the most from targeted cyberattacks - 303 large-scale attacks were registered;
- among the most detected malware are Heur.AdvML.C, Heur.AdvML.B and JS. downloader.

In Russia, in connection with the transition to a digital economy, the number of cyber threats is growing sharply. In total, in 2018, more than 4.3 billion computer attacks on critical information infrastructure were detected in Russia, of which over 17 thousand are the most dangerous computer attacks. Around the world, the damage from cyber security incidents is constantly growing. Companies have to take various preventive measures to be prepared to deal with emerging new

[1]See: Makhalina O.M., Makhalin V.N. Digitalization of business increases the costs of information security // Management. 2020. № 1. P. 138.

threats, and this is associated with a significant increase in the cost of protecting against cyber threats[1]. The average costs of companies to eliminate the consequences of only one cyber incident in Russia, for medium-sized businesses, is about 1.6 million rubles, and for the large business segment - 16.1 million rubles. Under these conditions, companies need to understand that their information security costs are not a negative factor that reduces the degree of economic efficiency, but must be considered a strategic investment that ensures the continuity of their business processes and that creates advantages in an era of rapidly evolving cyber threats. However, the sources of these costs need to be carefully selected and analyzed[2].

In the context of high digital interdependence between various economic entities, the creation of a secure information environment is becoming an integral element in the formation of a sustainable digital economy[3]. In terms of information security, the least controlled areas among the many digital technologies are big data, the Internet of things and artificial intelligence technologies. Already, companies such as Amazon, Apple and Google have formed digital platforms using artificial intelligence, and the social networking site Facebook has launched DeepTex technology, which has the ability to recognize user behavior trends by their messages[4]. The potential benefits of these digital technologies are certainly significant, but their implementation creates threats to the security of the public's personal information, and the slightest data leak undermines confidence in innovation and the economy as a whole.

Concern about the consequences of the loss of personal information is related to the presence of cases of data theft, directly or indirectly related to digital technologies. A significant part of the incidents is related to the violation of the policy of confidentiality, integrity and availability of information that underlies socio-economic activity in a digital environment. These violations over time become more large-scale, frequent and difficult in terms of eliminating their consequences. Information security breaches also occur due to the fraudulent activities of organizations to which users have provided personal information. Information leakage in this case occurs due to misleading users about the offered products, services and conditions for their purchase, as well as due to the low level of information protection on certain online platforms.

The increase in the number of information security violations in the context

[1]See: Ostroglazov A., Lipov D. How to increase the cost efficiency of financial organizations for cyber security // Bankir.ru [Electronic resource]. – Access: https://bankir.ru/publikacii/20181105/kak-povysit-effektivnost-zatrat-finansovykh-organizatsii-na kiberbezopasnost 10009623/ (appeal date: 12.02.2020).

[2]See: Mamaeva L.N. Characteristic problems of information security in the modern economy // Information security of regions. 2016. № 1. P. 21-24.

[3]See: Mayer R.C., Davis J.H., Schoorman F.D. An integrative model of organizational trust // The Academy of Management Review. 1995. Vol. 20. № 3. P. 709-734.

[4]See: Digital Economy Outlook. OECD. 2017.

of the digitalization of the economy is associated with the constant complication and growth in the use of digital technologies. In recent years, both large and small companies have faced more frequent and more severe information attacks on businesses[1]. Digital technologies used in a company are gradually becoming the main value of the company, so cases of industrial espionage for political or economic purposes are not rare.

Assessing the economic consequences of information attacks is very difficult, some companies try not to report information security violations, if it is not related to the legal consequences of theft of trade secrets. We can say that the loss of data leads to many negative results: damage to business reputation, loss of competitiveness, financial loss in case of fraud, disruption of production plans, deliveries, as well as increased costs due to the need to restore lost information.

One of the key problems in the information security system in the digital economy is the low level of information security culture. Employees are not always aware of the risks of losing economic information, in addition, it should be noted that the largest percentage of leakage falls on internal employees, it is internal employees who in most cases are involved in the loss of information.

In the modern conditions of the digital economy, each company must regularly assess the level of its information security, answering the following questions[2]:

1. How rationally are financial resources distributed between the company's staffing and digital technologies aimed at data protection? It is important to consider that hiring new staff without increasing digital awareness of the existing one is an ineffective way to improve the company's information security. Also, digital technologies are constantly being improved, and in order to maintain competitiveness in the market, it is important to use all the available opportunities provided by modern data protection tools.

2. Is the importance of certain measures to ensure information security correctly assessed? Determining the levels of information security of data will help to optimally evaluate the contribution of various information security tools.

3. Has the company created conditions for the introduction of modern digital technologies for information protection? The use of new technology should be preceded by planning and creating conditions for its effective use, which will reduce the number of failures and errors, and, therefore, reduce the cost of establishing the process of technology functioning.

4. How rationally is information security ensured throughout the entire chain of services or work? The company interacts with many counterparties with which it exchanges data, so it is important to analyze the security of information transfer to other economic entities.

[1]See: Managing digital security and privacy risk // OECD Digital Economy Papers. 2016. № 254.

[2]See: Asaul V.V., Mikhailova A.O. Ensuring information security in the context of the formation of the digital economy // Theory and practice of service: economics, social sphere, technologies. 2018. № 4 (38). P. 7.

5. Does the company's management effectively cope with the tasks of ensuring information security? Company management is the most important element in the formation of information security, since the success of the implementation of measures largely depends on the coherence of the actions of employees.

Increasing the information security of companies can be ensured through a multi-stage analysis of emerging threats[1]:

Stage 1: analysis initiation. At this stage, based on the analysis of emerging information threats, the need to revise the methods adopted in the company to ensure the safety of data is determined. As a rule, partial implementation of existing information protection measures is detected, and the development of internal company standards for optimal data protection is also required.

Stage 2: process management. Ensuring information security is divided into separate processes, responsibility for each of them is distributed.

Stage 3: implementation and control. The process of ensuring information security is integrated into the business model, consistent with the company's development strategy, control over the implementation of the measures taken is carried out, and the effectiveness of innovations is evaluated.

Stage 4: forecasting. Determination of the need to adjust the measures taken to ensure information security, further implementation of digital technologies in order to more fully cover possible threats.

Stage 5: optimization. Continuous improvement of the information security system is carried out; data protection is becoming a fully automated process, integrated into all areas of the company's activities.

In the context of the formation of the digital economy, information security issues should be considered not only at the level of individual companies and organizations, but also at the state level.

Thus, the digital transformation carried out in many sectors of the economy has led to a change in the scale of activities of economic entities and new risks and threats that the world has not encountered before. The formation of the digital economy largely depends on information security: the emergence of threats to the safety of digital data is becoming one of the main areas of security, both at the state level and at the level of individual organizations and citizens. At present, attacks on data storage systems are becoming more complex and frequent, so information security issues should be a priority in maintaining the sustainability of the economy.

[1]See: Asaul V.V., Mikhailova A.O. Ensuring information security in the context of the formation of the digital economy // Theory and practice of service: economics, social sphere, technologies. 2018. № 4 (38). P. 7-8.

CONCLUSION

The digital economy - is a new type of economic relations that is already present in all sectors of the world market and is actively developing. Business digitalization, which began with local intra-company and corporate projects, is gradually acquiring a global scale, and major digital business players have taken the lead in the world. Just as the economy and society as a whole develop unevenly, their digital transformation is also uneven. Politics, legal norms, traditions and culture, the achieved level of economic development, the development of education and its own technological base, as well as many other factors play a significant role in shaping the digital economy of a country. At the same time, the digital economy is inherently inter- and transnational. Therefore, despite the desire to protect the national digital space, which is demonstrated by the governments of many countries, at the same time there is an opposite trend associated with the unification of technical standards and regulations in this area.

The explosive growth of social networks, the increase in the number of smartphones, the facilitation of broadband Internet access, the spread of machine learning and artificial intelligence technologies are changing the modern world. The digital transformation of organizations, both commercial and non-commercial (including government ones), is a reaction to the development and active dissemination of new information digital technologies around the world. The effective development of markets in the digital economy is possible only in the presence of advanced technologies, so measures to stimulate it should be focused on two directions. The first - institutions; their restructuring and modernization is required to create conditions for the development of the digital economy (regulatory management of digital markets and digital production, training of personnel with digital competencies). The second - the technical infrastructure (data transmission networks, data processing centers, software services), the creation of which requires not only significant efforts, but also investments. Automation of production, big data and artificial intelligence, the use of which has become possible thanks to digital technologies, are transforming production processes and models of industrial and technological cooperation, speeding up and reducing the cost of producing various products, performing work and providing services. This makes it possible to open up new ways of using human potential, but at the same time, it can give rise to social problems associated with the disappearance (primarily - in developed countries) of a number of mass, "traditional" professions. Like any other large-scale phenomenon, the development of the digital economy is associated not only with positive consequences, but also with various risks and threats. Their sources are two main effects. Firstly, this is the emergence of new types of risks and threats inherent in the digital economy and based on its technological features. Secondly, during the transition to a digital economy, an institutional transforma-

tion takes place, which in itself, regardless of its causes and nature, is a powerful destabilizing factor for sustainable and successful socio-economic development.

The digital economy may soon become a leading segment, a driver of growth and development of the economic system as a whole. This is due to the fact that the digital economy has some advantages over material commodity-money exchanges, such as the speed of delivery of goods or the almost instantaneous provision of services. Another advantage of the digital economy is the lower cost of production and transaction execution. One of the key advantages of the digital economy over the traditional one is that electronic goods are practically inexhaustible and exist in a virtual form, while material goods are almost always limited in quantity and are much more difficult to access. To date, the electronic economy is already beyond the scope of purely economic processes. Digitalization is being introduced into social processes, the successful life of people increasingly depends on it, in addition, there is a large-scale introduction of digital technologies into the work of government organizations and structures. Efforts to digitalize Russia are based on the Strategy for the Development of the Information Society and the provisions of the state program "Digital Economy". These documents set goals and outline the main mechanisms for implementing the digital transformation of the Russian economy, as well as determining the sources and amounts of funding for the activities planned for implementation. In terms of the level of development of the digital economy, Russia does not occupy a leading position, but it confidently stays in the group of countries following the leaders, improving its position from year to year. At the same time, competition in the area under consideration remains very tough, therefore, we cannot stop there, the joint work of the state and business is necessary to further develop the digital economy.

REFERENCES

1. Abdikeev N.M., Bruskin S.N., Kitova O.V. et al. Business performance management systems / Sci. ed. Abdikeev N.M. and Kitova O.V.: collective monograph. - M.: INFRA-M, 2014. - 280 P.

2. Allen R. Global Economic History: a Very Short Introduction. - M.: Publishing House of the Gaidar Institute, 2017. - 221 P.

3. Amosov A. Issues of transition to an innovative type of reproduction // Economics. 2012. № 5. P. 23-32.

4. Asaul V.V., Mikhailova A.O. Ensuring information security in the context of the formation of the digital economy // Theory and practice of service: economics, social sphere, technologies. 2018. № 4 (38). P. 5-9.

5. The Atlas of New Professions. Agency for Strategic Initiatives and MSM "Skolkovo". 2019. URL: https://www.atlas100. ru/index/ (appeal date: 02.10.2020).

6. Bareiko S.N., Kozhukhina K.A. Economic and information security of Russia in the digital economy // Krasnoyarsk Science. 2019. V. 8. № 5. P. 7-18.

7. Barinov V.A., Eliferov V.G., Pirimova V.R. Process management development of corporate culture // Economics and management: problems, solutions. 2017. V. 2. № 8. P. 86-95.

8. Basaev Z.V. The Digitalization of the Economy: Russia in the Context of Global Transformation // World of the New Economy. 2018. № 12-4. P 32-38.

9. Bell D. The coming of post-industrial society. - M.: Academia, 1999. - 783 P.

10. Belousov Yu.V., Timofeeva O.I. Methodology for Defining the Digital Economy // The world of the new economy. 2019. V. 13. № 4. P. 79-89.

11. Bodrunov S.D. The Coming of New Industrial Society: Reloaded - M.: Cultural Revolution, 2016. - 328 P.

12. Bruskin S.N. The information-analytical system on the platform of business analytics to support the financial planning of the sales and services corporation // System Administrator. 2016. № 11. P. 86-88.

13. Bruskin S.N. Methods and tools of advanced business analytics for corporate information analytical systems in the digital transformation era // Modern information technologies and IT education. 2016. V. 12. № 3-1. P. 234-239.

14. Bruskin S.N. Models and tools of predictive analytics for a digital corporation // Bulletin of Plekhanov RUE. 2017. № 5 (9). P. 135-139.

15. Bruskin S.N. Perspective approaches and practical development of financial performance management models for a corporation based on the multidimensional dynamic objects // Scientific works of the Free Economic Society of Russia. 2014. V. 186. P. 159-164.

16. Bruskin S.N. Development and implementation of financial performance management systems // Business Informatics. 2010. № 02. P. 50-53.

17. Bruskin S.N. Decision support systems in corporate planning using information business analytics: practice and perspectives // Modern information technologies and IT education. V. 1 (№ 11). Lomonosov MSU. - M., 2015. P. 593-598.

18. Bruskin S.N. Corporate financial performance management. Analytical models and tools // Initiatives of the XXI century. 2012. № 4. P.53-54.

19. Bruskin S N, Kitova O V 2016 Information business analytics in corporate governance: approaches and tools//International scientific conference "Lomonosov readings-2016. Economic science and development of university scientific schools" // Collection of articles / Ed. A.A. Auzan, V.V. Gerasimenko - M.: Faculty of Economics of Lomonosov MSU, 2016. P. 1349-1358.

20. Bryukhanov Yu.M. Methodological approaches to estimating the cost of the communications complex: materials of the IX International Scientific Congress "The role of business in the transformation of society - 2014". - M.: Synergy, 2014. P. 168-169.

21. Bryukhanov Yu.M., Sadykova A.K., Chudrova V.U. Improving the planning and monitoring of high-tech banking product business lines // Marketing in Russia and abroad. 2015. № 5. P. 17-23.

22. Bukht R. Defining, Conceptualising and Measuring the Digital Economy / R. Bukht, R. Hicks // Bulletin of international organizations. 2018. V. 13. № 2. P. 143-172.

23. Wallerstein I. World-systems analysis and the situation in the modern world. - SPb.: University book, 2001. - 416 P.

24. Veblen T. Theory of the idle class. - M.: Progress, 1984. - 367 P.

25. Wissema J. Towards the Third Generation University: Managing the University in Transition. - M.: Olimp-Business, 2016. - 422 P.

26. Glazyev S.Yu. Theory of long-term technical and economic development. - M.: VlaDar, 1993. - 310 P.

27. Glazyev S.Yu. Economy of the future. Does Russia have a chance? - M.: Knizhny Mir, 2016. - 640 P.

28. Goloventchik G.G. Digitalization of the Belarusian Economy in the Modern Conditions of Globalization. - Minsk: BSU Publishing Center, 2019. - 257 P.

29. Dementiev V.E. Hybrid forms of business organization: to the question of the analysis of interfirm interactions / V.E. Dementiev, S.G. Evsyukov, E.V. Ustyuzhanina // Russian journal of management. 2017. V. 15. № 1. P. 89-122.

30. Dementiev V.E. Variability of long waves of economic development // Problems of theory and practice of management. 2016. № 6. P. 41-46.

31. Dementiev V.E. The problem of power in terms of institutional approach / V.E. Dementiev, E.V. Ustyuzhanina // Journal of institutional studies. 2016. V. 8. № 3. P. 91-101.

32. World Bank World Development Report "Digital Dividends". 2016. URL: https://openknowledge.worldbank. org/ (appeal date: 04.10.2020)

33. Zemlyakov D.N., Balakhanova D.K., Kotova L.R. Innovative development of the Russian economy on the basis of PPP-mechanisms of investment // Management and business administration. 2017. № 1. P. 110-117.

34. Sombart W. Bourgeois. Etudes on the history of the spiritual development of modern economic man. - M.: Iris-Press, 2004. - 245 P.

35. Ivanov O. Information security in numbers // Anti-Malware.ru [Electronic resource]. – Access: https://www.anti-malware.ru/analytics/Threats_ Analysis/2018-cybersecurity-statistics (appeal date: 12.02.2020).

36. Innovation management / ed. P.N. Zavlina, A.K. Kazantseva, L.E. Mindeli. - SPb.: Nauka, 2005. - 560 P.

37. California - territory of vanishing middle class. Vesti. Economy. 26.10.2018. URL: https://www.vestifinance. ru/articles/109254 (appeal date: 02.10.2020).

38. Kapelyushnikov R.I. Economic theory of property rights. - M.: IMEMO, 1990. - 90 P.

39. Karlik A.E., Krechko S.A., Platonov V.V. Organizational and managerial innovations for the modernization of labor relations in information and network economy // Labor economics. 2017. V. 4. № 4. P. 295-308.

40. Castells M. The Information Age: Economy, Society and Culture. - M.: HSE University, 2000. - 606 P.

41. Kiseleva O.N. Directions for optimizing the management system of domestic enterprises based on organizational and managerial innovations // Economics and management of control systems. 2015. V. 18. № 4-1. P. 160-165.

42. Kitova O.V., Bruskin S.N. Digital transformation of business // Digital economy. 2018. № 1 (1). P. 20-25.

43. Kitova O.V., Nefedov V.V., Starovoitov A.V. A simulation development model of retail network on the IBM Cognos TM1 platform // Bulletin of Plekhanov RUE. 2015. № 3. P. 99-105.

44. Kleiner G.B. A New Theory of Economic Systems and Its Application // Journal of economic theory. 2010. № 3. P. 41-58.

45. Kleiner G.B. A New Theory of Economic Systems and Its Application // Bulletin of the Russian Academy of Sciences. 2011. V. 81. № 9. P. 794-811.

46. Kleiner G.B. System bases of digital economy // Philosophy of economy. 2018. № 1 (115). P. 131-143.

47. Kleiner G.B., Rybachuk M.A. System balance of the economy. - M.: Publishing House "Scientific Library", 2017. - 320 P.

48. Kozyrev A.N. Modeling of scientific and technical progress, orderliness and digital economy // Economics and mathematical methods. 2011. V. 47. Iss. 4. P.131-142.

49. Kornai J. The system paradigm // Questions of Economics. 2002. № 4. P. 4-23.

50. Levshina V.V., Savchik E.N., Manakova I.A. Organizational and managerial innovations as a tool for quality assurance at enterprises of high-tech industries // Bulletin of Reshetnev Siberian State University of Science and Technology. 2016. V. 17. № 4. P. 1124-1128.

51. Lenchuk U.B. Formation of the industrial policy of Russia in the context of the tasks of new industrialization // Journal of the New Economic Association. 2018. № 3 (39). P. 138-145.

52. Lee K.-F. Ai Superpowers: China, Silicon Valley, and the New World Order. - M.: Mann, Ivanov, Ferber, 2019. - 233 P.

53. Linnikov A.S. Some features of information as an economic resource in modern society // Education and law. 2018. № 4. P. 52-60.

54. Meichner H.E. Corporate trainings. - M.: UNITY, 2002. - 354 P.

55. Mamaeva L.N. Characteristic problems of information security in the modern economy // Information security of regions. 2016. № 1. P. 21-24.

56. Makhalin V.N., Makhalina O.M. Management of calls and threats in the digital economy of Russia // Management. 2018. № 2. P. 57-60.

57. Makhalina O.M., Makhalin V.N. Digitalization of business increases the costs of information security // Management. 2020. № 1. P. 134-140.

58. Mises L. Human Action: A Treatise on Economics. - M.: Economics, 2000. - 875 P.

59. Noakk N.V., Larin S.N., Znamenskaya A.N. Modeling of manifestations of phenomenon of trust to digital economic products // International research journal. 2018. № 3 (69). P. 160-163.

60. Novikova E.S., Sigarev A.V. Education in the digital age: opportunities and threats for the economy // Economics: yesterday, today, tomorrow. 2019. V. 9. № 6A. P. 171-179.

61. Orekhov S.A. Influence of global tendencies of development of the information society on formation of economy of knowledge // Economics, statistics and informatics. Bulletin of UMO. 2008. № 2. P. 37-40.

62. Orekhov S.A., Maksimova T.P., Moreva E.L. et al. Transformation issues of the modern Russian economy: Theory and practice of management process and its support: a collective monograph. - M.: Institute of Scientific Information for Social Sciences RAS, 2011. - 420 P.

63. The main trends in the development of the digital economy in the financial sector. Legal aspects of regulation and practical application. - M.: Publishing house of the State Duma, 2019. - 160 P.

64. Ostroglazov A., Lipov D. How to increase the cost efficiency of financial organizations for cyber security // Bankir.ru [Electronic resource]. – Access: https://bankir.ru/publikacii/20181105/kak-povysit-effektivnost-zatrat-finansovykh-organizatsii-na kiberbezopasnost 10009623/ (appeal date: 12.02.2020).

65. Ostrom E. Governing the commons. The evolution of institutions for collective action. - M.: IRISEN: Mysl, 2010. - 445 P.

66. Parinov S.I. On the theory of network economy. - Novosibirsk: IEIE SB RAS, 2002. - 168 P.

67. Parfirova A.A., Kryukova A.A. Organizational and managerial innovations in modern business // Problems of modern science and education. 2016. № 26. P. 49-52.

68. Perez C. Technological Revolutions and Financial Capital: The Dynamics of Bubbles and Golden Ages - M.: Delo, 2011. - 231 P.

69. Polyanin A.V., Sinitsyna K.I. Digital Economy: Concept and Essence // Bulletin of the Automobile and Highway Institute. 2020. № 3 (34). P. 96-124.

70. Popov E.V., Semyachkov K.A. Problems of Economic Security for Digital Society in the Context of Globalization // Economics of the region. 2018. V. 14. № 4. P. 1088-1101.

71. Rybachuk M.A. Phenotype of digital economy products: analysis from position of systemic economic theory // Journal of economic theory. 2020. V. 17. № 1. P. 164-175.

72. Sadovaya E.A. Digital Economy and a New Paradigm of the Labor Market // World economy and international relations. 2018. V. 62. № 12. P. 35-45.

73. Business Performance Management Systems: Textbook / N.M. Abdikeev, S.N. Bruskin, T.P. Danko et al.; Under the sci. ed. N.M. Abdikeev and O.V. Kitova. - M.: INFRA-M, 2015. - 282 P.

74. Smirnov E.N. Digital transformation of the world economy: trade, production, markets. Monograph. - M.: World of science, 2019. - 95 P.

75. Telnov Yu.F. Actual directions of enterprise engineering in the digital economy // View of the generation of the XXI century on the future of the digital economy: a collection of articles of teachers of the IX International scientific and practical conference "Modern economics: concepts and models of innovative development". February 15-16, 2018 - M.: FSBEI HE "Plekhanov RUE", 2018. - 576 P.

76. Telnov Yu.F., Fedorov I.G. Enterprise engineering and business process management. - M.: Unity-Dana, 2015. - 207 P.

77. Toffler A. The Third Wave - M.: AST, 1980. - 795 P.

78. Udalov D.V. et al. State policy in the field of ensuring national security: economic and legal aspect: monograph / Gen. ed. S.Yu. Naumova, B.V. Chernyshev. - Saratov: Saratov Socio-Economic Institute (branch of the Plekhanov RUE), 2016. - 284 P.

79. Udalov D.V. Threats and challenges of digital economy // Economic security and quality. 2018. № 1. P. 12-18.

80. Williamson O. The economic institutions of capitalism. Firms, Markets, Relational Contracting. - SPb.: Lenizdat, 1996. - 702 P.

81. Ustyuzhanina E.V., Evsukov S.G. Digitalization of the educational environment: opportunities and threats // Bulletin of Plekhanov Russian University of Economics. 2018. 2018. № 1 (97). P. 3-12.

82. Ustyuzhanina E.V., Sigarev A.V., Shein R.A. Digital Economy as a new paradigm of economic development // National interests: priorities and security. 2017. V. 13. Iss. 10. P. 1788-1804.

83. Ustyuzhanina E.V., Sigarev A.V., Shein R.A. Digital Economy as a New Paradigm of Economic Development // Economic analysis: theory and practice. 2017. V. 16. № 12. P. 2238-2253.

84. Filin S.A. The Concept of Technical, Scientific and Technological Cycles // Regional economics: theory and practice. 2014. № 45. P. 29-45.

85. Filin S.A. Risk as an element strategic management in innovation sphere // Risk management. 2010. № 3 (55). P. 38-51.

86. Filin S.A. Theoretical foundations and methodology of strategic management of innovative development: a monograph. - Tula: Publishing house of the TSU, 2010. - 433 P.

87. Filin S.A., Yakushev A.Zh. Organizational and management innovations as the cornerstone of the digital economy // National interests: priorities and security. 2018. V. 14. № 7. P. 1319-1332.

88. Fligstein N. The Architecture of Markets: An Economic Sociology of Twenty-First-Century Capitalist Societies. - M: Higher School of Economics Publishing House, 2013. - 392 P.

89. Digitization: Practical recommendations for the transition of business to digital technologies; Transl. from Eng. - M.: Alpina Publisher, 2019. - 252 P.

90. Zhang D. The current state of the digital economy in China and the prospects for cooperation between China and Russia in the field of the digital economy // Power. 2017. V. 25. № 9. P. 37-43.

91. Schwab K. The fourth industrial revolution. - M.: Eksmo, 2016. - 138 P.

92. Sheer A.-V. Business administration drivers for I4.0: logistics and new business models. – URL: http://i-love-bpm.ru/scheer/drayvery-biznes-administrirovaniya-dlya-i40-logistika-i-novye-biznes-modeli.

93. Schaeffer E. Advantages of digital technologies for production / Eric Schaeffer: Transl. from Eng. - M.: Publishing group "Tochka", 2019. - 320 P.

94. Yakushev A.Zh. Modeling systemic contradictions in the development of the innovative and post-industrial sectors of the economy. In the book: Modernization of the national economy: problems and solutions / ed. N. A. Adamov. - M.: Expert consulting center "Professor", 2014. P. 27-64.

95. A Dictionary of Business and Management / Ed. by J. Law. - 6th Edition. - New York: Oxford University Press, 2016. - 656 P.

96. Ahmad N., Ribarsky J. Issue Paper on a Proposed Framework for a Satellite Account for Measuring the Digital Economy. STD/CSSP/WPNA (2017)10. Meeting of the OECD Advisory Group on Measuring GDP in a Digitalised Economy. Working Party on National Accounts. Paris, 2017, 14 November. - 17 P.

97. Arthur D. Little. Digital Transformation Study 2015. How to Become Digital Leader. - URL: http://www.adlittle.com/downloads/tx_adlreports/ADL_Ho wtoBecomeDigitalLeader_02.pdf (appeal date: 26.03.2020).

98. Atkinson R., McKay A. What is the digital economy? Government technology. 2007. April. URL: https://www. govtech.com/dc/articles/What-Is-the-Digital-Economy.html.

99. Baldwin R. Trade and industrialization after globalization's 2nd unbundling: how building and joining a supply chain are different and why it matters // Working paper 17716, NBER Working Paper Series. 2011. - 39 P.

100. Barefoot K., Curtis D., Jolliff W., Nicholson J. R., Omohundro R. Defining and Measuring the Digital Economy. BEA Working Paper. - Washington, D.C., 2018. March 15. - 24 P.

101. Bredford De Long, Michael Froomkin. The Next Economy. April 1997. URL: http://law.miami.edu/~froomkin/articles/newecon.html.

102. Brennen S., Kreiss D. Digitalization and digitization. Culture digitally. 2014. September. URL: http://culturedigitally. org/2014/09/digitalization-and-digitization/.

103. Bromwich D. Trapped in the Virtual Classroom // The New York Review of Books. 2015. July 9.

104. Christensen C. The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail. - Boston, MA: Harvard Business School Press, 1997.

105. Comparative Analysis of Pricing Policies in the Market for Network Goods / S. Evsukov, A. Sigarev, E. Ustyuzhanina, E. Zaytseva // Journal of Internet Banking and Commerce. 2016. V. 21. № 6. P. 2-18.

106. David A.J. Axson. Best Practices in Planning and Performance Management: Radically Rethinking Management for a Volatile World. Third edition //John Wiley & Sons, Inc, 2010. - 299 P.

107. Dietz J.L.G.: Enterprise Ontology - Theory and Methodology, Springer-Verlag Berlin Heidelberg, 2006.

108. Digital Economy Outlook. OECD. 2017.

109. Dresner Howard. Profiles in Performance. Business Intelligence Journeys and the Roadmap for Changes // John Wiley & Sons, Inc, 2009. - 174 P.

110. Fortanier F., Gonzalez J.L. Measuring Digital Trade: Towards a Conceptual Framework. STD/CSSP/WPTGS (2017) 3. Meeting of the OECD Working Party on International Trade in Goods and Trade in Services Statistics. OECD Headquarters. - Paris, 2017, 22-24 March. - 15 P.

111. IDC: the potential of digital transformation of small and medium-sized enterprises is not fully disclosed. – URL: https://www.itweek.ru/idea/news-company/detail.php?ID=192938.

112. IMF. Measuring the Digital Economy. International Monetary Fund Report. - Washington, D.C., 2018. - 47 P.

113. International Federation of Robotics. URL: https://ifr.org/ ifr-press-releases/news/robot-investment-reaches-record-16.5- billion-usd.

114. Laatikainen G., Ojala A. Pricing of digital goods and services // Information Systems Research Seminar in Scandinavia. IRIS Association, 2018. - 17 P.

115. Managing digital security and privacy risk // OECD Digital Economy Papers. 2016. № 254.

116. Mayer R.C., Davis J.H., Schoorman F.D. An integrative model of organizational trust // The Academy of Management Review. 1995. V. 20. № 3. P. 709-734.

117. Mesenbourg T.L. Measuring the digital economy. US Bureau of the Census, Suitland, MD, 2001. - 19 P.

118. MIT Sloan Management Review. George Westerman, Didier Bonnet and Andrew McAfee. The Nine Elements of Digital Transformation. January 07, 2014 // [Electronic resource] // URL: http://sloanrev iew.mit.edu/article/the-nine-elements-of-digital-transformation/ (appeal date: 26.03.2020).

119. Negroponte N. Being digital. - New York: Alfred A. Knopf, 1995. - 243 P.

120. Osterwalder A. et al. The Business Model Ontology - a Proposition in a Design Science Approach. Thesis PhD. - 2004.

121. Polanyi K. Primitive, archaic, and modern economies: Essays / Of Karl Polanyi; Ed. by George Dalton. - Boston: Beacon press, 1971. - LIV. - 346 P.

122. Polanyi M. The Tacit Dimension. Garden City. - New York: Doubleday, 1966. - 102 P.

123. Quah D. Digital Goods and the New Economy. CEPR Discussion Paper, 2003. № 3846. - 47 P.

124. Rauser A. Digital Strategy. A Guide to Digital Business Transformation. - Create Space Independent Publishing Platform, North Charleston, South Carolina, 2016.

125. Rayna T. Understanding the Challenges of the Digital Economy: The Nature of Digital Goods // Communications & Strategies. 2008. № 71. P. 13-16.

126. Rogers D.L. The Digital Transformation Playbook. Rethink your Business for the Digital Age. - New York: Columbia University Press, 2016.

127. STD/CSSP/WPNA(2017)10. Meeting of the OECD Advisory Group on Measuring GDP in a Digitalised Economy. Working Party on National Accounts. Paris, 2017, 14 November. - 17 P.

128. The global internet economy / Ed. by B. Kogut. - Cambridge, MA: MIT Press, 2004. - 540 P.

129. The Global Risks Report 2019. The World Economic Forum. URL: https://www3.weforum.org/docs/WEF_Global_Risks_Report_2019. pdf (appeal date: 02.10.2020).

130. The World University Rankings 2019. URL: https://www. timeshighereducation.com/world-university rankings/2019/worldranking#!/ page/0/length/25/sort_by/rank/sort_order/asc/cols/stats.

131. Top 10 Strategic Technology Trends for 2017. - URL: https://www. gartner.com/doc/ 3471559 (appeal date: 29.10.2020).

132. UNCTAD/DER/2019. - United Nations: New York and Geneva, 2019. - 172 P.

133. URL: http://www.idc.com/events/futurescapes (appeal date: 25.03.2020).

134. URL:http://www.adlittle.com/downloads/tx_adlreports/ADL_Howto Become Digital Leader_02.pdf (appeal date: 26.03.2020).

135. URL: https:// www. capgemini. com/resources/? search_term& filter_ content_type&filter_l bel&filter_research.

136. Westerman G., Bonnet D., McAfee A. Leading Digital: Turning Technology into Business Transformation. - Boston: Harvard Business Review Press, 2014.

137. Westerman G., Bonnet D., McAfee A. Leading Digital: Turning Technology into Business Transformation// Harvard Business Review Press, 2014. - 292 P.

138. World Bank Group. World Development Report 2016: Digital Dividends. - Washington, DC: World Bank, 2016. - 330 P.

NOTES

NOTES

Tretyakov Oleg Vladimirovich

DIGITAL ECONOMY AS A NEW DEVELOPMENT PARADIGM: OPPORTUNITIES, CHALLENGES AND PROSPECTS

Monograph

Translators S.E.Abbasova, O.V.Ryndin
Editor O.V.Ryndin
Design by Yu.S. Gracheva
Layout by Yu.S. Gracheva
Proofreader D.R. Khismatullin

Signed in print 10.03.2022. 60x84/16
Ed. No. 1. Circulation of 500 copies.
AUS PUBLISHERS, 2022.

DIGITAL ECONOMY AS A NEW DEVELOPMENT PARADIGM: OPPORTUNITIES, CHALLENGES AND PROSPECTS

Tretyakov Oleg Vladimirovich

**Candidate of Economic Sciences,
Head of the Department of "Innovative technologies for oil and gas production" of the FSBEI HE "Perm National Research Polytechnic University",
author of about forty scientific publications.**