

Multi-Level Transformation Processes: Digital Technologies in the Economy

Svetlana Gerasimova, Irina Zaytseva, Diana Burkaltseva, Lyudmila Borsch, Nataliya Apatova, Elena Vorobyova, Amina Zharova, Sergey Ivanov

Abstract: *The article is devoted to the study of a relevant scientific and practical problem – multi-level transformation processes in the economy. The purpose of the article is to study theoretical approaches to transformation processes in the reproduction of technologies.*

Keywords: *economic transformation, technologies, digital economy, creative destruction, innovation processes, ecosystem.*

I. INTRODUCTION

Multi-level transformation processes in the world have become the main direction in the formation of a new type of economy. The use of modern technologies in the field of the digital economy, the improvement of state and innovation policies and ambitious forecasts indicate an upcoming technological breakthrough [1, 2].

The development trend that emerged in the postwar period shows the positive dynamics of the introduction of digital technologies. The use of breakthrough technologies, such as blockchain, Internet of things, quantum computing and unmanned aerial vehicles, in various industries allows moving to a qualitatively new level of development [3].

The main direction of the transformation economy in Russia is the introduction of innovative technologies, modernization of production processes, improvement of the legislative framework, high level of secondary and higher technical education, decent level of cybersecurity and other prerequisites to enter the world leaders in the near future [4]. For the successful development of companies in the national economy, the introduction of new technologies, such as Industry 4.0 in industrial production and blockchain in agriculture, is of interest [5].

The following tasks have been solved to achieve the set goal:

- innovation processes have been identified and their influence on the digitalization of the economy has been revealed;

- cause-and-effect dependences of time paradigms of transformation and innovation processes have been established;

- general directions of state policy aimed at technological breakthrough have been disclosed.

An analysis of innovative development has been carried out. Innovations are considered as the basis for increasing GDP growth rates and developing a new economy based on the analysis of world experience. The prerequisites for the development of the digital economy have been revealed, as well as breakthrough technologies that are the forerunners of the transformation economy.

II. PROPOSED METHODOLOGY

A. Block diagram

Managing the development of regional economies and territories requires effective interaction between different levels of all government branches.

Taking into account the development directions of the digital economy in Russia (Fig. 1), the processes of economic modernization and formation of platforms associated with practical solutions should reveal a mutual understanding between institutional, legislative and industrial relations to ensure the optimal transition of technological processes to a new level of socio-economic relations. These relations should be based on new characteristics of standardization, the methodology of system functioning, technical conditions, norms, rules, instructions and regulations, which provide for changes in the legal and regulatory framework.

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* Correspondence Author

Svetlana Gerasimova*, V.I. Vernadsky Crimean Federal University, Simferopol, Russia.

Irina Zaytseva, Saint Petersburg State University of Economics (UNECON), Saint Petersburg, Russia.

Diana Burkaltseva, V.I. Vernadsky Crimean Federal University, Simferopol, Russia.

Lyudmila Borsch, V.I. Vernadsky Crimean Federal University, Simferopol, Russia.

Nataliya Apatova, V.I. Vernadsky Crimean Federal University, Simferopol, Russia.

Elena Vorobyova, V.I. Vernadsky Crimean Federal University, Simferopol, Russia.

Amina Zharova, V.I. Vernadsky Crimean Federal University, Simferopol, Russia.

Sergey Ivanov, V.I. Vernadsky Crimean Federal University, Simferopol, Russia.

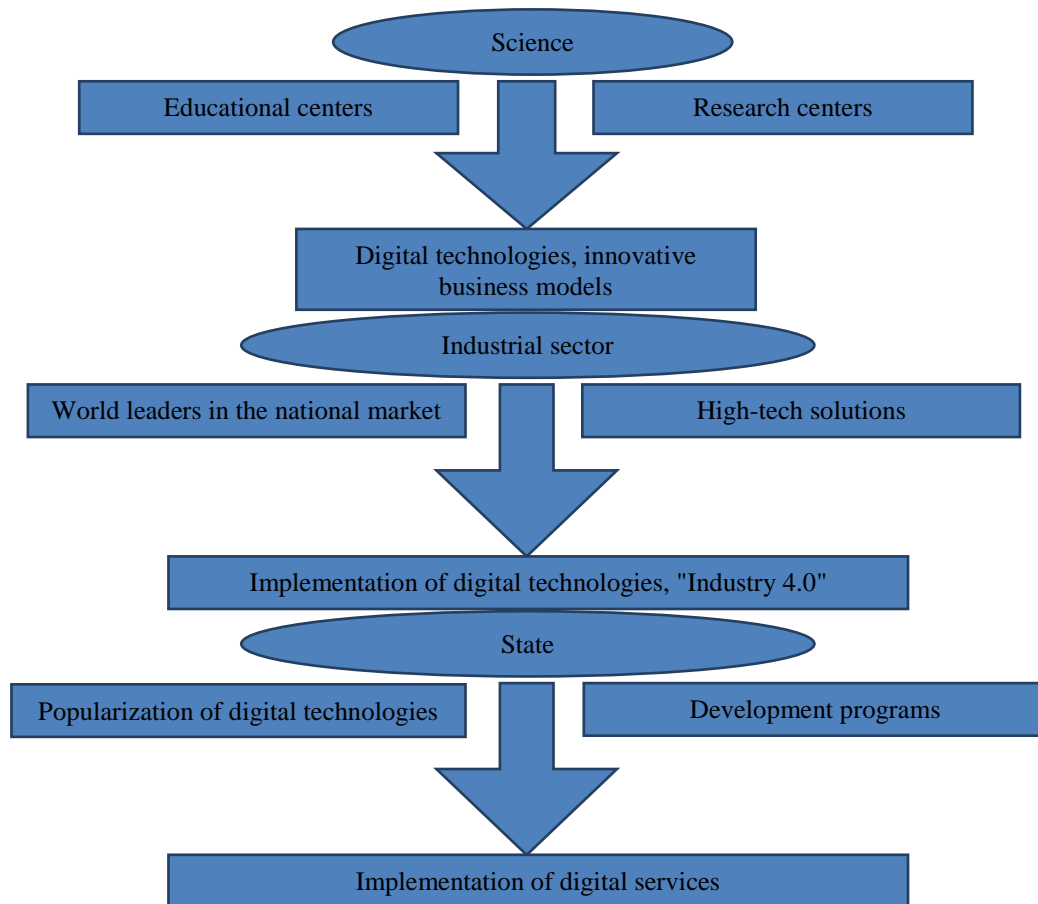


Fig. 1: Directions for the development of the digital economy in Russia

B. Algorithm

Data analysis, blockchain, Internet of things and artificial intelligence were considered based on the analysis of the international company McKinsey & Company [6].

Internet of things. The Internet of things is an innovative technology of wireless connectivity, cloud computing, sensors and artificial intelligence, which expands opportunities for such sectors of the economy as the industry.

The possibility of the Internet of things lies in its wide range of applications to solve global development problems in the areas of environmental protection, urban transport, road safety and energy conservation using Internet-connected devices. China has been actively implementing the Internet of things since 2010 and has reached a leading position in the global market [7].

Digital twins. Connection of the physical and virtual worlds. They are full digital reflections of individuals, objects, places and processes. It is planned to create digital counterparts for billions of things by 2020. Leading organizations use digital twin technology in the public sector.

Blockchain is changing the configuration of financial processes and creating new markets. This technology is based on the decentralization of transactional processes associated with the transfer of valuable assets and the distribution of responsibility for their execution among all participants.

Blockchain is used in public administration and business. Decisions based on the use of blockchain can be made without the intervention of a central authority in the process of certification, issuing land rights, storing medical records, etc.

In Russia, blockchain is used in Rosreestr and the agricultural sector as a pilot project to attract investments, track supplies and encrypt information.

Artificial intelligence is being introduced in retail, power engineering, manufacturing, health and education. Artificial intelligence involves the use of robots, autonomous vehicles and machine learning. The most promising use of artificial intelligence is machine learning.

The most complex breakthrough technology is *quantum computing*, which can improve financial models, simplify research in medicine, optimize risks and calculate large numbers.

The growing role of quantum computing causes an annual increase in government investment in different countries. "Future and Emerging Technologies" is a modern program in Europe aimed at the advancement of quantum technologies, based on the transformation of scientific achievements into competitive advantages.

The application of the Industry 4.0 technology in Russian industry involves the integration of innovative methods: big data analysis, machine learning, machine vision, Internet of things, 3D printing, drones, touch interfaces, robotics, etc.

Russia's path to technological breakthrough is conditioned by the growth of innovations, investment in national infrastructure, development of the legal and regulatory framework, high degree of technical knowledge and modern cybersecurity system, which are prerequisites for leadership in the world market.

Structural analysis of the economy and technological processes is one of the main elements of the structure defining their activities. The

global economy is introducing progressive transformation technologies at an accelerated pace, laying down the functions of continuous transformation in real-time based on updates. This transformation is accompanied by innovation processes that form their balance.

Improvement of the technological processes of the Russian economy is possible due to the VS mode of robotic advisers, managing and increasing the results of technology application and improving the manufacturability of the economic system (Fig. 2).

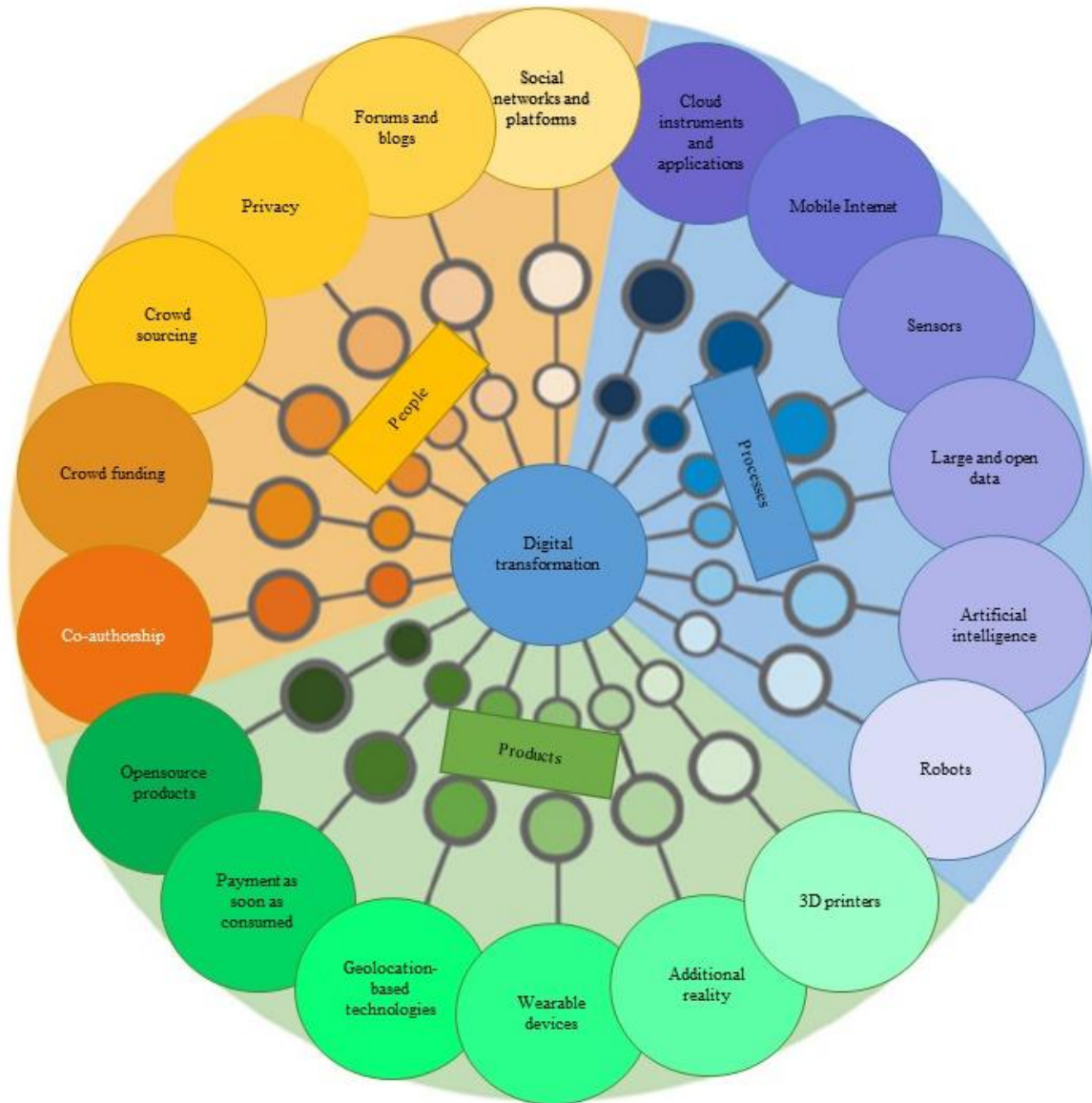


Fig. 2: Digital transformation

The methodology of this study is aimed at substantiating the choice of a resource management regime, including human, production and institutional resources in the context of a transition to a new level of development. The relevant factors of economic transformation in the applied sense of the provisions of the modern Neo-Schumpeterian theory should be taken into account in the framework of the analysis; a new economic reality of combinational build-up technologies is being formed [8, 9]. The processes of globalization lead to the transformation of the economic structure with highly developed industries and the formation of platforms hereinafter referred to as ecosystems. The model of the transformation economy itself is changing, transforming the paradigm; new essential characteristic features of the

economic theory are being formed [2].

III. RESULT ANALYSIS

A. Analysis of innovative development in Russia

Innovation can be interpreted in different ways, but many scientists identify a number of its features: 1) initiates the transformation process (introduction of new equipment and technologies in the production process gives positive results); 2) is a marketable product (formation of innovation is always justified by market demands); 3) has a high social effect from the introduction of new technologies (broadband); 4) represents the final result (patent, technology, new product).

Innovation leads to changes in quality of life. J. Keynes wrote in 1930 that technology would entail massive unemployment [10].

Recent studies conducted by the European Union, which is a global superpower, have shown that three-quarters of citizens believe that new technologies are beneficial for their jobs. Two-thirds claim that new technologies are beneficial to society and further improve the quality of life (Fig. 2). Despite these positive sentiments abroad, where the period of economic transformation began much earlier, it should be noted that most workers in developed countries are concerned about the impact of innovation processes on employment. The reduction in the number of employees occurs due to the automation of many processes (especially industrial). However, modern technologies are also aimed at creating new activities, industries and jobs [11].

For comparison, it is possible to cite the results of a survey of the Russian population aged 16 years and older, organized by the National Research University Higher School of Economics. The survey conducted in October 2016 – January 2017 shows a positive trend among the respondents in relation to achievements of science and technology; the role of digital technology is growing every year.

A distinctive feature of the current stage of technological progress is digital platforms: Facebook, iTunes, eBay, Yandex, Avito, OZON and others; consumers use digital platforms to buy and compare products (features, prices).

Attempts to build an innovative system have been being undertaken by the Russian government for a long time. The Strategy for Innovative Development of the Russian Federation for the Period until 2020 [12] developed in 2011 was based on the results of previous decisions. The strategy promotes innovative development of the country with the optimal modernization of the institutional structure. The foundations of the national innovation system are laid in it, including measures to develop R&D and to form innovative infrastructure and technological platforms, which are based on institutional changes with the support of the state, scientific sector and national economy according to regulatory and legal acts. Naturally, there are still many areas of development (science and business, innovative development sector) where there is potential and foreign experience in transforming the economy based on the innovative approach [12].

Table 1 shows the main legal acts regulating the innovation system in the Russian Federation.

Table 1: The main legal acts regulating the innovation system in the Russian Federation from 2005 to 2020

Legal act	Publication date
IV. Main directions of the policy of the Russian Federation in development of the innovation system for the period until 2010 [13]	2005
V. Strategy for development of science and innovations in the Russian Federation for the period until 2015 [14]	2006
VI. Order of the Government of the Russian Federation "On the approval of the Strategy for Innovative Development of the Russian Federation for the period until 2020" [12]	2011

The value of research costs is one of the elements of

innovation. Research costs in higher education have increased by 82.4 billion rubles over the past fifteen years and the increase in the public sector reached 16 times but the greatest dynamics are reflected in entrepreneurship. This condition is due to the development of state support and regulatory framework for innovation policy. However, the current state is characterized by unstable and low demand for innovations.

In Russia, the transition from the traditional form of economy to the modern one has lasted 20 years and involved a long duration. It is possible to identify several problems faced by the country during the transformation of the economy:

1. The predominance of industrial production and extractive industries (as the experience of foreign countries shows, the Soviet period did not give expected results). The fuel and raw materials industries, relying on the extremely favorable conditions of world prices, are the most successful and popular. Unfortunately, this hinders the progress of knowledge-intensive industries [15].

2. The activity of Russian entrepreneurs is aimed at sale, not production. Unfortunately, imports of machinery and consumer goods are increasing every year, despite the huge production opportunities in the country. The export trend has an unstable character: mainly agricultural products are exported while the country's imports include industrial production, machine parts and equipment.

3. As noted by S.V. Smolenskaya, innovation processes require significant investments, which began to deteriorate in 2014. The investment climate in Russia is characterized by a decrease in innovation activities. The main obstacle to any investment, including investment in the innovation sector, is macroeconomic instability, the deterioration of which is the result of imposed sanctions [16].

A good example would be the result of government support for innovation in developed countries. The support for the production of new technologies and products is financed by up to 50% in the US and France. Free paperwork, tax exemption, etc. are also applied in some countries (Table 2).

Table 2. State support of innovations in Russia and foreign countries

Country	Form of support
US, France	subsidies, loans for the creation of new technologies and products
Sweden	interest-free loans
Great Britain, France, Germany, Sweden, Holland	risk-based innovation funds
Austria, US	low state duties for individual entrepreneurs
Russia	privileges on tax payment; grants, credits, loans, contributions to the authorized capital, export support

Source: [17].

Studies presented in the fteval Journal for Research and Technology Policy Evaluation [18] devoted to the analysis of benefits and effects of tax and financial instruments of state



support of innovations in Russia allow highlighting the following features: 1) current state support, as well as tax and financial instruments, are acceptable to large firms, which have been working in the market; separate elements aimed to stimulate small and medium enterprises are lacking; 2) considerable efforts of the Russian government aimed at the development of research and industry in cooperation with universities and research institutes do not give desired results (financial support of projects for the development of high-tech industries, establishment of a network of technological platforms, creation and promotion of innovative development programs and territorial clusters); a possible reason for this is the lack of new connections; 3) investment in new equipment, increase in the production of new improved products and development and implementation of new promising projects are necessary for the further successful development of Russian innovation policy [18].

This study allows us to argue that new technologies have a beneficial effect on the development of society and created jobs are a production benefit for people. Undoubtedly, the processes of modernization of production facilities, technological and technical re-equipment have a negative side of employment.

It was determined that within the framework of the strategy, it is necessary to optimally modernize the institutional structure of the national innovation system by developing infrastructure and forming technological ecosystems, which will entail institutional changes ensuring the socio-economic development of economic and social sectors.

B. Innovation as the basis for GDP growth and the development of the new economy

The expected increase in GDP growth in Russia due to the introduction of innovations does not give sufficient effect and is at a low level. The positive trend of the 2000s was replaced by the crisis of 2008 and now – 2014-2015.

Among scenarios developed by the Ministry of Economic Development, the baseline scenario suggests a GDP growth of 2.2% by 2020, which certainly shows positive dynamics, but is not enough as compared to the global average level (global GDP increased in 2017 by 3%). The optimistic one scenario considers a growth of up to 2.6%, mainly associated with innovations and an increase in the capital factor. The ambitious scenario assumes a 1.5-fold increase in GDP due to the activation of the innovation potential in the coming years with the prospect of increasing the annual GDP growth to 5.7% in 2021-2025, which would make it possible for the country to rank fifth among world economies and outrun the global average rate growth [19].

It is also necessary to analyze the tax incentives for enterprises that use innovation in their activities. Russia introduced several tax incentives for innovative enterprises, having adopted the foreign experience of tax incentives in the development of science and technology support. According to Art. 149 of the Tax Code of the Russian Federation, R&D is not subject to taxation at the expense of the budgets of the accounting system of the Russian Federation, as well as finances of the Russian Fund for Fundamental Research, Russian Fund for Technological Development and funds for supporting scientific, scientific-technical, technical and

innovative activities created for these purposes in accordance with the federal law [20].

The following factors contribute to the successful development of the national innovation system: 1) consistent and long-term innovation policy of the state with clearly formulated aims and objectives; 2) rational use of existing innovative potential as the foundation for building an innovative economy and implementing innovative policies; 3) systematic efforts to establish and strengthen cooperation between the private, research and education sectors; 4) identification and target support is important for potential innovative and technological areas, developing quickly enough or not developing independently; 5) coverage of the increasing amount of potentially innovative firms by providing them with state support; 6) developed programs for the commercialization of innovations, created and borrowed technologies; 7) the reasonable attraction of foreign investment by transnational corporations; 8) presence of developed legislation in the field of intellectual property; 9) systematic study and implementation of best international practices [21].

The use of digital technologies contributes to the formation of a new type of economy, allowing to increase the level of trust of the population, increasing the availability and efficiency of public services: registration of legal entities, tax payment and declaration, accreditation, registration; improvement of business platforms for tendering and procurement and development of business servers (logistics services, mobile banking).

The use of the digital economy can quickly transform countries and regions in the world. Changes in the use of digital technologies have a profound impact on business and service delivery, competitiveness, decision-making efficiency, lifestyle and education.

Digital technologies are becoming an integral part of life: 1) for the consumer, due to the spread of smartphones and access to the Internet, one can gain knowledge much faster than before; increasing competition leads to lower prices on certain programs or free demonstration and alternative versions; 2) for the state, the provision of public services in the digital format eliminates the contractual relationship; through the introduction of intuitive interfaces, the interaction of government departments with citizens and enterprises becomes more convenient; the needs and individual approach to each client are taken into account; 3) for the labor market, despite the reduction in average-skilled workers performing typical tasks, new professions are appearing (there is no geographical attachment, which allows residents of the periphery to receive high-quality knowledge, improve their skills and find work irrespective of their location).

C. Prerequisites for the digital economy

The economy of developing countries does not stand still and the development of the digital economy over time can compete with the leaders of the world market. A significant place in the digital economy is occupied by such countries as Germany, Japan, South Korea, the US, but each of them is characterized by peculiarities of development (Table 3). 10% of the German population is employed in high-tech industries; the role of the state is to develop high-quality education and stimulate research without taking a central

role in the financing of digital projects. Innovations in South Korea and Japan are formed on the basis of global companies with a long history; startups are less developed. US government policy is aimed at investing in digital technologies, which shows positive dynamics in innovation and successful implementation in many sectors of the economy. Digitalization of the population is carried out; Internet retail and digital banking are used.

Table 3. Foreign experience in the development of the digital economy

Country	Distinctive features
Germany	innovator of industrial technologies, including the Industry 4.0 concept
Japan, South Korea	innovations on the basis of international corporations (Samsung, LG, Toyota, Sony, Toshiba); Internet commerce and ecosystems, creation of instant messengers (Line, Kakao, Rakuten)
US	manufacturing innovation put on mass production
China	online retail, online ecosystem, digital banking; projects aimed at exports (Alibaba, Huawei)

Source: [22].

The digital economy of the leading countries has been developed in different ways; it is united by the need to increase investment in innovations and favorable conditions for their further implementation.

Although Russia is not among the leading countries in the development of the digital economy, there are opportunities for a technological leap in many areas of activity. The main components of the digital economy for Russia today are consumption/e-commerce, investment for development, public administration, as well as export-import activities [23-25]. It should be noted that the country is looking for its path of development, choosing a worthy niche. Today, large Russian digital companies enjoy international reputation: Tinkoff Bank is the largest independent online bank; ecosystems of Mail.ru and Yandex services; manufacturer of marine equipment and electronic navigation systems "Transas"; electronic Avito ads; cellular services; social networks; the "Kaspersky Lab" company cybersecurity; common digital environment of medical institutions in Moscow; "Our town" and "Active citizen" portals.

Russia has all the necessary prerequisites to take its rightful place on the world stage in the next 15-20 years. There is the potential of an intellectual and scientific base (decent higher and secondary education) for this, as well as the development of infrastructure on a state scale, which occurred in recent years. It is necessary to use the country's potential as efficiently as possible for the development of Russia at a qualitatively new level and pay attention to a number of problems: 1) scientific base, reform of education, need to introduce new approaches to learning, development of research centers with state funding of promising projects; centers for advanced training and retraining of employees, including those that have lost their jobs due to automation of production; access to education systems for residents of any part of the country; 2) for sectors of the economy, studying the global experience of the leading countries of the digital economy; the development of modern technologies including Industry 4.0, Internet of things, 3D printing, virtual reality, blockchain and other breakthrough technologies; 3) state policy, digital development, continuous work in dialogue

mode to adjust the regulatory and legislative framework in accordance with digital development; expansion of digital public services; cooperation with educational and research organizations; leading companies will allow developing innovative digital solutions, products and standards.

The Russian government considers the development of IT-technologies as the basis of key initiatives of investment innovations, along with the creation of the Investment Fund of the Russian Federation, which is aimed at supporting small and medium companies. However, these companies do not have the opportunity to reach greater serialization of products. These contradictions are the main reasons for the emergence of cluster development, in which companies get the opportunity to reduce overhead costs for their activities while maintaining independence and development dynamics.

Each branch of the economy has its reserve for innovation; in most cases, innovation involves large investments and market outlets. The peculiarity of the industry is manifested in the use of new technologies; the general direction of development is the digitalization of industries and the introduction of the Industry 4.0 technology, including in terms of process automation.

Digital transformation is recognized as a priority for Russia. Future technological breakthroughs in the country are due to the new level of development of public administration and the use of digital technologies in the experimental form (data analysis, blockchain, Internet of things, artificial intelligence) considered on the basis of the analysis of the international company McKinsey & Company [17, 26].

VII. CONCLUSION

The conducted scientific discussion of the conditions for changing the model of economic development, modernization of the economy and formation of platforms determined the directions of transformation of the economy associated with the introduction of innovative technologies, modernization of production processes, improvement of the legislative framework, high level of higher education, modernization of institutional infrastructure and decent level of cybersecurity with the premise of entering global leadership.

The principal position of the difference between the theoretical argumentation of supporters of digital technologies used to promote competitive projects aimed at exporting products is determined. Differences of opponents are revealed, the efforts of which are aimed at digitalizing the population using Internet retail and digital banking. The positions of the arguments for the rapid transformation of countries and regions of the world under the influence of the digital economy are analyzed. Digital technologies are becoming an integral part of the life of society, which receives knowledge in the right amount at an accelerated pace.

New technologies are breakthrough at all levels of society and the formation of breakthrough technologies should be supported at the legislative level through the mechanism of institutional and socio-economic relations. In our opinion, this approach will lead to a change in the model of economic development,



raising social standards in society.

These combined technologies in the economy will provide modernization and transformation of social and economic relations on the basis of technological and innovative approach. First, the use of innovative approaches and progressive transformation processes will affect the change in the structure of the economy, ensuring economic growth. Second, the change of the economic development model is combined with the process of technological innovation and incorporation and its application in economic activity.

Further research should be directed at the consideration of the new knowledge-based economy in terms of complex multi-level phenomena using macroeconomic approaches.

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