



Relationship Between the Economy Digitalization and the “Knowledge” Production Factor

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Abstract. Economies of the leading countries of the world have been evolving towards digitalization, as a process of expansion and penetration of digital technologies into entire spheres of the economy of the post-industrial society during the past two decades. The article is a scientific research focused on solving the problem of grounding the digitalization of the modern economy as an objective process subject to creating the information society, knowledge-based economy and innovative economy in the post-industrial era. The purpose of the work is to study the relationship between the economy digitalization and the transformation of knowledge into a leading factor of the post-industrial production. Processes of digitalization of the economy in the post-industrial society are discussed in the article; transformations in the interaction of the post-industrial production factors are highlighted, and the separation of knowledge into an independent fifth production factor is substantiated here. The transformation of knowledge into a leading production factor is associated with the separation of intellectual activity in addition to labor and entrepreneurial activities. A relationship between functioning of the knowledge-based economy and its digitalization appears. Additional relevance of the study is to consider a status of digitalization of the Russian economy, to identify the strengths and weaknesses of the state program of the country digitalization, which should contribute to the process of the Russian economy digitalization.

Keywords: Knowledge · Information · Post-industrial society · Production factors · Digital economy · Digitalization · Knowledge economy

1 Introduction

The digitalization process is thought of as using “digitized data in organizational and public processes (including economic activities)” [3, 4]. The digitalization process is increased in the modern economy every year, as evidenced, first of all, by the development of information and communication technologies. The most developed countries of the world entered the stage of the post-industrial society, which economy can be described as an information economy, a knowledge-based economy, an innovative economy and an increasingly more digitalized economy. A modern developed economic system is impossible to be imagined without any of these elements.

The term “digital economy” was introduced by the Organization for Economic Cooperation and Development (OECD) in 2014. The digital revolution, often called as the 4th industrial revolution, is a transition from analog, mechanical and electronic technology to digital one. Technological and digital revolutions do not create new societies, but they change conditions in which social, political and economic relations are implemented.

The digital economy becomes a driving force of growth in recent years. There are the following indicators of the developed digital economy: a level of human capital, researches and innovations; a status of information infrastructure; and using digital technologies in public administration, business and the production process. The digital economy creates opportunities for the development of innovations, and the adoption of new technical and technological solutions. Digital transformation as integration of digital technologies into the economy results into essential changes in the strategy of doing business, communication and development at the national and international levels.

Many things depend on the state position in the process of digitalization of the economy. It should be noted that the program “Digital economy in the Russian Federation” was approved in Russia in July 2017. The program certainly defines a number of priorities, but it does not pay enough attention to e-commerce, economic mobility, the sharing economy and online platforms – those spheres that provide the basis of the country’s digital economy. The problems of the digital economy and the digitalization of the modern economy are one of the most discussed in the world economic literature in recent years [4, 5, 8, 21, 29–31].

At the same time, in our opinion, the problems of the development of the digital economy and the digitalization of the economy of the post-industrial society are not associated with transformation in the interaction of factors of the post-industrial production with the separation of knowledge into an independent, fifth and leading production factor in most of the studies. Namely, the latter determined the purpose of the study, which is to substantiate the relationship of the economy digitalization with the transformation of knowledge into a leading factor of the post-industrial production.

To achieve this purpose, we should perform the following tasks:

- to consider the processes of digitalization of the economy in the post-industrial society;
- to reveal transformations in the interaction of factors of the post-industrial production;
- to substantiate the separation of knowledge in an independent leading production factor;
- to explore the relationship between the knowledge-based economy and its digitalization;
- to show an objective background for developing the digital economy in Russia.

2 Methodology

The authors use a combination of general scientific and special methods of studying economic phenomena. Such an integrated approach includes methods of analysis and synthesis, concrete historical approach, abstract logical approach, method of

terminological analysis, as well as positive and normative analysis. The use of these methods to study the relationship of digitalization of the economy with the factor of “knowledge” production made it possible to analyze the constituent elements of economy of the post-industrial society, to consider transformations in the interaction of factors of the post-industrial production due to the transformation of knowledge into a leading factor, substantiate objective reasons and the need to digitalize the economy processes.

The following materials were used for the study:

- Reports, reviews, studies and publications of the World Bank;
- OECD Digital Economy Outlook 2017 – a biennial review prepared by the OECD (Organization for Economic Cooperation and Development), which reflects new opportunities and challenges in the digital economy;
- Russia 2025. Joint research by the Boston Consulting Group (BCG), Sberbank PJSC, the Sberbank Contribution to the Future Charitable Foundation, the WorldSkills Russia Union and the Global Education Futures.

The study includes more than 90 interviews with senior management of the largest Russian employer organizations from 22 industries collectively providing jobs for more than 3.5 million people: with representatives of boards of directors and shareholders, managers and their deputies on strategic and personnel issues, HR directors, as well as with representatives of state administration bodies, the education system, small and medium businesses, start-ups, business associations, Russian and international experts in the field of human capital.

In addition to the interview, an online survey of Russian employers was conducted, which aimed to collect opinions on the company’s priorities and objectives up to 2025, plans and barriers to development, changes in staff numbers and categories of employees, expectations from employees and requirements for them. In addition, the survey made it possible to form a vision of the influence of global trends and current realities on the image of the future labor market in Russia.

- The Global Innovation Index is an annual study of the level of development of innovations in countries around the world. The research was organized by INSEAD, an International Business School; Cornell University; World Intellectual Property Organization (WIPO).
- Digital Evolution Index 2017 reflects the state and rate of digital evolution and identifies the implications for investment, innovation and policy priorities.

3 Results

The formation of the economy of the post-industrial society includes a number of processes that characterize the post-industrial economy:

- firstly, this is a process of informatization, which allowed talking about the transition to the information society where information is a main economic resource and the economy becomes informational;

- secondly, the economy based on knowledge appears; knowledge becomes a main factor of the production; an economy of knowledge appears;
- thirdly, the economy becomes innovative; it is based on innovations, not only knowledge, but new knowledge in economic activity is used;
- fourthly, the digitalization process of the economy is underway, and the digital economy is being formed now.

These processes took place in the world economy in stages as the economy of the post-industrial society developed, but they can occur simultaneously. The latter is most typical for countries which are in transition from the industrial to post-industrial stage. The process of the economy digitalization is objectively due to the transformation of information into a main economic resource and knowledge into a leading factor of the production. Transformation in the interaction of factors in the post-industrial production is a consequence of this. Fundamental changes in the factors of the production take place; the process of their interaction is being transformed. And the technological method of the production of the post-industrial society, behind the development of which driving forces are information and knowledge, replaces the technological mode of the production of the industrial society.

These transformations did not occur spontaneously. People began considering information as a full-fledged economic resource in the middle of the last century, and economic development was always carried out at the expense of new knowledge and the development of new ideas, which were subsequently used in the production process. Knowledge was applied in the production process from the moment of their appearance, as far as their knowledge grew, so did their role. If we consider the genesis of economic history, knowledge has always been a part of the production process. Over time, knowledge and experience of each generation was accumulated, systematized and underwent changes. A life style, features, rules and production experience were formed based on knowledge. Empirical knowledge acquired a formal nature and became a basis for creating a regulatory and legal framework necessary for the functioning of society. Inventions and achievements of the scientific and technological revolution – all this is knowledge, thanks to which new products were created or labor productivity increased.

The transformation of the interaction of factors of the production and the deepening division of labor in the industrial society led to the separation of entrepreneurial activity as independent one, and entrepreneurship to an independent factor of the production. The division of labor in the post-industrial production leads to the separation as an independent production activity, along with labor and entrepreneurial activity, and that one for the knowledge application, related to innovations, innovations, as well as the introduction of scientific and technological revolution in the production process. In our opinion, the term “intellectual” is most suitable for defining this activity. This is an activity of applying and using knowledge, i.e. acquired and processed information. It was not separated as an independent one in the industrial society, but was carried out in the process of labor and business activity [19]. The modern production process becomes impossible without intellectual activity. An earthshaker in the interaction of factors of the production is connected with the fact that the activity on using and applying knowledge becomes determinative in the modern production process. As a

result, technological relations and interrelations between factors of the production fundamentally change; the process of their interaction is transformed, and a technological method of the post-industrial production appears.

The activity on applying knowledge in the post-industrial society is not directed like in the industrial society to the improvement of other factors of the production, the improvement of their organization and interaction. It is associated with the development and increase of knowledge itself and the production of an intellectual product [17]. The modern system of social reproduction can be described as innovative reproduction [18], which is based on new scientific knowledge [16], information technologies, services and products. Innovative processes fundamentally change the role of information and knowledge in the system of the production factors. They begin to play an independent and crucial role in it [19].

A significant number of concepts characterizing knowledge as an economic category, on the one side, is undoubtedly conditioned by the importance and relevance of this resource, but on the other side, they do not allow revealing its meaning and significance. No doubt that any product of the production includes a certain amount of knowledge having a certain value. Capitalization of knowledge in the production takes place through the transfer of their value to the value of the production product. And knowledge in the modern economy is not just equivalent, but also the prevailing factor in creating value.

Understanding the fact that the production process requires the combination of all factors of the production is one of the fundamental in economic theory. Modern economic science recognizes knowledge as a limited, valuable and unique production resource, but it is still not always ready to consider it as a full-fledged production factor. Knowledge acts as a factor that integrates and creates innovative content of other production factors by enriching them with fundamentally new content. If we consider the properties of knowledge as a production factor, then the following things can undoubtedly be included:

- the ability to create added value of a product;
- limitations;
- a rarity, in connection with which the process of obtaining knowledge requires capital investments, and the cost of knowledge is high;
- knowledge is the first principle of skill; it is impossible to form the necessary professional competence of an employee to create a product without knowledge;
- the inability to be replaced by any other resource;
- the ability to generate income (as intellectual income is payment for knowledge).

This is only a part of those properties that knowledge possesses. Production factors affect its quality at the stage of manufacturing a product. Knowledge is no exception. Unlike other production factors, there is no direct relationship between investment in knowledge and its effectiveness. It is level of intelligence, education, skills and experience of a carrier of knowledge that is a pledge to the quality of knowledge. Based on the aforesaid, it follows the conclusion that knowledge is undoubtedly a production factor.

Knowledge is a result of using human and intellectual capital [12, 15, 20]. Summing up the results of 2017 year, the World Bank notes that the human capital is two-

thirds of the world's wealth. Investing in people results in greater wealth and faster economic growth than investing in material production factors. Human capital, such as investing in skills, experience, knowledge and efforts of the population, is the biggest asset in the world. It accounts for more than 65% of global wealth. However, in low-income countries, human capital makes up no more than 41% of wealth – it is human capital. As the country's economy develops, the share of human capital becomes more and more significant. Among other problems, the acceleration of technological development requires that countries should urgently invest in their populations if they hope to compete in the economy of the future [1].

Using new digital technologies, the digitalization of the economy of the post-industrial society and the formation of the digital economy is the inevitable consequence of the processes of the economy intellectualization, the transformation of knowledge into a leading production factor and the development of the human capital.

According to rough estimate, a share of the digital economy in the world economy is about 5% of world GDP and it covers 3% of the world labor market. The digital economy is unevenly distributed on a worldwide scale – most of the digital economy is concentrated in the countries of the global North, but the countries of the global South demonstrate the most significant growth rates. However, potential growth may be even higher, so there is a need for further research on the current limitations and long-term impact of the digital economy [4]. The rate of the transformation processes that occur in the global economy is very high: many of urgent questions in 2016 are currently implemented and fully applied in business processes.

The value terms of the high-tech sector, which is especially in demand in the context of ubiquitous digitalization, exceeds the cost of traditional industrial production. The price of companies is influenced by the value of owning intangible assets – intellectual property and intellectual capital. Currently, the cost of raw materials, other materials and labor costs affect the economic result to a lesser extent. The development and creation of a beneficial environment for accumulating the experience and knowledge of employees, attracting highly qualified specialists, as well as maintaining and encouraging innovative activity are key factors for the development of a modern enterprise. This allows not only achieving an increase in production efficiency, but to create new knowledge and embody it into unique products. Companies with a high level of organizational and human capital that intensively use knowledge are more competitive now.

At the same time, the process of understanding the patterns of functioning of the digital economy is just beginning. It is possible that the countries with developed economies are still at the “installation stage” by concentrating on finding new ways of doing business in violation of the established practice. Successful digitalization requires government programs to manage the transition to the digital economy, which should maximally adapt existing institutions to this transition.

Understanding the need to move to the innovation-based development has been existing in Russia for a long time. But, despite the adoption of various programs, including at the state level and the implementation of large-scale projects, the production in the country remains at the industrial stage even at the level of the largest corporations in the fuel and energy complex. In our opinion, the lack of sufficient interest in the development of an innovative economy is one of the reasons for this.

A significant leap can occur if interests of main owners of production factors and, first of all, the owners of knowledge, are implemented in the process of innovation development [16].

The digital economy plays a key role in the new economic realities of the knowledge economy. At the same time, “Digital Economy in the Russian Federation”, a Russian program, is focused, first of all, not on the acquisition of knowledge, but on the acquisition of skills and groups of skills or competences. The development of digital skills of all members of society provided for by the state program is certainly necessary, but rather as a measure of social support of the population than as a priority direction of the development. The knowledge society is based on unique products of intellectual labor – namely, these intangible assets must be highlighted as a priority-oriented. The main incomes of the developed countries have been already formed due to the formation of intellectual capital.

Russia needs to focus on foreign experience in development and knowledge management: the creation of national hubs, free economic zones to attract specialists and the intellectual elites. Digital platforms, new technologies, etc. – all of these are products created by knowledgeable professionals. Now, namely digital flows, but not trade in traditional goods, determine global GDP growth.

Turning to assessing the objective development level of information and communication technologies in the Russian Federation, let us turn to the Global Innovation Index. In 2018, Russia ranked 46th out of 126 countries participating in the study. The index analyzes such indicators as human capital, research and developments, infrastructure and market potential. It should be noted that the result of innovation activity is evaluated not only from the point of view of specific technological innovations, but also takes into account the products of creative activity.

The next analytical indicator, Digital Evolution Index 2017, reflects both the status and speed of digital evolution and determines the implications for investment, innovation, and policy priorities. In 2017, Russia ranked 39th out of 60 countries analyzed. Components of the index refer the country to the category of “promising”, while China is a leader. The Chinese experience in building the digital economy is very important for Russia. China competes with Western mobile technologies to a large extent due to a combination of economic growth, huge investments in 4G infrastructure and a competitive mobile phone market formed by such companies as Xiaomi, Oppo, Huawei and Vivo. Having overcome the rest of the country in the field of mobile payments, online dating and lending through mobile services, China will soon become a leader in the export of mobile technologies. The economy of the PRC, the second largest after the USA, will be the largest by many estimates by mid-century [7, 9, 10, 28].

China’s unique growing progress in the digital economy is fueled by such Internet giants as Alibaba, Baidu and Tencent, which form fundamentally new business models in the international market. These three companies together have 500–900 million active monthly users in their respective sectors.

In terms of the attractiveness of the labor market for talents, Russia lags behind not only developed, but also many developing countries continuing to lose talents. This is largely due to the fact that the Russian economy continues to be primarily orientated on raw materials and focused on the export of natural resources. The demand for labor in general remains primitive, and the state dominates in the structure of employers. The

model of “social employment” is encouraged, i.e. inefficient jobs are preserved even in conditions of GDP reducing. A share of small and medium-sized businesses is growing very slowly (16%) in the country; the digital economy is stagnating (2–2.5%), and the venture capital market is represented in its infancy (it is hundreds of times smaller than in the USA, 12 times smaller than in Israel and 6 times smaller than in Japan) [26].

Such an approach to the formation of the labor market threatens in the near future that with onset of the “second era of machines”, more than a million professions can be automated in connection with using innovative technologies. As noted earlier, there is a problem of preserving inefficient jobs to maintain a relatively low unemployment rate in Russia; therefore, the Russian economy will have to face the dilemma of prioritization in the near future: either develop and implement digital technologies in the production, or maintain the current number of jobs. Automation of production, artificial intelligence, etc. – all this will help develop knowledge and intellectual potential of the economy, and eliminate routine work, but it can lead to increased social inequality.

Plans to digitize Russian economy are impossible to be implemented without a systematic approach to the development of human capital including both attracting and retaining the best minds and providing conditions for the growth of progressive employing companies. To create new highly skilled jobs that are inherent in a technological, diversified and creative economy – knowledge economy – is one of the most important tasks of these companies [26].

Several innovative companies, such as Yandex, Kaspersky Lab, M2M Telematics, Optogan, NPO Saturn, and even state-owned Sberbank, were successfully created in Russia. In addition, individual entrepreneurs have considerable innovative potential. However, these are only islands of innovation. Creating an innovative potential for productivity growth requires investing in capital to conduct researches, fully disclose creative human resources of Russia and strengthen the institutional environment in support of innovations including the protection of intellectual property. Only in this case, a path to innovation and increasing productivity will begin.

The relevance of the formation of the Russian digital economy is confirmed by the presence of global trends in the digitalization of international society and the need to preserve the digital sovereignty of the country. The Russian economic model, with difficulty moving from raw material to post-industrial ones, turned out to be at the crossroads. While the entire world turned to the development of the non-production sphere and the transition to digital markets, Russia cannot orient itself in its priorities. On the one side, attention is paid to the development of digital services and markets, but on the other side, there is virtually no development in the field of knowledge and no reception of real GDP growth from this. Production and innovation infrastructure do not work together to create and use innovations. Since infrastructure is still being developed, Adam Smith’s invisible hand will not work because of the lack of many markets [21].

The Russian economy is historically difficult to change itself. And changes are inevitable in the modern world. Over-dependence on oil issues challenge to the long-term sustainability of the economy. To create a competitive advantage, the main task of the Russian economy is to focus on the intellectualization of social and economic processes, active innovation, as well as the intensive development of intellectual human potential and digital technologies

4 Discussion

The global community monitors the state of the digital economy every year. Digital technologies potentially may increase the effectiveness in all sectors, while providing companies the possibility to increase their income and market share, as well as promoting continuous innovations. The Organization for Economic Cooperation and Development (OECD) publishes the official report that considers and documents the evolution, new features and problems of the digital economy. By the opinion of OECD specialists, the innovations managed by data, new business models and digital applications influence the current state of the science, governments, cities, and such industries and healthcare and agriculture. Political measures for support of digital innovations are mostly focused on innovative networks, access to finances and using data, but pay less attention to investments in information-communication technologies (ICT), the capital based on knowledge, and the analysis of data [23].

Recently, ICT draw the attention of economists as one of the sources of economic growth. ICT favorably influence the economic growth through two mechanisms: on the one hand, they operate as a production technology that directly promotes the growth of production due to increase in labor efficiency; on the other hand, they have specific features of knowledge and indirectly increase the productivity and the economic growth [27].

The digital economy includes a wide variety of types of economic activity, where using digital information and knowledge is the key factor. Contemporary information networks become an important sphere of activity, and the effective use of ICT acts as an important motive force in increasing the efficiency and optimizing the structure of the economy. Owing to digitalized, network and intellectual ICT, the today’s economic activity becomes even more flexible, dynamic and elaborate [8].

Meanwhile, the professor Van Ark (2016) from the Groningen University in his work “The paradox of the efficiency of the new digital economy” notes that only a limited number of companies in the USA, the Great Britain and Germany have completely passed on to the digital economy [31].

As Poloz, Bank of Canada Governor, notes, “In terms of economic models, it is worth considering whether the relationship between inflation and economic growth could change as the economy evolves [24]. Certainly, the concept of an output gap is gradually changing, as services capacity depends mainly on people and skills rather than industrial capacity, while some parts of our old industrial capacity could become redundant in the face of major structural changes. The concept of investment is shifting away from plants and machinery toward human capital.

The Professor of Economy of the Stanford University Bloom, the representative of the Harvard Business School Sadun, the Professor of Management and Economy of the Massachusetts Institute of Technology Van Reenen found that companies that use high-quality managerial and organizational practice and a qualified human force, or have the access to it (“talented human resources”), usually obtain more profit from their investments in ICT [2].

In the “Post-Capitalist Society” Drucker states: the knowledge is the only valuable resource as of today. Traditional “production factors” (i.e. natural resources), the labor

and the capital had not disappeared, but became secondary [6]. They can be easily obtained if one has the knowledge. In this new sense the knowledge is the utility, and the means to obtaining social and economic results.

Turning the knowledge into the main production factor alters the structure and transforms the interaction between the factors of production [17]. Working in the sphere of knowledge, which includes a complex identification of a problem, solving problems or a high-technological design, and which results in emerging of new products and services or creation of new means of using markets, had soon become the center of economic growth, individual and organizational prosperity [22].

While the digital economy is being formed, the need arises to effectively manage knowledge that is characterized by the highest level of development of the creative potential of the human person as the bearer and the generator of the knowledge. Within the economy of knowledge, the human capital is the most precious resource. The share of intellectual labor increases, and the labor content obtains the intellectual and mental significance [12].

Economical and political realities infuse with technological innovations and lead to a rapid development of the digital economy; meanwhile, such increase is most seen in the developing countries. The strategy for development of the digital economy should be designed by the private businesses; the role of the government is to forward this increase; the role of the civil and academic society is to analyze the growth of the digital economy [4].

Discussing innovations, the digital economy, and the increase of labor effectiveness and competitiveness on the basis of digitalization are paid top-level attention in the Russian economical literature. Changes historically never came easy to the Russian economy; nevertheless, changes are inevitable in the today's world. An excessive dependence on the oil poses a challenge for long-term stability of the economy. To create a competitive advantage, the main goal for the Russian economy is to fix on intellectualization of social-economic processes, the active innovative activity, as well as the intensive development of the intellectual human potential and digital technologies [11, 13, 14, 25].

5 Conclusion

The new global economy includes an information economy, a knowledge economy, an innovation economy and a digital economy. The knowledge economy is a fundamental basis of the digital economy that appeared in the last decade as a separate industry.

Knowledge becomes an independent fifth factor of the post-industrial production because the modern production process becomes impossible without intellectual activity. The earthshaker in the interaction of production factors is connected with the fact that the activity on the use and application of knowledge – intellectual activity – is essential to the production process. As a result, technological relations and interrelations between production factors fundamentally change, and the technological way of their interaction changes as well.

Information becomes a driving force of the production, and intellectual activity becomes a leading type of the production activity in the economy of the post-industrial

society. These processes require overall digitalization of the economy, and they are impossible without the formation of digital economy.

Russia has sufficient resources and advanced IT industry to achieve a competitive advantage when using digital platforms for processing big data masses using blockchain technologies. At the same time, the Russian innovation system is disorganized and unbalanced; its key elements exist separately from each other. The industrial economy of Russia needs a transition to the economy, in which knowledge and information are key factors. The program for the development of digital economy in Russia is based on the basic principles of the global development of digitalization, but does not create objective prerequisites for the general digitalization of the Russian economy.

The growth of the digital economy in Russia can be considered as another step for change that will play a leading role in subsequent events, such as creating an information society, a network society and a knowledge-based society. Russia needs not just a transition to a digital economy, but a transition to a convergence of economic innovations, in which knowledge will become competitive advantage of the country in the international market.

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