Regional aspects of studying the digital economy in the system of economic growth drivers

Abstract. Scientific thought is constantly looking for new sources and drivers of economic development and growth. In this regard, the digital economy becomes a buzzword as a major endogenous factor stimulating economic activity of a country and its regions. Therefore, its emergence, development, and measurement become high on the agenda. The paper summarises theoretical and methodological aspects of the study of the digital economy as the major driver boosting the regional economy. The methodological basis of the research rests on the contributions by Bukht and Heeks, the English scholars of the Global Development Institute, who introduced a three-scope approach to understanding the digital economy. The research team also draws on the method to compute the business digitalisation index developed by the Russian scholars of the National Research University Higher School of Economics. As a result of the research the authors propose their method for calculating the composite indicator of the regional economy digitalisation and test it on the Ural macroregion. The method uses a set of 12 specific indicators which shows how deep the digital economy and digital technologies have spread into the region. The study revealed the following distinctive features of the digital economy developing in the subjects of the Russian Federation constituting the Ural macroregion: significant differentiation of the digitalisation levels across the subjects; finished primary stage of the digitalisation process; dissimilar potential for the digital economy development among the subjects; correlation between the level of the regional economy digitalisation and economic growth.

Keywords: economic growth; digital economy; economy digitalisation; macroregion; Ural macroregion.

Introduction

Digital economy is one of the latest intensively developing areas of economics. Therefore, conceptualisation of the digitalisation processes in the economy and their scale remain hotly debated in science.

The reason behind a heightened scientific interest in the development of the digital economy is that it is considered as a driver of economic growth capable of causing significant economic shifts and affecting entire areas of business, labour market, and people's lifestyle. Digitalisation processes represent a significant endogenous driver of economic growth.

There were quite a few attempts to define the scope and quantitatively measure the digital economy by such scholars as Tapscott [1996], Lane [1999], Mesenbourg [2001], Castells [2004], Babkin et al. [2017], Schwab [2017], Silin, Animitsa [2018], Bukht, Heeks [2018].

The review of both Russian and foreign scientific literature revealed a notable lack of papers discussing the regional aspect of the spreading digital economy.
The purpose of the study is to develop the theoretical, methodological and procedural foundations for examining the development and spread of the digital economy as the major driver of economic growth in a macroregion, and to propose scientific approaches and methods for its analysis and measurement.

For this purpose, the objectives of the study are to:

- systematise theoretical approaches to researching the digital economy as the major driver of economic growth;
- summarise methodological approaches to studying the digital economy at a regional level;
- propose and test the method for calculating the composite indicator of the regional economy digitalisation.

**Theoretical approaches to research of the digital economy**

The evolution of definitions of the term “digital economy” available in scientific literature shows that all of them were a product of their time and respective technological trends. For example, early interpretations [Tapscott, 1996; Lane, 1999; Mesenbourg, 2001] were based on the Internet technologies. The authors of more recent definitions focus on the advancing mobile and wireless networks¹, as well as the cloud and big data technologies².

A fairly broad definition of the digital economy as “a system of economic, social, and cultural relations based on the use of digital information and communication technologies” is given in the World Bank report³.

The Organisation for Economic Cooperation and Development (OECD) uses the term “digital economy” to refer to the markets that use information and communication technologies (ICT) to trade in information and digital goods, or to provide services over the Internet⁴.

The Strategy for the Development of an Information Society in the Russian Federation for 2017–2030 defines the digital economy as an economic activity “wherein key factors of production are digital. In comparison with traditional forms of the economy, the processing of large arrays of data and the use of outcomes of their analysis allow for significantly more effective production, technology, equipment, storage, sales, and delivery of goods and services”⁵.

Objectives of the Strategy for the Development of an Information Society in the Russian Federation for 2017–2030 are elaborated in the Digital Economy of the Russian Federation National Program⁶ (hereinafter referred to as the Program) where the digital economy is represented by the following three layers:

1) *markets and sectors of the economy* (areas of activity) establishing interaction among specific entities (suppliers and consumers of goods, works, and services);

2) *platforms and technologies* building competencies required for the development of markets and sectors of the economy (areas of activity); and

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¹ DBCDE. (2009). Australia’s digital economy: Future directions. Canberra: Department of Broadband, Communications and the Digital Economy. Available at: https://trove.nla.gov.au/work/28580597?q&versionId=46286058.

² G20 DEFT. (2016). G20 Digital Economy Development and Cooperation Initiative. Available at: https://www.mofa.go.jp/files/000185874.pdf.

³ The Word Bank. (2016). Word Development Report 2016: Digital dividends. Available at: https://www.worldbank.org/en/publication/wdr2016.

⁴ OECD. (2015). Digital Economy Outlook. Available at: https://www.oecd.org/internet/oecd-digital-economy-outlook-2015-9789264232440-en.htm.

⁵ On the Strategy for the Development of an Information Society in the Russian Federation for 2017–2030: the Decree of the President of the Russian Federation of 9 May, 2017 no. 203. Corpus of Legislative Acts of the Russian Federation. 2017, no. 20, Art. 2901. (in Russ.)

⁶ On the approval of the Digital Economy of the Russian Federation Program: the resolution of the Government of the Russian Federation of 28 July 2017 No. 1632-r. Corpus of Legislative Acts of the Russian Federation. 2017. N 32, Art. 5138. (in Russ.)
3) *environment* which creates conditions for the development of platforms and technologies, as well as efficient interaction among certain entities and economic sectors, and comprises legal regulation, IT infrastructure, human resources, and cyber security.

In our research, we rely on the concept and methodology of the three-scope approach to understanding the digital economy as introduced by Bukht and Heeks [2018], the English scholars of the Global Development Institute. They prepared a detailed review of scientific literature on the digital economy in order to understand definition, conceptualisation and measurement of this phenomenon. In their study, Bukht and Heeks argue that there are three scopes of the digital economy. They characterise the first scope as follows: “The digital (IT/ICT) sector is the core of the digital economy but the scope of the digital economy is argued to stretch beyond this, encompassing a set of emerging digital business models” [Bukht, Heeks, 2018, p. 161].

Therefore, the first scope of the digital economy is the digital (IT/ICT) sector which comprises hardware manufacture, information services, software and IT consulting, and telecommunications (Fig. 1).

![Fig. 1. Scoping the digital economy [Bukht, Heeks, 2018, p. 155]](image-url)

The second scope of the digital economy adds to the first one the e-business, digital services, and it would cover some parts of emergent phenomena – the platform economy, the gig economy, the sharing economy – where those could be seen to be new economic activities that did not pre-exist digital technology. For example, platform-based companies would be included (Google, Facebook); platforms trading tangible goods (Amazon, eBay and Alibaba); and those reaching the blurred edge (Uber, Airbnb).

The third scope of the digital economy or “digitalised economy” is based on the application of digitisation to organisational and social processes (including economic activity). This scope therefore “covers e-business (ICT-enabled business transactions) and its sub-set, e-commerce...
(ICT-enabled external business transactions), algorithmic decision-making in business, use of digitally-automated technologies in manufacturing and agriculture including Industry 4.0 and precision agriculture, etc.” [Bukht, Heeks, 2018, p. 153].

To summarise the studies under various scholarly traditions, by the digital economy we will mean the set of economic processes resulting from the activity to create, spread, and use digital technologies and related goods and services.

Crucially, digital technologies are the core of the digital economy and act as an important factor for its development [Romanova, 2018].

By digital technologies we will mean the “technologies used to collect, store, process, retrieve, transmit, and provide data in electronic form” as defined by the scholars of the National Research University Higher School of Economics [Abdrakhmanova et al., 2019а, p. 13].

Digital technologies include “datafication (an expansion of the phenomena about which data are held), digitisation (conversion of all parts of the information value chain from analogue to digital), virtualisation (physical disembedding of processes), and generativity (use of data and technologies in ways not planned at their origination through reprogramming and recombination)” [Bukht, Heeks, 2018, p. 144].

The Program identified the following main end-to-end digital technologies:

• big data;
• neurotechnologies and artificial intelligence;
• systems of the distributed registry;
• quantum technologies;
• new production technologies;
• industrial Internet;
• components to use in robotics technology and sensors;
• technologies of wireless communication;
• technologies of the virtual and augmented realities.

Literature review [Kling, Lamb, 2000; Bahl, 2016; Dahlman, Mealy, Wermelinger, 2016; Heeks, 2016; Yudina, 2016; Dobrynin et al., 2016; Babkin et al., 2017; Kupriyanovskiy et al., 2017, Ustyuzhanina, Sigarev, Shein, 2017; Bodrunov, 2018; Khalin, Chernova, 2018] demonstrates a number attempts to identify the key features of the digital economy:

• Information and Communication Technologies are getting generally accepted, allow for numerous updates, different uses, and can be applied in various economic sectors and significantly improve their performance when combined with other technologies;
• geographically dispersed location of the members of economic cooperation: from online transactions to telecommuting;
• improved IT support for decision-making processes resulting from real-time the remote access to information and availability of new systems for processing large arrays of data, which changes the logic behind the management process both at the business level and at the state and regional levels;
• human labour being supplanted by the robotic machinery, digitalisation of a significant portion of production;
• spread of additive technologies for industrial, medical, construction, domestic, and other application;
• emergence of the Internet of Things – products with built-in electronic devices sharing information about the condition of an external object or consumer without human involvement;
• digital platforms bringing together suppliers (sellers) and consumers (buyers) of goods become increasingly important for the economy;
• transaction costs cut down by replacing intermediaries with automatic networking services;
• population and business turning to online cooperation and online service;
• emergence of new, electronic types of money, etc.

Each of these features of the digital economy can potentially improve economic performance, stimulate economic growth, and boost economic activity.

Based on Russia’s official statistics, it is almost impossible to prove any correlation between the development of the digital economy and the economic growth or increased labour productivity. Therefore, we provide digital evidence obtained by foreign authors.

Labour productivity in the digital economy tends to be higher than that in the overall economy. For example, average labour productivity in major OECD economies is about 90 thousand US dollars per capita, while in the ICT-segment it goes up to 160 thousand US dollars; productivity levels are 160% above those of the total economy in telecommunications services 1.

The digital economy creates additional jobs and its development promises future growth of the labour market. McKinsey data show that, globally, the Internet creates 3.1 jobs for every job that it destroys [Nottebohm et al., 2012]. In foreign studies digitisation is claimed to have created 17 million jobs in emerging economies 2009–2011 [Bukht, Heeks, 2018, p. 160].

Therefore, we believe that the theory of economic growth is the theoretical and methodological basis to study the digital economy the scientific foundation of which is yet to be completed. This theory mentions innovation factors in particular, as their absence causes the slowdown in economic growth [Solow, 1956; Mensch, 1979; Kondratieff, 2015]. Scholars consider innovation activity to be an endogenous mechanism to boost the economy [Romer, 1990].

Digital technologies lying at the core of the digital economy are innovative, high-tech developments. For example, while describing the third industrial revolution which began in the 1960s, Schwab refers to it as “a computer or digital revolution as it was catalysed by the development of semiconductors, mainframe computing (1960s), personal computing (1970s–80s) and the Internet (1990s)” [Schwab, 2017, p. 16]. According to his findings, the fourth industrial revolution, which began at the turn of the new millennium, also relies on digital revolution and digital technologies [Schwab, Davis, 2018].

This fact makes them the “general-purpose technologies” capable of changing the global pattern of economic growth. To study the digital economy, one should proceed from economic development in the meaning of a change in the techno-economic paradigm, the concept of which was proposed by Perez [2011] and elaborated further by leading contemporary Russian scholars Glazyev [1993], Sukharev [2015], Tsvetkov [Tsvetkov, Sukharev, 2017].

Methodological approaches to study the digital economy at a regional level

Research findings provided by Russian scholars and particularly by the research team of the National Research University Higher School of Economics (HSE) served as the methodological basis for the study. They summarised “the key aspects of the digital economy development, trends in digital technologies and the resultant changes in human living conditions, digitalisation in public administration and science” [Abdrakhmanova et al., 2019a, p. 2]. It was the first attempt by the Russian scholars to implement “original approaches to statistically measure the digital economy”, to provide “experimental estimates of the volume and structure of costs for its development in Russia”, as well as the “contribution of the digital economy to economic growth” [Abdrakhmanova et al., 2019a, p. 2].

Members of the Institute for Statistical Studies and Economics of Knowledge at HSE proposed a method for calculating the business digitalisation index – a composite indicator of how widespread the digital technologies are in the business sector. It characterises “the speed of

1 OECD. (2014). Measuring the digital economy. Paris. Available at: http://www.oecd.org/sti/measuringthedigital-economy-9789264221796-en.htm.
adaptation to digital transformation, utilisation of the broadband Internet, cloud services, RFID-technologies, ERP-systems, and enterprises’ engagement in e-commerce” [Abdrakhmanova et al., 2019a, p. 10].

Definitions of the ERP-system and RFID-technologies found in the literature are quite laconic. “An ERP-system is an organisation’s resource planning system which consists of one or more software applications used to integrate the information and production processes (functions) of the corporate divisions. The ERP-system integrates planning, procurement, sales, marketing, customer interaction, finance, human resources, etc. ... RFID-technologies are the automatic object identification technologies which can read or write data stored in RFID tags using radio signals” [Abdrakhmanova et al., 2019b, p. 241].

The object of this study is the Ural macroregion according to the current regional division of the country, outlined by the boundaries of the seven subjects of the Russian Federation: Sverdlovsk, Chelyabinsk, Kurgan, Orenburg oblasts, Perm Krai, the Republic of Bashkortostan and the Udmurt Republic.

We will use the statistics for the Ural macroregion to test the method for calculating the composite indicator of the regional economy digitalisation.

Based on statistical indicators suggested by the HSE scholars for the quantitative measurement of the digital economy, we compiled a table listing the business digitalisation indices by the territories of the Ural macroregion (Table 1).

Table 1. Business digitalisation indices for the Russian Federation and the territories of the Ural macroregion in 2017

| Territory of the Ural macroregion | Business digitalisation index | Including indicators of the Index |
|-----------------------------------|------------------------------|----------------------------------|
|                                   |                              | using the broadband Internet | using cloud services | using RFID-technologies | using ERP-systems | engaged in e-commerce |
| the Republic of Bashkortostan      | 29.0                         | 88.5                             | 22.1                             | 4.3                             | 19.5                             | 12.2                             |
| the Udmurt Republic               | 23.0                         | 80.1                             | 17.1                             | 3.7                             | 8.9                             | 7.6                             |
| Perm Krai                         | 27.0                         | 84.5                             | 23.1                             | 4.6                             | 13.4                             | 9.7                             |
| Orenburg oblast                   | 28.0                         | 92.9                             | 21.3                             | 5.0                             | 11.9                             | 9.6                             |
| Kurgan oblast                     | 21.0                         | 69.6                             | 18.1                             | 2.7                             | 8.1                             | 7.1                             |
| Sverdlovsk oblast                 | 30.0                         | 86.9                             | 26.9                             | 7.0                             | 15.8                             | 12.4                             |
| Chelyabinsk oblast                | 28.0                         | 85.4                             | 23.4                             | 5.1                             | 13.7                             | 11.3                             |
| Russian Federation                | 28.0                         | 82.0                             | 23.0                             | 6.0                             | 19.0                             | 12.0                             |

Note. Compiled using [Abdrakhmanova et al., 2019b, pp. 216–219].

Table 1 shows that the territories of the Ural macroregion rank differently by the value of their business digitalisation index. The difference between the leader – Sverdlovsk oblast (30) and the outsider – Kurgan oblast (21) is 9 points.

Sverdlovsk oblast (30) holds a leading position within the Ural macroregion, and is followed by the Republic of Bashkortostan (29), Orenburg and Chelyabinsk oblasts (28). Only two territories of the Ural macroregion – Sverdlovsk oblast and the Republic of Bashkortostan exceed the average Russian value (28).

To justify the factors behind the differing business digitalisation levels of the Ural regions, we devised a method to calculate the composite indicator of the regional economy digitalisation. This task is complicated by the fact that these are the first attempts to measure the
digitalisation processes, and of the whole set of indicators monitored by the Russian Federal State Statistics Service, most closely these processes can be indirectly assessed by the ICT performance indicators. Note that according to the English scholars Bukht and Heeks, Information and Communication Technologies characterise the first scope of the digital economy [Bukht, Heeks, 2018].

As part of the method for calculating the composite indicator of the regional economy digitalisation, we transformed individual indicators by normalising them which involved computing the ratio of a region’s indicator value to the group-average value for the regions in question (in our case, the macroregion).

To calculate the composite indicator of the regional economy digitalisation, we aggregated single transformed indicators by summing them up. The indicators were assigned equal weights when being summed up to avoid subjectivity.

Our calculations are based on 12 individual indicators, each of which reflects how far the digital economy and digital technologies have spread over the region. They include the following:

1) organisations using personal computers, in % of the total number of organisations surveyed in the corresponding subject of the Russian Federation;
2) organisations using servers, in % of the total number of organisations surveyed in the corresponding subject of the Russian Federation;
3) organisations using local area networks, in % of the total number of organisations surveyed in the corresponding subject of the Russian Federation;
4) organisations having broadband Internet access, in % of the total number of organisations surveyed in the corresponding subject of the Russian Federation;
5) organisations having a website, in % of the total number of organisations surveyed in the corresponding subject of the Russian Federation:
6) number of personal computers per 100 employees, units;
7) organisations using electronic document management systems, in % of the total number of organisations surveyed in the corresponding subject of the Russian Federation;
8) organisations using electronic data interchange between internal and external information systems, in % of the total number of organisations surveyed in the corresponding subject of the Russian Federation;
9) number of active fixed-line broadband subscriptions per 100 people, as of the year end, units;
10) number of active mobile broadband subscriptions per 100 people, as of the year end, units;
11) special software utilisation in the organisations, in % of the total number of organisations surveyed in the corresponding subject of the Russian Federation;
12) expenditure on Information and Communication Technologies per person employed in the economy, thousand roubles per person.

When putting together the set of these specific indicators, we relied on the above definitions of the digital economy, digital technologies, and digitalisation processes.

The data derived from the selected indicators imply that the digital economy in the Ural macroregion is actively developing (Figs. 2–6, Table 2).

Growth in the share of Ural’s organisations using servers looks very convincing. In 2003–2018, this indicator increased by 45.2 % or 6.7 times – from 7.9 to 53.1 % (Fig. 2). Currently, more than 53 % of all organisations in the Ural macroregion, as well as in the Russian Federation as a whole, have their own servers. The curves in Fig. 2 indicate that the 2014 recession gave this process a boost. In 2015, the value increased by 22.96 %.
The proportion of organisations having broadband Internet access is steadily increasing in the Ural macroregion and in Russia as a whole (Fig. 3). Over 2006–2018, the indicator’s value went up by 62.8 pp. or 3.6 times. Currently, more than 87.23 % of all organisations in Ural have such access, which allows them to cut down the operation time and reduce transaction costs.

In 2003–2018, the share of organisations in the Ural macroregion having a website increased 4.3 times, from 11.9 to 50.4 % (Fig. 4). A website allows firms to quickly make their contractors aware of their products (services), prices, and ensures efficient communication.

The trend lines reflecting the number of personal computers per 100 employees in the Russian Federation and the Ural macroregion are fairly stable (Fig. 5). Currently, 48 out of 100 employees in the Ural macroregion have a personal computer. In 2003, the number was only 15.

PC availability is the basic factor for the digital economy as it is an important initial condition for the collection, storage, processing, retrieval, transmission, and visualisation of data in electronic form – a precondition for digital technology application.

PC availability contributes to a larger share of organisations actively using electronic data interchange between internal and external information systems. Over the seven years between 2011 and 2018, this indicator doubled – from 33.3 to 66.7 % (Fig. 6).
Trend data for ten indicators of the Russian and Ural economy digitalisation over a comparable period of 2011–2018 (Table 2) show the highest growth in the following values for the macroregion:

- number of active mobile broadband subscriptions per 100 people – by 35.63 %;
- share of organisations using servers – by 34.26 %;

Fig. 4. Change in the share of organisations in the Russian Federation and territories of the Ural macroregion having a website, %

Fig. 5. Change in the number of personal computers per 100 employees in the Russian Federation and the Ural macroregion, units

Fig. 6. Change in the share of organisations using electronic data interchange between internal and external information systems, %
### Table 2. Changes in the key indicators of economy digitalisation in Russia and the Ural macroregion

| Indicator                                                                 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | Change of the indicator in 2018 compared to 2011 |
|--------------------------------------------------------------------------|------|------|------|------|------|------|------|------|--------------------------------------------------|
| 1. Organisations using personal computers, % of the total number of organisations surveyed |      |      |      |      |      |      |      |      |                                                  |
| the Russian Federation                                                   | 94.1 | 94.0 | 94.0 | 93.8 | 92.3 | 92.4 | 92.1 | 94.0 | –0.1                                            |
| the Ural macroregion                                                     | 96.4 | 96.63| 95.81| 95.76| 93.49| 93.26| 92.98| 95.03| –1.36                                           |
| 2. Organisations using servers, % of the total number of organisations   |      |      |      |      |      |      |      |      |                                                  |
| the Russian Federation                                                   | 19.7 | 18.9 | 19.7 | 26.6 | 47.7 | 50.8 | 50.6 | 53.4 | 33.64                                           |
| the Ural macroregion                                                     | 18.79| 18.2 | 19.03| 24.23| 47.19| 49.97| 49.95| 53.05| 34.26                                           |
| 3. Organisations using local area networks, % of the total number of organisations surveyed |      |      |      |      |      |      |      |      |                                                  |
| the Russian Federation                                                   | 71.3 | 71.7 | 73.4 | 67.2 | 63.5 | 62.3 | 61.1 | 63.9 | –7.35                                           |
| the Ural macroregion                                                     | 73.29| 75.01| 75.93| 68.64| 64.93| 64.56| 63.36| 66.01| –7.28                                           |
| 4. Organisations having broadband Internet access, % of the total number of organisations surveyed |      |      |      |      |      |      |      |      |                                                  |
| the Russian Federation                                                   | 63.4 | 76.6 | 79.4 | 81.2 | 79.5 | 81.8 | 83.2 | 86.5 | 23.09                                           |
| the Ural macroregion                                                     | 69.3 | 81.67| 83.14| 83.63| 81.57| 82.73| 83.99| 87.23| 17.93                                           |
| 5. Organisations having a website, % of the total number of organisations surveyed |      |      |      |      |      |      |      |      |                                                  |
| the Russian Federation                                                   | 33.0 | 37.8 | 41.3 | 40.3 | 42.6 | 45.9 | 47.4 | 50.9 | 17.94                                           |
| the Ural macroregion                                                     | 33.57| 39.34| 44.23| 43.59| 44.1 | 46.54| 48.09| 50.42| 16.85                                           |
| 6. Number of personal computers per 100 employees, units                 |      |      |      |      |      |      |      |      |                                                  |
| the Russian Federation                                                   | 39   | 43   | 44   | 47   | 49   | 49   | 50   | 51   | 12                                              |
| the Ural macroregion                                                     | 35.29| 38.14| 40.14| 42.57| 43.29| 44.86| 46.14| 47.71| 12.43                                           |
| 7. Organisations using electronic document management systems, % of the total number of organisations surveyed |      |      |      |      |      |      |      |      |                                                  |
| the Russian Federation                                                   | 61.9 | 60.4 | 61.7 | 58.9 | 62.7 | 66.1 | 66.1 | 68.6 | 6.73                                            |
| the Ural macroregion                                                     | 68.7 | 67.39| 66.64| 67.67| 67.46| 68.86| 67.64| 70.4 | 1.7                                             |
| 8. Organisations using electronic data interchange between internal and external information systems, % of the total number of organisations surveyed |      |      |      |      |      |      |      |      |                                                  |
| the Russian Federation                                                   | 31.3 | 24.3 | 25.7 | 52.7 | 59.6 | 62.4 | 63.1 | 64.9 | 33.61                                           |
| the Ural macroregion                                                     | 33.3 | 25.96| 26.39| 55.26| 62.26| 65.81| 65.34| 66.72| 33.42                                           |
| 9. Number of active fixed-line broadband subscriptions per 100 people, as of the year end, units |      |      |      |      |      |      |      |      |                                                  |
| the Russian Federation                                                   | 12.2 | 14.4 | 16.5 | 17.0 | 18.3 | 18.6 | 21.0 | 21.7 | 9.5                                             |
| the Ural macroregion                                                     | 12.53| 15.17| 17.23| 17.77| 18.83| 18.89| 21.33| 21.79| 9.26                                           |
| 10. Number of active mobile broadband subscriptions per 100 people, as of the year end, units |      |      |      |      |      |      |      |      |                                                  |
| the Russian Federation                                                   | 47.8 | 52.6 | 59.8 | 64.5 | 68.1 | 71.1 | 79.9 | 86.2 | 38.4                                            |
| the Ural macroregion                                                     | 41.47| 45.64| 52.37| 57.14| 53.43| 57.77| 68.73| 77.1 | 35.63                                           |
• share of organisations using electronic data interchange between internal and external information systems – by 33.42 %.

We believe these trends to signify that the Ural macroregion is accumulating potential for economic growth based on the use of digital technologies.

The calculated transformed individual and composite indicators of the regional economy digitalisation broken down by the territories of the Ural macroregion as of 2018 are shown in Table 3.

The test of our proposed method for assessing the level of the regional economy digitalisation highlights the following distinctive features of the digital economy development in the territories of the Ural macroregion.

1. Significant differentiation of the levels of the regional economy digitalisation across the subjects of the Russian Federation making up the Ural macroregion.

As the composite indicator shows the level of digitalisation of the regional leader – Sverdlovsk oblast is 1.066, while that of the regional outsider – Kurgan oblast is 0.835. This is a 1.28 times difference. Our proposed method can distinguish two outsider territories – Kurgan and Orenburg oblasts, which ranked the lowest in 8 out of 12 and 2 out of 12 indicators respectively.

2. The primary stage of the digitalisation process in the territories of the Ural macroregion, associated with building up the PC availability, providing the Internet access, and spreading the Internet across the region, is complete, as evidenced by minor maximum/minimum ratios of the following transformed individual indicators (Table 3):
   • organisations using personal computers (1.090);
   • special software utilisation in the organisations (1.046);
   • number of active mobile broadband subscriptions per 100 people (1.211);
   • number of active fixed-line broadband subscriptions per 100 people (1.251);
   • organisations using local area networks (1.256).

3. Dissimilar potential for the digital economy development among the territories of the Ural macroregion.

This is evidenced by the largest inter-regional gap in terms of expenditure on Information and Communication Technologies per person employed in the economy – 3.053, with Sverdlovsk oblast (1.395), Perm Krai (1.350), and the Republic of Bashkortostan (1.048) as leaders. Other territories – Chelyabinsk oblast (0.739), and the Udmurt Republic (0.606) – lag starkly behind them. The future of the digital economy in Orenburg (0.589) and Kurgan oblasts (0.457) raises concerns.

4. Correlation between the level of the regional economy digitalisation and economic growth.

To confirm this conclusion, we used the results obtained in our previous studies. More specifically, we compared the rankings of the Ural macroregion’s territories by the level of the regional economy digitalisation with the rankings of the same territories by the new high-tech industrialisation potential [Novikova, 2018, p. 194]. Our choice of the new high-tech industrialisation potential to prove the correlation between the level of the regional economy digitalisation and economic growth is justified below.

In their previous studies, Ural scholars established a strong correlation between the rates of economic growth and the development of high-tech (for each particular time period) industrial production based on the industrial output statistics for the Ural companies over a three-hundred-year period [Silin, Animitsa, Novikova, 2018, 2019; Novikova, 2018]. The reason for such a strong correlation is a historical “genetic code” of the Ural economy based on the consistent industrial specialisation that has emerged over a three-hundred-year period. As a result, the new industrialisation potential of the Ural industrial territories defines, to a large extent, their potential for economic growth.
Table 3. Transformed individual and composite indicators of the regional economy digitalisation for the territories constituting the Ural macroregion in 2018

Таблица 3. Трансформированные частные индикаторы и агрегированные показатели уровня цифровизации региональной экономики в разрезе территорий Уральского макрорегиона по состоянию на 2018 г.

| Indicator                                                                 | the Republic of Bashkortostan | the Udmurt Republic | Perm Krai | Orenburg oblast | Kurgan oblast | Sverdlovsk oblast | Chelyabinsk oblast | Maximum/minimum ratio, times |
|--------------------------------------------------------------------------|-------------------------------|---------------------|----------|----------------|--------------|-------------------|-------------------|-----------------------------|
| Organisations using personal computers, %                               | 1.019                         | 1.016               | 1.001    | 1.018          | 0.935        | 1.013             | 0.997             | 1.090                       |
| Organisations using servers, %                                           | 1.026                         | 1.016               | 1.052    | 0.953          | 0.707        | 1.137             | 1.110             | 1.608                       |
| Organisations using local area networks, %                              | 1.030                         | 1.035               | 0.982    | 1.034          | 0.835        | 1.034             | 1.049             | 1.256                       |
| Organisations having broadband Internet access, %                        | 1.018                         | 0.997               | 1.031    | 1.081          | 0.864        | 1.016             | 0.993             | 1.251                       |
| Organisations having a website, %                                        | 1.067                         | 1.079               | 1.020    | 1.051          | 0.894        | 0.968             | 0.987             | 1.195                       |
| Number of personal computers per 100 employees, units                   | 0.964                         | 1.069               | 0.888    | 1.090          | 0.781        | 1.051             | 1.044             | 1.396                       |
| Organisations using electronic document management systems, %            | 1.068                         | 1.013               | 1.020    | 1.051          | 0.894        | 0.968             | 0.987             | 1.195                       |
| Organisations using electronic data interchange between internal and external information systems, % | 0.904                         | 1.003               | 1.267    | 1.051          | 0.795        | 0.989             | 0.991             | 1.594                       |
| Number of active fixed-line broad-band subscriptions per 100 people, as of the year end, units | 0.987                         | 0.941               | 1.005    | 0.835          | 0.936        | 1.125             | 1.170             | 1.347                       |
| Number of active mobile broadband subscriptions per 100 people, as of the year end, units | 0.987                         | 0.984               | 1.023    | 1.058          | 0.874        | 1.016             | 1.057             | 1.211                       |
| Special software utilisation in the organisations, %                     | 1.003                         | 0.982               | 0.999    | 1.027          | 1.000        | 0.999             | 0.989             | 1.046                       |
| Expenditure on Information and Communication Technologies per person employed in the economy, thousand roubles per person | 1.048                         | 0.606               | 1.350    | 0.589          | 0.457        | 1.395             | 0.739             | 3.053                       |
| Sum of the transformed individual indicators                               | 12.120                        | 11.742              | 12.689   | 11.709         | 10.022       | 12.791            | 12.111            |                             |
| **Level of digitalisation**                                               | **Composite indicator**       | **Ranking of the territory** | **Ranking of the territory by the new industrialisation potential [Novikova, 2018, p. 194]** |
| **Territory of the Ural macroregion**                                    | **1.010**                     | **3**               | **978**   | **1.057**      | **0.976**    | **0.835**         | **1.066**         | **1.009**                   |
| **Ranking of the territory**                                              | **3**                         | **5**               | **2**     | **6**          | **7**        | **1**             | **4**             | **x**                       |
| **Ranking of the territory by the new industrialisation potential [Novikova, 2018, p. 194]** | **3**                         | **4**               | **1**     | **6**          | **7**        | **2**             | **5**             | **x**                       |
Based on the findings, the scholars demonstrated the prospects for achieving economic growth in Ural by actively making use of the advancements of the third and fourth industrial revolutions which rely on digital technologies.

Comparison of the level of the regional economy digitalisation with the new industrialisation potential among the Ural territories showed similar rankings. Territories with a more digitalised economy also tend to have a higher new industrialisation potential, which forms the basis of economic growth. For instance, Sverdlovsk oblast (digitalisation ranking 1 / new industrialisation potential ranking 2), Perm Krai (2/1), and the Republic of Bashkortostan (3/3) leading in the regional economy digitalisation, also hold the first places by the new industrialisation potential (see Table 3). While digital outsiders (Chelyabinsk oblast (4/5), the Udmurt Republic (5/4), Orenburg oblast (6/6), Kurgan oblast (7/7)) also performed worst in terms of the new industrialisation potential.

The figures and relationship between them suggest a correlation between the level of the regional economy digitalisation and economic growth. Digitalisation processes serve as the major endogenous driver of the regional performance.

**Conclusion**

Researchers representing various scholarly traditions are actively looking for new sources of economic development and growth. This challenge is fuelled by the prolonged period of the “new normal” characterised by the stumbling economy. Previous resources that used to ensure economic growth have run dry. Most researchers concluded that no transition to the upward wave of the fifth large Kondratieff cycle is possible without the widespread use of innovative technologies with digital technologies playing the key part.

The digital economy, characteristics and measurement criteria of which are currently under development, is becoming a fact of life. Special attention is required to put together a scientific methodology for measuring regional digitalisation processes and the digital economy.

The paper proposed the methodological approach to studying the regional economy digitalisation processes, which was tested on seven territories constituting the Ural macroregion. The study revealed the following features of the digital economy developing in the Ural macroregion: significant differentiation of the levels of the regional economy digitalisation among the subjects of the Russian Federation making up the Ural macroregion; finished primary stage of the digitalisation process in the territories of the Ural macroregion, associated with building up the PC availability, providing the Internet access, and spreading the Internet across the region; dissimilar potential for the digital economy development among the territories of the Ural macroregion; correlation between the level of the regional economy digitalisation and economic growth.

It should be emphasised that the proposed method can only measure the first scope of the digital economy associated with Information and Communication Technologies’ development. It will need further refinement to allow for the second and third scope of the digital economy, which are still quite poorly measured.

**References**

Abdrakhmanova G. I., Vishnevskiy K. O., Gokhberg L. M., Dranev Yu. Ya., Zinina T. S., Kovaleva G. G., … Shmatko N. A. (2019a). Chto takoe tsifrovaya ekonomika? Trendy, kompetentsii, izmerenie [What is a digital economy? Trends, competencies, measurement]. Report at the 20th April International research conference on the problems of economic and social development. Moscow: HSE Publ. 82 p. (in Russ.)

Abdrakhmanova G. I., Vishnevskiy K. O., Volkova G. L., Gokhberg L. M., Demyanova A. V., Dyachenko E. L., … Shmatko N. A. (2019b). Indikatory tsifrovoiy ekonomiki. 2019 [Digital economy indicators: 2019]. Moscow: HSE Publ. 248 p. (in Russ.)
Бабкин А. В., Буркальцева Д. Д., Костен Д. Г., Vorобев Ю. Н. (2017). Formirovanie tsifrovoy ekonomiki v Rossii: sushchnost', osobennosti, tekhnicheskaya normalizatsiya, problemy razvitiya [Formation of digital economy in Russia: Essence, features, technical normalisation, development problems]. Nauchnotekhnicheskie vedomosti SPbGPU. Ekonomsckie nauki = St. Petersburg State Polytechnical University Journal. Economics, vol. 10, no. 3, pp. 9–25. DOI: 10.18721/IE.10301. (in Russ.)

Бодрунов С. Д. (2018). Noonomaika [Noonomics]. Moscow: Kul'turnaya revolyutsiya Publ. 432 p. (in Russ.)

Букхт Р., Heeks Р. (2018). Opredelenie, kontseptsiya i izmerenie tsifrovoy ekonomiki [Defining, conceptualising and measuring the digital economy]. Vestnik mezhdunarodnykh organizatsiy = International Organisations Research Journal, vol. 13, no. 2, pp. 143–172. DOI: 10.17323/1996‑7845‑2018‑02‑07. (in Russ.)

Глазьев С. Ю. (1993). Teoriya dolgosrochnogo tekhniko-ekonomicheskogo razvitiya [Theory of long-term techno-economic development]. Moscow: VladDar Publ. 310 p. (in Russ.)

Добрынин А. П., Chernykh К. Ю., Kupriyanovskiy V. P., Kupriyanovskiy P. V., Sinyagov S. A. (2016). Tsifrovaya ekonomika – razlichnye puti k effektivnomu primeneniyu tekhnologiy (BIM, PLM, CAD, IOT, Smart City, Big DATA i drugie) [The digital economy – the various ways to the effective use of technology (BIM, PLM, CAD, IOT, Smart City, BIG DATA, and others)]. International Journal of Open Information Technologies, vol. 4, no. 1, pp. 4–10. (in Russ.)

Кондратьев Н. Д. (2015). Model’ ekonomicheskoy dinamiki kapitalisticheskogo khozyaystva [The model of economic dynamics in a capitalist economy]. In: Bol’shie tsikly konyunktury i teoriya predvideniya: izbrannye Trudy [Long wave economic cycles and prediction theory: Selected articles]. Moscow: Akademicheskij proekt Publ, pp. 466–468. (in Russ.)

Куприяновский V. P., Sinyagov S. A., Namiot D. E., Utkin N. A., Nikolaev D. E., Dobrynin A. P. (2017). Transformatiya promyslennosti v tsifrovoy ekonomike – ekosistema i zhiznennyy tsikl [Industries transformation in the digital economy – the design and production]. International Journal of Open Information Technologies, vol. 5, no. 1, pp. 34–49. (in Russ.)

Новикова Н. В. (2018). Novaya industrializatsiya: regional’naya paradigm [New industrialisation: A regional paradigm]. Ekaterinburg: U‑Faktoriya Publ. 328 p. (in Russ.)

Романова О. А. (2018). Prioriteti promyshlennoy politiki Rossii v kontekste vyzovov chetvertoy promyshlennoy revolyutsii. Ch. 1 [Industrial policy priorities of Russia in the context of challenges of the fourth industrial revolution. Part 1]. Ekonomika regiona = Economy of Region, vol.1, no. 2, pp. 420–432. DOI 10.17059/2018‑2‑7. (in Russ.)

Сильин Я. П., Animitsa E. G. (2018). Kontury formirovaniya tsifrovoy ekonomiki v Rossii [Contours of the digital economy in Russia]. Izvestiya Ural’skogo gosudarstvennogo ekonomicheskogo universiteta = Journal of the Ural State University of Economics, vol. 19, no. 3, pp. 18–25. DOI: 10.29141/2073‑1019‑2018‑19‑3‑3. (in Russ.)

Сильин Я. П., Animitsa E. G., Novikova N. V. (2018). Strategicheskie prioritets novoy industrializatsii v prostranstve Ural’skogo makroregiona [Strategic priorities of new industrialisation in space of the Ural macroregion]. In: Bodrunov S. D., Silin Я. P., Ryazanov V. T., Animitsa E. G. (eds.) Novaya industrializatsiya Rossii: strategicheskie prioritets strany i vozmozhnosti Urala [New industrialisation of Russia: Strategic priorities of the country and possibilities of Urals]. Ekaterinburg: Ural State University of Economics, pp. 165–190. (in Russ.)

Сильин Я. П., Animitsa E. G., Novikova N. V. (2019). Ural’skiy makroregion: bol’shie tsikly industrializatsii [Ural macroregion: Large cycles of industrialisation]. Ekaterinburg: Ural State University of Economics. 371 p. (in Russ.)

Сухарев О. С. (2015). Ekonomicheskiy rost, instituty i tekhnologii [Economic growth, institutions and technologies]. Moscow: Finansi i statistika Publ. 464 p. (in Russ.)
Regional Aspects of Economic Growth

Ustyuzhanina E. V., Sigarev A. V., Shein R. A. (2017). Tsifrovaya ekonomika kak novaya paradigma ekonomicheskogo razvitiya [Digital economy as a new paradigm of economic development]. *Ekonomicheskii analiz: teoriya i praktika = Economic Analysis: Theory and Practice*, vol. 16, no. 12, pp. 2238–2253. DOI: 10.24891/ea.16.12.2238. (in Russ.)

Khali V. G., Chernova G. V. (2018). Tsifrovizatsiya i ee vliyanie na rossiyskuyu ekonomiku i obshchestvo: preimushchestva, vyzyvy, ugrozy i riski [Digitalisation and its impact on the Russian economy and society: Advantages, challenges, threats and risks]. *Upravlencheskoe konsul'tirovanie = Administrative Consulting*, no. 10, pp. 46–62. DOI 10.22394/1726-1139-2018-10-46-63. (in Russ.)

Tsvetkov V. A., Sukharev O. S. (2017). *Ekonomscheskiy rost Rossii: Novaya model' upravleniya [Economic growth in Russia: New management model]*. Moscow: LENAND Publ. 352 p. (in Russ.)

Schwab K. (2017). *Chetvertaya promyshlennaya revolyutsiya [The fourth industrial revolution]*. Moscow: Eksmo Publ. 208 p. (in Russ.)

Schwab K., Davis N. (2018). *Tekhnologii chetvertoy promyshlennoy revolyutsii [Shaping the fourth industrial revolution]*. Moscow: Eksmo Publ. 320 p. (in Russ.)

Yudina T. N. (2016). Omsylenie tsifrovoy ekonomiki [Understanding the digital economy]. *Teoreticheskaya ekonomika = Theoretical Economics*, no. 3, pp. 12–16. (in Russ.)

Bahl M. (2016). The work ahead: The future of businesses and jobs in Asia Pacific’s digital economy. Chennai: Cognizant. Available at: https://www.cognizant.com/whitepapers/the-work-ahead-the-future-of-business-and-jobs-in-asia-pacifics-digital-economy-codex2255.pdf.

Dahlman C., Mealy S., Wermelinger M. (2016). Harnessing the digital economy for developing countries. Paris: OECD. Available at: https://ideas.repec.org/p/oec/devaaa/334-en.html.

Heeks R. (2016). Examining “Digital Development”. Development Informatics Working Paper 64, University of Manchester. Available at: http://hummedia.manchester.ac.uk/institutes/gdi/publications/workingpapers/di/di_wp64.pdf.

Kling R., Lamb R. (2000). IT and organization change in digital economies: A sociotechnical approach. In: Brynjolfsson E., Kahin B. (eds.) *Understanding the digital economy: Data, tools and research*. Cambridge: MIT Press, pp. 295–324.

Lane N. (1999). Advancing the digital economy into the 21st century. *Information Systems Frontiers*, vol. 1, no. 3, pp. 317–320. DOI: 10.1023/a:1010010630396.

Mensch G. (1979). Stalemate in technology — innovation overcame the depression. N. Y.: Ballinger Pub. Co. 241 p.

Mesenbourg T. L. (2001). *Measuring the digital economy*. Suitland: US Bureau of the Census. Available at: https://www.census.gov/content/dam/Census/library/working‑papers/2001/econ/umdigital.pdf.

Nottebohm O., Manyika J., Bughin J., Chui M., Syed A.-R. (2012). Online and upcoming: The Internet’s impact on aspiring countries. Palo Alto: McKinsey & Company. Available at: http://www.mckinsey.com/industries/high-tech/our-insights/impact-of-the-internet-on-aspiring-countries.

Romer P. (1990). Endogenous technological change. *Journal of Political Economy*, vol. 98, no. 5, part 2, pp. 71–102. DOI: 10.1086/261725.

Solow R. (1956). A contribution to the theory of economic growth. *Quarterly Journal of Economics*, vol. 70, no. 1, pp. 65–94. DOI: 10.2307/1884513.

Tapscott D. (1996). The digital economy: Promise and peril in the age of networked intelligence. N. Y.: McGraw-Hill. 342 p.

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Региональные аспекты исследования цифровой экономики в системе факторов экономического роста

Аннотация. Научная мысль нацелена на поиск новых ресурсов и факторов экономического развития и роста. В связи с этим на передний план выходит дискуссия о становлении, развитии и измерении процессов цифровой экономики как важнейшего эндогенного фактора ускорения экономической динамики страны и ее регионов. Статья посвящена обозначению теоретических и методологических аспектов изучения цифровой экономики как важнейшей составляющей региональной экономической динамики. Методологической базой исследования послужили разработки английских ученых Института глобального развития Р. Бухта и Р. Хикса, применивших трехуровневый подход к анализу и измерению масштабов цифровой экономики. Авторы статьи также опираются на методологию российских ученых Национального исследовательского университета «Высшая школа экономики», разработанную для вычисления индекса цифровизации бизнеса. В результате исследования предложена методика расчета интегрального показателя цифровизации региональной экономики, апробированная на примере Уральского макрорегиона. Основу методики составляют 12 частных индикаторов, совокупность которых характеризует масштабы проникновения цифровой экономики и цифровых технологий на территорию региона. Выявлены следующие характерные черты формирования цифровой экономики в Уральском макрорегионе: существенное территориальное различие уровня цифровизации региональной экономики; завершение первичного этапа процесса цифровизации; дифференциация регионального потенциала развития цифровой экономики; наличие взаимосвязи между уровнем цифровизации региональной экономики и ее ростом.

Ключевые слова: экономический рост; цифровая экономика; цифровизация экономики; макрорегион; Уральский макрорегион.

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Источники

Абдрахманова Г. И., Вишневский К. О., Гохберг Л. М., Дранев Ю. Я., Зинина Т. С., Ковалева Г. Г., … Шматко Н. А. (2019а). Что такое цифровая экономика? Тренды, компетенции, измерение : докл. к ХХ Апр. междунар. науч. конф. по проблемам развития экономики и общества, Москва, 9–12 апр. 2019 г.; науч. ред. Л. М. Гохберг; НИУ «ВШЭ». М.: Изд. дом ВШЭ. 82 с.
Абдрахманова Г. И., Вишневский К. О., Волкова Г. Л., Гохберг Л. М., Демьянова А. В., Дьяченко Е. Л., … Шматко Н. А. (2019б). Индикаторы цифровой экономики: 2019 ; НИУ «ВШЭ». М.: Изд. дом ВШЭ. 248 с.
Бабкин А. В., Буркальцева Д. Д., Костень Д. Г., Воробьев Ю. Н. (2017). Формирование цифровой экономики в России: сущность, особенности, техническая нормализация, проблемы развития // Научно-технические ведомosti СПб.ГПУ. Экономические науки. Т. 10, № 3. С. 9–25. DOI: 10.18721/JE.10301.

Бодрунов С. Д. (2018). Ноомоника. М.: Культурная революция. 432 с.

Бухт Р., Хикс Р. (2018). Определение, концепция и измерение цифровой экономики // Вестник международных организаций. Т. 13, № 2. С. 143–172. DOI: 10.17323/1996-7845-2018-02-07.

Глазьев С. Ю. (1993). Теория долгосрочного технико-экономического развития. М.: ВладДар. 310 с.

Добрынин А. П., Черных К. Ю., Купряновский В. П., Купряновский П. В., Синягов С. А. (2016). Цифровая экономика – различные пути к эффективному применению технологий (BIM, PLM, CAD, IOT, Smart City, Big DATA и другие) // International Journal of Open Information Technologies. Т. 4, № 1. С. 4–10.

Кастель М. (2004). Галактика Интернет. Размышления об Интернете, бизнесе и обществе. Екатеринбург: У‑Фактория. 328 с.

Кондратьев Н. Д. (2015). Модель экономической динамики капиталистического хозяйства // Большие циклы конъюнктуры и теория предвидения: избранные труды. М.: Академический проект. С. 466–468.

Купряновский В. П., Синягов С. А., Намиот Д. Е., Уткин Н. А., Николаев Д. Е., Добрынин А. П. (2017). Трансформация промышленности в цифровой экономике – экосистема и жизненный цикл // International Journal of Open Information Technologies. Т. 5, № 1. С. 34–49.

Новикова Н. В. (2018). Новая индустриализация: региональная парадигма. Екатеринбург: Изд‑во Урал гос. экон. ун‑та. 264 с.

Перес К. (2011). Технологические революции и финансовый капитал. Динамика пузырей и периодов процветания. М.: Дело. 232 с.

Романова О. А. (2018). Приоритеты промышленной политики России в контексте вызовов четвертой промышленной революции. Ч. 1 // Экономика региона. Т. 14 (2). С. 420–432. DOI: 10.17059/2018-2-7.

Силин Я. П., Анимица Е. Г. (2018). Контуры формирования цифровой экономики в России // Известия Уральского государственного экономического университета. Т. 19, № 3. С. 18–25. DOI: 10.29141/2073-1019-2018-19-3-3.

Силин Я. П., Анимица Е. Г., Новикова Н. В. (2018). Стратегические приоритеты новой индустриализации в пространстве Уральского макрорегиона // Новая индустриализация России: стратегические приоритеты страны и возможности Урала / под ред. С. Д. Бодрунова, Я. П. Силина, В. Т. Рязанова, Е. Г. Анимицы. Екатеринбург: Изд‑во Урал гос. экон. ун‑та. С. 165–190.

Силин Я. П., Анимица Е. Г., Новикова Н. В. (2019). Уральский макрорегион: большие циклы индустриализации / под науч. ред. С. Ю. Глазьева, С. Д. Бодрунова. Екатеринбург: Изд‑во Урал гос. экон. ун‑та. 371 с.

Сухарев О. С. (2015). Экономический рост, институты и технологии. М.: Финансы и статистика. 464 с.

Устюжанина Е. В., Сигарев А. В., Шеин Р. А. (2017). Цифровая экономика как новая парадигма экономического развития // Экономический анализ: теория и практика. Т. 16, № 12. С. 2238–2253. DOI: 10.24891/ea.16.12.2238.

Халин В. Г., Чернова Г. В. (2018). Цифровизация и ее влияние на российскую экономику и общество: преимущества, вызовы, угрозы и риски // Управленческое консультирование. № 10. С. 46–62. DOI 10.22394/1726‑1139‑2018‑10‑46‑63.

Цветков В. А., Сухарев О. С. (2017). Экономический рост России: Новая модель управления. М.: ЛЕНАНД. 352 с.

Шваб К. (2017). Четвертая промышленная революция. М.: Эксмо. 208 с.

Шваб К., Давис Н. (2018) Технологии четвертой промышленной революции. М.: Эксмо. 320 с.

Юдина Т. Н. (2016). Осмысление цифровой экономики // Теоретическая экономика. № 3. С. 12–16.
Bahl M. (2016). *The work ahead: The future of businesses and jobs in Asia Pacific’s digital economy*. Chennai: Cognizant. Available at: https://www.cognizant.com/whitepapers/the-work-ahead-the-future-of-business-and-jobs-in-asia-pacifics-digital-economy-codex2255.pdf.

Dahlman C., Mealy S., Wermelinger M. (2016). *Harnessing the digital economy for developing countries*. Paris: OECD. Available at: https://ideas.repec.org/p/oec/devaaa/334-en.html.

Heeks R. (2016). *Examining “Digital Development”*. Development Informatics Working Paper 64, University of Manchester. Available at: http://hummedia.manchester.ac.uk/institutes/gdi/publications/workingpapers/di/di_wp64.pdf.

Kling R., Lamb R. (2000). IT and organization change in digital economies: A sociotechnical approach. In: Brynjolfsson E., Kahin B. (eds.) *Understanding the digital economy: Data, tools and research*. Cambridge: MIT Press, pp. 295–324.

Lane N. (1999). Advancing the digital economy into the 21st century. *Information Systems Frontiers*, vol. 1, no. 3, pp. 317–320. DOI: 10.1023/a:1010010630396.

Mensch G. (1979). *Stalemate in technology — innovation overcame the depression*. N. Y.: Ballinger Pub. Co. 241 p.

Mesenbourg T. L. (2001). *Measuring the digital economy*. Suitland: US Bureau of the Census. Available at: https://www.census.gov/content/dam/Census/library/working-papers/2001/econ/umdigital.pdf.

Nottebohm O., Manyika J., Bughin J., Chui M., Syed A.-R. (2012). *Online and upcoming: The Internet’s impact on aspiring countries*. Palo Alto: McKinsey & Company. Available at: http://www.mckinsey.com/industries/high-tech/our-insights/impact-of-the-internet-on-aspiring-countries.

Romer P. (1990). Endogenous technological change. *Journal of Political Economy*, vol. 98, no. 5, part 2, pp. 71–102. DOI: 10.1086/261725.

Solow R. (1956). A contribution to the theory of economic growth. *Quarterly Journal of Economics*, vol. 70, no. 1, pp. 65–94. DOI: 10.2307/1884513.

Tapscott D. (1996). *The digital economy: Promise and peril in the age of networked intelligence*. N. Y.: McGraw-Hill. 342 p.

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