

ANALYSIS OF THE DIGITAL TRANSFORMATION INFLUENCE ON THE ECONOMIC GROWTH OF THE REGION

Vladimir Glinskiy

*Novosibirsk State University of Economics and Management, Russian Federation
v.v.glinskij@nsuem.ru*

Lyudmila Serga

*Novosibirsk State University of Economics and Management, Russian Federation
l.k.serga@nsuem.ru*

Sergey Tsurikov

*Novosibirsk State University of Economics and Management, Russian Federation
s.v.tsurikov@nsuem.ru*

Victor Plotnikov

*Novosibirsk State University of Economics and Management, Russian Federation
v.s.plotnikov@nsuem.ru*

ABSTRACT

We live in an era of digital transformation. Informatization of society has led to new realities, to a new paradigm of the state development, economy and society as a whole. Today, the main trend of Russian domestic policy is digitalization, accelerating the pace of technological change, opening up new opportunities for economic growth through digital transformations, including changes in the regions. However, the following problem remains unresolved – What is the digital economy and how to evaluate it? The authors offer their interpretation of the digital economy definition and the solution of its statistical evaluation problem. The study is devoted to the analysis of the impact of digital transformation on the socio-economic development of territories; attempts are made to solve the problem of assessing of digitalization contribution to the economy of the country and regions. An analysis of the advantages and disadvantages of various methods and techniques for assessing the unevenness of the digitalization process of the state, business and society has been performed. Well-known methods and indicators are not always effective, for example, the problem of the formation of the socio-economic indicators system, indicators of the digital transformation level at the municipal management level remains. To assess the digitalization level of business and households, we propose using integrated indicators calculated using 5 primary business indicators and 6 households indicators. A methodology for assessing of disproportions scale in the digital transformation of the Russian regions is proposed in the work. The authors performed a typology of the Russian Federation constituent entities according to the digitalization degree of business and households. Using the regression model, the dependence of the region economic development on the level of digital transformation and the territories disproportions degree is proved.

Keywords: *Disproportions in Digital Transformation, Digital Economy, Economic Growth, Region, Russian Federation*

1. INTRODUCTION

We live in the digital age. Digital technologies, digital data and new connections and relationships arising in the process of their use cause cardinal changes in society and the economy. A multiple increase in the volume of information, the global digitalization of society and the transformation of socio-economic phenomena associated with it have led to new

realities, to a new paradigm for the development of the state, economy and society as a whole (Glinskiy, Serga, 2011, p. 110). A new impetus for the development of the digital economy in Russia has become the “Digital economy of the Russian Federation” Program (Russian Federation Government Order, 2017), which has identified three priority areas: Markets and sectors of the economy, Platforms and technologies, Information ecosystem. In the process of solving the strategic task of the development of the digital economy, there are tactical tasks of assessing the level of digitalization of society and measuring the digital economy, analysis of the degree of influence of digital transformation on the economic growth and region development. However, the problem of the content of the definition “digital economy” and the problem of its assessment remain unresolved in the scientific community. The authors of the article offer their interpretation of the digital economy definition and the issues of its statistical accounting. Today, statisticians from different countries are quite actively and fruitfully addressing the issues of assessing the digitalization level of countries, territories, industries, society and population. This is solved by collecting information and analyzing certain aspects of the digitalization process, such as resources, technologies, and personnel (Competition in the digital age, 2018; Development of the digital economy, 2018; Digital Dividends, 2016; DECA, 2017; Digital Russia, 2017; Methodology, 2018; Social and economic impact, 2017; Value creation, 2019). However, the problem of measuring the scale of the digital economy has not yet been resolved, even approximately. All attempts to estimate the volume of the digital economy come down to assessing the resources and scope of the digitalization process. The problems of measuring the digital economy are in the center of attention of statisticians of all countries: they are discussed at meetings of international statistical organizations, they are on the agenda of national statistical services, and they are the subject of scientific research (Gokhberg, 2019; Khokhlov, 2017; Lovelock 2018). There are various approaches. For example, Tatarinov A.A. believes that the measurement system should be based on a system of national accounts (SNA) (Tatarinov, 2019, p. 7). SNA satellite accounts will be able to objectively measure the economic transactions that forming the digital economy because they are the tool for measuring fuzzy industries that do not have clear boundaries in the framework of the International Standard Industrial Classification (ISIC). Other approaches are simply aimed at measuring individual aspects of digitalization (Gokhberg, 2019).

2. DIGITAL ECONOMY AS AN OBJECT OF STATISTICAL ACCOUNTING

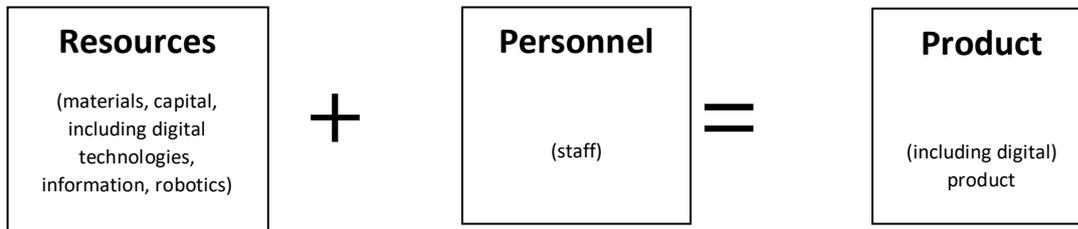
To solve the problems of accounting for the digital economy, it is very important to correctly identify it as an object of statistical accounting. The term digital economy is very young (it was first proposed in 1995 by the American scientist Nicholas Negroponte), today it is as popular as it is not defined. There is confusion in terms. Digital economy represent a set of concepts, such as the Internet economy, the electronic economy, the ICT sector, the digital sector, electronic business, the digitalization process, the digital society and the information society. So what is the digital economy and how to take it into account, measure it?

2.1. Definition of the digital economy

A critical analysis of modern publications on digitalization and informatization testifies that the digital economy is not digitalization itself, but it is digitalization result in the following areas:

- digital transformation of the economy, society, business and government;
- transition from analogue to digital production;
- digital production that is optimization of the workflow through hardware and software solutions (it implies not only the replacement of production tools, but also the introduction of analytical systems that make production as cost-effective as possible).

At the same time, not any digitalization is a blessing, but only one that leads to additional profit growth. Analysis of economic entities functioning mechanism revealed that the “digital economy” action principle is the same as that of any economic activity (Figure 1). At the same time, resource consumption is growing while reducing personnel costs, and the growth rate of product manufacturing is higher than the growth of resource consumption.



*Figure 1: The operating principle of "Digital Economy"
(Source: Submitted by the authors)*

Thus, the digital economy is not something new, but part of the general concept of “economy”. If the traditional economy is the society economic activity, as well as the totality of the relations that take shape in the system of production, distribution, exchange and consumption, then the digital economy is an economic activity based on digital technologies and associated with electronic business and e-commerce, but also electronic goods and services that produced and sold by them. Payments for services and goods of the electronic economy are often carried out also by electronic money. This is the evolutionary development of a traditional economy. All terms and categories related to the traditional economy (an object of economic relations, an economic entity, a product, a service, an economic transaction, etc.) can be used in relation to the digital economy. So, the economy is one! An economy with any adjectives (green, innovative, resource-saving, efficient, competitive, new) is the same economy!

2.2. Problems of accounting and evaluation of the digital economy

However, the digital economy has its own specifics and, first of all, as an object of statistical accounting and analysis:

- lack of a clear and approved (or at least well-established) concept of the digital economy;
- artificially allocated statistical population uniting business entities, economic entities, and economic operations;
- lack of international standards and methodology in the field of statistical measurement of the digital economy;
- the relevance of monitoring this phenomenon is related to the need to evaluate the results of the implementation of the Russian Federation National Project “Digital Economy”;
- the problem of reliability of the obtained statistical information from business entities;
- an open system with a global market, new connections and relationships (B2B, B2C, p2p, distributed production, consumption, etc.), new intangible products, new forms of activity (IoT), resulting in unobservability of certain operations (the possibility of going into the shadows);
- unstructured and unclear transformations and transactions in terms of accounting.

There are 9 main problems of accounting and analysis of the digital economy (Glinskiy, Serga, 2018, p. 47):

1. The complexity of the object of observation;
2. The problem of identification of subjects and objects of the digital economy;

3. The problem of identifying business transactions (production and distribution of products, financial and non-financial services, consumption, accumulation) that are forming the digital economy (Glinskiy, Serga, Zaykov, 2017);
4. The lack of a scorecard;
5. Lack of methods for evaluating the results of the digital economy;
6. The problem of coverage of all business entities operating in the digital economy segment;
7. The problem of the reliability of information at the level of types of economic activity and regions;
8. There is no single methodology for collecting, processing and analyzing statistical information on the digital economy;
9. Lack of flexible use of statistical information by all interested users.

The proposed lists of indicators, including indicators of the national project “Digital Economy of the Russian Federation”, cannot be called a system, since these are indicators that characterize only certain aspects of the digitalization process in the country. The proposed lists of indicators, including indicators of the national project “Digital Economy of the Russian Federation”, cannot be called a system, since these are not related indicators that characterize not the digital economy, but only certain aspects of the digitalization process in the country. None of the reporting forms and none of the lists of indicators include efficiency indicators of digitalization and the digital economy. Business entities of not all types of economic activity and not all categories of business participate in the survey, due to the fact that there is a misunderstanding of the essence of the digital economy and its subjects. The digital economy, according to the authors, is not only an activity carried out within the framework of electronic communication channels, but also production based on computer technologies (additive production), the use of artificial intelligence, and robotics. As a result, we have a truncated, incomplete picture of the development of the digital economy in the country.

2.3. The possible ways of solving the observation problems of the digital economy

To get out of the existing situation, we offer possible solutions to the identified problems:

1. It is necessary to theoretically distinguish between the concepts of digitalization and the digital economy;
2. To solve the problem of identifying subjects and objects of the digital economy, it is possible to establish criteria for classifying business entities as the studied population, either by the share of high-tech products produced, digital services provided, or by the level of automation and digitalization of business processes;
3. To identify business transactions (production and distribution of products, financial and non-financial services, consumption, accumulation) that form the digital economy, define and establish clear criteria for classifying business (economic) operations as a digital economy (Glinskiy, Serga, Zaykov, 2017)
4. Develop a system of indicators characterizing all aspects of the digital economy, and not just digitalization processes, starting with resources, the number of organizations by type of economic activity, and moving on to the gross output of digital and high-tech products and services, and the amount of value added received in the digital economy and profit;
5. Develop a methodology for evaluating the results of the digital economy, for example, based on the formation of satellite accounts of the Digital Economy (like tourism and health accounts), which will determine the contribution of the digital economy to the country's economic growth;
6. In order to cover all business entities operating in the digital economy segment, apply, on a par with paper forms of reporting, electronic, the creation of a statistical platform, the use, for example, of the public services platform formed in Russia, subject to the mandatory

registration of all organizations, individual entrepreneurs, self-employed and home households for reporting and mandatory online surveys;

7. The solution to the problem of reliability and reliability of information at the level of types of economic activity and regions is possible by optimizing the processes of collecting and processing primary data (statistical reporting, information obtained through a statistical platform, using alternative sources of data - big data if possible);
8. Development and approval of a unified methodology for the collection, processing and research of the digital economy at the regional level and type of economic activity, in order to determine the contribution of the types of economic activity, the region to the digital economy of the country;
9. To enable flexible use of statistical information by all interested users, posting information on the websites of national statistical services, including on the Rosstat website in Russia.

3. ASSESSMENT OF THE INFLUENCE OF DIGITAL TRANSFORMATION ON THE ECONOMIC GROWTH OF TERRITORIES

Until the above statistical problems have been resolved, researchers are able to use only the characteristics of the digitalization level of the economy and society and determine on their basis the degree of influence of digital changes on the economy as a whole. The following is an analysis by the authors of the impact of digital transformation on the socio-economic development of the territories of the Russian Federation.

3.1. Scorecard and methodology for assessing indicators of the level of digitalization

Based on the statistics of the Higher School of Economics (Digital Economy Indicators, 2019), the authors identified two indicators characterizing the level of digitalization of households and the level of digitalization of business in 82 regions of the Russian Federation for 2018. To calculate the first indicator, 6 indicators of telecommunication infrastructure and Internet use in households and the population in the constituent entities of the Russian Federation were used:

1. Subscribers of fixed broadband Internet access per 100 people population (units);
2. Subscribers of mobile broadband Internet access per 100 people population (units);
3. The proportion of households with broadband Internet access, in the total number of households (percent);
4. The proportion of the population using the Internet in the total population aged 15-74 years (percent);
5. The proportion of the population using the Internet to order goods, services, in the total population aged 15-74 years (percent);
6. The proportion of the population using the Internet to receive state and municipal services in electronic form, in the population aged 15-72 years, who received state and municipal services (percent).

The following 5 indicators were used to calculate the indicator of the degree of business digitalization:

1. The proportion of organizations (in the total number of organizations) using broadband Internet (percent);
2. The proportion of organizations (in the total number of organizations) using cloud services (percent);
3. The proportion of organizations (in the total number of organizations) using RFID technology (percent);
4. The proportion of organizations (in the total number of organizations) using ERP-systems (percent);

5. The proportion of organizations engaged in electronic sales using special forms available on the website / extranet, EDI systems, in the total number of organizations (percent).

As a result, 2 source data matrices were generated for the Russian Federation: the first have with a dimension of 82 regions for 6 indicators, the second - 82 regions with 5 indicators, according to which regional digitalization indicators were determined. Indicators are integral characteristics. Indicators were calculated by the multivariate average method for several key digitalization indicators, normalized to the maximum value among the subjects of the Russian Federation. Indicators do not have units.

3.2. Typology of the Russian Federation constituent entities on the level of digitalization

The applied standardization technology allows determining the limits of variation of the indicators of the degree of digitalization in the range from 0 to 1 (Glinskiy, Serga, Khvan, 2016; Glinskiy V., Serga L., Khvan M., 2015; Glinskiy V., Serga L., Khvan M., Zaykov K., 2018). This makes it possible to divide the totality of regions into three equal groups for each indicator obtained:

- Low level [0 - 0.33];
- Middle level (0.33 - 0.67];
- High level (0.67 - 1].

According to the results of the calculation of indicators, it turned out that the degree of digitalization of both households and business in Russia is at an average and high level. A low level of business digitalization is observed only in the Republic of Dagestan. As a result, 9 groups obtained (Table 1) can be combined into 4 types of subjects:

1. Regions in which the business does not use the potential of digitalization of households. One region belongs to this type - the Republic of Dagestan;
2. Regions in which the business is not sufficiently exploiting the potential of digitalization of households. Most of the regions (50) belong to this type;
3. Regions in which the business makes good use of the digitalization potential of households, there are 26 in the Russian Federation;
4. Regions - drivers of the digitalization process for both households and businesses. These are 5 regions: Moscow, St. Petersburg, Moscow Region, the Republic of Tatarstan and Sverdlovsk Region.

Table following on the next page

Household Digitalization Indicator	Business Digitalization Indicator		
	Low	Middle	High
Low	0 Regions	50 Regions – Altai Territory, Amur Region, Arkhangelsk Region, Astrakhan Region, Belgorod Region, Bryansk Region, Volgograd Region, Vologda Region, Voronezh Region, Irkutsk Region, Kaliningrad Region, Kaluga Region, Kamchatka Region, Kostroma Region, Krasnodar Region, Krasnoyarsk Region, Kursk Region, Leningrad region, Lipetsk region, Magadan region, Murmansk region, Omsk region, Orenburg region, Nizhny Novgorod region, Novosibirsk region, Penza region, Primorsky Ai, Altai Republic, Republic of Bashkortostan, Republic of Buryatia, Republic of Karelia, Republic of Komi, Republic of Sakha (Yakutia), Republic of North Ossetia-Alania, Rostov Region, Ryazan Region, Samara Region, Saratov Region, Sakhalin Region, Smolensk Region, Stavropol Territory, Tambov Region, Tomsk Region, Tula Region, Tyumen Region, Udmurt Republic, Khabarovsk Territory, Chelyabinsk Region, Chuvash Republic, Yaroslavl Region	5 Regions – Moscow, St. Petersburg, Moscow region, Republic of Tatarstan, Sverdlovsk region
Middle	1 Region – Republic of Dagestan	25 Regions – Vladimir Region, Trans-Baikal Territory, Jewish Autonomous Region, Ivanovo Region, Kabardino-Balkarian Republic, Karachay-Cherkess Republic, Kemerovo Region, Kirov Region, Kurgan Region, Oryol Region, Novgorod Region, Perm Region, Pskov Region, Republic of Adygea, Republic of Kalmykia, Republic of Crimea, Republic of Mari El, Republic of Mordovia, Republic of Tuva, Republic of Khakassia, Sevastopol, Tver Oblast, Ulyanovsk Oblast, Chechen Republic, Chukotka Autonomous Okrug	1 Region – Republic of Ingushetia
High	0 Regions	0 Regions	0 Regions

Table 1: Typology of the Russian Federation subjects in 2018 by the level of household and business digitalization

(Source: Submitted by the authors)

3.3. Scorecard and methodology for assessing digitalization indicators

An assessment of the unevenness of the digitalization process of the business and society of the Russian Federation indicates that the variation in the results of the introduction of digital technologies in the territorial context in business is higher than for households (the coefficient of variation is respectively 17.3% and 11.1%). The imbalances in the digital transformation of the regions of the Russian Federation can be estimated using the quartile or decile coefficient of differentiation (Table 2). These coefficients indicate a slight regional differentiation of the process in question.

Index	Household Digitalization	Business Digitalization
The coefficient of variation, %	11.1	17.3
Quartile coefficient of differentiation	1.120	1.243
Decile coefficient of differentiation	1.302	1.520

Table 2: The indicators of variation and differentiation of the business and society digitalization level in the Russian Federation in 2018

(Source: Submitted by the authors)

3.4. Model of the dependence of regional development on the level of digitalization

Correlation analysis allowed us to establish an average relationship between the indicators of digitalization of households and businesses ($r = 0.568$), and between the average per capita level of gross regional product (GRP) (the average per capita level of gross regional product is an indicator of the level of economic development of the region) and the indicators of digitalization of the population ($r = 0.479$) and business ($r = 0.283$). Using the regression model, the dependence of the economic development of the regions (y) on the level and scale of the digital transformation of society and business is constructed and proved:

$$y = -1236430 + 2415234,8 x_1 + 63858,8 x_2$$

Here:

x_1 is the indicator of household digitalization,

x_2 is an indicator of business digitalization.

The multiple correlation coefficient is 0.480, the multiple regression equation is significant according to the F-criterion ($F_{calc} = 11.8$). The model indicates that the digitalization of households affects the level of regional economic development 37.8 times more than the digitalization of business ($2415234.8 / 63858.8 = 37.8$).

4. CONCLUSION

As conclusions, it can be noted that the digitalization of households and businesses in the regions of the Russian Federation is at an average and high level, with an overall low territorial unevenness in the introduction of digital technologies, it is higher in business than among households. In addition, enterprises and organizations use digital technologies to a lesser extent than the population (in 62.1% of the regions, the business does not sufficiently use the digital potential of households). There is an average correlation between the average per capita level of the gross regional product and the indicators of digitalization of the population and business; the regression model shows that the active introduction of digital technologies by households has a 37.8 times stronger effect on the level of regional economic development than digitalization of business.

ACKNOWLEDGEMENT: *The reported study was funded by Russian Foundation for Basic Research according to the research projects No 20-010-00560.*

LITERATURE:

1. Competition in the digital age: strategic challenges for the Russian Federation (2018). *Report on the development of the digital economy in Russia*, September 2018, World Bank, Washington, DC.
2. *Development of the digital economy in Russia as a key factor in economic growth and improving the quality of life of the population (2018)*. Nizhny Novgorod: Professional Science Publishing House, 2018, 131 p.
3. Digital Dividends (2016). *World Development Report, Overview*, 2016, World Bank, Washington, DC.
4. *Digital Economy Country Assessment (DECA) (2017)*. The World Bank in collaboration with IIS, 2017.
5. *Digital Russia: A New Reality (2017)*. Moscow: McKinsey and CIS, 132 p. Retrieved 20.03.2020 from <http://www.mckinsey.com/~media/McKinsey/Locations/Europe%20and%20Middle%20East/Russia/Our%20Insights/Digital%20Russia/Digital-Russia-report.ashx>
6. Glinskiy V.V., Serga L.K. (2018) Chances and risks of Russian statistics in the context of the development of the digital economy. *Statistics in the digital economy: training and use*. St.Petersburg, 2018. pp. 46-48.
7. Glinskiy V., Serga L., Khvan M. (2016). Assessment of Environmental Parameters Impact on the Level of Sustainable Development of Territories, *Procedia CIRP*, 2016 (Vol. 40), pp. 626-631.
8. Glinskiy V., Serga L., Khvan M. (2015). Environmental Safety of the Region: New Approach to Assessment. *Procedia CIRP*, 2015 (Vol. 26), pp. 30–34.
9. Glinskiy V., Serga L., Khvan M., Zaykov K. (2018). The Assessment Methods of the Level of Countries Environmental Safety. *Procedia Manufacturing*, 2018 (Vol. 21), pp. 494-501.
10. Glinskiy V.V., Serga L.K. (2011). Statistics of the XXI century. Development Vector. *Vestnik NGUEU*, 2011 (No. 1), pp. 108-118.
11. Glinskiy V., Serga L., Zaykov K. (2017). Identification method of the Russian Federation Arctic Zone regions statistical aggregate as the object of strategy development and a source of sustainable growth. *Procedia Manufacturing*. 2017 (Vol. 8), pp. 308-314.
12. Gokhberg L.M. et al. (2019). *What is a digital economy? Trends, competencies, measurement*. Moscow: Publishing. House of the Higher School of Economics, 2019, 82 p.
13. *Khokhlov Yu.E. (2017). Analysis of the current level of development of the digital economy in the Russian Federation*. World Bank, Institute for the Development of the Information Society, October 2017. Retrieved 20.03.2020 from <http://deca.iis.ru/>.
14. *Lovelock P. (2018). Framing policies for the digital economy: towards policy frameworks in the Asia-Pacific*. UNDP Global Centre for Public Service Excellence, Singapore, 2018.
15. *Methodology for calculating the Digital Russia index of the constituent entities of the Russian Federation (2018)*. Moscow School of Management SKOLKOVO; Center for Financial Innovation and Cashless Economy. Moscow, 2018.
16. On approval of the "Digital economy of the Russian Federation Program" (2017). *Russian Federation Government Order*, N 1632-r Retrieved 20.03.2020 from <http://government.ru/docs/28653/>.
17. Social and economic impact of digital transformation on the economy (2017). *Discussion paper*, ITU, GSR-17, 2017.
18. Tatarinov A.A. (2019). Measuring the digital economy in the national accounts. *Questions of Statistics*, 2019 (Vol. 26, No. 2), pp. 5-17.

19. Value creation and capture: implications for developing countries (2019). *Digital economy report*, Overview, United Nations United Nations Publications, New York, United States of America, 2019.