

# Monitoring of the State and Dynamics of the Development of the Digitalization of the Industrial Economy

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**Abstract**— The economy enters the era of post-industrial digitalization, so there is a need to develop information infrastructure and use modern information systems in the economy of industry. The development of the digital economy involves changing the paradigms of the traditional regulation of the industrial economy and in this case information becomes the main resource. The purpose of the research is to monitor the state and dynamics of the development of the digitalization of the Russian industry by leading indicators and signal indicators, and to develop methodological recommendations for transforming the digital economy of industry. The methodical basis of the research is the systematization of the publication of domestic and foreign economists on the problem of the development of the digital economy using the Russian and international regulatory framework; statistical and economic-mathematical methods for analyzing the indices of the development of the digital economy of industry, as well as a systematic approach to assessing the level of development of the digital economy in Russia on the basis of leading and signaling indicators were used. The results of the research are the systematization of approaches to assessing the level of development of the digital economy in Russia, the classification and formation of a system of indicators, the evaluation of the digital transformation of the industrial economy on the basis of advanced and signal indicators. The practical importance of the study is to develop methodological recommendations for increasing the level of transformation of the digital economy of industry, improving the infrastructure of information and communication technologies on a national scale, increasing the digital culture of specialists in the industrial sector, which will simplify the interaction between the main economic subjects of industry.

**Keywords**— *Digital Economy, Digital Transformation, the Economy of Industry, Advanced and Signal Indicators*

## 1. INTRODUCTION

On the eve of the fourth technological revolution, the development of an industrial economy based on innovation becomes the main source of long-term economic growth for any country. Currently, the economy of the industry is transforming associated with the formation of the fundamental system of the future - the digital economy. In view of the qualitative changes taking place in the economy of industry and society, the idea of transition to a digital economy assumes a priority for the state. The digital economy assumes digitalization and integration of absolutely all business processes in the economy of industry. Large enterprises and

individuals are increasingly using new technologies and platforms to manage their business, as they reduce transaction costs and allow direct access and more direct contact with economic entities and government agencies. Thus, the formation of a digital (electronic) economy based on network services is taking place.

## 2. RESULTS

Russian and foreign economists, as well as world companies, assess the impact of the digitalization level on the competitiveness of the industrial economy and provide the conditions for a gradual transition to an innovative economy and knowledge economy [1,2]:

1) The regional approach includes:

- The program "Digital Economy of the Russian Federation", consists of the following groups of indicators: ecosystem assessment; staff and education; research competences and technological reserves; information security;
- Research of the Higher School of Economics "Indicators of the Digital Economy".

2) the sectoral approach includes:

- Indicators of the International Telecommunication Union (ITU) of the United Nations, which proposes to calculate the ICT Development Index (IDI), consisting of 3 sub-indices: access to ICT; use of ICT; practical skills of using ICT.

- The program "Strategy of development of the information technology industry in the Russian Federation for 2014-2020 and for the future up to 2025", based on the indicators of the development of the information technology sector.

3) the organizational approach includes:

- The performance of Huawei Technologies Co. Ltd., based on the calculation of the global index of network interaction (Global Connectivity Index (GCI), which includes two groups: the first group - parameters of productivity, supply, demand, quality, potential, and the second group - the technological parameters of the transformation.

- Indicators of the company "Boston Consulting Group", based on the calculation of the Digitalization of the economy (e-Intensity) as a weighted average of three sub index: infrastructure development, online spending and user activity[3,4].

These approaches include single indicators that characterize the development of certain areas of the industrial

economy, this system can be divided into leading and signal indicators.

A leading indicator is an integral indicator that reflects a market situation that indicates a likely change in the state of the socio-economic system (business, industry, the economy as a whole) in the short term.

When forming a system of leading indicators, it is necessary to pay attention to the fact that one or another indicator may turn out to be ahead if it earlier than the economy as a whole reacts to the change in the economic situation.

The main advantage of using the model of leading indicators is that it is able to predict turning points in the dynamics of the indicator under study by converting turning points in their dynamics [5,6,7].

In the world space, the most famous developer of leading indexes for different countries is OECD (Organization for Economic Cooperation and Development). Thus, the cumulative leading index for Russia is only one of 42 indices compiled using the OECD methodology.

Russian scientific organizations have developed several approaches to the formation of systems of leading indicators. The Center for Development of the National Research University - Higher School of Economics quarterly publishes a bulletin of consolidated leading and other cyclical indicators. Specific indicators are used to calculate the composite leading indicator: the average monthly price of Urals oil; change in the proportion of enterprises with growing and constant demand; change in the proportion of enterprises without surplus stocks;

RTS index; nominal interest rate MIACR-overnight; real effective ruble exchange rate; increase in money supply M2. The weighted average of the changes in these variables is a composite leading index.

The Institute of Economics of the Russian Academy of Sciences proposed its concept of a system of indicators for determining a composite leading index, which is similar to the system of indicators of the Development Center, but also includes the measurement of the trade balance.

Signal indicators are more accurate when it indicates the actual crisis that has actually occurred to a greater extent than to periods in which crises are not really there.

Based on the analysis carried out using a number of signal indicators, several conditional groups can be distinguished:

- 1) Short-term signal indicators, most of them warning about the existence of a crisis in the money market 1 quarter before it and using information from the stock and currency markets;
- 2) Long-term signal indicators, built on the basis of monetary aggregates and data on GDP;
- 3) Long-term signal indicators, built on the basis of data on loans, deposits and interest rates [7,8,9].

The results of the research showed that many states already have their own developed system of leading indicators. On the basis of generalization of the existing Russian experience and the experience of foreign countries, the authors outlined the leading and signal indicators of the development of the digital economy. The systematization of these indicators is shown in Figure 1.

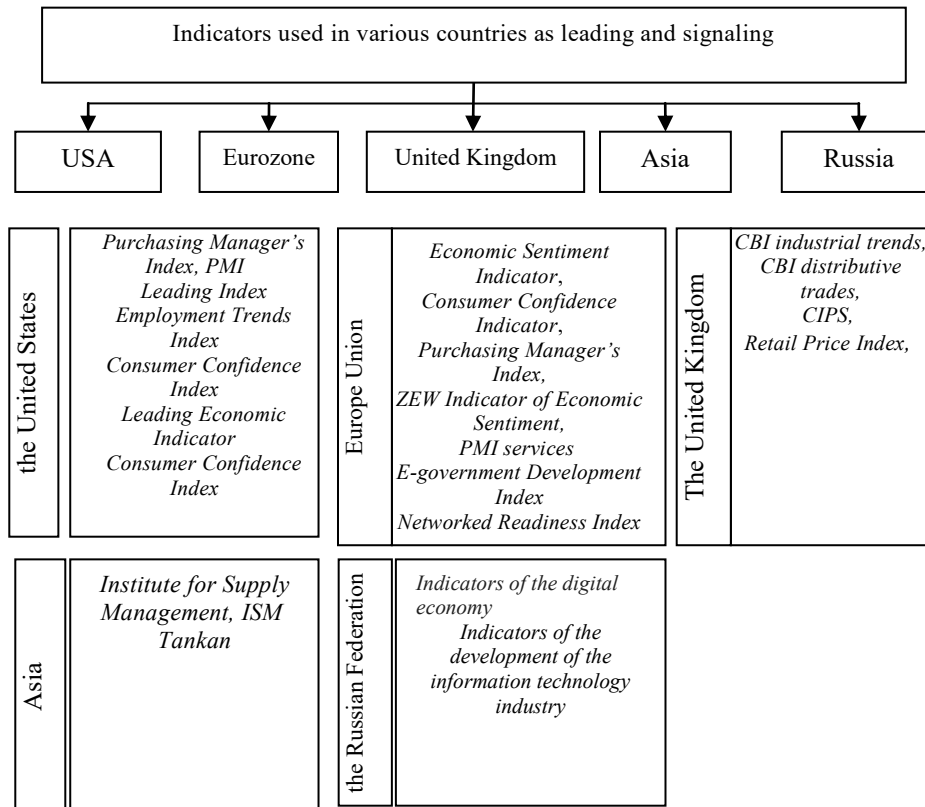


Fig. 1. Indicators used in various countries as leading and signaling

At present, Russia occupies the 39th place in the world in the development of the digital economy. The digitization index of the country in 2016 was 113 points, which allowed Russia to move from the category of catching countries to the main group. The main problem of the country is the incomplete use of the potential of digital transformation of industries [10,11].

In 2016, the share of the digital economy in Russia's GDP was 2%. The contribution of the digital economy to Russia's GDP grew from 1.5 trillion. Rub in 2015 to 1.7 trillion. Rub in 2016. On average in Europe, the share of the digital economy exceeds 5% of GDP, in the USA - 6% and these indicators are growing annually.

According to the influential Global Institute McKinsey, the digitalization of Russia's economy by 2025 could achieve an increase in the country's GDP to 4.1-8.9 trillion. Rubles. Such forecasts are associated with the introduction of such completely new, advanced business models and technologies as: digital platforms, digital ecosystems, Big Data technology, Industry 4.0 technologies, 3D printing, robotization, Internet of things, etc.

We also analyzed some indicators of the development of the digital economy in industry (Table). An assessment of individual private indicators characterizing the use of information systems and the Internet, as well as "cloud" services [12,13,14].

Table 1. Research of indicators of development of digital economy in the industry

Indicators 2016, in% of the total number of organizations of the business sector	Mining	Manufacturing Processes	Production and distribution of electricity, gas and water
Broadband Internet access in organizations,	88,8	91,3	80,1
Providing workers with mobile devices for access to the Internet,	48,3	46,3	38,4
The use of the Internet in organizations for procurement, including	15,1	19,3	24,5
using special forms posted on a website or in an extranet	14,1	17,0	23,4
EDI-systems	5,4	8,3	6,9
Using the Internet in organizations for sales, including	7,3	19,3	9,4
using special forms posted on a website or in an extranet	6,7	14,3	8,5
EDI-systems	3,4	11,7	3,8
Using "cloud" services in organizations	17,7	23,3	16,2
The use of RFID technologies in organizations,	3,5	8,7	4,4
Use of software in			

Indicators 2016, in% of the total number of organizations of the business sector	Mining	Manufacturing Processes	Production and distribution of electricity, gas and water
organizations to conduct business			
-financial calculations in electronic form	23,3	70,0	59,4
-resolution of organizational, managerial and economic tasks	21,2	64,8	56,5
- providing access to databases through global information networks	9,0	31,4	31,6
Using CRM-systems in organizations	13,0	15,0	10,0
Use of EPR-systems in organizations	24,5	22,1	13,3
Using SCM-systems in organizations	6,3	5,6	4,0

Private indicators are selected taking into account the measurement of leading indicators in industry in international practice and reflect the level of development of the digital economy of Russia.

### 3. CONCLUSION

The special importance of using advanced indicators and composite leading indexes increases significantly during the economic crisis. In these circumstances, the discrepancy between economic policy measures and the real situation can significantly increase the depth of the cyclical recession and "delay" the economy's exit from the crisis.

In our opinion, Russia will be able to rapidly achieve the set targets for increasing the level of digitalization of industry, developing the following areas:

1. On the basis of a network of educational and research centers (including those based on universities), actively cooperating with companies and investing in information technologies, it is possible to increase the number of graduates of specialists in the field of application of information technologies in industry.

2. Support for Russian IT companies that create innovative technologies and successfully operate on the world market will increase the share of value added of the ICT sector in the country's GDP.

3. Increase market share in the industrial sector of the country's economy of existing Russian leaders who are engaged in the introduction of such digital technologies as: Big Data, Internet of things, cloud services, etc.

4. Implementation of digital mass-use technologies at the state level for the interaction of state bodies with the population and business, which will reduce transaction costs and increase the speed and quality of solving social and similar problems.

5. Expanding the infrastructure of information and communication technologies across the country will simplify the delivery of quality public services.

Thus, the achievement of these targets and an increase in the digitization index will enable the country to have high competitiveness in the future. It will also help create favorable organizational and regulatory conditions for effective development of digital economy institutions with the participation of the state, the national business community and civil society in Russia. These measures will lead to a rapid growth of the national economy by changing the structure and management system of national economic assets in a global digital ecosystem.

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