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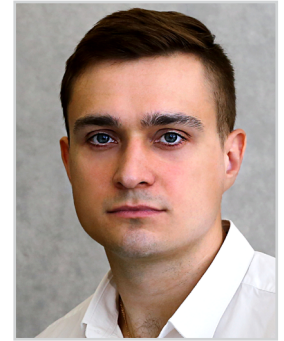
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Effects of the economic space digitalization in the context of modern society transformation

Abstract. The study systematizes approaches to the concept of digital economy and presents an analysis of the key indicators of digitalization development in the countries worldwide. The pace of economy digitalization in the world community is compared based on the increase of expenditures for ICT accompanied by mass digitalization. The level of expenditures for ICT in the Russian Federation has been estimated, and a positive trend in increasing its share in the GDP has been shown. The main effects of economy digitalization are identified and classified depending on the combination of various conditions prevailing in modern society. The main directions that determine the successful development of the digital economy are proposed.

Keywords: digital economy; socio-economic development; digital transformation; informatization; digitalization; territories; SMART cities

JEL Classification: F63; O31; O33

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Ефекти від цифровізації економічного простору в умовах трансформації сучасного суспільства

Анотація. У дослідженні здійснено систематизацію підходів до поняття «цифрова економіка». Проведено аналіз ключових індикаторів розвитку рівня цифровізації країн світу. Зіставлено рівні швидкості цифровізації економіки в світовому співтоваристві, на основі збільшення витрат на ІКТ, що супроводжуються загальною діджиталізацією. Здійснено прогноз рівня витрат на ІКТ в Росії, визначено тренд, який показує позитивну тенденцію щодо збільшення частки ІКТ у ВВП країни. Виділено та класифіковано основні ефекти від цифровізації економіки в залежності від комбінації різних умов, що склалися в сучасному суспільстві. Запропоновано основні напрямки, розвиток яких зумовлює успішне формування цифрової економіки.

Ключові слова: цифрова економіка; соціально-економічний розвиток; цифрова трансформація; інформатизація; цифровізація; території; SMART-міста.

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**Эффекты от цифровизации экономического пространства
в условиях трансформации современного общества**

Аннотация. В исследовании осуществлена систематизация подходов к понятию «цифровая экономика». Проведен анализ ключевых индикаторов развития уровня цифровизации стран мира. Сопоставлены уровни скорости цифровизации экономики в мировом сообществе на основе увеличения расходов на ИКТ, сопровождающихся всеобщей диджитализацией. Осуществлен прогноз уровня расходов на ИКТ в России, определен тренд, показывающий положительную тенденцию увеличения доли ИКТ в ВВП страны. Выделены и классифицированы основные эффекты от цифровизации экономики в зависимости от комбинации различных условий, сложившихся в современном обществе. Предложены основные направления, обеспечение которых предопределяет успешное формирование цифровой экономики.

Ключевые слова: цифровая экономика; социально-экономическое развитие; цифровая трансформация; информатизация; цифровизация; территории; SMART-города.

1. Introduction

The process of transformation of the digital economy in its scale and impact on the society is considered to be the new industrial revolution; its development leads to radical changes in the world community, creating an impulse for the rapid growth in many countries. At the same time, digitalization represents a new paradigm of accelerated economic development of the world economy. Its study in terms of modern society transformation which has replaced informatization and computerization, based on the digital presentation of information, leads to the increase in the efficiency of the economy and improves the quality of life.

Despite the fact that the programs «Digital economy of the Russian Federation,» Strategy of scientific and technological development of the Russian Federation and the National Technology Initiative are currently approved in Russia, the roadmaps are developed, the program of «Digital industry» is being prepared, and the priority project «National Champions» is being implemented, «Tekhspekh» («Techsuccess») ranking is being calculated, we should admit the lack of specific mechanisms and scenarios for the implementation of the breakthrough development in the priority sectors. Analyzing the features of society digitalization and the development of the digital economy, the main strategic priorities, positive and negative effects of digitalization of the Russian economy as well as methods for measuring the level of digitalization of a separate economic and social system, the current level of development and integration of digital technologies, and timely identification and assessment of risks of digitalization of the economy are the urgent issues for the research in the field.

2. Brief Literature Review

The entire global community is actively engaged in research of digital technologies. However, it is difficult to use traditional methods and standard indicators to study digital transformation of the economy. The attempts to form sets of indicators that characterize the degree and intensity of digital transformation of the economy are made by the Russian and foreign economists, leading

companies, and government agencies, for example: B. Carlsson (2004), Z. D. Sui & D. V. Rejeski (2002), D. Perrons (2004), D. Garcia, S. Y. Tessone, P. Mavrodiev & N. Peroni (2014), S. Antonelli (2003), D. Eleodor (2019), A. Ting & S. J. Gray (2019). Recently, Russian scientists have also been actively studying the processes of digitalization and the use of virtual technologies in the modern economy, namely: T. Kuladzhi, A. Babkin & S.-A. Murtazaev (2018), Yu. V. Vertakova, T. A. Golovina & A. V. Polyanin (2019), A. Polyanin, T. Golovina, I. Avdeeva, A. Merkulov & M. Klevtsova (2018), D. N. Karlov, Yu. S. Polozhentseva, L. V. Kremleva & D. D. Kalimullin (2019).

3. The purpose of the paper is to analyze the level of the digital economy development in modern conditions and determine positive and negative effects of digitalization.

4. Results

Digital technologies and platforms allow not only improving the organization of internal business processes by virtualizing the economic space, but also reducing transaction costs, and forming a digital (electronic) economy based on the network services.

Despite the fact that the concept of «digital economy» was introduced into the scientific discourse quite recently, in modern society, digitalization has become one of the priority areas of development, and a key infrastructure element of the economy as a whole. This term was first used in 1995 by an American computer scientist Nicholas Negroponte (1995). Currently, the digital space includes most areas of the society: healthcare, industry, education, housing and utilities, etc. On the basis of digitalization, such concepts as a SMART system are also being developed, for example, SMART cities (houses).

The digital economy is the basis for economy development as a whole and affects the development of such industries as banking, retail trade, transport, energy, education, healthcare, and many others. The introduction and development of digital technologies (cloud and mobile technologies, the Internet of things, Big Data, etc.) are changing the traditional ways of social interaction in society, as well as economic and institutional relations between economic entities. There are new ways of cooperation and coordination between economic stakeholders to jointly solve certain tasks in the field of digital transformation.

In the scientific discourse, in connection with the development of digital direction the following definitions were introduced:

- digital transformation - changes in human nature, thinking, life and management caused by digital technologies application;
- digitalization - the process of implementing digital technologies to improve the life of a person, society and the state;
- digitalization of public administration - a step-wise process of digital transformation of public administration into digital management,
- digital management - service-oriented organization of the functioning of the public management system based on digital technologies.

There are various approaches to the definition of digital economy in the economic literature. Thus, the originator of this term, N. Negroponte (1995), said that a digital economy is a specific transition from the movement of atoms to the movement of bits which indicates that there is a virtualization of such categories as raw materials, transport and others, since there is no real weight of the product.

A. Engovatova, an economist and an associate professor of the Lomonosov Moscow State University, described digital economy as an economy based primarily on new (alternative) methods of acquiring, processing, storing and transmitting data using digital technologies (Ivaschenko, Kuznetsov, & Engovatova, 2017).

From the point of view of the scientists-economists of the Trapeznikov Institute of Management Problems of the Russian Academy of Sciences, the digital economy is primarily based on the use of digital technologies, distribution of electronic goods and services, and economic production also based on digital technologies (Evsutin, Kokurina, & Mescheryakov, 2019).

The scientist-economist R. Mescheryakov, the digital economy is primarily based on the use of digital technologies, distribution of electronic goods and services, and economic production, also based on the digital technologies (cit. by Urmantseva, 2017).

From the position of the World Bank, digital economy is defined as a complex system that includes various types of relations, in particular economic, cultural, social, based on the use

of digitalization processes or digital information and communication technologies (cit. by Efimushkin, 2017).

Not only theorists but also representatives of the real sector and experts from leading companies are engaged in the research and application of the digital economy tools. For example, Alexey Galuschenko (2017), a partner at Ultima Consulting, claims that the digital economy does not exist in isolation from the traditional one, it is only a connecting element between the individual processes and objects (cit. by BIT. Business & Information Technology, 2017). At the same time, Vladimir Andreev (2019), the President of DocsVision company, says that digital transformation is not only automation and virtualization of the economic space, but also the creation of new business models, new markets and new consumers based on real opportunities and potentialities of the digital economy. Konstantin Tsivin (2017), the Vice President for marketing and business development at AstroSoft, also talks about new business models at the intersection of real and virtual economic space (cit. by BIT. Business & Information Technology, 2017).

Organization for Economic Cooperation and Development (2018) characterizes the digital economy highlighting the following main components:

- 1) infrastructure (hardware and software, telecommunication, networks, etc.);
- 2) e-business (conducting business activities and any other business processes through computer networks);
- 3) e-commerce (distribution of goods via the Internet).

The world organization Open Society Justice Initiative (2013) has developed 10 principles/standards for the access to the official information recognized by the international community which may be generalized as following:

- 1) maximum transparency of information;
- 2) access to information should extend to all subjects of public administration;
- 3) access to information is the right of every subject;
- 4) the principle of freedom of access to information;
- 5) the process of accessing information should be simple and fast;
- 6) the need to determine the exact conditions for denial of access to information de jure;
- 7) guarantee of the right to appeal against a decision to deny access to information;
- 8) obligations of managers of public information to assist in providing access to information;
- 9) the principle of preventive publication of information;
- 10) the principle of harmonization of the right of access to information with other laws.

Consolidation of promising directions for the development of digital economy at the state level in the Russian Federation began only in 2016. So, the presidential decree «About the Strategy for the Development of the Information Society in the Russian Federation for 2017-2030» (President of the Russian Federation, 2017) says that digital economy is an economic activity, in which the key production factor are data in the digital form and big data processing. Mass adoption and use of the digital Big Data technologies in comparison with traditional forms of economic activity are more efficient, productive, flexible, and dynamic.

Based on the presented definitions, we can say that digital or electronic economy is a sector of the economy based on the virtualization of the economic space, utilization of the modern digital platforms and technologies, combining the advantages of the traditional and network structures, based on the use of large amounts of information.

The processes of the development and transformation of the economy into the digital one are influenced by many factors. Four main factors play an important role in promoting the digital economy development:

- 1) digital finance - introduction of digital technologies in the banking sector of the economy, cybersecurity of data transfer, online payments in electronic commerce, electronic transfers, electronic auctions, electronic public procurement, electronic state budget, state social benefits, mobile money, digital currency;
- 2) social networks - virtual interaction is a base for acquiring and distributing information, helps to attract participants to political life, stimulates social changes, simplifies and accelerates interaction;
- 3) digital identification - the use of a single electronic identity card system for secure banking operations, voting, access to social services, payment of utility bills, use of biometrics, etc.;
- 4) data revolution - the focus is on interrelated innovations - Big Data. At the same time, analytics of big data arrays is used to improve various types of flows, evaluate generalized macroeconomic indicators, and improve management processes.

In the course of the research of the dominant development of the digital economy, its qualitative characteristics are considered. The key integrated determinants of the digital economy are:

- secure documentation through the automatic digital solution;
- a qualitatively new standard of living for the population (nature and conditions of work, education, leisure, etc.)
- quality of relationships and interaction between enterprises, society and the government;
- saving free time of individuals as a result of functioning of such economy, automation of production, system and complex modernization and reform of the health care system and education, etc.

The digital economy is a tool for implementing transformation processes of economic relations into a digital format. Under these conditions, the electronic format of interaction between participants in economic relations is developing.

The development of digital technologies in the public sector of the economy is important. Digital government and e-government services are increasingly seen as a means to reduce costs while providing more efficient services to the citizens and businesses.

In the Russian Federation, the development of the digital economy has become one of the priorities for the country's overall development, which is reflected in the key strategic development documents.

The state allocated USD 17.01 bln for the implementation of the program «Digital economy» until 2024, about USD 8.28 bln are extra-budgetary expenditures for the program. However, as for 2019, the «Digital economy» has unexpectedly come to a standstill. However, achieving these targets and increasing the digitalization index will allow the country to be highly competitive in the future.

The level of digitalization of the world's economies is uneven; this is primarily due to the development of the countries' entire economic systems, their potential and efficiency of functioning. Thus, according to the International Data Corporation (IDC, 2018-2022 Forecast), it is forecast that expenditures for the traditional technologies will continue to grow, but the growth rate of expenditures for the new technologies (artificial intelligence, robotics and augmented/virtual reality) will grow at a higher rate (Figure 1). According to the world expert groups, the share of the digital sector in the GDP of developed countries should be 5.5%, and developing countries - 4.9%. Currently, the share of the digital sector in Russia's GDP is about 3%, but according to the analysts' forecasts, it may reach 5.6% in 2021, mainly due to the digitalization of industries.

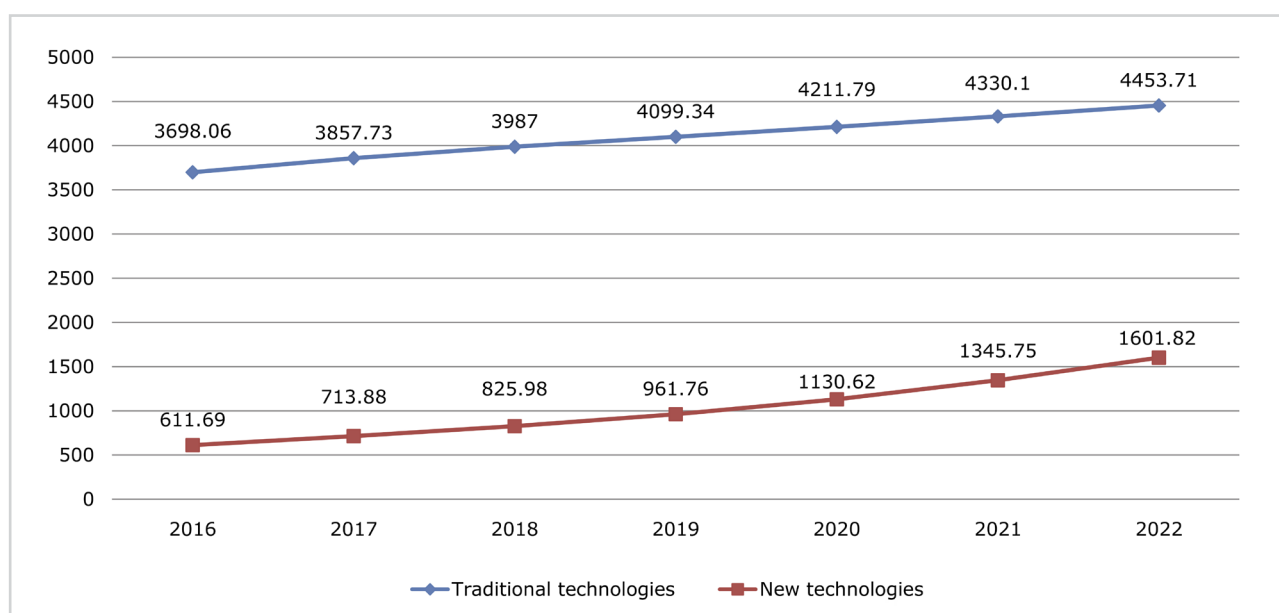


Figure 1:
Dynamics and forecast of expenditures for ICT in the world in 2016-2022,
USD bln

Source: Compiled by the authors based on the IDC Corporate data
(2018-2022 Forecast)

The most common indicators for estimating the level of digitalization development in the world are the following indices:

- according to the report of the International Telecommunication Union (ITU, 2019), the most developed countries according to the ICT Development Index (IDI) 2017 are Iceland (the 1st place - 8.98 points), as well as South Korea, Switzerland, Denmark, Great Britain, Hong Kong, the Netherlands, Norway, Luxembourg, Japan. In the Russian Federation the value of this index has been constantly growing for 10 years and currently stands at 7.07;
- the country-wise analysis of the E-government Development Index (the UN Global E-Government Development Index - EGDI) (UN, 2018) carried out every two years. According to the latest research conducted in 2018, the leader is Denmark (0.7969), which in comparison with 2016 has risen by 8 positions, South Korea and Australia are among the leaders, too. The Russian Federation as of 2018 ranks 32nd (0.7969), and compared to the previous period, it has risen by 3 points;
- according to the World Digital Competitiveness index (IMD World Digital Competitiveness Index - WDCI) (IMD, 2018) in 2018, the first place is taken by the United States (100), followed by Singapore (99.373), Sweden (96.070), Denmark (95.225), Switzerland (94.648), while the Russian Federation is only in 38th place (70.406) increased by 2 points as compared to 2017;
- according to the Global Connectivity Index (Huawei GCI, 2019) for 2019, the leaders are the United States (85 points), Switzerland (83), Sweden (81), Singapore (81), Denmark (78), while Russia is in 41st place (49 points).
- according to the Digital Economy and Society Index (DESI) (European Commission, 2019) for 2019, the leaders in the field of digitalization are mainly EU countries: Finland, Sweden, the Netherlands, Denmark, Great Britain, Luxembourg, Ireland, Estonia and Belgium. Other countries lag far behind the leaders in this index.

At the same time, Russia lags behind the leading countries regarding digitalization by at least 5-8 years. We have made a forecast of the level of ICT expenditures as share of GDP in the Russian Federation based on the extrapolation of a time series (Figure 2).

Taking into account the projected GDP values obtained from the analytical data of the International Monetary Fund's World Economic Outlook (WEO) study, we can determine the increase in the share of ICT expenditures in the GDP of the Russian Federation (Figure 3). The analysis shows that the share of ICT expenditures is growing, with the growth rate doubling in 2019 and 2020 as compared to the previous periods.

Today, there is no unanimous point of view among scientists and practitioners regarding the degree of the impact of the digital transformation of the economy on the functioning of the national

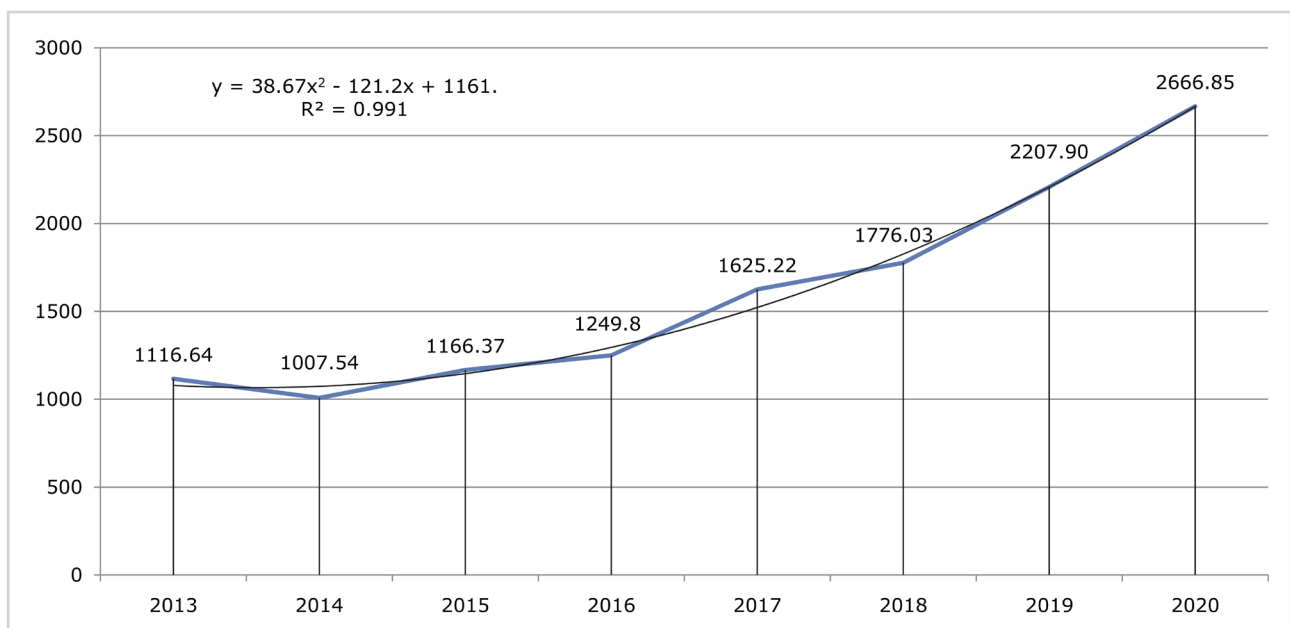


Figure 2:
Expenditures on ICT in Russia, 2013-2020 (analysis and forecast), USD million

Source: Developed by the authors based on data from the Federal State Statistics Service (2019)

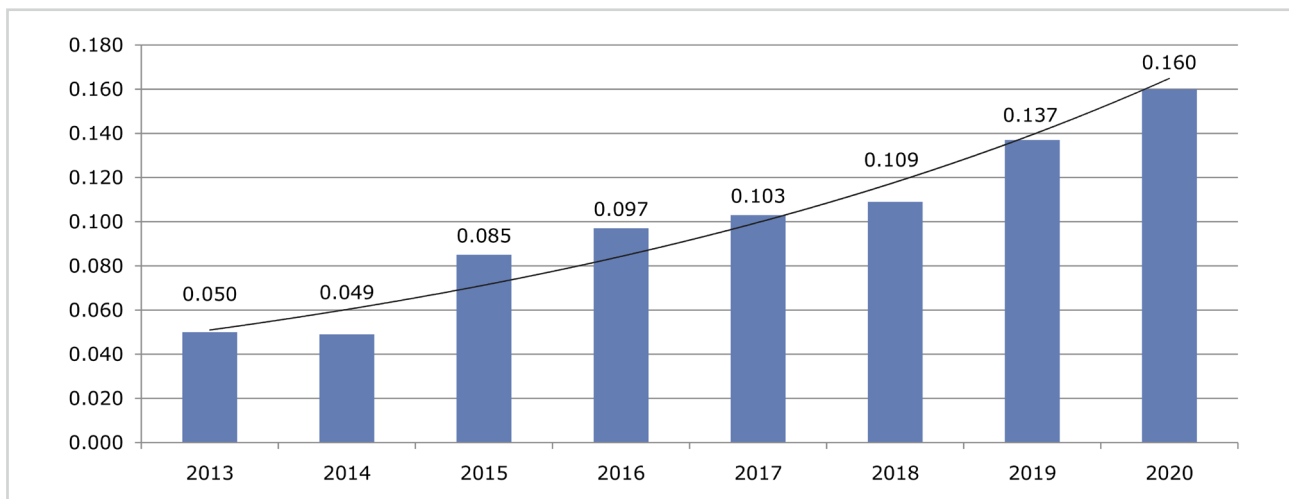


Figure 3:

Share of the expenditures on ICT in GDP of Russia in 2013-2020, %

Source: Developed by the authors based on data from the Federal State Statistics Service (2019)

economic systems. For example, the World Bank highlights «digital dividends» as the effect of digital transformation which include extensive dynamic economic growth based on the creation of new business platforms that stimulate investment and tax revenue (WB, 2016). The research results of McKinsey, an international consulting company that specializes in solving problems related to strategic management, are quite optimistic for Russia. According to McKinsey (2017), the potential economic effect of the Russian economy digitalization will increase the country's GDP by USD 77.33 billion by 2025.

The benefits of digitalization for the society are obvious since the users of digital products and services are the people who can get a high-speed access to the Internet, information and knowledge bases, which makes our life more comfortable and convenient, that is, relevant to the today realities (Lammi & Pantzar, 2019).

Thus, the positive effect of digitalization of the economy will not be long in coming. We have systematized the main effects of the Russian economy digitalization (Figure 4) which will contribute to the development of new technologies, create a reliable digital environment, optimize and scale operations, make them consistent and secure.

The digital economy changes traditional models of industry markets and increases the competitiveness of their participants. Thus, digitalization creates new growth prospects for the companies, industries and national economies in general by switching to new platforms and integrating new digital strategies with existing operations and indicators. Smart ideas and breakthrough technologies can quickly replace old business models that once were quite competitive. These trends are clearly visible in the example of Uber in the taxi industry or the housing booking site Airbnb in the hotel business.

Digitalization of the business processes helps companies quickly deploy at new platforms and involve a large number of stakeholders, as well as reduce costs and complexity in outdated operations, which allows companies to focus on new digital innovations.

Digitalization of enterprise management processes and automation of decision-making allows reducing expenditures for administrative staff and improving the efficiency of organization management. Digital management systems and data acquisition and analysis systems have become firmly embedded in the business environment over the past 15-20 years, outlining the corresponding digital drivers for enterprises. Using of automatic data acquisition and analysis, industrial sensors for the Internet of things, integrated enterprise management platforms, machine learning systems for optimal decision making are implemented and improved at most large enterprises and corporations (Nguyen & Dang, 2018). The digitalization allows reducing the risks in management and mitigating the incompleteness of information when making decisions. If the information security standards are met, digitalization can ensure an increase in the efficiency of all management processes.

Achieving a positive effect of digitalization at the state level requires institutional intervention of the government into the process of forming the necessary regulatory framework (work on improving existing legislation).

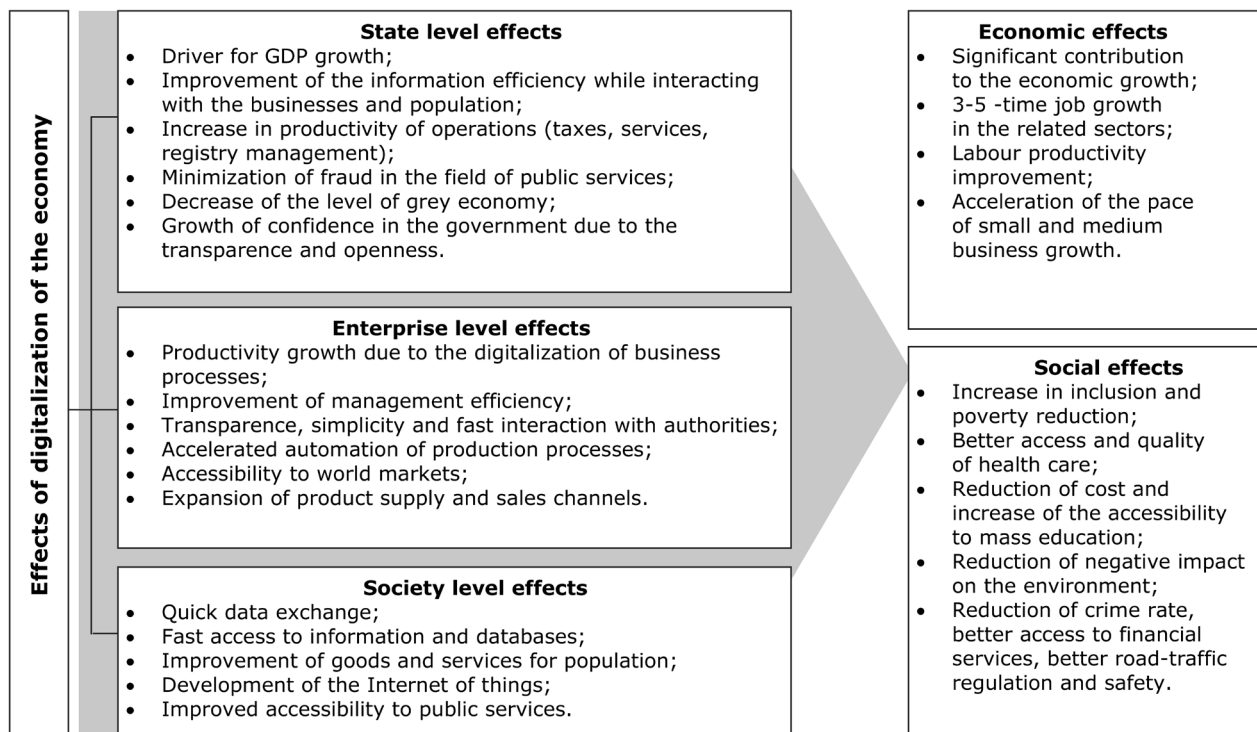


Figure 4:
Effects of the digitalization
Source: Developed by the authors

Digitalization of the real sector of the economy will strengthen the competitive position of domestic enterprises by increasing labour productivity, management efficiency, accelerated automation of production processes, production safety, and will make the domestic economy more attractive for investment.

Due to digitalization, it becomes possible to accelerate the development of innovations, support startups, teach everyone the basics of programming, and introduce digital technologies in the field of economy. The implementation of all the above conditions will increase the performance of the entire economic system of the state and gain additional competitive advantages in the global digital world.

Recently adopted strategic development documents in Russia provide for measures aimed at creating necessary conditions for the development of digital economy and formation of information society. At the same time, digital technologies are constantly being improved and integrated into global networks, integrated into various spheres of society and changing the global economy, which in turn requires scientific research of this issue. Therefore, today the issue of forming and implementing a strategy for the development of digital economy is an important area of research and practice-oriented activities, because it is the digital economy that involves digital transformation of all spheres of life, providing them with significant economic and social effects. In particular, countries that invest in new technologies are implementing large-scale economic reforms, and as a result, they receive digital dividends in the form of:

- 1) acceleration of the growth of the national economy;
- 2) improvement of the standard of living of the population and saving free time of individuals;
- 3) increase in the number of jobs;
- 4) improvement of the quality of relationships and interaction between business entities, citizens and the state.

To obtain maximum benefit from the digitization of the economy it is imperative to include appropriate legal and regulatory frameworks, accountability of institutions and providing opportunities to improve skills and employee training and education in the strategies of digital development.

To increase the values of indicators within the «Digital business» sub-index in the Russian Federation, it is necessary to overcome a number of obstacles, the main of which are the following:

- low level of investment in R&D;
- low innovative activity of the Russian enterprises;
- low share of innovative (venture) enterprises and a decrease in the volume of foreign investment in their creation and development;
- reduction of labor productivity indicators;
- low activity (at the level of enterprises and the state as a whole) regarding the development of human capital for digital business;
- lack of digital skills; significant differences in the level of digital literacy of the population;
- relatively low efficiency of the existing tools for coordinating and monitoring the use of public financial resources to support business digitalization;
- low level of equipment in most areas directly and indirectly related to the country's digital business system.

5. Conclusions

In order to effectively create the digital economy and eliminate the «digital divide», we should focus on the following areas:

- 1) development of digital infrastructure, provision of a broadband Internet access throughout the country, especially in remote areas, as well as those business infrastructure facilities that are located in the «digital gap» zone;
- 2) development of a highly efficient system to identify and protect personal data and trust operations that form the basis of the «soft» infrastructure;
- 3) development of the applications and services, such as «Smart city» and «digitalization of education», which are important components of «Industry 4.0.» and relate to those areas of life (industry, public safety, medicine, ecology, transport, etc.) that are still in the analog format;
- 4) formation of the highly qualified human capital that meets the requirements of modern conditions of digitalization, growth of new technologies to develop of specific human competencies and skills for successful activities in the digital space;
- 5) protection of intellectual property, which is the main factor that affects the motivation for creating innovations, the possibility to get profit and guarantee the protection of their intellectual results;
- 6) proper «digital» legislation aimed at securing the rights of citizens in the digital field, defining the basic principles of digitalization, ensuring measures to eliminate barriers and promote digitalization of certain sectors of the economy.

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