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РОЛЬ ЦИФРОВЫХ ТЕХНОЛОГИЙ В ТРАНСФОРМАЦИИ ЭКОНОМИКИ, ФИНАНСОВ И ГОСУДАРСТВЕННОГО УПРАВЛЕНИЯ[1]

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В статье рассматриваются новые технологии, которые позволяют правительству и бизнесу ускорить цифровую трансформацию и даже изменить ее масштабы. Цифровизация неразрывно связана с инновационной моделью развития как частных компаний, так и государства, чтобы не отставать в глобальной гонке технологий. В условиях быстро развивающейся цифровой экономики и все более широкого использования искусственного интеллекта проблема применения этих технологий в государственном управлении становится все более актуальной. Разработка эффективных стратегий и методов интеграции новых технологий в процессы государственного управления имеет решающее значение для повышения эффективности и прозрачности государственного управления и различных экономических процессов, улучшения предоставления услуг гражданам и в конечном счете – для обеспечения устойчивого и сбалансированного развития общества и экономики. Тем не менее применение таких технологий в государственном и частном управлении сопряжено с рядом вызовов и проблем, например, с этическими и правовыми вопросами использования искусственного интеллекта, защитой данных и кибербезопасностью, а также необходимостью подготовки квалифицированных специалистов, способных работать с этими технологиями. В данном контексте актуальность темы статьи определяется необходимостью углубленного изучения потенциала применения технологий цифровой трансформации в государственном управлении, экономике и финансах.
Ключевые слова: цифровая экономика, искусственный интеллект, машинное обучение, цифровая трансформация, государственное управление, бизнес-модели, финансы.

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ROLE OF DIGITAL TECHNOLOGIES IN TRANSFORMATION OF ECONOMICS, FINANCE AND PUBLIC ADMINISTRATION[1]

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This article examines new technologies that enable government and business to accelerate their digital transformation and even change its scope. Digitalization is inextricably linked to the innovative development model of both private company and state in order not to lag behind in the global technology race. With the rapidly developing digital economy and the increasing use of artificial intelligence, the problem of applying these technologies in public administration is becoming more and more urgent. The development of effective strategies and methods for integrating new technologies into public administration processes is crucial for increasing the efficiency and transparency of government and various economic processes, improving the provision of services to citizens, and ultimately for ensuring sustainable and balanced development of society and the economy. Nevertheless, the application of such technologies in public and private administration brings with it a number of challenges and problems. For example, it is related to ethical and legal issues of using artificial intelligence, the problem of data security and cybersecurity, as well as the need to train qualified specialists capable of working with these technologies. In this context, the relevance of the topic of this article is determined by the need for an in-depth study of the potential for the application of digital transformation technologies in public administration, economics and finance.
Keywords: digital economy, artificial intelligence, machine learning, digital transformation, public administration, business models, finance.

The transition from the industrial and post-industrial economy to the digital economy is based on the networked use of information and communication technologies (ICT). Digital technologies, which have a significant impact on the development of traditional sectors of the economy, have become an integral part of modern management systems in the public sector, industrial production, medicine, entrepreneurship, finance, creating new business models. The formation of the digital economy takes place at three levels that closely interact and influence the life of society and citizens as a whole, namely:

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1) economic sectors and markets, which are the traditional sphere of activity, where direct interaction between suppliers and consumers of goods, works and services takes place;

2) platforms and technologies, within which competencies for the development of markets and economic sectors are formed;

3) environment that creates conditions for the development of platforms and technologies, effective interaction of market actors and industries and includes regulatory framework, information infrastructure and human resources [7. – P. 187].

The digital economy is studied by both foreign and domestic authors from different positions: the formation of the foundations of the digital economy, digital infrastructure, institutional issues of digitalization, etc. Many foreign and domestic researchers identify the digital economy with such categories as information economy, knowledge economy, Internet economy, network economy, electronic economy, new economy. However the definitions of all these categories reflect separate processes summarized in the concept of "digital economy", which not only encompasses the attributes of all the listed economies, but also has a number of differences that characterize its essence, namely:

– concentration of economic activity on the platforms of the digital economy is a digital environment that provides the needs of consumers and producers, and realizes the possibilities of direct interaction between them;

– personalized service models that allow to produce goods and provide services in accordance with the requirements of each specific customer;

– direct interaction between producers and consumers, which reduces the number of intermediaries between them;

– spreading the sharing economy of material and information resources.

The main role in this is played by ICT, which ensures network-centered interaction at all levels of management. Therefore, the digital economy can be regarded as economic activity with the application of digital and information technologies based on the development of telecommunications infrastructure. Digitalization of the economy provides fundamental transformations in all areas of human activity. The technologies used in the transformation process are the engine for the development of new industries and contribute to the solution of society's problems [4. – P. 3]. The use of digital economy technologies becomes a prerequisite for the emergence of a smart society, the basis of which are new values oriented to human needs. The labor market, health care and education, and social society are also changing under the influence of digitalization.

The new business models are customer-centric, i. e. their structure is based on customer needs. The main source of value creation in the digital

economy is the high-speed processing of big data because transactions occur in real time and mostly simultaneously. For example, big data analytics and artificial intelligence technologies are helping to find new sources of value creation by monitoring open data platforms on consumer demand for materials, products, services, homes, smart businesses, workshops, and jobs. Digital economy technologies are becoming an integral part of everyday human life. Key components of digital economy infrastructure (devices, software, telecommunications), e-business (digital processes in organizations), e-commerce (selling goods online), and human capital are used to assess the development of the digital economy and society.

For this purpose, the international Digital Economy and Society Index DESI is used, the analysis of which is an integral part of the study of digital indicators of Europe. The DESI index of a country gives an idea of the state of its digitalization. It is a composite index that summarizes the relevant digital performance indicators in Europe and tracks the evolution of EU member states in the field of digital competitiveness [5. – P. 31]. The DESI sub-indices include:

2) connectivity – reflects the level of development of fixed and wireless broadband access infrastructure;

3) human capital and digital skills – estimates the share of the population possessing the skills necessary to use the services provided by the Internet;

4) Internet usage – assesses online activities such as online content consumption, video calls, as well as online shopping and banking;

5) integration of business technologies – determines the level of digitalization of business, including the use of e-commerce;

6) digital public services – assesses the volume of public services provided in electronic form. The use of the last two sub-indices gives an idea of the level of digital transformation of the economy. Each of the listed sub-indices is characterized by a certain composition of indicators.

Digital transformation is a process of qualitative restructuring of the way of doing business or changing the business model in order to obtain a significant optimization of resources or competitive advantage due to the introduction of new technologies, including algorithms using artificial intelligence and machine learning. This involves not only the installation of modern hardware or software, but also fundamental changes in management approaches, corporate culture and external communications. The digital economy, creating new business models, sets the directions of transformation of traditional sectors of the economy, which occurs in two directions: optimization and digitalization of existing business processes and creation of new business models. The main factors and key attributes of the digitalization of the economy, which have a significant impact on the conditions and ways of doing business, are:

– mobility and Internet connectivity – characterizes the implication of business and population in cyberspace due to the development of mobile technologies and the spread of the Internet. As a result, new forms of doing business are formed, transaction costs of doing business are reduced and forms of interaction with customers are changing;

– datification (translation of any information into data format) – indicates the exponential growth of the amount of information used by mankind. Data is turning into a key economic factor and profit forming an asset of digital business, accompanied by changes in classic business models and the formation of new profit-making tools;

– widespread computerization – a process that involves: introduction of computers into all spheres of human life; development of new technologies of material production; use of information as a direct productive force; increase in the level of education and awareness of society; formation of humanitarian orientation in the use of computer technologies; creation of computer networks that ensure, in particular, the effectiveness of managerial decisions;

– development of digital technologies and artificial intelligence – simplifies processing a large amount of information, creating conditions for increasing firm efficiency, automating operational processes and reducing costs;

– development of the computer networking system – substantiates the need to move away from traditional forms of management that do not allow making operational management decisions;

– ecosystem – promotes the formation of an environment in which complex conditions for the development of innovation processes and digital technologies, their active dissemination and interpenetration are realized;

– network effect – ensures the dissemination of technologies, resulting in a network effect, when the behavior of one economic agent affects the value of product or service development, which is used by other agents. Big data analytics and artificial intelligence technologies make it possible to find new sources of value creation based on the study of digital portraits of customers and their economic behavior.

A relevant trend is the development of open platforms that provide predictive analytics in customer relations and stimulate the emergence and spread of new business models in the economy. The main parameter of competitiveness of business models in the digital economy is the reduction of time to bring a new product to market. This is made possible by creating a digital space where there is an integrated product experience based on the customer's use of all communication channels, as well as the synchronization of data and information across all digital and physical interaction channels to meet customer needs anytime, anywhere.

The transition to new categories of business models is due to the spread of Internet of Things (IoT) technologies, big data, artificial intelligence and machine learning and other digital technologies, which have led to the development of the following areas: digital platforms that provide direct interaction between sellers, suppliers and buyers, minimizing transaction costs and expanding opportunities for consumption of goods and services; service models that promote the personalization of goods and services, allowing the customer to consume goods and services in a more personalized way; crowdsourcing models based on attracting external resources (money, people, ideas, etc.) for the implementation of business processes; business models whose pricing is based on achieving results and effect for the client; business models based on monetization of clients' personal data [11. – P. 152].

New digital technologies expand business opportunities to optimize many processes and improve the quality of decision-making. The use of digital business models not only allows increasing a firm's income, but also determines its sustainability in the modern world. For an integral assessment of the level of digital technology diffusion in the business sector, we developed the BDI (Business Digitalization Index), which characterizes the speed of adaptation to digital transformation, the level of use of broadband Internet, cloud services, RFID-technologies, ERP-systems, and involvement in e-commerce of organizations in the business sector. This index integrates five sub-indices:

1) channels of information transmission and storage – the use of cloud technologies, corporate mail, messengers, automation systems;

2) integration of digital technologies - the level of implementation in the firm of such technologies as artificial intelligence, Internet of Things, 3D printing, use of online documents, electronic document management, etc.;

3) use of Internet tools for the promotion and development of the firm – the presence of a website, a page in social networks, the use of promotion channels;

4) information security – the level of readiness of the firm to potential digital threats in the course of doing business;

5) human capital – the level of readiness of enterprise management to train personnel in digital technologies.

For example, most industries are characterized by: a large and constantly updated range of manufactured products; a long production period, from design to service; the presence of both serial and unique production; the complexity of manufactured products; presence of a large number of contractors, etc. Each industry has its own characteristic of production processes, which extends the above list.

In order to optimize production processes, it is necessary to integrate them into a single online complex, which will make it possible to control all stages of production. The digitalization of industrial production primarily

involves automation, in particular real-time data collection, interconnecting the various parameters of the production process and coordinating them in a single system to ensure network-centric control.

Industrial digitalization is the concept of a new digital space as a system where the entire production infrastructure and digital twin technology are integrated, combining industrial IoT and digital simulation.

Tools of digital transformation of industry for the production chain are development (digital design and modeling, technology transfer networks), production (digital enterprise, industrial cooperation networks), logistics (digital warehouse, digital transport), sales (e-commerce, smart store), service (digital services, IoT, including industrial IoT). The introduction of digital technologies is carried out at all stages of automation, with the formation of an end-to-end process covering not only production, but also the accompanying financial and organizational activities, which increases the speed of decision-making, mobility in changing production processes depending on customer needs [21. – P. 190].

Digitalization provides enterprises with high flexibility in the formation of business models and a wide coverage of the potential customer base by integrating digital twins, cyber-physical systems and the Internet of Things into the production process.

All this contributes to changing the business model of enterprises in the transition from product-oriented to service-oriented. The main directions in the process of digitalization of industry are accelerating the launch of new products on the market; increasing the safety and reliability of production; increasing the flexibility of production; improving the quality of manufactured goods; generally increasing the efficiency of production.

Digital Public Administration. Digitalization of public administration is used for planning, monitoring and evaluating the performance of public authorities. The goal of digital transformation of public administration is to create a digital government based on the ideas of customer focus on the basis of mutual integration of disparate communication channels into a single system, providing seamless and continuous communication with the customer [1. – P. 410]. In the digital economy, the most significant sphere is service provision, including social and public services.

Digitalization of public administration is the processes of implementation and use of innovative technologies and principles of the digital economy in socio-economic spheres of society, accompanied by total automation, robotization and introduction of artificial intelligence. It also includes the development and application of new technologies and management tools to improve the efficiency of management decisions and public services provided to the population.

An important place is given to the formation of a platform model in the public administration system. This involves the creation of an integrated

infrastructure for the provision of public services and the growth of the efficiency of the public administration system, which should significantly reduce transaction costs and risks, increase labor productivity, service quality and customer satisfaction [2. – P. 101]. To minimize possible risks and ensure stable development of the economy in the conditions of digital transformation, new tools for public management decision-making are needed. The potential of modern digital technologies implies their use in digital public administration.

Among them:

1) Big Data – a series of approaches, tools and techniques for processing structured and unstructured data of large volumes and variety to produce results that are human-sensitive and effective in a continuously growing, distributed across multiple network nodes, formed in the early 2000s as an alternative to traditional database management systems;

2) Industrial Internet of Things – is a global network of Internet-connected physical devices equipped with sensors and data transmission modules.

They come together through connectivity to control, management and data centers. IoT is now almost the most popular of the current IT concepts, and one of the few that is rapidly becoming a reality. This concept suggests that IoT is capable of dramatically intervening in the development of society and the global economy, as it allows many processes to be carried out without direct human involvement [19. – P. 260].

Industrial IoT consists of Internet-connected equipment and advanced analytics platforms that process data from connected devices:

– distributed registry technology (DRT) – a relatively new approach to recording and distributing data among many data registries, each of which contains similar records and is collectively maintained and controlled by a distributed network of computer servers called nodes. This approach emerged in the field of Internet finance and is at the stage of active implementation to solve economic problems;

– artificial intelligence – the use of computers to simulate the human thought process in order to solve problems and make managerial decisions;

– wireless communication – a subclass of information technologies that serve to transmit information between two or more points at a distance without requiring a wired connection, in particular, in the coverage area of mobile operator services using 5G networks;

– augmented reality (AR) – information technologies of augmenting the physical world with the help of digital data provided by computer devices (smartphones, tablets and AR glasses) in real time. Fundamental to the digital transformation of public administration are extensive data and methods of data processing. The development of analytical tools related to the use of big data allows to significantly improve the quality of forecasting of political and

economic processes, which expands the management capabilities of the state in the digital environment.

The transition to big data-based management becomes the basis for public policy formulation, decision-making, monitoring and evaluation of results, which will take place by involving unstructured and partially structured data arrays in the analysis [10. – P. 15]. The order of transition of public administration systems to digital technologies is determined by open standards, unified recommendations and criteria of digital development, developed by supranational organizations.

The use of extensive data and industrial IoT capabilities to generate statistics provides public administration in real time and contributes to a significant reduction in administrative costs, improving the reliability of data and decisions made on their basis, and reducing the corruption component [22. – P. 571].

The criterion for assessing the infrastructural readiness for digitalization in the public administration sector is the share of interactions of citizens and commercial organizations with government agencies and budget institutions carried out in digital format.

The G2G (Government-to-Government) segment involves interagency communication based on improving the efficiency of information exchange through online communication systems. In the G2B (Government-to-Business) segment, the government communicates with commercial entities within the framework of electronic transactions and creation of conditions for their development. The segments are actively working to establish interdepartmental interaction and digital connections at different levels of government. The government, presented as a platform, becomes a model of public administration, the basis of which are platform solutions that allow to realize the functions of the state in a digital format.

Digitalization of public administration is carried out by creating a unified architecture of the state digital platform, overcoming the fragmentation of departmental systems and based on a single data set, transferring all public services into electronic form with a system of remote biometric identification, forming digital twins of citizens, organizations, objects and providing public services based on the development of digital twin.

Thus, the state digital platform is the only hardware and software environment that supports algorithmic relations of a significant number of participants (state, citizens, business) and provides them with integrated business processes, services, information and analytics. The use of a state digital platform leads to a reduction in transaction costs and provides opportunities for attracting new participants.

In the context of a rapidly developing digital economy and the increasing use of artificial intelligence, the problem of applying these technologies in public administration is becoming more and more urgent. The development of

effective strategies and methods for integrating AI into public administration processes is crucial for increasing the efficiency and transparency of government processes, improving the delivery of services to citizens, and ultimately ensuring sustainable and balanced development of society.

Nevertheless, the application of AI in public administration also brings with it a number of challenges and problems. First of all, it is related to the ethical and legal issues of using artificial intelligence, the problem of data security and cybersecurity, as well as the need to train qualified specialists capable of working with these technologies.

Digital Technologies in Finance

Organizations operating in an era of rapidly evolving information technology must have a dynamic structure to be competitive in a changing business environment both internally and externally. The transformation of finance is underpinned by technological advances in two rising technologies: artificial intelligence and robotic processes in the financial sector. Emerging technologies will lead to a transformation of the operating model of finance and customer service and internal operational processes in the financial sector with current and future potential implications [18. – P.65]. Institutions must prepare their business models and employees for this future to turn this development into an opportunity. These groups of technologies have formed a single model – the financial technology integration model – fintech.

Finance has undergone many transformations in the technology sector: from the emergence of the first banks to the formation of a large number of different organizations, i.e. financial service providers that enable companies at all levels to implement the functioning of finance for organizations [16. – P. 16]. This has resulted in a vast network of interconnections that can be described as more complex and less linear than in the traditional manufacturing and retail industries. This is what started the formation of a new format for finance.

Fintech are key technologies in managing financial processes. Processes can be based on analog and on digital technologies of the financial sector. The basis of the primary stages of the transformation of finance were physical objects-carriers of information. The distribution of tangible assets was underpinned by real transportation formats. Information technologies have simplified the transportation process, allowing for shorter timeframes for information exchange, as well as greatly expanding the geographical boundaries of information transfer.

The emergence of digital technologies has formed the beginning of a new stage of transformation of finance. The era of digital technologies has also led to the emergence of electronic finance. The formation and active use of digital finance is based on the use of electronic transactions that operate at the level of financial organizations and participants of financial transactions. The banking

sector uses forms of electronic circulation of finances to create additional value for its products [17. – P. 95]. Value creation of financial organizations' services consists of the following elements: consumers, financial organizations, providers and communication channels. The spread of information technology has led to an increase in the number of processes and activities outsourced, the degree of vertical integration in the banking industry remains high. This can be seen as a potential for automation and for digital processes that overcome the problem of mechanical activities between different information systems. Following the core business services in banking, a set of new digital services have emerged in the areas of financial information, planning, consulting, payments, investments and cross-process support. Very often these solutions were limited in scope and focused on solving a specific customer problem.

At the intersection of the use of financial technologies the models of transformation of finances were formed, which have become widespread in the conditions of active use of artificial intelligence products. The tools of finance transformation are products of information technology development [13. – P. 323]. The most progressive forms are products based on artificial intelligence technologies or integration technologies. Artificial intelligence allows to optimize the functioning of finances in the conditions of modern banking structure. Among the tools of finance transformation the following can be singled out: cloud technologies, robotization, big data analytics, blockchain, artificial intelligence, in-memory computing and securitization.

The tools make it possible to most effectively transform finance for use in a digital environment, an environment in which information technology is proving its worth. The trends of global digitalization have touched the financial sphere as well. To realize the circulation of finances in the conditions of "digital" infrastructure requires tools that are designed on the basis of the most progressive products of information technologies, including those that are actively involved in the process of banking operations [15. – P. 147]. The models of finance transformation in the conditions of artificial intelligence spreading are the American, Russian and European models of finance transformation. One more model of finance transformation can be singled out - the ecosystem model. This model implies the creation of platforms, within which financial services turn into an integral ecosystem.

European Model or Startup-Fintech Model

The European model is based on decisions that are made predominantly in a startup environment, i.e. in a niche solutions industry. The technology ecosystem is formed on the basis of financial startup projects.

The Russian model, or the model of traditional fintech. The Russian model is based on the development of financial and technical initiatives with a limited number of market participants. In this case, the basis of the entire ecosystem is the traditional elements of the financial services system. As a rule,

a bank as a traditional provider of financial services realizes a set of financial and non-financial products. All activities within the framework of this model are realized for the benefit of the bank's development, for the bank and its support. All technologies of realization of functioning of finances are concentrated within the company and the most progressive departments. The structural elements of the bank actively use the tools of finance transformation.

American model, or the model of big technologies. Financial innovation transforms financial services to a large extent, causing fundamental changes in most organizations in the conditions of the financial services market.

In the ecosystem model, it is not only finance that is transformed, but also the company that uses that finance. The company that lies at the heart of the ecosystem within this model must provide a wide range of financial services. As global trends impact all industries, companies are looking to be at the center of many ecosystems, interacting with customers throughout the entire lifecycle, not just while the customer is using the product. Industry boundaries are blurring, so large companies are not only operating within their industry, but also in related industries. There are several views on financial services strategies based on current challenges, opportunities and trends.

In general, most focus on building their own ecosystems or partnering with large technology companies. It is important to note that the realization of financial services is already an integral part of ecosystems.

On the territory of the Russian Federation, there is a widespread practice of using the Russian model of finance transformation, which implies the creation of an ecosystem, the traditional participants of which are traditional financial service providers.

Thus, at the moment the transformation processes have been launched and the pace of their development is so high that it is impossible to stop them, which is also associated with the strong position of artificial intelligence as a natural and harmonious tool of modern man. The processes of finance transformation under the influence of artificial intelligence can be evaluated as actively realized and constantly developing against the background of information technology development. Financial operations are realized in a multitude of sectors of economic activity, so it is fair to say that the harmonious development of information technologies and transformational forms of finance in the conditions of modernity.

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