THE DIGITAL TRANSFORMATION OF THE RUSSIAN ELECTRIC POWER INDUSTRY

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Chronique : Industries

THE DIGITAL TRANSFORMATION OF THE RUSSIAN ELECTRIC POWER INDUSTRY

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This chronicle is devoted to the problems of improvement of state policy and corporate governance in the Russian Federation under conditions of transition to the digital economy business model. The main goal is to analyze new challenges and understand the need to change the energy paradigm applying a system analytical approach to study the level of digitalization.

New challenges related to the advancement of digital technologies in the context of global trends of economic and social development couldn't leave an electric power industry untouched. It is possible to distinguish three characteristic features that determine the specificity of the electric power sphere and the way digital technologies are being implemented.

Firstly, the specific status of the industry, i.e. electric energy demand derives from the other sectors of economy, which develop according to an innovation scenario. Such status determines the significant role of the electric power industry in the digitalization of the economic and social spheres (public health care, education, state governance structures).

Secondly, the electric power industry belongs to a group of traditional industries, which already have a fully established institutional basis, in contrast to, for instance, the Internet-economy, which is yet to be structured by sectors in the classification of economic activities (Plaksin *et al.*, 2017, p. 59-60).

Thirdly and finally, the industry provides workplaces for a great amount of employable people, who have certain skills and competences in accordance with the current energy paradigm and established business model. So, according to the Ministry of Energy of the Russian Federation, the share of employees in the fuel and energy complex of Russia accounted for 3.6% in 2016. At the same time, the share of those directly engaged in the production and distribution of electricity, gas and water was 2.8% according to the Federal State Statistics Service (Rosstat).

In the digital economy, when developed industrial countries increase their own volumes of material production, energy technologies and energy conservation along with biotechnology, new generation of information and communication technologies (ICT) and new materials are among the top five priority scientific and technological areas (Ponomarev *et al.*, 2016, p. 13). According to the forecasted estimates of several analytical agencies in the long-term period, the demand for electricity will grow two times faster than the demand for transport fuel. It is expected that by the year 2050, electricity will account for a quarter of all energy needs compared to 18% at the present time (Knyaginin *et al.*, 2017, p. 44).

DIGITAL ECONOMY AND DIGITALIZATION PROCESSES IN RUSSIAN FEDERATION. LESSONS FROM THE DIGITAL TRANSFORMATION OF THE ELECTRIC POWER INDUSTRY

Despite the relevance and high practical importance of digital economy studies, there is no single approach to its definition in scientific community. An American computer scientist Nicholas Negroponte was the first to introduce a term «digital economy» in 1995 (Negroponte, 1995, p. 34). Its appearance is connected with an intensive advancement of ICT as well as with the beginning of second generation informatization processes, which served as one of prerequisites for the Fourth Industrial Revolution («Industry 4.0»). There is a widely spread approach in modern foreign literature, that considers the digital economy as a phenomenon, dealing not only with economical aspects but also referring to

a society as a whole (Zhao, 2015, p. 735). Digitalization or «a process of digital technologies' implementation» is characterized by the use of breakthrough ICT, implying new forms of interaction, service provision and consumption (Ahmad *et al.*, 2016, p. 15). The Russian scientists in majority of cases define a «digital economy» expression more narrowly, associating it exclusively with e-commerce. However, the digital economy today encompasses a whole range of activities based on digital technologies.

The chronology of digital economy legislative definitions [in Russia] is presented below. Thus, on December 1, 2016, the President of the Russian Federation signed the Executive Order № 642 «On the Strategy for Scientific and Technological Development of the Russian Federation», according to which digital technologies play a key role in innovative development of the state. At the *first* stage of the Strategy implementation (2017-2019), it was planned to create organizational, financial and legislative mechanisms to prepare for transition to an innovative economy, while the *second* stage (2020-2025) meant a fully-fledged implementation of the digital economy, involving the use of digital and intellectual production technologies, robot-assisted systems as well as commercialization and export of new scientific research results (President of the Russian Federation, executive order № 642, 01.12.2016, p. 12-13). The Strategy for the Development of an Information Society in the Russian Federation, approved by the Presidential Executive Order № 203 of May 9, 2017, provides the following legislated definition for the term. «Digital economy is an economic activity, in which a key role in production is given to data in digital form, processing and using the analysis results of which in comparison with traditional forms of management can significantly improve efficiency of various production types, technologies, equipment, storage, sales, delivery of goods and services» (President of the Russian Federation, executive order № 203, 09.05.2017, p. 4). Later, the Order of the Government of the Russian Federation of July 28, 2017 № 1632-r approved the program «Digital Economy of the Russian Federation» (Government of the Russian Federation, executive order № 1632-r, 27.07.2017). The purpose of that program is to create a legal, technical and financial basis for the further introduction of digital economy in Russia and its integration with the digital economies of the Eurasian Union countries. Due to its importance, such a task can be compared with the Russia's overall electrification in the beginning of the 20th century.

Theoretical approaches to the definition of the digital economy are reflected in the digital transformation of real economy sector's enterprises (Kupriyanovskiy, 2017, p. 35). Let us consider such transformation using the example of electric power industry companies.

Foreign experts are inclined to highlight a number of key trends in modern energy development, which are closely related to the use of digital technologies: increased use of renewable energy; the need for development of distributed generation; a change in the balance of supply and demand; geopolitical changes; the inability of existing systems to self-regulate; the blurring of system and market boundaries in the sector;, the change in the characteristics of electricity consumers (KPMG, 2016; International Energy Agency, 2017).

The Centre for Strategic Developments of the Russian Federation considers the following factors, which determine digitalization processes in the world power energy sphere: demand growth challenges, the challenges of changing the quality characteristics of demand, environmental challenges, investment challenges, new industrialization challenges (Knyaginin *et al*., 2017, p. 12-13).

The Energy Forecasting Agency of Russia on the instructions of the Ministry of Energy in 2010, with an adjustment in 2012, developed the «Scenario Conditions for the Development of the Electric Power Industry of the Russian Federation for the Period until 2030,» in which three scenarios are described (Energy Forecasting Agency, 2012, p. 10):

1. *maximum* scenario, providing for the possibility of a significant increase in economic growth with the achievement of average annual GDP growth rates in the period from 2011 to 2030 to 5.3%;
2. *innovative* scenario, describing the transition from stable and gradual movement of the Russian economy to its intensive growth with an obligatory implementation of an innovative component. This scenario relies on modernization of energy source complex along with creation of modern transport infrastructure, competitive high-tech production sector and knowledge-driven economy.
3. *conservative* scenario, considered as a risk analysis in connection with the incompleteness of reaching the pre-crisis parameters of the Russian economy.

New energy paradigm, worked out by the Agency for Strategic Initiatives with regard of current global trends and successful experience of developed countries, is based on an innovative scenario. Such approach assumes the following directions of the Russian electric power industry prospective development (Knyaginin *et al.*, 2017, p. 18):

- transition to the use of renewable energy sources (RES);
- decentralization of energy production;
- growth of electric energy role in fuel and energy resources consumption;
- decentralized markets, private investment;
- intellectualization of basic infrastructure (electric networks), development of "smart grid" technologies;
- consumers' transition to active behavior models;
- energy storage technologies;
- increase in energy use efficiency.

It is of high importance to think about the practical implementation of the actions mentioned above. A variant of their implementation may be the formation of digital economic platforms in various energy segments.

The digital platform is a business model entirely based on high-tech solutions, which creates profit through information exchange among independent groups of participants. In the electric power industry, it can be a platform for buying/selling of electricity and capacity, equipment, training specialists, a platform for examining the costs of electricity buyers, a forecast platform for electricity demand taking into account weather, climatic conditions and economic activity, equipment parameters, etc.

DIGITALIZATION LEVEL EVALUATION

In the modern world, the digitalization level is considered as a synonym for competitiveness of companies, industries and national economics. As a rule, enterprises that actively implement digital products show better financial results. It is considered that 10% of companies demonstrating the best digitalization levels bring two or three times more incomes for their stakeholders and provide higher rates of revenue growth (McKinsey,

2017, p. 39). The foregoing raises the need for a comparative evaluation of digital technologies' implementation processes, i.e. digitalization level, from a perspective of countries and industries.

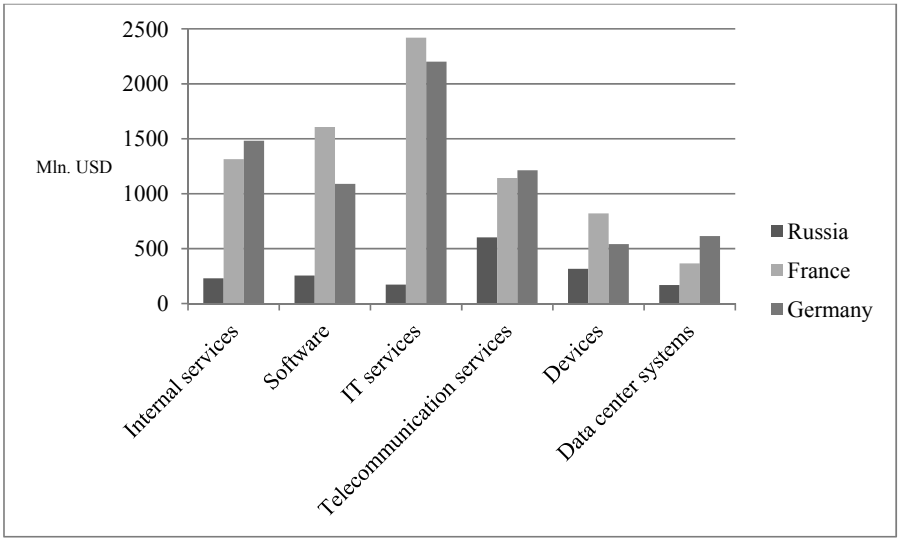
The analysis of the Russian and foreign literature shows, that there is no commonly used international scientometric base for digitalization level evaluation. The analytical works of the Organization for Economic Cooperation and Development (OECD) and consulting company McKinsey are among the most accredited. Thus, leading experts in statistics N. Ahmad and P. Schreyer (2016) note that, although the basic scheme for GDP calculation can solve the information assurance problems caused by digitalization, many practical problems, related to the price change and specifically to the digitalization processes' identification in those parts of economy, which are deeply integrated to world economy, remain unsolved (Ahmad, 2016).

Nowadays, there are indicators which allow the digitalization level of a country's economy in general to be evaluated. To measure the level of digitization in the country profile, the indicators of the volume of both public and private investments in information technology are used. So, according to McKinsey estimates (2017), investments in information technologies in Russia make up only 6.5% of a total private investment, which is about half the average for Western Europe. Along with that, a share of Russia in the global ICT consumption in the corporate sector accounts for 1%, in Great Britain 7%, in Germany 5%, for comparison in China – 6% (McKinsey, 2017, p. 42). The volume of private companies' investments in digitalization in Russia amounts to 2.2% of GDP, in Western Europe – 3.9%, in the USA – 5% (McKinsey, 2017, p. 40). Insufficient funding for the development of digital technologies indicates the need to revise the state and corporate policy of investing in digital solutions.

In the sectoral context, statistics for the evaluation of how successful the measures of ICT implementation are presented much less often. As an example, we cite data from a published by McKinsey report (2017) on information technology costs per end-user, which compares the performance of 12 countries across different market segments (McKinsey, 2017, p. 124). To assess the level of digitalization, the following indicators are used: internal services, software, IT services, telecommunication services, devices, data center systems. Fig. 1 presents data on the «energy supply» segment

by the example of two countries of the European Union (EU) – France and Germany, and Russia.

Figure 1. The share of costs for digital technologies in GDP in the "energy supply" segment in 2015, mln. USD



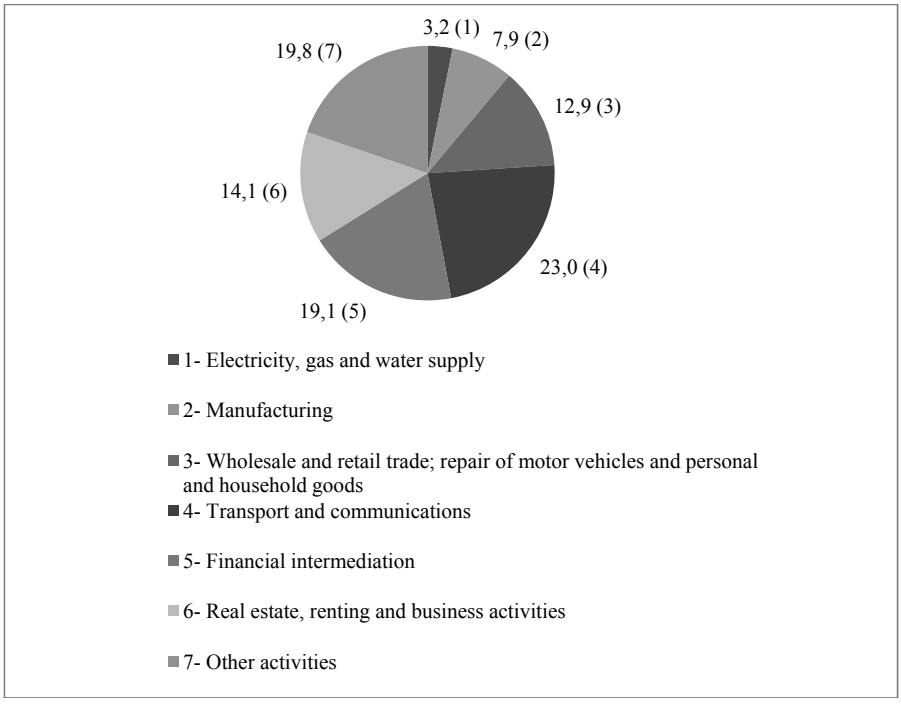
Source: compiled by the authors on *McKinsey, 2017*

As can be seen in Fig. 1, Russia lags far behind in all six indicators that characterize the power supply segment. At the same time, in such sectors as telecommunications and finance, as well as education, Russia, with its level of digitalization, according to McKinsey estimates, is approaching the world level (McKinsey, 2017, p. 40).

Another indicator that allows us to evaluate the level of development and implementation of digital technologies in the sectoral context, but this time in accordance with official domestic statistics, is expenditures of organizations on ICT. According to Rosstat, such expenditures represent actual expenditures of organizations revealed in monetary form on purchasing of computers and software, payments for communication services, training of personnel to develop and use ICT, payments for outsourcing, as well as other expenditures on ICT, including expenditures of organizations on development of software using one's own resources. Expenditures on ICT take into account current and capital costs of observed organizations

(excluding small business entities). As Fig. 2 shows, the most digitized types of economic activity following the data of 2016 include transport and communications (23%), other activities affecting the formation of social capital, which is reflected in the development of e-health, education, public services (19.8%) (Plaksin *et al.*, 2017, p. 58), as well as financial activities (19.1%).

Figure 2. Expenditures of organizations on ICT by types of economic activity in Russia in 2016, %

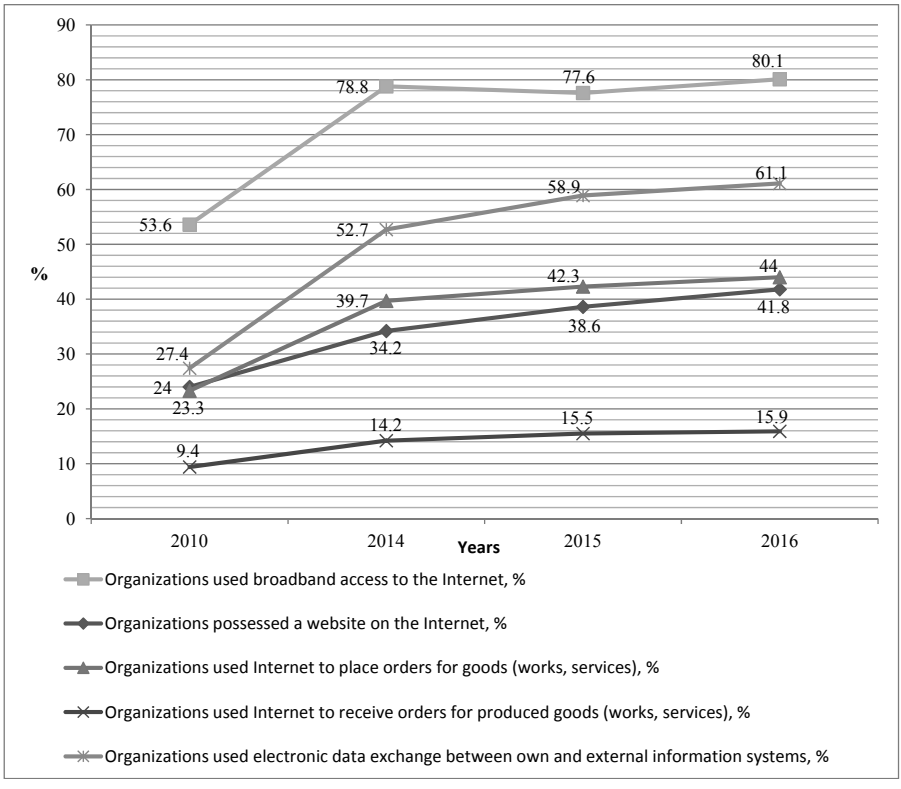


Source: compiled by the authors on *Federal State Statistics Service, 2017*

The costs of organizations for production and distribution of electricity, gas and water are estimated at 40 billion rubles, which is 3.2% of the total cost of organizations for ICT. On the one hand, the introduction of digital products into the electricity sector provides for a certain transformation of production processes, therefore, we believe that the speed of distribution and the growth rate of ICT costs may be lower than that in other industries. On the other hand, the complex organizational structure of the production of such goods as electricity requires large amounts of costs

for digital conversion. Fig. 3 shows the dynamics of the distribution of specific digital technologies in the industry.

Figure 3. Dynamics of indicators of the use of ICT in the organizations of production and distribution of electricity, gas and water in Russia for 2010 – 2016, %



Source: compiled by the authors on *Federal State Statistics Service, 2017*

As we can see, almost all five indicators of the use of digital technologies demonstrate steady growth. Broadband Internet access and electronic data exchange got the most widespread use. Due to the specifics of the industry under discussion, the use of the Internet for placing and taking orders has not yet received sufficient application. Obviously, in these areas there is a considerable potential for the further development of digital technologies.

As for comparative evaluation of the level of digitalization of individual companies, the world practice indicates the use of digitalization coefficient

(Digital Quotient) for such purposes. This coefficient includes four characteristics: strategy, digital culture, competences, organizational model (McKinsey, 2017, p. 39). In Russia, however, at the level of the enterprises such coefficient isn't calculated.

Thus, the indicators of the enterprises' ICT use by types of economic activity, presented in domestic statistics, are narrowly focused and do not reflect the whole essence of the economy's digital transformation. Solutions of the development of a statistical base adequate to the digital economy ensuring information reliability were discussed in St. Petersburg on the 1st and 2nd of February 2018 during the International Conference «Statistics in the Digital Economy: Learning and Use». Moreover, in frames of the second Smart Energy Summit held on the 27-28th of March 2018 in Moscow, the experts announced the start of working on index of digitalization of Russian energy companies.

CONCLUSION. SOME RECOMMENDATIONS FOR THE DIGITAL TRANSFORMATION OF THE ELECTRIC POWER INDUSTRY

The new energy paradigm of Russia's electric power industry as a «system of systems» includes both the «electric world» of the consumer, and the «smart» infrastructure network, and the energy-information union UES-2.0 (Bushuev *et al.*, 2016, p. 2). Proceeding from the assumption that «the key drivers of transformation of the electric power industry today are the evolution of consumer behavior supported by new technologies, and strategically-oriented state regulation» (Knyaginin *et al.*, 2017, p. 20), we will formulate some features of ICT introduction inherent in the electric power industry of Russia at the end of the second decade of the 21st century.

Firstly, compatibility and integrability of technologies and softwares used by enterprises must become an indispensable condition for digitalization, which is especially important in the context of existing unified energy system (UES) of Russia.

Secondly, one of the main tasks of electric power enterprises, as key infrastructure objects, is to ensure the reliability of operation, including in the

digital space, as well as information security. In this regard, the requirements for safety at work in the process of ICT use are significantly increasing.

Thirdly, development and implementation of breakthrough ICT requires a constant improvement of regulatory framework in information sphere in order to explain and regulate the legal value of actions, made by digital space subjects. However, because of a high share of conservative energy companies and governmental structures, the process of digital transformation in energy industry meets certain difficulties.

Fourthly, the introduction of ICT in domestic electric power enterprises is highly dependent on imported developments and technologies. To date, the domestic market of digital products for the energy industry is extremely weak.

Fifthly, a sustainable rise in prices for electric power is an acutely discussed problem of the current stage of Russian electric power industry functioning. According to A.S. Kareva, change in electricity prices not only remains to be a mechanism for direct financing of the industry, but also should be a way to attract private investment (Kareva, 2017, p. 76). The transition to promising digital technologies in the electricity sector will be facilitated by the redistribution of sources of financing – from public to private, in which the significant importance is given to the leading Russian IT companies (Tavrida Electric, Kaspersky Lab, Yandex, Mail.ru Group, etc.). They can play the role of leaders of the new Russian electric power industry (Knyaginin *et al*., 2017, p. 6).

Sixthly and finally, the introduction of digital technologies into electric power enterprises, both traditional and innovative, places high demands on the skill level of the staff and necessitates the systematic acquisition of new knowledge on the basis of competence centers in priority areas, and their continuous improvement. The digitalization of business models and of the electric power industry as a whole in the coming decades will lead to a partial substitution of human labor by machinery and the release of a significant share of the labor force, which will increase labor productivity, improve the situation with the involvement of personnel in the economy through remote workplaces and provide access to qualified education.

Let us summarize what was said above. Digitalization in Russia is understood more narrowly than abroad, nowadays there is no single definition among researchers. The official statistics, as well as the research results of consulting companies show, that in spite of the priority position of the industry, the level of ICT introduction in Russia is substantially lower than that of developed European countries. To a certain extent, this can be explained by the immaturity of Russia's regulatory and legal framework and the lack of a single methodological approach to measuring the level of digitization both in the country and in individual sectors. This chronicle has allowed to formulate a number of features of digitalization of energy companies, to identify the most promising ways of modernization of the energy system. Their implementation could significantly improve the energy efficiency of the Russian economy.

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