

# Impact of the digital economy on the development of economic systems

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**Abstract.** The digital economy, which is based on new development concepts and driven by emerging technologies, relies on the application of information networks and platforms, renews factors and resources, and aims at high-quality and sustainable development as an important cornerstone for building a modern economic system. Digitalization affects most of the production processes and activities in the economy. In a period of rapid development of the digital economy, its significance is manifested in deep integration with economic and social industries, promoting digital transformation and constantly introducing new technologies, new models and new industry processes. This leads to the transformation and modernization of society, industry and enterprises, contributing to sustainable economic development based on innovation models. This paper discusses the importance of the digital economy in the modern economic system, which is expressed in an increase in production efficiency, the creation of new jobs, and a synergistic effect in various industries.

## 1 Introduction

Digitalization has become an objective pattern of modern economic development. Digitalization affects most production processes and activities in the economy. Inventor R. Kurzweil and Professor V. Vinge determine that today the world is at the point of “technical singularity” — at a moment when technological progress cannot be stopped or reversed, which will inevitably transform the global economic space [1]. Already now, integration processes are becoming so complex and showing exponential growth that they are often incomprehensible, the characteristics of globalization processes are changing under the influence of the digital economy. So, in their scientific research, Professor Efremov V.S. and Vladimirova I.G. define this period of development of the world economy as “technologization” [2].

At the same time, studies do not provide enough analysis of the impact of the economy digitalization processes on economic growth and the level of social welfare, especially since the acceleration of such processes has not led to the rapid development of individual countries and the world economy as a whole.

Digital globalization now has a more tangible impact on economic growth than trade in goods [3]. The growing value of data and digital intelligence is reflected in their high market capitalization, and their growing role has far-reaching implications for all economic activity. The digital economy is becoming an integral part of global economic processes, being the engine of growth and development of companies. With the acceleration of the development of industry 4.0, the world has entered the digital economy era led by a new generation of information and communication technologies. The digital economy has broken down barriers in the implementation of communications between market participants, ensured the development of the domestic and international economy in the post-epidemic era. In a period of rapid development of the digital economy, its importance is manifested in deep integration with economic and social industries, promoting digital transformation and constantly introducing new technologies, new models and new industry processes. This leads to the transformation and modernization of society, industry and enterprises, contributing to sustainable economic development based on innovation models. In addition, as a result of the economic and industrial restructuring, these innovations are causing a new round of technological revolution.

## **2 Materials and methods**

The purpose of this study is to analyze the importance of the digital economy in the modern economic system of Russia and the world, to identify directions for its further development and formation. The theoretical and methodological basis of the study was the scientific works of domestic and foreign researchers studying the application of modern information technologies in the process of making managerial decisions. During the study, methods of general scientific analysis and comparison, tabular and graphical techniques for visualizing the calculations, methods of induction and deduction were used in the formation of the conclusions of the study.

## **3 Results and discussion**

The term “digital economy” first appeared in the 1990s and began to attract attention thanks to the book “The Digital Economy: Promise and Peril in The Age of Networked Intelligence”, written by the American scientist D. Tapscott in 1996 [4]. Later, the "G20 Digital Economy Development and Cooperation Initiative" published at the G20 Hangzhou Summit in 2016 officially stated that “the digital economy refers to the type of economic activity using digital knowledge and information as key production factors and is an important carrier of information and communication technologies as an important driving force for increasing efficiency and optimizing the economic structure” [5]. From this definition, it can be seen that the digital economy has two key characteristics:

- firstly, digital knowledge and information are key factors of production;
- secondly, modern information networks and information and communication technologies have changed the way of production and economic structure.

In the process of collecting, storing, analyzing and sharing information, digital technologies such as the Internet, cloud computing, big data and blockchain are widely used, and the methods of social interaction are gradually changing. It should be noted that digital technologies are general-purpose technologies that are used in a variety of economic activities.

The core of the digital economy is continuous innovation and breakthrough achievements in the field of information and communication technologies. The structure of costs for innovation activities in Russia is shown in Fig. 1.

The cost structure for innovation activities is dominated by research and development costs – 44.6%, the cost of purchasing machinery and equipment is 33.6%, followed by the cost of engineering – 9.2%, development and purchase of computer programs and databases – 3.6% [6].

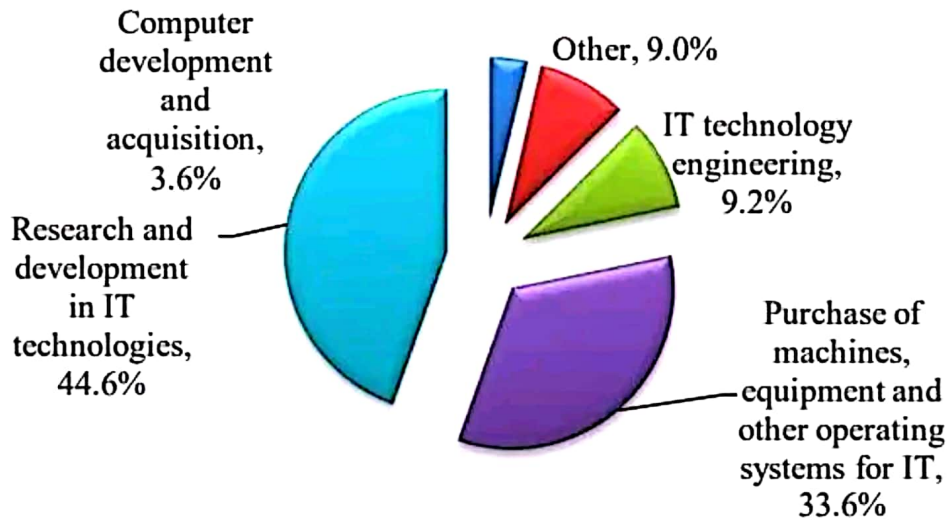


Fig. 1. Cost structure for innovation activities.

The significance of the digital economy for the development of the economic system is determined in terms of increasing productivity and in terms of developing industrial relations (Fig. 2), since the active development of the digital economy contributes to increased productivity and the transformation of industrial relations.

From the point of view of increasing production efficiency, the digital economy is revealed in two aspects: industrialization and digitization of industry. Digital industrialization refers to the information industry (Internet, big data, artificial intelligence, etc.), which is the basis for the development of the digital economy.

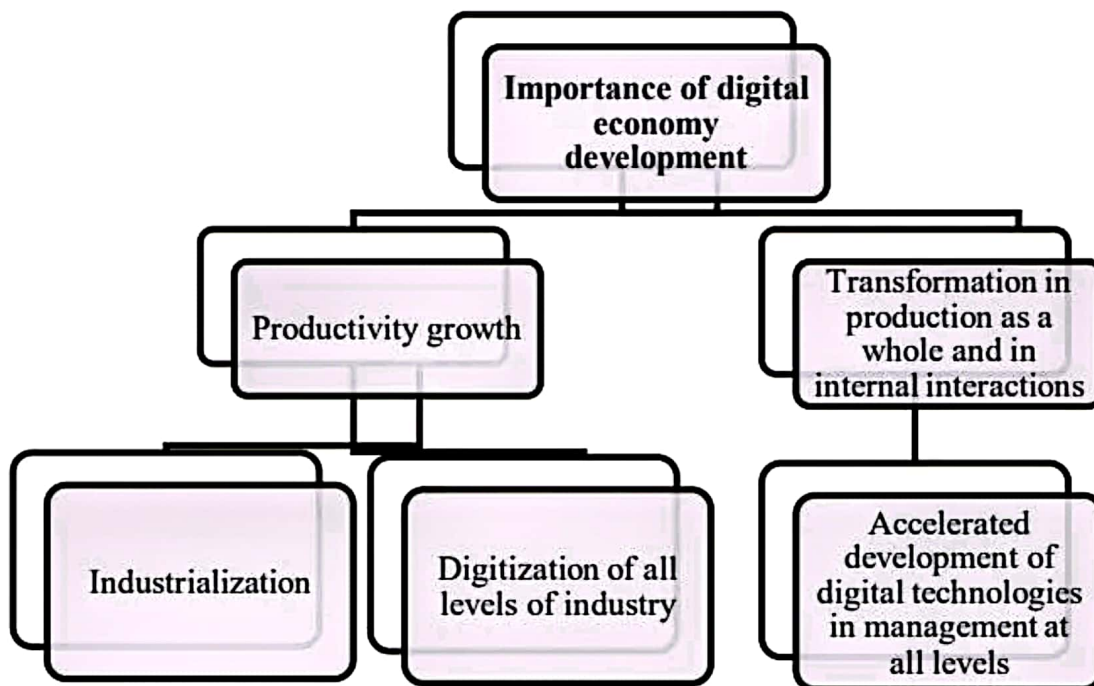


Fig. 2. The importance of the digital economy for the economic system development.

Industrial digitization refers to the development of the main national industries (agriculture, industry and services) with the assistance of digital technologies to significantly improve production efficiency.

Industrial digitization and digital industrialization in the digital economy have network effects, economies of scale and innovation effects, expand the scale and reach of the market, allow economic activity to be free from geographic and temporal restrictions, which leads to increased labor productivity, meeting diverse consumer needs and promoting labor specialization, professional diversification.

The value of data in the digital economy is changing the system of production factors, data is now becoming a key factor for the development of the digital economy. Under the influence of value-based data elements, traditional production factors such as land, labor, capital are further optimized and reorganized to promote the development of the digital economy.

From the point of view of the development of industrial relations, the importance of the digital economy is manifested in the development of digital management, achieved through innovation in the management mode, improving the management system and increasing management capacity using digital technologies. Digital governance ensures the rapid and healthy development of the digital economy.

Digital governance is a complex system, including system and mechanism of decision making, supervision and implementation. In the era of the digital economy, with the advent of a large number of platform enterprises, buyers and sellers conduct fast transactions, which greatly improves resource efficiency. Without the support of platform companies, highly asymmetric information between buyer and seller and high transaction costs make it difficult to find trading partners, negotiate prices, and seamlessly complete transactions.

Platform companies have integrated systems, such as online scoring and information feedback, to significantly reduce for consumers the cost of finding quality products, the cost of negotiating, and the risk of transactions. Due to a significant reduction in transaction costs, market coverage is further expanding, the division of labor is being further developed, and the efficiency of resource allocation is increasing [7].

From these points of view, the rapid and efficient development of the digital economy reflects the dialectical unity of productivity and industrial relations. Relying on digital infrastructure, the digital economy realizes the digitalization of industry, digital industrialization and digital management through technological change, and this improves the transactions efficiency, promotes the labor division evolution, and improves the efficiency of resource allocation.

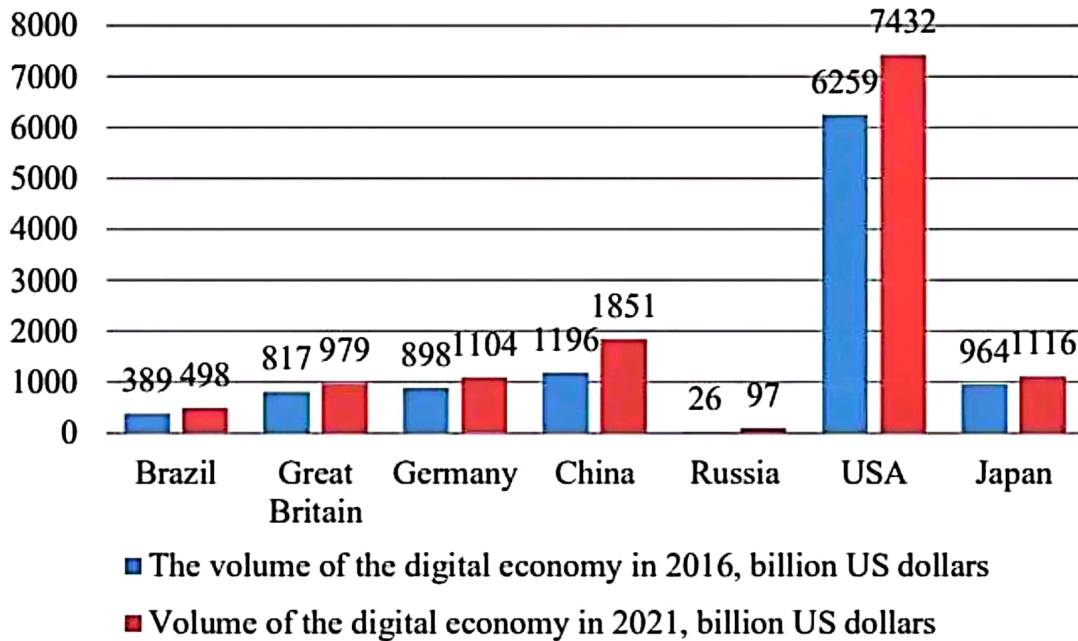
At the same time, in an era of massive growth in digitalization, digital information is becoming a new factor of production, undermining the use of traditional factors of production. The structure of production factors is changing to integrate new elements, accelerate the dissemination of knowledge and technology and the transformation of achievements, optimize resource allocation, accelerate the development of green, clean, intelligent industrial chain, and change the global industry value chain.

The economic growth brought about by the digital economy is irreversible. Technological innovation, technological integration and the continuous emergence of information elements lead to the fact that the share of the value of products associated with the digital economy in the economy of all countries continues to increase and further contributes to sustainable economic growth. Nowadays, the leaders in the field of the digital economy are the United States and Great Britain, the volume of the US digital economy segment in 2021 amounted to 36.3% of GDP, in the world this figure is 24.7%. At the same time, in most countries of the world, the growth of the digital sector of the economy is ahead of the development of non-digital sectors (Fig. 4, 5, 6).

According to Boston Consulting Group (BCG), the share of the digital segment in Russia in 2009 was 1.2%, in 2016 this figure reached 2%, and in 2021 amounted to 5.6% of GDP. Digital McKinsey estimates the contribution of the digital economy to Russia's GDP at 3.9%, the US – 10.9%, China – 10.0% (Fig. 3).

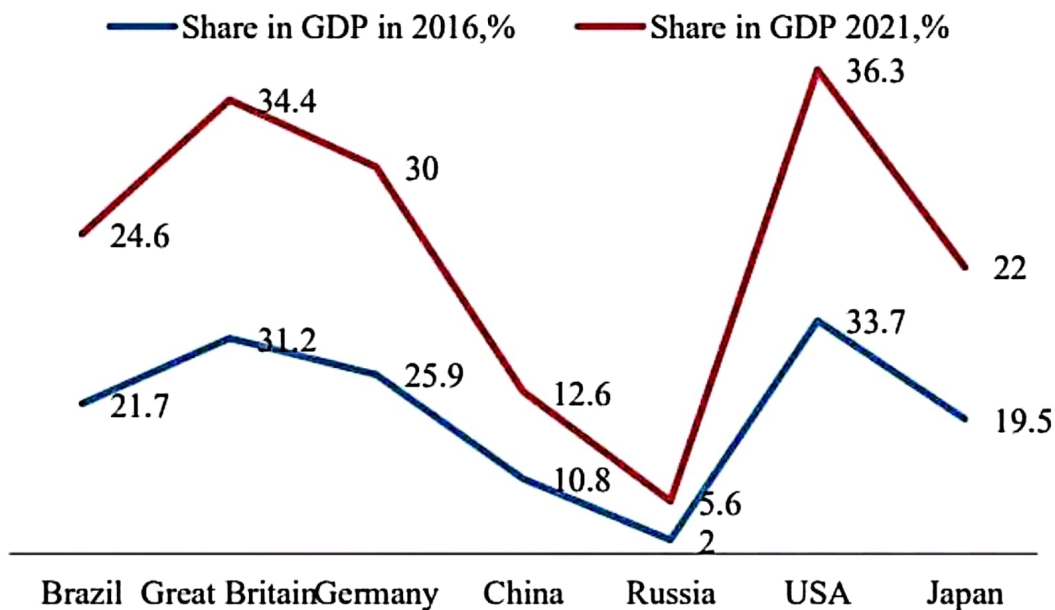
BCG experts predict that the global economy based on Internet technologies will reach 16 trillion US dollars in 2035 [8].

**The volume of the digital economy in the period 2016-2021, billion US dollars**



**Fig. 3.** The volume of the digital economy in the period 2016-2021, billion US dollars.

**The share of the digital economy in GDP for the period 2016-2021, %**



**Fig. 4.** The share of the digital economy in GDP for the period 2016-2021, %.

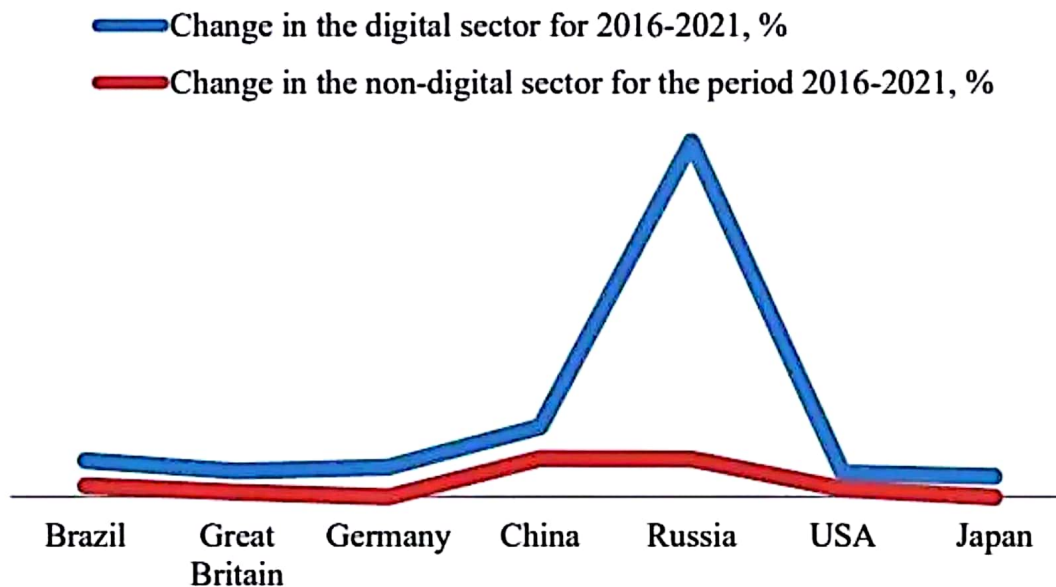


Fig. 5. Change in the digital sector and in the non-digital sector for the period 2016-2021, %.

Since digital technologies have a strong impact on energy consumption and exacerbate environmental problems, researchers are increasingly focusing on achieving energy and environmental sustainability when using digital technologies. An important goal of the development of the digital economy is to change the habits and motivations of producers, consumers and investors, as well as to obtain as many useful products or services as possible with the lowest possible carbon emissions or associated environmental costs.

The use of digital technologies makes it possible to reduce carbon dioxide emissions into the atmosphere, track energy consumption and increase the sustainability of agriculture. In the near future, we can expect a balanced solution to the problems of ecosystem restoration and the reduction of greenhouse gas emissions into the atmosphere. The countries that emit the most CO<sub>2</sub> in the world are among the most densely populated and industrialized. In 2021, China emitted 10.5 billion tons of CO<sub>2</sub>, well ahead of the United States (4.7 billion), India (2.5 billion), and Russia (1.5 billion) [9].

Nowadays, digital technologies account for 8-10% of our energy consumption and 2-4% of greenhouse gas emissions. It is estimated that extending the life of all smartphones by just 1 year will save 2.1 million tons of CO<sub>2</sub> per year by 2030, which is equivalent to removing 1 million cars. Switching from 4G networks to 5G networks can reduce power consumption by up to 90%.

Digital transformation and the integration of digital technologies in all areas of business will lead to fundamental changes in how businesses operate and how they deliver customer satisfaction, while enhancing the competitiveness of industrial sectors, impacting not only the private but also the public sector.

By the end of 2021, more than 130 countries around the world have put forward a “zero carbon” or “carbon neutral” climate goal, and “green” development within the carbon neutral goal has become the consensus of most countries of the world. At the same time, the digital economy, as one of the most active areas in the world, is developing rapidly and has become a new driver of economic growth in recent years. According to the Global Conference on the Digital Economy 2021, the total scale of the digital economy of 47 countries will reach 32.6 trillion US dollars in 2020 with a nominal annual growth of 3.0%, which is 43.7% of GDP [10].

At present, the transformation of digital technologies has led to increased productivity,

labor and other factors into more efficient industries and increases the efficiency of labor in the economy as a whole. On the other hand, the use of digital technologies means that enterprises can use them to process a large amount of non-standard information. Enterprises can intelligently allocate labor resources and improve production efficiency. Thus, the digital economy can increase labor efficiency by changing the distribution of labor resources and improving the workforce quality.

In the context of the digital economy development, additional high-quality labor, capital and other resources of production factors are attracted to industrial sectors with high added value, the importance of which continues to grow. This transfer contributes to the modernization of traditional industries and the emergence of new enterprises. On the other hand, companies are more likely to choose high-performance labor. This choice forces workers to constantly improve their quality and this can improve the overall quality of work in the industry. As a result of attracting additional highly qualified personnel and capital to this industry, the effect of human capital agglomeration is formed. Digital technologies, with their increased connectivity and networking, are revolutionizing society with more opportunities to communicate, provide services and trade.

Simultaneously with the development of technology industries, traditional industries can master new technologies of the digital economy, thereby promoting technological innovation in traditional sectors. In general, the digital economy has created innovation incentives for traditional industries due to the diffusion effect. On the other hand, the digital economy has a demonstrative impact on the traditional economy, since the digital industry is highly competitive, contributing to the transformation of enterprises in the traditional industry and improving the service quality [11].

The governments of many countries, predicting such changes, are increasingly striving for the development of the digital economy, using its advantages to respond to the key challenges of our time, such as reducing unemployment, fighting poverty, and environmental degradation. Modern national digital strategies relate to the development of the economy, the creation of innovative enterprises, the increase in employment, and the formation of an effective public sector. The importance of the digital economy is development increasingly being announced in Russia.

In general, the following list of measures implemented by states and aimed at developing the digital economy can be distinguished: the development of infrastructure, which is the basis for the formation of new business models and the construction of scientific and social networks; reducing barriers in the sectors of the digital economy; increasing the level of knowledge of digital technologies, training and retraining of specialists; ensuring confidence in the reliability and security of digital infrastructure, risk assessment; development of the digital sector of the economy.

The digital sector of the economy is based on innovative technologies created by the electronics industry. It is represented by two elements. First, it is the electronics industry, the production of microchips, computers and telecommunications devices, and household electronics. Secondly, these are companies that provide services in the field of digital technologies and use digital means of production, storage, and data management. The importance of developing the digital sector for national economies is confirmed by the fact that a number of countries are currently implementing comprehensive and fairly large-scale programs aimed at developing the digital sectors of their economies, creating new jobs in these areas, and increasing the competitiveness of the electronics industry and IT technologies. One of the key points is investment in the digital sector of the economy [12].

In modern conditions, the problems of the digital sector inevitably affect the competitiveness of the economy, since the lag in obtaining and processing up-to-date data, the inability to use the digital resource is ultimately accompanied by the loss of the previous market positions. From the standpoint of the theory of international trade asymmetry, the

digital dependence of one country on another one leads to an increase in the lag in economic development between these countries. A feature of this structural dependence is the impossibility of overcoming it, since progress in the field of digital technologies occurs at a fairly high speed, and new technologies can only be reproduced on the basis of previous results. If a country does not have them, or some technical and technological solutions are lost, then it is impossible to create something new and take the next step. For this reason, the state of the digital sector, in particular, its element base, special technological equipment that provides the necessary parameters for microcircuits, is a determining factor in the development prospects of the whole society. The arrival of digital products by imports can relieve the acuteness of problems for some time, but given that the rate of renewal in this sector is very high and a complete change of equipment and software occurs every 2-3 years, linking such systems to imports cannot be a reason to create a strong competitive position in this area. In the modern global economy, there is a struggle for leadership in the field of digital technologies, which allow acquiring indisputable analytical advantages. The emerging digital economy has created a new type of resource – data, which, despite the debatability of such a statement, is a modern factor in successful economic activity [13-15].

## **4 Conclusions**

Thus, the application of digital technologies can provide a more reasonable distribution of factors in the market, thereby contributing to high-quality economic development. In order to achieve the goals of economic development, the following directions for the development of the digital economy can be identified:

1. Optimize the industrial structure of the digital economy in accordance with the conditions of unbalanced regional development. Each region has its own unique advantages in terms of resources, geographical location, natural conditions and other characteristics, resulting in a large gap between regional development in the development level of the digital economy.

2. Strengthen support for digital innovation and infrastructure construction, which helps create a solid foundation for the digital economy. On the one hand, in order to improve digital innovation, increasing the contribution of digital resources, capital, data elements and technologies is equivalent to accumulating the innovative capacity necessary for the development of the digital economy.

3. Deepen the application of digital integration and enrich the end result of the digital economy. The integration and application of digital technologies is the ultimate goal of the digital economy development, and this is a necessary prerequisite for building a dual cycle economy in order to achieve a combination of digital technologies and the harmonious development of the three sectors (agriculture, industry and services).

Nowadays, all countries in the world are actively exploring the development of the digital economy, hoping to take advantage of the new economic revolution of the digital economy and lead the world economic development. The digital economy is changing the structure of competition between countries and is becoming a new driving force for economic development. Thus, assessing the level of the digital economy development contributes to a detailed study of the advantages and disadvantages of digitalization, putting forward practical and targeted proposals for the sustainable and rapid development of the digital economy in the future.



## References

1. World Economic Forum in collaboration with McKinsey & Company: Fourth Industrial Revolution Beacons of Technology and Innovation in Manufacturing, January 2019.  
[http://www3.weforum.org/docs/WEF\\_4IR\\_Beacons\\_of\\_Technology\\_and\\_Innovation\\_in\\_Manufacturing](http://www3.weforum.org/docs/WEF_4IR_Beacons_of_Technology_and_Innovation_in_Manufacturing)
2. Efremov V, Vladimirova I (2019) Globalization of The World Economy: Features of The Current Stage. Economic and Social Development: Book of Proceedings, Varazdin. Varazdin Development and Entrepreneurship Agency (VADEA). (May 10/May 11, 2019), 2019 11. How the Best Companies Create Value from, pp. 27-36
3. Smyslov D (2019) Evolution of the world economy globalization: current trends. *Mirovaya ekonomika i mezhdunarodnye otnosheniya* 2:5-12  
<https://doi.org/10.20542/0131-2227-2019-63-2-5-12>.
4. Nyangarika A, et al (2022) Energy stability and decarbonization in developing countries: Random Forest approach for forecasting of crude oil trade flows and macro indicators. *Frontiers in Environmental Science* 10:1031343  
<https://doi.org/10.3389/fenvs.2022.1031343>
5. Evsyukov VD (2018) Evolution of the views of foreign economists on the content of the digital economy. *Proceedings of the South-Western State University. Series: Economy. Sociology. Management* 1(26):184-191
6. Niyazbekova S et al. (2021) The Growth of “Green” finance at the global level in the context of sustainable economic development. *E3S Web of Conferences* 244:10058  
<https://doi.org/10.1051/e3sconf/202124410058>
7. Ganebnykh E, Burtseva T, Mironova N, Feoktistova O (2019) Quality assessment of urban environment. *E3S Web Conf.* 110:01077  
<https://doi.org/10.1051/e3sconf/201911001077>
8. Monitoring of Current Events in the Field of International Trade N 5. Digital Economy: Russia and the World
9. Wu T, Shao W (2022) How does digital economy drive industrial structure upgrading: An empirical study based on 249 prefecture-level cities in China. *PLoS ONE* 17(11):e0277787 doi: 10.1371/journal.pone.0277787.
10. Pan W, Xie T, Wang Z, Ma L (2022) Digital economy: An innovation driver for total factor productivity. *J. Bus. Res.* 139:303-311
11. Statistical Review of World Energy 2022 [Electronic resource]. URL:  
<https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy/co2-emissions.htm>
12. Shvakov EE, Krupnov YA, Gureeva EA, Karpovich OG (2021) Sources of income in the economy of pleasure: new growth vectors of developing countries in industry 4.0. *International Journal of Trade and Global Markets* 14(4-5):441-449
13. Cruz-Jesus F, Oliveira T, Bacao F, Irani Z (2017) Assessing the pattern between economic and digital development of countries. *Inf Syst Front* 19(4) doi 10.1007/s10796-016-9634-1
14. Barykin S, et al. (2014) Evaluating energy financing considerations and sustainable energy innovation with the role of financial development and energy development. *Environmental Science and Pollution Research* <https://doi.org/10.1007/s11356-022-22576-x>